



U.S. FISH AND WILDLIFE SERVICE

Region 2

Environmental Contaminants Program



RECOMMENDED PROTECTION MEASURES FOR PESTICIDE APPLICATIONS IN REGION 2 OF THE U.S. FISH AND WILDLIFE SERVICE



by

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Memorandum

To: Supervisors, Ecological Services Field Offices, Region 2

From: Regional Director, Region 2

Subject: Transmittal of Regional Pesticide Recommendations

This memorandum transmits the attached document, "Recommended Protection Measures for Pesticide Applications in Region 2 of the U. S. Fish and Wildlife Service," for use as a reference by Service personnel. The referenced document will serve as the regional pesticide recommendations (RPR) for protecting Service trust resources (refuges/hatcheries, migratory birds, and threatened and endangered (T&E) species) in Region 2. The RPR was compiled from Service biologists, Service biological consultations on pesticides, and scientific literature on pesticides. A draft of this document has previously been reviewed by Region 2 field offices as requested under my memorandum of January 31, 2002, and comments from that review have been incorporated into the current document.

Pesticide protection measures listed in the RPR may be used in Endangered Species Act (ESA) actions such as section 7 consultations or section 10 permit processes involving T&E species in Region 2. However, the RPR cannot be used in lieu of section 7 consultations or section 10 permits. The RPR may also be used in conjunction with developing protection measures for the Pesticide Use Program (PUP) on refuges and hatcheries. Copies of the document may be provided to agencies or pesticide applicators for specific pesticide actions involving Service trust resources.

Recommendations in the RPR do not constitute rules, regulations, requirements, or project evaluation criteria of the Service. The recommendations also do not create or establish any legal obligations, binding effects, minimum standards, or criteria to be adopted by the private sector or by government agencies at the Federal, state, or local levels. Recommended protection measures in the RPR may be modified on a case-by-case basis with additional information. As part of a Federal agency action or HCP permit process under the ESA, agencies or applicators can submit alternative protection measures for specific pesticides to the nearest Service field office. These alternative protection measures should be based on ecological risk assessments, field trials, or peer-reviewed publications.

A copy of the referenced document should be available at each Ecological Services Field Office in Region 2, and the document should be updated with new information on pesticides and species, as necessary. Updates for the RPR will also be available in the Contaminants section of the Region 2 website at <http://ifw2es.fws.gov>. Any new information on pesticides or necessary protection measures for T&E species should be coordinated with Allen White, Regional Pesticide Coordinator, in the Austin Ecological Services Field Office.

Geoffrey L. Haskett
/s/ H. Dale Hall

Attachment

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Cover photo - Attwater's greater prairie-chicken, courtesy of George Levandoski

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1.0 INTRODUCTION

This document contains information on protecting U.S. Fish and Wildlife Service (Service) trust resources in Region 2 from pesticide applications. Region 2 (Southwest Region) of the Service includes Arizona, New Mexico, Oklahoma, and Texas. The document serves as the regional pesticide recommendations (RPR) for Region 2 and will be updated when new species are listed or new information becomes available. The Service regional pesticide coordinator in Austin, Texas, should be contacted at 512-490-0057 for information on pesticides or protection measures not covered in the RPR.

The purpose of the RPR is to provide recommendations to Service personnel, regulatory agencies, and pesticide users for pesticide applications involving Service trust resources of (1) national wildlife refuges and fish hatcheries, (2) migratory birds, and (3) threatened and endangered (T&E) species that have been listed under the Endangered Species Act of 1973. The document specifically provides pesticide protection measures that can be used to protect Federally-listed species, species proposed for listing, and critical habitat.¹ Recommended protection measures in the RPR may be modified on a case-by-case basis with additional information. However, the RPR cannot be used in lieu of section 7 consultations or section 10 permits as required under the Endangered Species Act. Recommendations in the RPR do not constitute rules, regulations, requirements, or project evaluation criteria of the Service. The recommendations also do not create or establish any legal obligations, binding effects, minimum standards, or criteria to be adopted by the private sector or by government agencies at the Federal, state, or local level.

Note - Any product, active ingredient, or formulation of a pesticide addressed in this document does not infer recommendation or endorsement by the U. S. Fish and Wildlife Service for its use.

¹ Critical habitat refers to geographic areas that have been designated under the Endangered Species Act as essential for the protection of listed species. Areas designated as critical habitat are found in 50 CFR [Code of Federal Regulations] § 17.95-17.96 which can be accessed at the U.S. Government Printing Office website: <http://www.gpo.gov>.

2.0 GENERAL INFORMATION FOR PESTICIDE APPLICATIONS

2.1 Regulatory Compliance

2.1.1 Federal statutory authorities

Unlawful uses of pesticides that potentially involve Service trust resources can have substantial penalties according to various Federal regulatory statutes. The Endangered Species Act of 1973 (ESA), as amended (16 U.S.C 153 *et seq.*), protects plant and animal species that have been listed by the Federal government under the act as either threatened or endangered. Civil penalties can be assessed under the ESA for up to \$25,000 for knowing violations of the act and up to \$500 for unknowing violations. Criminal penalties for individuals under the act include up to \$100,000 in fines and one year imprisonment. The Migratory Bird Treaty Act of 1918 prohibits the killing of migratory birds and assesses penalties for up to \$15,000 and six months imprisonment for misdemeanor violations.² Felony violations by individuals under the act can involve up to \$250,000 in fines and two years' imprisonment. The Bald Eagle Protection Act of 1940 assesses penalties for killing, poisoning, or disturbing both bald eagles and golden eagles with up to \$5,000 in fines for civil penalties and up to \$250,000 in fines and two years' imprisonment for a felony violation. The National Wildlife Refuge System Administration Act of 1966 prohibits disturbing, injuring, or damaging plants and animals within a refuge. Criminal penalties under the act include up to \$100,000 in fines and one year imprisonment. In addition to the aforementioned acts, penalties for unlawful pesticide use may also be assessed under the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA), as amended (7 U.S.C. 135 *et seq.*), and other regulatory statutes.³

2.1.2 The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

The U. S. Environmental Protection Agency (EPA) regulates pesticides that are sold, distributed, or used in the United States by requiring either (1) full registration of a pesticide under FIFRA section 3; (2) exemption status for a pesticide under FIFRA section 18 for use in individual counties or states during emergency conditions; or (3) a special local need registration for a pesticide by an individual state under FIFRA section 24(c). Before registration can occur, EPA must make a determination that a pesticide will generally not cause unreasonable adverse effects on humans or the environment. In addition, a pesticide must be registered in a state by an appropriate state agency before it can be sold or used. A pesticide may be suspended after registration under FIFRA section 6(c)(1) if EPA determines that the pesticide is an imminent hazard that can jeopardize a listed species.

A pesticide may only be used as specified by the pesticide label, and application of a pesticide other than as directed by the label is a FIFRA violation. The label is a legal document that regulates specific uses and applications of a pesticide. For example, only a limited number of pesticides are registered for use in waterbodies or wetlands. Pesticide use in these areas is restricted to aquatic pesticide formulations (piscicides, mosquito control agents, aquatic herbicides, etc.) that have a product label that specifically states that the pesticide is intended for aquatic use. Some pesticides such as 2, 4-D, glyphosate, and imazapyr have different formulations to allow use with both land and aquatic areas.

2.1.3 Pesticide use and the Endangered Species Act

Under the ESA, “take” of animal species listed as threatened or endangered is prohibited. Take of

² A list of bird species protected by the Migratory Bird Treaty Act may be found under 50 CFR § 10.13.

³ FIFRA was amended in 1996 by the Food Quality Protection Act (FQPA) to address issues regarding diet and risk.

Federally-listed animal species includes harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Take can only be exempted under limited circumstances through (1) incidental take provisions as authorized by a biological opinion in an ESA section 7 consultation or (2) an incidental take permit obtained under section 10 of the ESA. Incidental take refers to take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity (e.g., loss of individuals of a listed animal species through pesticide spray drift from nearby cropland).

Pesticide use can cause take of listed animals through killing, harming, or harassment. As defined under 50 CFR (Code of Federal Regulations) § 17.3, harm to listed animal species can include significant habitat modification or degradation that results in death or injury to listed species by impairing essential behavioral patterns such as breeding, feeding, or sheltering. Examples of harm to listed animal species that can be caused by pesticide applications include loss of prey species, abnormal behavioral changes, and induced sublethal effects (e.g., endocrine system disruption). Harassment of listed animal species under 50 CFR § 17.3 can be an intentional or negligent action (or omission of an action) that creates a likelihood of injury to a listed species by annoying individuals of the species to such an extent as to significantly disrupt normal behavior patterns that include (but are not limited to) breeding, feeding, or sheltering. Noise disturbance from pesticide application equipment can result in harassment through (1) nest abandonment by birds or (2) disruption of nesting colonies of shorebirds or wading birds.

Although take does not apply to listed plant species, the ESA does prohibit the following actions in areas under Federal jurisdiction: (1) removal, damage, or destruction of endangered plant species and (2) removal of threatened plant species. In addition, actions that remove, damage, or cause destruction of endangered plant species in non-Federal areas that are in violation of state or local laws are prohibited. Experimental populations of listed species are protected by the ESA (as modified by special rules in 50 CFR § 17.80-17.85) against unlawful use of pesticides if these populations are (1) essential experimental populations on either public or private lands or (2) nonessential experimental populations on national parks or wildlife refuges. Candidate species and species proposed for listing do not have ESA protections until the time of listing; however, Federal agencies are required to confer with the Service about potential actions that may jeopardize the continued existence of proposed species. Federal agencies are also required to consult with Service on actions that can adversely modify critical habitat of listed species.

2.1.4 ESA section 7 consultation for a pesticide action by a Federal agency

Section 7(a)(2) of the ESA requires Federal agencies to ensure that any action (e.g., pesticide use) they authorize, fund, or carry out is not likely to jeopardize the continued existence of any Federally-listed threatened or endangered species or result in the destruction or adverse modification of designated critical habitat.⁴ Actions conducted by Federal agencies that involve pesticide use include, but are not limited to, the following examples:

1. Area-wide programs for control of insect pest species (cotton bollweevil, grasshopper, etc.), invasive species, rodents, or predators; and
2. FIFRA authorizations such as pesticide registrations (section 3), emergency exemptions (section 18), and state-specific registrations (section 24(c)).

⁴ Presidential Executive Order 13186 of January 10, 2001 requires Federal agencies to avoid or minimize adverse impacts to migratory bird resources, as practicable, when conducting agency actions.

In the event that a Federal agency concludes that its action “may affect” a listed species or designated critical habitat, the agency is required to consult with the Service regarding the degree of impact to the species from the agency’s action and the measures necessary to avoid or minimize adverse effects. Federal agencies involved with pesticide programs that can modify critical habitat through activities such as brush control or removal of prey species must consult with the Service.

During ESA section 7 consultations, informal consultation between the Federal agency initiating the action and the Service may be used to determine whether (1) any adverse effects to listed species or critical habitat by the proposed action can be avoided or summarily minimized or (2) formal consultation is needed with the Service. To initiate formal consultation on pesticides, the Federal action agency is required to send information to the Service:

1. A description of the action to be considered;
2. A description of the specific area that may be affected by the action;
3. A description of any listed species or critical habitat that may be affected by the action;
4. A description of the manner in which the action may affect any listed species or critical habitat and an analysis of any cumulative effects;
5. Relevant reports including any environmental impact statement, environmental assessment, or biological assessment prepared; and
6. Any other relevant available information on the action, the affected listed species, or critical habitat.

If listed species or critical habitat are present in the action area, a biological assessment must be prepared by the Federal agency initiating the action pursuant to regulations implementing section 7 (e.g., 50 CFR § 402). Biological assessments made by Federal agencies may be done as part of the compliance for the National Environmental Policy Act of 1969. After a Federal action agency has provided any necessary documents such as a biological assessment, the Service will issue a biological opinion for the agency action. If the proposed action does not involve jeopardy for a listed species or adverse modification of critical habitat, the biological opinion will provide the Federal agency with an incidental take statement and non-discretionary reasonable and prudent measures (RPMs) to protect the species. In the event that jeopardy to a listed species (animal or plant) or adverse modification of critical habitat has been found by the Service for the action, the biological opinion will stipulate non-discretionary reasonable and prudent alternatives (RPAs) that must be followed by the Federal agency to protect the species or critical habitat.

2.1.5 ESA section 10 permit actions involving pesticide use on private, state, or local government lands

Section 10 of the ESA authorizes the Service to issue permits allowing normally prohibited actions against Federally-listed species such as collection of species for scientific purposes. The section also gives the Service the authority to provide incidental take permits of listed animal species by non-Federal activities. Unless incidental take of listed animal species has previously been authorized by consultation under section 7 of the ESA, pesticide users who believe that their otherwise-lawful

pesticide application(s) may cause take of a listed animal species should obtain an incidental take permit under section 10 (a)(1)(B). The permits may be issued by the Service to private individuals, associations, businesses, and to state, municipal, or tribal governments. Since the ESA does not prohibit killing or damaging listed plant species on non-Federal lands except in the event that killing or damaging of those plants is in violation of state or local law, incidental take permits are not issued by the Service for listed plant species. However, the Service cannot issue a permit for incidental take of listed animal species if a proposed action will jeopardize listed plant species in the project area.

A Habitat Conservation Plan (HCP) must accompany any application for an incidental take permit. The purpose of the HCP is to provide measures that will minimize and mitigate impacts to listed species. The application for a HCP should include the following information:

1. An assessment of impacts likely to result from the proposed taking of one or more listed species.
2. Measures that the permit applicant will undertake to monitor, minimize, and mitigate for such impacts; the funding that will be made available to implement such measures; and the procedures to deal with unforeseen or extraordinary circumstances.
3. Alternative actions to the taking that the applicant analyzed, and the reasons as to why the applicant did not adopt such alternatives.
4. Additional measures that the Service may require as necessary or appropriate.

2.2 Procedures for Pesticide Incidents Involving Service Trust Resources

For incidents where a pesticide application may have caused mortality or damage to a Service trust resource, qualified Service personnel (e.g., law enforcement agents, environmental contaminant specialists) should be contacted prior to initial entry into an area involving a pesticide incident. Only Service law enforcement agents are authorized to enter private property without landowner permission to investigate a mortality incident related to use of a pesticide. All other Service personnel must obtain permission of landowners to enter private property.

According to Service regulations (Fish and Wildlife Service Manual, 242 FW 6, Hazardous Materials Operations), Service personnel are prohibited from entering sites that (1) involve contamination of personnel by hazardous materials or (2) require personal protection equipment (chemical-resistant clothing, respirators, breathing apparatuses, etc.). Service personnel may only enter sites where there are no known atmospheric hazard and no possible involvement with hazardous chemicals through physical contact, splashes, immersion, or unexpected inhalation. After a site has been determined to be adequately safe for conducting a response by qualified Service personnel, a determination should be made as to whether dead or injured animals are the result of a pesticide incident or an infectious disease. Since some pesticides and wildlife diseases can affect humans, each carcass or injured animal must be approached or processed as a potential health hazard. Appropriate equipment (binoculars, chemical-resistant gloves, coveralls, rubber boots, handling tongs, etc.) must be used for investigation of animal die-offs or collection of dead specimens. Procedures for conducting a field response to a mortality incident can be found in the **Field Manual of Wildlife Diseases: General Field Procedures and Diseases of Birds** which can be accessed at the internet website of the U. S. Geological Survey: http://www.nwhc.usgs.gov/pub_metadata/field_manual/field_manual.html.

2.3 Contacts for Pesticide Incidents Involving Service Trust Resources in Region 2

Since a single observed mortality or damaging effect involving a Service trust resource (migratory bird, listed species, or facility) may be a potential violation of a statutory authority, any pesticide-related mortality or incident involving a Service trust resource should be reported. Minimal information to be collected for reporting a pesticide incident includes

1. Location of incident (including county and state),
2. Date(s) of incident,
3. Known or suspected pesticide(s) to which animals/plants were exposed,
4. Species killed or affected, and
5. Number killed or affected (by species).

Notifications for pesticide incidents in Region 2 should involve the following personnel or agencies:

1. Any incident where pesticides have killed or injured migratory birds, listed species, or proposed species in Region 2 should be reported to Service law enforcement:

(a) Arizona Field Stations	Mesa	602-379-6443
	Flagstaff	520-556-7451
(b) New Mexico Field Station	Albuquerque	505-883-7814, 7890, 6715
(c) Oklahoma Field Station	Oklahoma City	405-231-5251
(d) Texas Field Stations	Austin	512-490-0057
	Dallas/Fort Worth	972-574-3254
	El Paso	915-534-6660, 6661
	San Antonio	210-681-8419
2. Any incident where pesticides may have killed or injured migratory birds, listed species, or proposed species should be reported to the Service regional pesticide coordinator at 512-490-0057. Additional contacts for pesticide incidents include state departments of agriculture or wildlife.
3. Any incident where a pesticide may have killed or injured wildlife or plants on a Service refuge or fish hatchery should be reported to the refuge manager or hatchery manager.
4. Any incident where determination of pesticide-related kills or infectious diseases is necessary for migratory birds, listed species, or proposed species should be coordinated with the USGS National Wildlife Health Center in Madison, Wisconsin, at 608-270-2460.

5. Incidents where pesticides may have killed or injured nontarget plants or wildlife (migratory birds, fish, listed species, etc.) should be reported to the Ecological Incident Information System of the U. S. Environmental Protection Agency. Reports may be made by phone at 703-305-7695, fax at 703-305-6309, or letter:

Ecological Incident Information System Database Manager
US Environmental Protection Agency
Environmental Fate and Effects Division (7507C)
Office of Pesticide Programs
1200 Pennsylvania Avenue, NW
Washington, DC 20460

When available, additional information on a pesticide incident that can be sent to EPA includes

- (a.) Application rate and method of application during pesticide use,
- (b.) Pesticide product name and/or EPA registration number,
- (c.) Weather conditions during application,
- (d.) Results of necropsy examinations,
- (e.) Results of pesticide residue analyses,
- (f.) Measurements of cholinesterase inhibitions,
- (g.) Information related to the certainty that a particular pesticide caused the incident, and
- (h.) Information on whether the pesticide was applied in accordance to the label.

2.4 Procedures for Pesticide Applications Involving Habitat of Proposed or Listed Species

2.4.1 Control of pests or invasive species

In some cases, pesticide control of pests or invasive species may be necessary inside or adjacent to (1) habitat of a proposed or listed species or (2) other areas involving a Service trust resource. An invasive species is defined as an alien species (plant or animal) whose introduction either causes or is likely to cause economic or environmental harm or harm to human health (64 FR 6183). Pesticide applications such as mosquito pest control may be required inside or adjacent to habitat of migratory birds or proposed or listed species because of human health concerns. Invasive plant or animal species can be a greater threat to migratory birds, proposed or listed species, and/or their habitat than impacts from pesticide use. To accomplish recovery of certain listed species, pesticides may be required for temporary elimination of populations of both invasive species and resident listed species (e.g., use of piscicides in aquatic habitat of listed fish species to remove competing or hybridizing species). Many invasive plant species can only be controlled by pesticides due to aggressive reproductive strategies, root sprouting, spreading root systems, etc. As an example, saltcedar (*Tamarix* spp.) has rapidly expanded into riparian areas of the western United States and can be a major competitor in habitat of certain listed species such as Pecos sunflower (*Helianthus paradoxus*). Due to high seed production and root sprouting, broad scale aerial applications of herbicides are usually required to control saltcedar over extensive areas such as watershed basins.

The nearest Service field office, as given in section **2.5 Service Office Contacts** below, should be contacted prior to applying pesticide inside or adjacent to habitat of proposed or listed species. The Invasive Species Coordinator in the Resource Management Division of the Service Regional Office may be contacted at 505-248-6632 for assistance in control of invasive plants. For information on control of invasive or undesirable aquatic species other than plants, the Regional Service Non-indigenous Species Coordinator may be contacted at 505-248-6471. General information on invasive species and listed species can be found at the Service internet website: <http://www.fws.gov>.

2.4.2 Species surveys

Before pesticides can be applied inside or adjacent to habitat of a proposed or listed species, a determination should be made as to whether the habitat is occupied. Occupied habitat of proposed or listed species is defined to be an area where the species is known to occur based on (1) species presence confirmed by a Service-approved survey, (2) visual sightings of the species or its habitat components (nests, roosts, etc.), or (3) the best available scientific knowledge. Habitat is considered to be occupied even if the species is absent from the habitat at some point during the annual breeding cycle (e.g., migration). To determine occupied habitat of a proposed or listed animal species, a survey usually should be conducted for the species before pesticide application. As part of a Federal action involving habitat of a listed plant species, Federal agencies should require a survey to be conducted for the listed plant species before application of herbicide. For all other applicators or relevant agencies, a survey for listed plant species is recommended prior to herbicide application within species habitat on non-Federal land.

Pesticide applicators and relevant agencies should contact the nearest Service field office for information on protocols for conducting listed species surveys. Generally, a scientific permit must be obtained from the Service before conducting a survey for a listed animal species. Inholdings of nonhabitat areas (e.g., cropland) within habitat of proposed or listed animal species may be excluded in a survey if the species substantially avoids utilizing the nonhabitat areas. In some cases, a species

survey can be used to flag or otherwise mark individual plants or animal habitat components (nests, roosts, etc.) prior to actual pesticide application. The Service may be consulted to determine when a survey is no longer applicable for a particular area and a new survey is necessary. Applicators or relevant agencies should also consult with the Service on surveys for pesticide applications in right-of-way corridors that traverse habitat of listed species.

2.4.3 Requirements for ESA authorizations or permits

When results of a Service-approved survey or other information indicate that a habitat is occupied by a listed species, applicators should coordinate with the nearest Service field office to determine (1) measures to protect the species and (2) any necessary incidental take authorizations or permits as stipulated under section 7 or section 10 of the ESA. In addition to incidental take permits of listed animal species, scientific permits may also be issued by the Service under ESA's section 10. These scientific permits allow for incidental take of listed species as part of activities intended to promote species recovery (e.g., use of a pesticide in listed species habitat to reduce competition by an invasive species). Service field offices, as given in section **2.5 Service Office Contacts** below, can be contacted for information on scientific permits.

Before incidental take authorizations or permits can be given by the Service, either a Habitat Conservation Plan (HCP) or an action document by a Federal agency (e.g., a biological assessment) must ordinarily be prepared for pesticide treatments involving habitat of proposed or listed species. The HCP or Federal action document should be consistent with any Integrated Pesticide Management (IPM) plan that has been previously developed for a project area. Any HCP or Federal action document that involves control of pests or invasive species inside or adjacent to habitat of proposed or listed species should minimize short-term habitat damage from pesticide application while enabling habitat recovery. The HCP or Federal action document should address pest control necessary for recovery of species or the habitat, as well as management of sources of re-infestation, such as seed vectors (prevailing winds, flood corridors, etc.). When necessary, the HCP or Federal action document should also address re-establishment of native plant species.

2.4.4 Work plans

As part of a Habitat Conservation Plan or Federal action document involving pesticide treatment that may adversely affect proposed or listed species, the Service recommends that standard operating procedures (SOPs) be written separately into a work plan and approved by the Service prior to application of pesticide. For situations involving small areas of treatment and relatively low impacts by selected pesticides, the written work plan may be omitted; however, the nearest Service field office should be consulted. At a minimum, the work plan for pesticide treatment should include the following items:

1. A description and map of the area to be treated,
2. The schedule for applying pesticide in the field,
3. A survey or detailed habitat analysis for proposed or listed species,
4. Procedures for applying pesticide, and
5. Any necessary protection measures such as monitoring.

Work plans should ordinarily require that (1) application of pesticide be closely supervised and (2)

applicators using any type of ground equipment must be able to identify proposed or listed species in treated areas when these species are present. In areas with varied distributions of proposed or listed species, the work plan may allow only spot applications by handheld equipment in zones that have relatively high impact to proposed or listed species while restricting use of mechanized ground equipment or aerial applications to zones that have relatively low impact. When a single pesticide treatment has the potential to substantially impact an entire population of a proposed or listed species or its habitat, the Service recommends a staggered sequence of pesticide treatments over different time periods. For treatments involving extensive land areas, relatively new populations of invasive species should generally be treated with pesticide prior to treatment of well-established populations. Residual pesticide activity in soils or on vegetation within the project area should be considered in setting up the application schedule for the work plan. If feasible, applications of pesticides should generally be restricted to periods when (1) proposed or listed migratory species are absent from the habitat or (2) proposed or listed plant species are dormant.

2.4.5 Pesticide selection

Pesticide active ingredients and any adjuvants (drift retardants, surfactants, etc.), carrier materials, or other types of pesticide additives used inside or adjacent to habitat of proposed or listed species should be fully evaluated for relative risk to these species and elements of their habitat such as plant cover, prey species, pollinators, etc. In addition to acute toxicity, other factors associated with pesticides such as chronic toxicity, bioaccumulation, and secondary poisoning potential should also be evaluated. The evaluation process for a particular pesticide should include the use of the pesticide, mode of action, and environmental fate. Pesticide use is determined by

1. Type of control (insect, broadleaf weed, etc.),
2. Treatment category (pre-emergent herbicides, post-emergent herbicides, etc.), and
3. Formulation (liquid, granular, etc.).

The mode of action for a pesticide includes

1. Route or pathway of exposure into an organism (root absorption, inhalation, etc.),
2. Ability to translocate within an organism (e.g., systemic vs. nonsystemic), and
3. Behavior as an antimetabolite (respiratory depression, photosynthesis inhibition, reproductive impairment, endocrine system disruption, etc.).

Environmental fate of pesticides involves persistence, leaching ability, volatilization, transformations (e.g., lethal degradates), bioaccumulation, and other attributes of pesticides after release into the environment. Comparisons should be made between alternative pesticides and their individual characteristics for applications inside species habitat, critical habitat, or Pesticide Sensitive Areas. Information on pesticides may be found at internet sources such as the EXTOTOXNET website (<http://ace.orst.edu/info/extotoxnet>). Site-specific information for the evaluation process may be obtained from aerial maps, soil surveys, and other sources.

In general, pesticides with the least acute toxicity and persistence should be selected for use inside or adjacent to habitat of proposed or listed species. Selection of pesticide active ingredients that have the least toxicity will tend to decrease buffer zone sizes as recommended in the RPR. The volatility of a particular pesticide should be considered in the pesticide selection process if drift from the volatilized

pesticide can impact species habitat after treatment has occurred. The ability of a pesticide to leach or absorb onto soil or sediment particles should be taken into account for applications that could affect proposed or listed species that are aquatic (plant or animal) or are restricted to aquifers or caves (animal only). A pesticide's potential for inducing chronic toxicity in proposed or listed animal species should be considered if (1) the proposed treatment involves repeated applications, (2) the pesticide in question is persistent in the environment with a relatively long half-life, or (3) a chronic condition may be induced in proposed or listed species by a single application of pesticide. Pesticide formulations that are attractive to proposed or listed species should be avoided (e.g., granular formulations applied in areas with grit-eating or seed-eating bird species). Pesticides with secondary poisoning potential should also be avoided if proposed or listed species may be affected.⁵ If possible, only nontoxic carrier materials or adjuvants (drift retardants, surfactants, etc.) should be used for any application. Since the toxicity of carrier materials or adjuvants in a pesticide formulation may exceed the toxicity of the active ingredient(s) for a given species, a determination of toxicity should be made for these additives through informational sources such as container labels or MSDSs (material safety data sheets) or by contacting the manufacturer.

Unless proposed or listed animal species are to be purposely removed by a pesticide treatment, the Service recommends that any pesticide applied should be practically non-toxic for the toxicity group of proposed or listed animal species when these species can be directly or indirectly exposed to the pesticide via ingestion, skin absorption, secondary poisoning, etc. The Service also recommends that pesticides with slight to very high toxicity be applied in areas with proposed or listed species only if (1) direct or indirect exposure pathways for the species do not exist (e.g., rodenticides used in areas with listed insectivore birds) or (2) the pesticide is applied in formulations with extremely low concentrations that normally cannot impact the species (e.g., fire ant baits). Pesticides rated as slightly toxic to very highly toxic may be used when proposed or listed animal species are absent; however, these pesticides should not remain active within the soil or on surfaces of vegetation in species habitat by the time when (1) migratory proposed or listed species have returned to the habitat or (2) proposed or listed species break hibernation or aestivation (summer dormancy).

For habitat with proposed or listed plant species, the Service recommends that only post-emergent herbicides be used providing that the pesticide is nontoxic to the dicot or monocot classification of resident proposed or listed plant species (e.g., a post-emergent, broadleaf herbicide used in habitat of a listed monocot species). However, applicators or relevant agencies should determine whether such applications may indirectly impact proposed or listed plants through factors such as increased competition by non-affected plants, change in soil properties, etc. Pre-emergent herbicides or pesticides that remain active within the soil after application should generally not be applied in habitat of proposed or listed plant species by any application method. A possible exception is use of a pesticide whose residual soil activity is gone by the time when dormancy of a proposed or listed plant species has been broken.

⁵ Secondary poisoning by pesticides may occur when animals consume other animals (target or nontarget) that have been killed or injured by a pesticide. Vertebrate control agents such as aminopyridine, diphacinone, and sodium cyanide (e.g., M-44 devices) can cause secondary poisoning as well as certain insecticides (e.g., aldicarb, carbofuran, and famphur). In some cases, a "ring of death" may occur locally in an area when predators or scavenging animals die from (1) directly eating poison baits or (2) secondary poisoning after eating previously poisoned animals. Another example of secondary poisoning is bioaccumulation of a persistent pesticide (e.g., organochlorine pesticides) in tissues of nontarget animals through ingestion of pesticide-poisoned food in sublethal dosages. Due to the decline in use of persistent pesticides in the U.S., secondary poisoning is generally limited to vertebrate control agents and a relatively few insecticides that have secondary poisoning potential.

2.4.6 Application equipment

Applicators should avoid physical injury to proposed or listed species or their habitat components (nests, roosts, etc.) in using pesticide application equipment. If possible, application equipment should be selected on the basis of reducing hazards to Service trust resources from

1. Spray drift (e.g., using mechanized ground equipment rather than aircraft),
2. Surface runoff (e.g., using application equipment that can inject pesticide below ground), and
3. Pesticide formulation (e.g., using application equipment with closed system technology to prevent spills of granules, pellets, or treated seed).

Spray nozzles designed for low nozzle pressures and coarse droplet sizes should generally be used in applications near sensitive areas. To reduce spray drift in aerial applications, the width of the spray boom should not exceed 75 percent of the wingspan for fixed-wing aircraft or 90 percent of the rotary blade for helicopters.⁶ As an alternative to boom sprayers or other similar ground equipment, a spray gun operated under pressure from a pesticide spray tank may be used if the pesticide is applied in liquid streams. In areas where invasive species are in close proximity to proposed or listed species, application of pesticide should be made by handheld equipment rather than by mechanized application equipment (ground or aerial). A backpack sprayer, wicking tool, paintbrush or other types of hand-operated equipment can be used for pesticide applications such as (1) spot applications involving single plants or plant clusters, (2) basal applications on woody species, or (3) “cut-and-daub” treatments on tree stumps or peeled-back tree bark.

2.4.7 Pesticide application procedures

Pesticides should not be applied during temperature inversions or when rainfall is likely to occur within 48 hours after treatment. To avoid temperature inversions, wind speeds should be at least 3 miles per hour; however, wind speeds should not exceed 10 miles per hour during pesticide application. Wind direction and speed should be monitored during any pesticide application. Meteorological equipment such as wind socks, anemometers, or smoke devices may be used to assess wind conditions or detect temperature inversions. If a pesticide is applied during a wind greater than 10 miles per hour, pesticide users should increase buffer zones for both ground and aerial applications to prevent spray drift or residue in surface runoff from entering areas that require protection.

Best management practices for pesticide applications should be followed to protect species and habitat. Aerial flight paths made during pesticide application should be parallel to sensitive areas and buffer zones rather than flying directly over them. Pesticides should not be mixed, stored, or handled near sensitive areas. Excess pesticide and empty pesticide containers should not be allowed to remain near species habitat or waterbodies and should be discarded at authorized landfills or other appropriate sites. Application equipment should be well-maintained and checked periodically for leaks, worn parts, and calibration. Nontoxic drift retardants should be used in pesticide applications of a liquid formulation to limit pesticide spray drift into sensitive areas. Prior to application, pesticide-sensitive dye cards or other types of monitoring devices should be used to calibrate application equipment. Dye cards or other types of monitoring devices may also be placed at the outlying edge of areas requiring protection to determine the effectiveness of spray drift reduction during pesticide application.

⁶ Reference: U. S. Environmental Protection Agency. 2001. Draft pesticide registration notice: spray and dust drift label statements for pesticide products. URL http://www.epa.gov/opprmsd1/RP_Notices/prdraftspraydrift-t801.html

2.4.8 Monitoring

Federal agencies should either conduct monitoring or otherwise require monitoring in any action that the Federal agency authorizes, funds, or carries out under section 7 of the ESA with respect to pesticide applications either inside or adjacent to habitat of proposed or listed species or critical habitat. For all other applicators or relevant agencies, monitoring is recommended during pesticide application inside or adjacent to species habitat or critical habitat. In addition to weather monitoring during pesticide application, monitoring may be necessary for pesticide applications involving Pesticide Sensitive Areas or species habitat near managed areas (golf courses, municipal parks, etc.). Measures for monitoring should be described in the work plan. State agricultural departments, county extension services, and other appropriate agencies (e.g., land grant universities) may be consulted on procedures and techniques to implement pesticide monitoring.

Pre-application monitoring and/or post-application monitoring may be necessary for pesticide applications that can affect proposed or listed species or critical habitat. Pre-application monitoring may be used to determine prerequisites for pesticide application. The population dynamics and life stages of pest or invasive species may have to be monitored by sampling (frequency measurements, trapping, etc.) prior to pesticide application. This information can be used for determination of threshold levels of pest or invasive species that will require control by pesticides.

In post-application monitoring, applicators or relevant agencies may need to monitor areas with proposed or listed species or critical habitat for (1) ambient pesticide concentrations after application or (2) possible long-term trends in adverse effects for species or habitat. The monitoring portion of the work plan should address sampling locations, sample matrices (soil, sediment, tissue, etc.), numbers of samples, and the schedule for sampling. Monitoring equipment should be placed in areas where pesticides can be transported into species habitat by spray drift or surface runoff.

Water quality in habitat of aquatic listed species should be monitored continuously when this habitat is in close proximity to managed areas that require repeated applications of pesticide (golf courses, municipal parks, etc.). To determine pesticide concentrations, samples should be collected during normal flow periods and during storm events large enough to produce surface runoff. If only a single storm runoff sample can be taken, sampling should occur near the beginning of the runoff event to capture the first pulse of runoff-borne pesticides.

2.5 Service Office Contacts

For pesticide applications involving Service trust resources inside individual states of Region 2, applicators or agencies can contact Service field offices:

- | | |
|---------------|--|
| 1. Arizona | USFWS Arizona Field Office
2321 West Royal Palm Road, Suite 103
Phoenix, AZ 85021-4951
Phone: 602-242-0210
Fax: 602-242-2513 |
| 2. New Mexico | USFWS New Mexico Field Office
2105 Osuna Road, NE
Albuquerque, NM 87113
Phone: 505-346-2525
Fax: 505-346-2542 |

3. Oklahoma USFWS Oklahoma Field Office
222 South Houston, Suite A
Tulsa, OK 74127
Phone: 918-581-7458
Fax: 918-581-7467
4. Texas USFWS Arlington Field Office
711 Stadium Drive, Suite 252
Arlington, TX 76011
Phone: 817-277-1100
Fax: 817-277-7835
- USFWS Austin Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758
Phone: 512-490-0057
Fax: 512-490-0974
- USFWS Clear Lake (Houston) Field Office
17629 El Camino Real, Suite 211
Houston, TX 77058
Phone: 281-286-8282
Fax: 281-488-5882
- USFWS Corpus Christi Field Office
c/o TAMU-CC, Campus Box 338
6300 Ocean Drive
Corpus Christi, TX 78412
Phone: 361-994-9005
Fax: 361-994-8262

For pest control programs involving Service trust resources in more than one state of Region 2, applicators or agencies should contact the Service's regional office:

Southwest Regional Office	Division of Ecological Services
	P. O. Box 1306
	Albuquerque, NM 87103-1306
	Phone: 505-248-6454
	Fax: 505-248-6922

3.0 RPR PROTECTION MEASURES

3.1 Recommended Measures, Pesticide Ecotoxicity Classes, and Species Information

Table 1 of this document specifies recommended protection measures for Service trust resources of facilities, migratory birds, and proposed or listed species. The table also specifies recommended protection measures for (1) critical habitat when proposed or designated, and (2) pollinators of a proposed or listed plant species. Protection measures for certain species are not specified in Table 1 if the species is unaffected by pesticides due to

1. Relatively large body weight (e.g., Sonoran pronghorn),
2. Location (e.g., brown pelicans nesting on coastal bay islands), or
3. Seasonality (e.g., piping plovers wintering in Texas).

Protection measures are based in this document on a screening-level hazard assessment for pesticide ecotoxicity as determined in Table 2. In the table, pesticides are rated by a classification system that categorizes the level or type of protection to be given for a particular pesticide with respect to ecotoxicity. Four ecotox classes for animals and three ecotox classes for plants are used in the classification system to rank active ingredients or formulations of pesticides. For animal species, the four ecotox classes cover ranges of pesticide toxicity:

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| Class 0 | This class includes pesticides that are practically nontoxic to a specific group of animal species that have similar toxicological responses (e.g., fungicidal toxicity for large mammal species). Class 0 pesticides ordinarily do not require protection measures for animal species. |
| Class 1 | This class includes pesticides that are slightly to moderately toxic to a specific group of animal species that have similar toxicological responses (e.g., malathion toxicity for small mammal species). Buffer zones and other protection measures for Class 1 pesticides are minimal for animal species. |
| Class 2 | This class includes pesticides that are highly toxic to a specific group of animal species that have similar toxicological responses (e.g., diazinon toxicity for warm water fish species). Buffer zones and other protection measures for Class 2 pesticides are relatively substantial for animal species. |
| Class 3 | This class includes pesticides that are very highly toxic to a specific group of animal species that have similar toxicological responses (e.g., carbofuran toxicity for small avian species). Buffer zones and other protection measures for Class 3 pesticides can be highly stringent for animal species depending on the sensitivity of a species or its habitat. |

Toxicity endpoints for the four pesticide ecotoxicity classes for animals are defined at the back of this document (see Appendix A). Although plant species do not have ranges of pesticide toxicity similar to animal species, pesticides can be rated by ecotox class according to their herbicidal toxicity. Pesticide ecotox classes for plants in Table 2 are:

- Class D This class includes pesticides that have specific toxicity for dicot plants such as legumes, mustards, sunflowers, etc. Class D herbicides include broadleaf herbicides that can affect gymnosperm plants (pines, spruces, firs, etc.) in addition to angiosperm dicot plants. Buffer zones and other protection measures for Class D herbicides depend on the dicot classification of a particular proposed or listed plant species and the canopy structure of its habitat.
- Class M This class includes pesticides that have specific toxicity for monocot plants such as grasses, sedges, orchids, etc. Buffer zones and other protection measures for Class M herbicides depend on the monocot classification of a particular proposed or listed plant species and the canopy structure of its habitat.
- Class NS This class includes pesticides that have nonspecific toxicity for any plant species. Buffer zones and other protection measures for Class NS herbicides do not depend on the dicot or monocot classification of individual proposed or listed plant species but can depend on the canopy structure of their habitat.

The seven ecotox class ratings for animals and plants are used in Table 2 to rate each pesticide active ingredient or formulation by ecotox class according to its overall toxic effect on individual groups of species (e.g., the Large Avian toxicity group is used to reflect general responses of species such as the brown pelican and whooping crane). These species toxicity groups reflect general responses of species with respect to individual pesticide active ingredients or formulations. Species toxicity groups listed in Table 2 are:

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|------------------------------|---|
| 1. Large Mammal (L-MA) | 10. Aquatic Amphibian (A-AM) |
| 2. Predatory Mammal (P-MA) | 11. Terrestrial Amphibian (T-AM) |
| 3. Small Mammal (S-MA) | 12. Cold Water Fish (CW-F) |
| 4. Gallinaceous Avian (G-AV) | 13. Warm Water Fish (WW-F) |
| 5. Large Avian (L-AV) | 14. Aquatic Arthropod (A-AR) |
| 6. Predatory Avian (P-AV) | 15. Bee (BEE) |
| 7. Small Avian (S-AV) | 16. Terrestrial Arthropod (T-AR) ⁷ |
| 8. Waterfowl Avian (W-AV) | 17. Fresh Water Mollusk (FW-M) |
| 9. Reptile (REP) | 18. Plant (PLANT) |

When pesticide toxicity data are lacking for a particular species toxicity group, the rating is modeled after the closest taxonomic group:

1. Large Mammal and Predatory Mammal from Small Mammal;
2. Large Avian from Waterfowl Avian;
3. Predatory Avian, Small Avian, and Reptile from Gallinaceous Avian; and
4. Fresh Water Mollusk from Aquatic Arthropod.

The toxicity groups of Aquatic Amphibian and Terrestrial Amphibian (e.g., toads) are modeled from the highest rating of either Cold Water Fish or Warm Water Fish when amphibian toxicity data are unavailable. Pesticides are rated as Class 3 in the Terrestrial Arthropod toxicity group if a particular

⁷ The Terrestrial Arthropod toxicity group includes pollinator species.

active ingredient is used as an insecticide; otherwise, the Terrestrial Arthropod toxicity group is modeled from the higher rating of either the Aquatic Arthropod or Bee toxicity groups. Blank cells in the table indicate insufficient information to (1) make a determination of a pesticide's ecotoxicity rating or (2) justify modeling from an appropriate species toxicity group.

Pesticide active ingredients listed in Table 2 may have more than one line entry for individual formulations if these formulations have different ecotox class ratings for individual species toxicity groups (e.g., aquatic formulations of glyphosate vs. nonaquatic formulations). Ecotox class ratings in Table 2 for individual pesticides may have letter subscripts to describe various types of pesticide application or toxicity. For example, burrow fumigants are indicated by the subscript "b" whereas pesticides that have a potential for secondary poisoning are indicated by the subscript "sp" (e.g., rodenticide bait rated as Class 2_{sp} that can kill a predatory animal after the predator has consumed bait-poisoned rodents). Pesticides rated for eye or skin irritancy are respectively designated in the table by "e" and "s" subscripts. An herbicide rated as Class NS_f indicates that individual formulations of the herbicide may have either dicot-specific or monocot-specific toxicity as determined by the application rate (e.g., triazine herbicides).

In general, the ecotox ratings in the table reflect the highest level of protection necessary according to potential pesticide hazards (acute oral toxicity, subacute dietary toxicity, eye irritancy, etc.).⁸ The final ecotox class rating for an active ingredient or formulation may reflect pesticide hazards for species such as eye or skin irritancy rather than acute lethal toxicity (e.g., an herbicide that is practically non-toxic for terrestrial animal species on the basis of oral toxicity but is rated as Class 2_e for corrosive eye irritancy). Toxicity groups of mammals, birds, reptiles, and terrestrial amphibians can be rated for eye irritancy from pesticide active ingredients, but only mammalian toxicity groups (L-MA, P-MA, and S-MA) are rated for skin irritancy. Pesticide ratings in the table may also be adjusted for factors such as sublethal effects (e.g., a pyrethroid pesticide rated for endocrine system disruption rather than for actual toxicity in field applications) or lethal byproducts (e.g., moderately toxic acephate transformed into highly toxic methamidphos).

Table 3 lists habitat and/or range, seasonality, and pesticide uses involving proposed or listed species of Region 2. When feasible, the specific range for certain proposed or listed species in Table 3 is given according to individual counties; otherwise, occurrence of species in Region 2 is identified by habitat. The various types of habitat and/or range can be used to set up areas requiring buffer zones or other protection measures. In some cases, habitat may be described according to landscape features that require protection from pesticide application (e.g., entrances to caves, sinkholes, or crevices for cave-dwelling arthropods). The seasonality of species may be used in developing protection measures for biological opinions or biological assessments. Pesticide uses are used to determine which types of pesticides may affect individual species, species habitat, or food sources. Nine pesticide uses are defined in Table 3:

⁸ Animal irritancy tests ordinarily rely on the rabbit or similar mammalian species to serve as a surrogate test species and model. The Draize test for eye irritancy uses albino rabbits to determine whether exposure to a particular contaminant such as a pesticide can cause eye irritation or loss of eye function in humans. However, the rabbit eye has a protective nictitating membrane (third eyelid) which is commonly found in mammals, avians, reptiles, and anuran amphibians (i.e., frogs and toads). Since Draize testing with rabbits can indicate eye irritancy for species that have nictitating membranes as well as species that lack the membrane (e.g., humans), the tests may be used to indicate eye irritancy for terrestrial vertebrates in general despite potential differences in eye structure and other factors (lachrymal systems, blinking response, etc.).

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|-------------------------|--|
| 1. Cropland (C) | 6. Rangeland/Pasture (R/P) |
| 2. Forest (F) | 7. Right-of-Way (ROW) |
| 3. Mosquito Control (M) | 8. Specialty (rodenticides, piscicides, etc.) (S) ⁹ |
| 4. Pasture (P) | 9. Urban (U) |
| 5. Rangeland (R) | |

3.2 Buffer Zones

A buffer zone is considered to be the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath.¹⁰ Pesticide buffer zones are recommended in the RPR principally for protection of species and habitat from (1) downwind spray drift during pesticide application and (2) pesticide residues in surface runoff. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone for any type of application if the border area itself does not involve species habitat or a sensitive area. In addition to providing protection against spray drift or residues in surface runoff, buffer zones can also reflect minimal distances necessary to address various attributes of species with respect to

1. Mobility (e.g., foraging areas of Attwater's greater prairie-chicken),
2. Sensitivity to disturbance (e.g., nesting birds-of-prey),
3. Exposure to secondary poisoning (e.g., carrion-eating mammals), and
4. Dietary habits (e.g., seed-eating or grit-eating birds).

The size of the buffer zone is relative to the type of application (i.e., spot, mechanized ground, or aerial) and depositional pattern of the formulation (liquid, granular, etc.) used during pesticide treatment. For purposes of defining pesticide formulations with respect to depositional patterns, solid-type formulations are defined in this document as including baits, granules, pellets, and treated seed formulations but do not include dust formulations. Liquid formulations of pesticides are defined as including all formulations of emulsifiable concentrates, flowables, invert emulsions, micro-encapsulated sprays, soluble powders, water-soluble packets, wettable powders, or any other type of liquid-based formulation except for ULV formulations. ULV (ultra low volume) formulations are liquid concentrates that are applied at a rate of 1/2 gallon or less per acre. Applications of ULV formulations are highly prone to spray drift due to very small droplet sizes (i.e., generally less than 141 µm diam.). Dust formulations also can have very small particle sizes (as little as 5 µm diam.) and are considered to have drift characteristics similar to ULV formulations.

⁹ These pesticides are specifically formulated for a narrow range of species when applied inside their habitat (e.g., a rodenticide used for control of rodents). However, formulations of specialty pesticides can impact nontarget species through direct toxicity or by secondary poisoning and other indirect effects (e.g., removal of vegetative cover of a listed fish species by an aquatic herbicide).

¹⁰ A swath is the width of treated area covered by mechanized ground equipment or aircraft during a single trip across the area receiving pesticide treatment. The swath includes the pesticide volume (liquid, granules, etc.) applied directly to the targeted area by spray nozzles or spreaders but does not include pesticide applied indirectly as spray drift. Since large, solid formulations (granules, pellets, or treated seed) have practically no drift, an application swath involving these formulations is the width of the treated area wherever the pesticide is deposited upon the ground during the single trip across the treatment area. Since crosswinds may cause swaths to become offset during application, applications made during a crosswind near an area to be protected should not allow any part of the swath from entering a specified buffer zone.

3.2.1 Buffer zone approximations

Various buffer zone sizes and ecotox class ratings are used in the RPR to attain adequate reduction of residues in spray drift and/or surface runoff with respect to pesticide toxicity. In some cases, alternative applications or formulations may be provided in the RPR to reduce a particular buffer zone (e.g., a relatively small buffer zone used in conjunction with a belowground application of a solid formulation to protect seed-eating bird species). Due to low probability of toxicity and exposure, bait formulations specific for insects (particularly fire ant baits) are generally not given buffer zones except for species habitat where proposed or listed species may be affected (e.g., invertebrate species).

For animal species, minimal buffer zones for Class 1 pesticides are based on estimates of the distance required for attaining (1) approximately 98-99 percent reduction of deposited active ingredient or (2) minimal effects during ground or aerial application.¹¹ Minimal buffer zones recommended in this document for application of Class 1 pesticides by mechanized ground equipment or aircraft are

1. Thirty feet for mechanized ground applications of liquid formulations,
2. Eighty feet for mechanized ground applications of ULV (ultra low volume) formulations,
3. One hundred fifty feet for low (< 10 feet) aerial applications of liquid formulations,
4. Five hundred feet for low (< 10 feet) aerial applications of ULV or dust formulations,
5. One-eighth mile for high (> 10 feet) aerial applications of liquid formulations, and
6. One-fourth mile for high (> 10 feet) aerial applications of ULV or dust formulations.¹²

For proposed or listed species, an additional safety factor is provided for Class 2 and Class 3 pesticides by respectively doubling and tripling buffer zones required of Class 1 pesticides. Class 2 and Class 3 pesticides may have the same buffer zone when the habitat of a proposed or listed species is less vulnerable to pesticide applications (e.g., aquatic species in large rivers). Otherwise, buffer zones for Class 3 pesticides are three times the minimal buffer zones of Class 1 pesticides when the Class 3 pesticides are applied in proximity to (1) edge habitat of sensitive species (e.g., bird species nesting along the edge of cropland) or (2) species habitat with a limited range (e.g., fish species restricted to a small spring system). Except for small aquatic habitat and other types of relatively vulnerable habitat, species serving as food sources for proposed or listed species are not given additional safety factors and have the same buffer zones designated for Class 1 pesticides when necessary.

¹¹ Generic buffer zones are typically derived from spray drift graphs and are used for planning and informational purposes; however, actual deposition of pesticide spray drift can vary by several orders of magnitude according to the application technique and environmental scenario. Specific estimates for spray drift and residues in runoff should be determined by computer models such as AgDRIFT or AGDISP (H. Thistle. 2004. USDA Forest Service – pers. comm.).

¹² References: (a) Spray Drift Task Force. 1997. A summary of ground application studies. Stewart Agric. Services, Macon, MO.; (b) Mulrooney, J., L. Smith, and B. Jones. 1999. Comparison of air-assist and mist-blower high boys. Unpublished study. Feb. 1999. USDA Agric. Res. Serv., Stoneville, MS; (c) Spray Drift Task Force. 1997. A summary of aerial application studies. Stewart Agric. Services, Macon, MO.; (d) Mierjewski, K., W.G. Yendol, W. McLane, M. Legendre, B. Tanner, T. Roland, and K. Ducharme. 1993. Study of off-site deposition of malathion using operational procedures for the southeastern cotton boll weevil eradication program. Unpublished study. Dec. 1993. Pennsylvania State Univ., Univ. Park. Grant No. 12-34-81-0202-GR; (e) Beyers, D.W., M.S. Farmer, and P.J. Kikoski. 1995. Effects of rangeland aerial application of Sevin-4-Oil® on fish and aquatic invertebrate drift in the Little Missouri River, North Dakota. Arch. Environ. Contam. Toxicol. 28:27-34; and (f) H. Thistle. 2004. USDA Forest Service – pers. comm.

Buffer zones for proposed or listed plant species are relative to the type of plant canopy associated with the habitat. Minimal buffer zones (i.e., buffer zones used for Class 1 pesticides) are used for proposed or listed plant species in plant communities with closed or dense canopies (e.g., forest or thick woodland). Proposed or listed plant species in plant communities with open to semi-open canopies (e.g., grassland or brushland) that are susceptible to spray drift are given minimal buffer zones plus an additional safety factor (i.e., buffer zones used for Class 2 pesticides). Buffer zones for plant pollinators (bees and/or terrestrial arthropods) are based on a pollinator's ability (as determined by size) to range from the area of a listed plant species. A buffer zone of 1/2 mile at the edge of sites occupied by listed plant species is recommended for small pollinators such as halictid (metallic) bees whereas a 2-mile buffer zone is recommended for relatively large pollinators such as bumble bees or hawkmoths.¹³ Alternative buffer zones for pollinators are recommended according to seasonality of flowering of listed plant species.¹⁴

For aquatic habitats with proposed or listed species, buffer zones are based on the potential for adverse pesticide concentrations relative to water volume. Small water bodies are considered to include

1. Ponds, lakes, and reservoirs less than 100 surface acres;
2. Spring runs, streams, and rivers less than 100 cfs (cubic feet per second, mean monthly discharge); or
3. Shallows of relatively large waterbodies.

Large waterbodies include either

1. Lakes or reservoirs of 100 to 1000 surface acres; or
2. Spring runs, streams, and rivers of 100 to 1000 cfs (mean monthly discharge).

Because of a relatively low potential for lethal or sublethal pesticide concentrations, buffer zones for larger waterbodies (i.e., coastal bays, large lakes, or reservoirs greater than 1000 surface acres; rivers greater than 1000 cfs) are not given in the RPR.

Calculated distances for buffer zones are given in Appendix B of this document. Due to lack of spray drift and relatively low environmental concentrations, buffer zones for spot applications are generally derived in 10-foot increments. Buffer zones between 100 feet and 500 feet for mechanized ground and aerial applications are rounded to the nearest 50 feet. Beyond 500 feet, buffer zones are rounded to the nearest 1/8 mile, 1/4 mile, or 1/2 mile, where appropriate. The buffer zones are relative to the height of nozzles or spreaders during pesticide application. Buffer zones for mechanized ground applications are based on a nozzle or spreader height of no more than four feet above the plant canopy or ground surface. The buffer zones for aerial applications are specified according to low or high applications. Low aerial applications are 10 feet or less above the plant canopy or bare ground surface and are used

¹³ Although a 3-mile buffer zone is generally recommended for large pollinators, a 2-mile buffer will protect nearly 90% of long-ranging pollinators (S. Buchmann. 2000. pollinator consultant – pers. comm.).

¹⁴ Since pollinators may be active during periods other than flowering periods of listed plant species, buffer zones for these plant species should ordinarily be implemented throughout the year unless specific information on pollinators is known (Tepedino, V.J. 1996. The reproductive biology of rare rangeland plants and their vulnerability to insecticides. p. III.5-10. *In* G.L. Cunningham and M.W. Sampson (coord.) Grasshopper integrated pest management user handbook. USDA-APHIS. Tech. Bull.1809. Washington, DC. Available at <http://www.sidney.ars.usda.gov/grasshopper/Handbook/index.htm>).

mostly in cropland. High aerial applications are more than 10 feet above the plant canopy or bare ground surface and are generally used for rangeland or forest.

In addition to the buffer distances necessary for attaining adequate deposition of pesticide spray and reduction of pesticide toxicity, buffer zones in this document may include setbacks (untreated areas) to allow for species use of edge habitat or habitat susceptibility (e.g., small waterbodies). A setback distance of 30 or 60 feet may be used for terrestrial species when these species can travel relatively short distances from species habitat into areas of pesticide treatment. To protect aquatic species or aquatic habitat, setback distances of 50 and 300 feet are used, respectively, for relatively large waterbodies and small waterbodies to allow adequate filtration by vegetative filter strips or other types of filtering. Other examples of setbacks include red-cockaded woodpecker clusters and protected activity centers of the Mexican spotted owl. Such areas should generally remain untreated to preserve habitat characteristics essential for survival of local populations or individuals of proposed or listed species.

3.2.2 Uses and limitations of buffer zones

Three broadly-defined geographic zones are considered in the RPR with respect to pesticide applications and protection measures such as pesticide buffer zones. The first geographic zone is the area involving the habitat of a species or a facility (refuge, fish hatchery, preserve, etc.). Potential protection measures for applications inside species habitat or a facility include pesticide buffer zones, species surveys, and pesticide use restrictions. The second geographic zone is the area that interfaces between (1) species habitat or a facility and (2) nonhabitat areas such as cropland. Pesticide buffer zones are the principal protection measures defined for this geographic zone, and the size of the geographic zone itself is relative to individual buffer zones. The third geographic zone comprises areas outside the effective range of buffer zones. Pesticide applications in the outlying zone can still impact species habitat or a facility by movement of pesticide residues into surface runoff or other transport mechanisms (e.g., groundwater flow). Protection measures such as pesticide use restrictions may be necessary in this zone to prevent residues from adversely affecting species or the facility.

Buffer zones provided in the RPR can generally prevent or reduce the likelihood of killing or injuring species associated with Service trust resources. In particular, a buffer zone provides greater protection against “take” for proposed or listed animal species including take from

1. Sublethal effects (abnormal behavioral changes, endocrine system disruption, etc.),
2. Indirect effects (e.g., loss of prey species), or
3. Bioaccumulation of pesticide antimetabolites through food chains or the water environment.

Buildup of pesticide residues in edge habitat of terrestrial species from repeated field applications can also be reduced by using prescribed buffer zones thereby decreasing the potential for chronic toxicity (i.e., exposure to a toxicant for relatively long periods of time during the life cycle or stage of a species). Chronic toxicities for proposed or listed species in aquatic habitat may be reduced by using buffer zones; however, chronic conditions of toxicity in these habitats are potentially influenced by mass transport of pesticide residues (e.g., sediment-borne residues) from portions of the watershed that lie beyond the habitat itself.

In some situations, buffer zones alone are not always adequate to address complexities involved with pesticide applications (see section **3.3 Pesticide Sensitive Areas for Listed Species** below). Also, buffer zones may not always reflect necessary levels of protection for a given pesticide due to

approximations that are made in deriving buffer zone sizes. Relatively limited numbers of surrogate test species and pesticide formulations (ordinarily a technical formulation with at least 90 percent active ingredient) are ordinarily used to determine ecotox ratings.¹⁵ Therefore, the ratings found in Table 2 may only represent a general case in regard to the toxicity of pesticide active ingredients and their various formulations. Another limitation is that ecotox ratings do not account for the environmental fate of individual pesticides that can reduce exposure for species (e.g., high volatilization). Buffer zone sizes may, therefore, be underestimated or overestimated in terms of pesticide toxicity and exposure for certain species; however, safety factors associated with buffer zones as given by the RPR should help to protect against underestimation of an appropriate buffer zone size.

3.3 Pesticide Sensitive Areas for Listed Species

Pesticide Sensitive Areas have been designated in the RPR to simplify or adequately address complex situations associated with pesticide applications that potentially affect proposed or listed species and critical habitat. Pesticide Sensitive Areas designated in the RPR are shown in the following list.

List of Counties and T&E Species with Pesticide Sensitive Areas		
State	County	Species
Arizona	Pima County	Masked bobwhite
Oklahoma	Alfalfa County	Whooping crane
Texas	Aransas County	Whooping crane
	Austin County	Attwater's greater prairie chicken
	Bexar County	Braken Bat Cave Meshweaver, Cokendolpher Cave Harvestman, Government Canyon Bat Cave Meshweaver, Government Canyon Bat Cave Spider, Helotes mold beetle, Madla's Cave Meshweaver, <i>Rhadine exilis</i> , <i>Rhadine infernalis</i> , Robber Baron Cave Meshweaver
	Calhoun County	Whooping crane
	Clay County	Whooping crane
	Colorado County	Attwater's greater prairie chicken
	Comal County	Comal Springs riffle beetle and fountain darter
	Hays County	Barton Springs salamander, Comal Springs riffle beetle, fountain darter, San Marcos gambusia, San Marcos salamander, and Texas wild-rice
	Jeff Davis County	Comanche Springs pupfish, Pecos gambusia, and Pecos sunflower
	Pecos County	Leon Springs pupfish, Pecos gambusia, and Pecos sunflower

¹⁵ Pesticide toxicity testing is generally conducted for only a small number of animal species that are representative of small mammals, gallinaceous birds, waterfowl, cold water fish, warm water fish, aquatic arthropods, and bees.

	Reeves County	Comanche Springs pupfish, Pecos gambusia, and Pecos sunflower
	Refugio County	Whooping crane
	Travis County	Barton Springs salamander, Bee Creek Cave harvestman, Bone Cave harvestman, Kretschmarr Cave mold beetle, Tooth Cave ground beetle, Tooth Cave pseudoscorpion, and Tooth Cave spider
	Williamson County	Bone Cave harvestman, Coffin Cave mold beetle, and Tooth Cave ground beetle

Pesticide Sensitive Areas are used in the RPR to address different requirements for buffer zones and other protection measures caused by

1. Proposed or listed species entering areas involving pesticide applications (e.g., Attwater's greater prairie-chicken entering cropland adjacent to its habitat), or
2. Co-location of more than one species and/or areas of critical habitat (e.g., co-location of five listed aquatic species with four areas of overlapping critical habitat in the San Marcos River of central Texas).

Pesticide Sensitive Areas are also used to define watersheds where pesticide monitoring and restrictions on pesticide use should possibly be implemented. In some Pesticide Sensitive Areas, an integrated pest management (IPM) plan may be used to protect listed species. IPM strategies include

1. Cultural controls (e.g., crop rotation),
2. Biological controls (e.g., insect predators),
3. Mechanical controls (e.g., pest barriers),
4. Chemical controls (e.g., pesticides), and
5. Selection for host resistance.

State agricultural departments, county extension services, and other appropriate agencies such as the EPA should be consulted to coordinate or implement any necessary use restrictions and/or pesticide monitoring inside a Pesticide Sensitive Area.

4.0 RPR PROCEDURE

4.1 Use of the RPR

This document provides recommendations for pesticide applications in Region 2 that involve Service trust resources of (1) national wildlife refuges and fish hatcheries, (2) migratory birds, and (3) Federally-listed species. The RPR specifically provides pesticide protection measures that can be used to protect listed species, species proposed for listing, and critical habitat in Region 2. Pesticide protection measures listed in the RPR may be used in ESA section 7 consultations or section 10 permit processes. However, the RPR itself cannot be used in lieu of section 7 consultations or section 10 permits as required under the ESA. In addition to ESA pesticide consultations, the RPR may be used in conjunction with development of protection measures for various pesticide programs such as the Service's Pesticide Use Program (PUP) for refuges or hatcheries. Recommendations in the RPR do not constitute rules, regulations, requirements, or project evaluation criteria of the Service. The recommendations also do not create or establish any legal obligations, binding effects, minimum standards, or criteria to be adopted by the private sector or by government agencies at the Federal, state, or local level.

Service trust resources are protected from pesticide applications under various statutory authorities and regulations (ESA, FIFRA, etc.). Pesticide use restrictions as stated on FIFRA pesticide labels (i.e., labels for section 3 registrations, section 18 emergency exemptions, or section 24(c) state-specific registrations) must be implemented by all pesticide applicators. However, protection measures in the RPR may be used in ESA consultations if the RPR protection measures are more protective than pesticide use restrictions prescribed by FIFRA-related pesticide labels. Protection measures for proposed or listed species as provided below may be used by Service personnel as baseline information in preparing a Biological Opinion (BO) or Habitat Conservation Plan (HCP). The protection measures can be used as appropriate for developing BO components such as reasonable and prudent alternatives (RPAs), reasonable and prudent measures (RPMs), and conservation measures. However, potential take of listed animal species or injury to listed plants should not be inferred when recommended protection measures in the RPR are not used. Actual determination of take or listed plant injury can only be made by the Service after pesticide application has occurred.

Protection measures recommended in the RPR are based on a screening-level hazard assessment for various pesticide ecotoxicities as determined in Table 2; therefore, protection measures in the RPR may be further modified with additional information on a case by case basis. As part of a Federal agency action or HCP permit process under the ESA, agencies or applicators can submit alternative protection measures (including ecotox class ratings) for specific pesticides to the nearest Service field office. These alternative protection measures should be based on ecological risk assessments, field trials, or peer-reviewed publications. County extension services, state agricultural departments, and other agencies may be consulted for alternative protection measures.

Pesticide applications involving Service trust resources should be based on the assumption that risk to these resources from pesticides can never be completely evaluated or necessarily eliminated. In particular, the use of surrogate animal species for estimating pesticide toxicities may not always accurately predict all potential outcomes with respect to exposure of a listed species to specific pesticides. Variability in pesticide operations (methods, equipment, etc.) also contributes to risk factors involved with pesticide applications. Although protection measures in the RPR should provide adequate protection under most circumstances, prudent care should be taken in using this document for individual pesticide applications. During any pesticide application, it is the responsibility of the applicator or action agency to ensure that ESA provisions are not violated such as unauthorized take of listed animal species, killing or damaging endangered plant species on Federal lands, etc.

4.2 Determination of Protection Measures

To develop pesticide protection measures from the RPR, the following process should be applied:

1. Find appropriate protection measures and species toxicity groups in **Table 1. Specific Protection Measures for Service Facilities, Migratory Birds, and Proposed or Listed Species** found below in section 4.2.2.
2. Cross-reference individual protection measure numbers from Table 1 to corresponding protection measures found in **List of Recommended Protection Measures for Service Trust Resources in Region 2** in section 4.3.
3. Determine relevant parts from each protection measure that pertain to the proposed pesticide application or action. When required by a particular protection measure, determine:
 - a. Ecotox class ratings for pesticides from **Table 2. Ecotoxicity Ratings for Pesticide Active Ingredients and Various Formulations** in section 4.4.1.
 - b. Biological factors (habitat/range, seasonality, plant classification, plant flowering periods, and pollinators) for proposed or listed species from **Table 3. Biological Information for Proposed or Listed Species in Region 2** in section 4.4.2.

After determining general protection measures from the RPR process as shown above, individual protection measures may be developed for specific pesticide applications in a given area. Alternative buffer zones suggested by individual protection measures may be used as appropriate according to the type of application or formulation being used. Supplementary sources of information (e.g., habitat maps, soil surveys, and evaluations such as risk assessments) should be used to further refine final protection measures for pesticide applications.

Protection measures for pesticide applications involving Service facilities should be used on a default basis if protection measures derived for proposed or listed species are less stringent. When two or more sets of protection measures are applicable for a particular pesticide formulation or application, the more restrictive protection measures are recommended. This may occur when (1) more than one listed species is involved in a given area (e.g., listed birds-of-prey nesting in an area that has a listed plant species) or (2) a pesticide has more than one active ingredient with different toxicities for individual toxicity groups (e.g., an herbicide that has 2, 4-D combined with bromacil).

4.2.1 Approximation of ecotox class ratings

For determination of buffer zones or other levels of protection, pesticides that have the same ecotox class ratings are given the same level of protection regardless of the subscript descriptor (e.g., Class 2_b, Class 2_e, or Class 2_{sp} pesticides should all be treated as Class 2 pesticides with respect to buffer zones). Active ingredients or formulations in Table 2 that have a Class 0 rating for a given toxicity group do not ordinarily require protection measures for that particular toxicity group unless otherwise indicated by the pesticide label or other informational sources. Since blank cells in Table 2 generally reflect cases where pesticide toxicity testing has not been performed (e.g., household pesticides untested for outdoor uses), additional information should be obtained on active ingredients or formulations of pesticides that have blank cells with respect to individual species prior to use of these particular pesticides in proximity to Service trust resources. Determination of toxicity for active ingredients or formulations can generally be made by (1) consulting pesticide informational sources (e.g., pesticide

container labels) or (2) contacting the pesticide manufacturer to obtain a material safety data sheet (MSDS).

In addition to the ecotox ratings given in Table 2 for individual active ingredients, the toxicity ratings scales in Appendix A may be used to classify pesticide formulations that have (1) more than one active ingredient and/or (2) potentially toxic adjuvants or carriers. The following process should be used in approximating ecotox class ratings from Appendix A:

1. When toxicity data for a pesticide are available from the manufacturer or other sources for toxicity groups tested under FIFRA regulations (i.e., Small Mammal, Gallinaceous Avian, Waterfowl Avian, Cold Water Fish, Warm Water Fish, and Aquatic Arthropod), the pesticide should be rated by ecotox class according to the ratings scale in Appendix A for individual species toxicity groups that potentially will be affected during application of the pesticide.
2. For toxicity groups other than those tested under FIFRA, the following taxonomic groups may be modeled accordingly:
 - a. Large Mammal and Predatory Mammal from the ecotox ratings for Small Mammal.
 - b. Large Avian from the ecotox ratings for Waterfowl Avian.
 - c. Predatory Avian, Small Avian, and Reptile from the ecotox ratings for Gallinaceous Avian.
 - d. Aquatic Amphibian or Terrestrial Amphibian from the highest rating of either Cold Water Fish or Warm Water Fish.
 - e. For the Terrestrial Arthropod toxicity group, pesticides should be rated as Class 3 if a particular active ingredient is used as an insecticide; otherwise, the Terrestrial Arthropod toxicity group should be modeled from the higher rating of either the Aquatic Arthropod or Bee toxicity groups.
 - f. Bee toxicity group from the ecotox ratings for Aquatic Arthropod.
 - g. Fresh Water Mollusk from the ecotox ratings for Aquatic Arthropod.

Pesticides with multiple active ingredients and/or toxic agents (adjuvants, carrier materials, etc.) should be assigned an overall class rating to match the highest level of toxicity indicated by ratings in Appendix A, Table 2, or other sources. For example, a nontoxic active ingredient combined in a formulation together with a highly toxic active ingredient should have an ecotox rating of Class 2.

4.2.2 Specific protection measures

Recommended protection measures for pesticide applications involving Service trust resources in Region 2 are specified by number in Table 1 below. Individual protection measures for Service facilities, migratory birds, and proposed or listed species can then be referenced according to their corresponding number from the list of protection measures that follows the table.

Table 1. Specific Protection Measures Recommended for Service Facilities, Migratory Birds, and Proposed or Listed Species		
Service facilities		
facility		protection measures
Refuge or hatchery		1
Migratory birds		
toxicity group	birds	protection measures
Large Avian or Small Avian	Wading birds (egrets, herons, ibises, spoonbills, etc.)	2
Predatory Avian	Burrowing owls	3
Predatory Avian	Falcons, kites, ospreys, owls (other than burrowing owls), and small hawks (Cooper's hawk, sharp-shinned hawk, Swainson's hawk, etc.)	4
Predatory Avian	Golden eagles	5
Predatory Avian or Small Avian	Large hawks (red-tailed hawk, red-shouldered hawk, etc.) and other birds that eat carrion such as caracaras, ravens, vultures, etc.	6
Small Avian	Shorebirds (avocets, plovers, sandpipers, terns, etc.)	7
Small Avian	Small migratory birds that may eat granular, pellet, or treated seed formulations (seed-eating or grit-eating species such as doves, finches, meadow larks, sparrows, etc.) ¹⁶	8
Small Avian	Small migratory birds that will not eat granular, pellet, or treated seed formulations (insect-eating species such as flycatchers, swallows, warblers, woodpeckers, wrens, etc.)	9
Waterfowl	Geese	10
Waterfowl	Waterfowl (ducks, grebes, loons, mergansers, etc.) other than geese	11

¹⁶ Seed-eating gallinaceous birds are not listed under the Migratory Bird Treaty Act (see 50 CFR § 10.13).

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Large Mammal	Sonoran pronghorn	<i>Antilocapra americana sonoriensis</i>	E	none
Large Mammal	West Indian manatee	<i>Trichechus manatus</i>	E	none
Predatory Mammal	black-footed ferret	<i>Mustela nigripes</i>	E, EXPN	13, 17, 41
Predatory Mammal	gray wolf	<i>Canis lupus</i>	DR, E, EXPN	13, 17, 42
Predatory Mammal	Gulf Coast jaguarundi	<i>Herpailurus (= Felis) yagouaroundi cacomitli</i>	E	1, 13, 18
Predatory Mammal	jaguar	<i>Panthera onca</i>	E	13, 18
Predatory Mammal	Louisiana black bear	<i>Ursus americanus luteolus</i>	T w/ CH	12, 13, 43
Predatory Mammal	ocelot	<i>Leopardus (= Felis) pardalis</i>	E	1, 13, 18
Small Mammal	gray bat	<i>Myotis grisescens</i>	E	1, 13, 19
Small Mammal	Hualapai Mexican vole	<i>Microtus mexicanus hualpaiensis</i>	E	13, 14, 21
Small Mammal	Indiana bat	<i>Myotis sodalis</i>	E w/ CH	12, 13, 19
Small Mammal	lesser (Sanborn's) long-nosed bat	<i>Leptonycteris curasoae yerbabuenae</i>	E	1, 13, 20
Small Mammal	Mexican long-nosed bat	<i>Leptonycteris navalis</i>	E	13, 20
Small Mammal	Mount Graham red squirrel	<i>Tamiasciurus hudsonicus grahamensis</i>	E w/ CH	12, 13, 14, 21
Small Mammal	Ozark big-eared bat	<i>Corynorhinus (= Plecotus) townsendii ingens</i>	E	1, 13, 19

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Gallinaceous Avian	Attwater's greater prairie-chicken	<i>Tympanuchus cupido attwateri</i>	E	1, 13, 14, 44
Gallinaceous Avian	masked bobwhite	<i>Colinus virginianus ridgewayi</i>	E	1, 13, 14, 48
Large Avian	brown pelican	<i>Pelicanus occidentalis</i>	T	none
Large Avian	whooping crane	<i>Grus americana</i>	E w/ CH, EXPN	1, 12, 13, 52
Predatory Avian	bald eagle	<i>Haliaeetus leucocephalus</i>	AD, T	1, 13, 45
Predatory Avian	California condor	<i>Gymnogyps californianus</i>	EXPN	13, 17, 46
Predatory Avian	Mexican spotted owl	<i>Strix occidentalis lucida</i>	T w/ CH	12, 13, 49
Predatory Avian	Northern aplomado falcon	<i>Falco femoralis septentrionalis</i>	E	1, 13, 50
Small Avian	black-capped vireo	<i>Vireo atricapilla</i>	E	1, 13, 14, 23
Small Avian	Eskimo curlew	<i>Numenius borealis</i>	E	none
Small Avian	golden-cheeked warbler	<i>Dendroica chrysoparia</i>	E	1, 13, 14, 23
Small Avian	least tern, interior population	<i>Sterna antillarum</i>	E	1, 13, 14, 47
Small Avian	pipit plover	<i>Charadrius melodus</i>	T w/ CH	1, 12, 13, 14
Small Avian	red-cockaded woodpecker	<i>Picoides borealis</i>	E	13, 51
Small Avian	southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	E w/ CH	1, 12, 13, 14, 23
Small Avian	Yuma clapper rail	<i>Rallus longirostris yumanensis</i>	E	1, 13, 27

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Reptile	American alligator ¹⁷	<i>Alligator mississippiensis</i>	E(S/A)	none
Reptile	Concho water snake	<i>Nerodia paucimaculata</i>	T w/ CH	12, 13,14, 27
Reptile	desert tortoise ¹⁸	<i>Gopherus agassizii</i>	T w/ CH, T(S/A)	1, 12, 13, 14, 53
Reptile	green sea turtle	<i>Chelonia mydas</i>	T	none
Reptile	hawksbill sea turtle	<i>Eretmochelys imbricata</i>	E	none
Reptile	Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	E	none
Reptile	leatherback sea turtle	<i>Dermochelys coriacea</i>	E	none
Reptile	loggerhead sea turtle	<i>Chelonia caretta</i>	T	none
Reptile	New Mexican ridge-nosed rattlesnake	<i>Crotalus willardi obscurus</i>	T w/ CH	12, 13, 14, 25
Aquatic Amphibian	Barton Springs salamander	<i>Eurycea sosorum</i>	E	13, 15, 16, 54
Aquatic Amphibian	Chiricahua leopard frog	<i>Rana chiricahuensis</i>	T	1, 13, 14, 55
Aquatic Amphibian	San Marcos salamander	<i>Eurycea nana</i>	T w/ CH	1, 12, 13, 14, 15, 16, 30
Aquatic Amphibian	Sonoran tiger salamander	<i>Ambystoma tigrinum stebbinsi</i>	E	13, 14, 26
Aquatic Amphibian	Texas blind salamander	<i>Eurycea rathbuni</i>	E	1, 16

¹⁷ The alligator is designated as E(S/A) due to similarity of appearance with an endangered taxon – the American crocodile (*Crocodylus acutus*). As an E(S/A) species, the alligator does not receive ESA protections.

¹⁸ The desert tortoise is currently designated as threatened in Arizona except for south and east of the Colorado River. When found south and east of the Colorado River in Arizona, the species is designated as T(S/A) due to similarity of appearance to a threatened taxon. Within the range where it is designated as a T(S/A) species, the desert tortoise does not receive ESA protections.

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Terrestrial Amphibian	Houston toad	<i>Bufo houstonensis</i>	E w/ CH	12, 13, 14, 15, 56
Cold Water Fish	Apache trout	<i>Oncorhynchus apache</i>	T	1, 13, 14, 26
Cold Water Fish	fountain darter ¹⁹	<i>Etheostoma fonticola</i>	E w/ CH	14, 15, 16, 28 (Comal County) or 1, 12, 14, 15, 16, 30 (Hays County) or 1 (Uvalde County)
Cold Water Fish	Gila trout	<i>Salmo gilae</i>	T	1, 13, 14, 26
Cold Water Fish	Ozark cavefish	<i>Amblyopsis rosae</i>	T	16
Warm Water Fish	Arkansas River shiner	<i>Notropis girardi</i>	T w/ CH	12, 13, 14, 27
Warm Water Fish	beautiful shiner	<i>Cyprinella formosa</i>	T w/ CH	1, 12, 13, 14, 26
Warm Water Fish	Big Bend gambusia	<i>Gambusia gaigei</i>	E	13, 14, 26
Warm Water Fish	bonytail chub	<i>Gila elegans</i>	E w/ CH	1, 12, 13, 14, 27
Warm Water Fish	Chihuahua chub	<i>Gila nigrescens</i>	T	1, 13, 14, 27
Warm Water Fish	Clear Creek gambusia	<i>Gambusia heterochir</i>	E	13, 14, 26
Warm Water Fish	Colorado pikeminnow ²⁰	<i>Ptychocheilus lucius</i>	E w/ CH, EXPN	1, 12, 13, 14, 17, 27

¹⁹ Although native to central Texas, the fountain darter is categorized in the Cold Water Fish toxicity group due to its relatively cool spring water habitat and a reproductive sensitivity to warm water above 74 °F.

²⁰ Colorado pikeminnow is currently designated as endangered except for drainages of the Salt and Verde rivers in Arizona.

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Warm Water Fish	Comanche Springs pupfish	<i>Cyprinodon elegans</i>	E	13, 14, 31 (Jeff Davis and Reeves counties) or 1 (Uvalde County)
Warm Water Fish	desert pupfish	<i>Cyprinodon macularius</i>	E w/ CH	1, 12, 13, 14, 26
Warm Water Fish	Devils River minnow	<i>Dionda diaboli</i>	T	1, 13, 14, 26
Warm Water Fish	Gila chub	<i>Gila intermedia</i>	E w/ CH	12, 13, 14, 26
Warm Water Fish	Gila topminnow (includes Yaqui topminnow)	<i>Poeciliopsis occidentalis</i>	E	1, 13, 14, 26
Warm Water Fish	humpback chub	<i>Gila cypha</i>	E	1, 13, 14, 27
Warm Water Fish	Leon Springs pupfish	<i>Cyprinodon bovinus</i>	E w/ CH	1, 12, 13, 14, 29
Warm Water Fish	leopard darter	<i>Percina pantherina</i>	T w/ CH	12, 13, 14, 27
Warm Water Fish	Little Colorado spinedace	<i>Lepidomeda vittata</i>	T w/ CH	12, 13, 14, 26
Warm Water Fish	loach minnow	<i>Tiaroga (= Rhinichthys) cobitis</i>	T	1, 13, 14, 27
Warm Water Fish	Neosho madtom	<i>Noturus placidus</i>	T	13, 14, 27
Warm Water Fish	Pecos bluntnose shiner	<i>Notropis simus pecosensis</i>	T w/ CH	1, 12, 13, 14, 27

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Warm Water Fish	Pecos gambusia	<i>Gambusia nobilis</i>	E	1, 13, 14, 26 (New Mexico) or 13, 14, 31 (Texas: Jeff Davis and Reeves counties) or 13, 14, 29 (Texas: Pecos County)
Warm Water Fish	razorback sucker	<i>Xyrauchen texanus</i>	E w/ CH	1, 12, 13, 14, 27
Warm Water Fish	Rio Grande silvery minnow	<i>Hybognathus amarus</i>	E w/ CH	1, 12, 13, 14, 27
Warm Water Fish	San Marcos gambusia	<i>Gambusia georgei</i>	E w/ CH	12, 14, 15, 16, 30
Warm Water Fish	Sonora chub	<i>Gila ditaenia</i>	T w/ CH	12, 13, 14, 26
Warm Water Fish	spikedace	<i>Meda fulgida</i>	T w/ CH	12, 13, 14, 27
Warm Water Fish	Virgin River chub	<i>Gila seminuda (= robusta)</i>	E	1, 13, 14, 27
Warm Water Fish	woundfin	<i>Plagopterus argentissimus</i>	E, EXPN	1, 13, 14, 17, 27
Warm Water Fish	Yaqui catfish	<i>Ictalurus pricei</i>	T w/ CH	1, 12, 13, 14, 27
Warm Water Fish	Yaqui chub	<i>Gila purpurea</i>	E w/ CH	1, 12, 13, 14, 26
Aquatic Arthropod	Comal Springs dryopid beetle	<i>Stygoparnus comalensis</i>	E w/ P/CH	16
Aquatic Arthropod	Comal Springs riffle beetle	<i>Heterelmis comalensis</i>	E w/ P/CH	14, 15, 28 (Comal County) or 14, 15, 30 (Hays County)
Aquatic Arthropod	Noel=s Amphipod	<i>Gammarus desperatus</i>	E	1, 12, 14, 26

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Aquatic Arthropod	Peck's cave amphipod	<i>Stygobromus pecki</i>	E w/ P/CH	16
Aquatic Arthropod	Socorro isopod	<i>Thermosphaeroma thermophilus</i>	E	14, 26
Terrestrial Arthropod	American burying beetle	<i>Nicrophorus americanus</i>	E	13, 57
Terrestrial Arthropod	Bee Creek Cave harvestman	<i>Texella reddelli</i>	E	13, 14, 32
Terrestrial Arthropod	Bone Cave harvestman	<i>Texella reyesi</i>	E	13, 14, 32
Terrestrial Arthropod	Braken Bat Cave meshweaver	<i>Cicurina venii</i>	E	13, 14, 32
Terrestrial Arthropod	Coffin Cave mold beetle	<i>Batrisodes texanus</i>	E	13, 14, 32
Terrestrial Arthropod	Cokendolpher Cave Harvestman	<i>Texella cokendolpheri</i>	E	13, 14, 32
Terrestrial Arthropod	Government Canyon Bat Cave Meshweaver	<i>Cicurina vespara</i>	E	13, 14, 32
Terrestrial Arthropod	Government Canyon Bat Cave Spider	<i>Neoleptoneta microps</i>	E	13, 14, 32
Terrestrial Arthropod	Helotes mold beetle	<i>Batrisodes ventyivi</i>	E	13, 14, 32
Terrestrial Arthropod	Kretschmarr Cave mold beetle	<i>Texamaurops reddelli</i>	E	13, 14, 32
Terrestrial Arthropod	Madla's Cave Meshweaver	<i>Cicurina madla</i>	E	13, 14, 32
Terrestrial Arthropod	(no common name)	<i>Rhadine exilis</i>	E	13, 14, 32
Terrestrial Arthropod	(no common name)	<i>Rhadine infernalis</i>	E	13, 14, 32

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Terrestrial Arthropod	Robber Baron Cave Meshweaver	<i>Cicurina baronia</i>	E	13, 14, 32
Terrestrial Arthropod	Tooth Cave ground beetle	<i>Rhadine persephone</i>	E	13, 14, 32
Terrestrial Arthropod	Tooth Cave pseudoscorpion	<i>Tartarocreagris texana</i>	E	13, 14, 32
Terrestrial Arthropod	Tooth Cave spider	<i>Neoleptoneta myopica</i>	E	13, 14, 32
Freshwater Mollusk	Alamosa springsnail	<i>Tryonia alamosae</i>	E	13, 14, 26
Freshwater Mollusk	Kanab ambersnail	<i>Oxyloma haydeni kanabensis</i>	E	13, 14, 24
Freshwater Mollusk	Koster=s tryonia snail	<i>Tryonia kosteri</i>	E	1, 12, 14, 26
Freshwater Mollusk	Ouachita rock pocketbook	<i>Arkansia wheeleri</i>	E	13, 14, 27
Freshwater Mollusk	Pecos assiminea snail	<i>Assiminea pecos</i>	E w/ CH	1, 12, 14, 26 (New Mexico) or 12, 13, 14, 29 (Texas: Pecos County) or 12, 13, 14, 31 (Texas: Reeves County)
Freshwater Mollusk	Roswell springsnail	<i>Pyrgulopsis roswellensis</i>	E	1, 12, 14, 26
Freshwater Mollusk	scaleshell mussel	<i>Leptodea leptidon</i>	E	13, 14, 27
Freshwater Mollusk	Socorro springsnail	<i>Pyrgulopsis neomexicana</i>	E	13, 14, 26
Freshwater Mollusk	winged mapleleaf mussel	<i>Quadula fragosa</i>	E	13, 14, 27
Plant	Arizona agave	<i>Agave arizonica</i>	E	13, 14, 37, 40

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Plant	Arizona Cliff-rose	<i>Purshia subintegra</i>	E	13, 14, 34, 39
Plant	Arizona hedgehog cactus	<i>Echinocereus triglochidiatus</i> <i>var. arizonicus</i>	E	13, 14, 34, 39
Plant	ashy dogweed	<i>Thymophylla tephroleuca</i>	E	1, 13, 14, 34, 39
Plant	black lace cactus	<i>Echinocereus reichenbachii</i> <i>var. albertii</i>	E	13, 14, 34, 40
Plant	Brady pincushion cactus	<i>Pediocactus bradyi</i>	E	13, 14, 34, 39
Plant	bunched cory cactus	<i>Coryphantha ramillosa</i>	T	13, 14, 34, 39
Plant	Canelo Hills ladies'-tresses	<i>Spiranthes delitescens</i>	E	13, 14, 37, 39
Plant	Chisos Mountain hedgehog cactus	<i>Echinocereus chisoensis</i> <i>var. chisoensis</i>	T	13, 14, 34, 40
Plant	Cochise pincushion cactus	<i>Coryphantha robbinsorum</i>	T	13, 14, 34, 39
Plant	Davis green pitaya	<i>Echinocereus viridiflorus</i> <i>var. davisii</i>	E	13, 14, 34, 39
Plant	eastern prairie-fringed orchid	<i>Platanthera leucophaea</i>	T	13, 14, 36, 40
Plant	(no common name)	<i>Geocarpon minimum</i>	T	13, 14, 34, 39
Plant	gypsum wild-buckwheat	<i>Eriogonum gypsophilum</i>	T w/ CH	12, 13, 14, 34, 39
Plant	Hinckley's oak	<i>Quercus hinckleyi</i>	T	13, 14, 34
Plant	Holmgren milk-vetch	<i>Astragalus holmgreniorum</i>	E w/ P/CH	13, 14, 34, 39
Plant	Holy Ghost ipomopsis	<i>Ipomopsis sancti-spiritus</i>	E	13, 14, 34, 39

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Plant	Huachucha water-umbel	<i>Lilaeopsis schaffneriana</i> var. <i>recurva</i>	E	1, 13, 14, 35, 39
Plant	Johnston=s frankenia	<i>Frankenia johnstonii</i>	AD, E	1, 13, 14, 34, 39
Plant	Jones Cycladenia	<i>Cycladenia jonesii</i> (=humilis)	T	13, 14, 34, 39
Plant	Kearney=s bluestar	<i>Amsonia kearneyana</i>	E	1, 13, 14, 34, 39
Plant	Knowlton cactus	<i>Pediocactus knowltonii</i>	E	13, 14, 34, 39
Plant	Kuenzler hedgehog cactus	<i>Echinocereus fendleri</i> var. <i>kuenzleri</i>	E	1, 13, 14, 34, 39
Plant	Lee pincushion cactus	<i>Coryphantha sneedii</i> var. <i>leei</i>	T	13, 14, 34, 39
Plant	Large-fruited sand-verbena	<i>Abronia macrocarpa</i>	E	13, 14, 34, 40
Plant	Little Aguja pondweed	<i>Potamogeton clystocarpus</i>	E	13, 14, 38, 39
Plant	Lloyd's Mariposa cactus	<i>Echinomastus mariposensis</i>	T	13, 14, 34, 39
Plant	Mancos milk-vetch	<i>Astragalus humillimus</i>	E	13, 14, 34, 39
Plant	Mesa Verde cactus	<i>Sclerocactus mesae-verdae</i>	T	13, 14, 34, 39
Plant	Navajo sedge	<i>Carex specuicloa</i>	T w/ CH	12, 13, 37
Plant	Navasota ladies=-tresses	<i>Spiranthes parksii</i>	E	13, 14, 36, 40
Plant	Nellie cory cactus	<i>Coryphantha minima</i>	E	13, 14, 34, 39
Plant	Nichol's Turk's head cactus	<i>Echinocactus horizonthalonius nicholii</i>	E	13, 14, 34, 39

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Plant	Pecos (= puzzle, = paradox) sunflower	<i>Helianthus paradoxus</i>	T	1, 13, 14, 34, 40 (New Mexico) or 13, 14, 29, 40 (Texas: Pecos County) or 13, 14, 31, 40 (Texas: Reeves County)
Plant	Peebles Navajo cactus	<i>Pediocactus peeblesianus peeblesianus</i>	E	13, 14, 34, 39
Plant	Pima pineapple cactus	<i>Coryphantha scheeri</i> var. <i>robustispina</i>	E	1, 13, 14, 34, 39
Plant	Sacramento Mountains thistle	<i>Cirsium vinaceum</i>	T	13, 34, 40
Plant	Sacramento prickly-poppy	<i>Argemone pleiacantha</i> ssp. <i>pinnatisecta</i>	E	13, 34, 40
Plant	San Francisco Peaks groundsel	<i>Senecio franciscanus</i>	T w/ CH	12, 13, 39
Plant	Sentry milk-vetch	<i>Astragalus cremnophylax</i> var. <i>cremnophylax</i>	E	13, 14, 34, 39
Plant	Siler pincushion cactus	<i>Pediocactus (= Echinocactus) sileri</i>	T	13, 14, 34, 39
Plant	Slender rush-pea	<i>Hoffmannseggia tenella</i>	E	13, 14, 34, 39
Plant	Sneed pincushion cactus	<i>Coryphantha sneedii</i> var. <i>sneedii</i>	E	1, 13, 14, 34, 39
Plant	South Texas ambrosia	<i>Ambrosia cheiranthifolia</i>	E	13, 14, 34
Plant	star cactus	<i>Astrophytum asterias</i>	E	13, 14, 34, 39
Plant	Terlingua Creek cat's-eye	<i>Cryptantha crassipes</i>	E	13, 14, 34, 39

Proposed or listed species				
toxicity group	common name	scientific name	status*	protection measures
Plant	Texas ayenia	<i>Ayenia limitaris</i>	E	13, 14, 34, 39
Plant	Texas poppy-mallow	<i>Callirhoe scabriuscula</i>	E	13, 14, 34, 40
Plant	Texas prairie dawn-flower	<i>Hymenoxys texana</i>	E	13, 14, 34, 39
Plant	Texas snowbells	<i>Styrax texanus</i>	E	13, 14, 34, 39
Plant	Texas trailing phlox	<i>Phlox nivalis ssp. texensis</i>	E	13, 14, 33, 40
Plant	Texas wild-rice	<i>Zizania texana</i>	E w/ CH	1, 12, 13, 14, 15, 30
Plant	Tobusch fishhook cactus	<i>Ancistrocactus tobuschii</i>	E	13, 14, 34, 39
Plant	Todsen's pennyroyal	<i>Hedeoma todsenii</i>	E w/ CH	12, 13, 14, 34, 40
Plant	Walker's manioc	<i>Manihot walkerae</i>	E	1, 13, 14, 34, 40
Plant	Welsh's milkweed	<i>Asclepias welshii</i>	T w/ CH	12, 13, 14, 34, 40
Plant	western prairie fringed orchid	<i>Platanthera praeclara</i>	T	13, 14, 36, 40
Plant	white bladderpod	<i>Lesquerella pallida</i>	E	13, 14, 34, 39
Plant	Zapata bladderpod	<i>Lesquerella thamnophila</i>	E w/ CH	12, 13, 14, 34, 39
Plant	Zuni fleabane	<i>Erigeron rhizomatus</i>	T	13, 14, 34, 39
<p>* Status (in Region 2): E = Endangered T = Threatened DR = Delisted Taxon, Taxonomic Revision (Improved Understanding) P/E = Proposed for Endangered Status P/T = Proposed for Threatened Status AD = Proposed for Delisting w/ CH = with Critical Habitat w/ P/CH = with Proposed Critical Habitat EXPN = Experimental TSA = Threatened due to Similarity of Appearance</p>				

4.3 List of Recommended Protection Measures for Service Trust Resources in Region 2

4.3.1 Service facilities

1. To protect Service refuges or fish hatcheries, the Service recommends —

- a. Applicators should contact the facility before (1) applying pesticides near facility boundaries with mechanized ground or aerial equipment or (2) implementing a pest control program in the vicinity of the facility. Pesticides with the least toxicity and persistence in both soil and water should be used adjacent to a facility's boundary. Pesticide should not be used in or adjacent to wetlands or waterbodies such as canals, ditches, sloughs, etc. that drain into these facilities. Aerial pesticide applications should be made in swaths parallel to the facility and its aerial buffer zone. If flight over a facility is necessary, applicators should maintain a minimal altitude of 2,000 feet and make sure that shutoff of pesticide sprayers or spreaders has occurred.
- b. Applicators should use at least a 1-mile buffer zone at a facility's boundary when applying the following avian toxicants/deterrents or any other avian toxicant/deterrent.

aminopyridine (e.g., Avitrol⁷)
 chloro-p-toludine hydrochloride (e.g., CPTH, DRC-1339, Starlicide⁷)
 fenthion (e.g., Rid-A-Bird⁷)
 polybutene adhesive (e.g., Tanglefoot Bird Repellent⁷)

- c. Applicators should use at least a 3-mile buffer zone from a facility's boundary when applying the following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp} or Class 2_{sp}) in the Predatory Mammal toxicity group.

brodifacoum	diphacinone *	sodium cyanide	strychnine
chlorophacinone *	famphur (e.g., Warbex ⁷) †	sodium fluoroacetate	zinc phosphide

Alternative Buffer Zones:

* Chlorophacinone or diphacinone may be applied below ground for control of rodents inside the 3-mile buffer zone if (1) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony and (2) all tunnel entrances of the colony are covered up.

H Animal carcasses with famphur-treated hides should be removed, buried, or otherwise covered inside the 3-mile buffer zone.

- d. Applicators should use the following protection measures to protect Service refuges or fish hatcheries for applying pesticides except for the pesticides previously indicated above (i.e., avian toxicants/deterrents, predator/rodent control agents, or pesticides that can cause secondary poisoning):

- ◆ The following buffer zones should be implemented at the facility's boundary for (1) any herbicide that rates as either Class 0 or Class 1 for all animal toxicity groups and (2) any non-herbicidal pesticide (except for avian toxicants/deterrents, predator/rodent control

agents, or secondary poisoning agents) that rates no higher than Class 1 in any animal toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	None	None
Solid formulations other than insect baits ⁴	none	30 feet *	30 feet	30 feet
Liquid formulations ⁵	none	30 feet *H	150 feet † §	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.</p> <p>H These applications and formulations can have a buffer zone of 30 feet from the facility=s boundary if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.</p> <p>§ These applications and formulations can have a buffer zone of 30 feet at the facility=s boundary if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides (except for avian toxicants/deterrents, predator/rodent control agents, or secondary poisoning agents as indicated above) that rate as Class 2 in any animal toxicity group should have the following buffer zones at the facility's boundary.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	None	none	none	none
Solid formulations other than insect baits ⁴	10 feet *	60 feet *	60 feet	60 feet
Liquid formulations ⁵	10 feet *	60 feet *	300 feet H§	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

- * A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth. Applicators should make sure that granules, pellets, or treated seeds are completely covered by soil for up to 60 feet from the facility=s boundary.
- H These applications and formulations can have a buffer zone of 60 feet from the facility=s boundary if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.
- § These applications and formulations can have a buffer zone of 60 feet at the facility=s boundary if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides (except for avian toxicants/deterrents, predator/rodent control agents, or secondary poisoning agents as indicated above) that rate as Class 3 in any animal toxicity group should have the following buffer zones at the facility=s boundary.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	None	None	none	none

Solid formulations other than insect baits ⁴	20 feet *	90 feet *	90 feet	90 feet
Liquid formulations ⁵	20 feet *	90 feet *	450 feet H§	1/2 mile
ULV or dust formulations ⁶	250 feet H	250 feet H	1/4 mile H	3/4 mile

Alternative Buffer Zones:

* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth. Applicators should make sure that granules, pellets, or treated seeds are completely covered by soil for up to 90 feet from the area to be protected.

H These applications and formulations can have a buffer zone of 90 feet from the facility=s boundary if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.

' These applications and formulations can have a buffer zone of 90 feet at the facility=s boundary if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

4.3.2 Migratory birds

2. To protect wading birds (egrets, herons, ibises, spoonbills, etc.), the Service recommends —

The following buffer zones should be used near nesting areas (colonies, rookeries, etc.) of wading birds for all pesticide applications until juveniles have left the nest.²¹ Aerial pesticide applications should be made in swaths parallel to a colony or rookery and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations	1/8 mile	1/4 mile	1/4 mile	1/4 mile
Notes: ¹ A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones. ² Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank. ³ Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.				

3. To protect burrowing owls, the Service recommends —

- a. The following burrow fumigants or any other burrow fumigant should not be used in nest areas of burrowing owls.

acrolein	magnesium phosphide	sodium nitrate
aluminum phosphide	potassium nitrate	

- b. Pesticides that rate as Class 2 or Class 3 in the Predatory Avian, Small Mammal, or Terrestrial Arthropod toxicity groups should not be applied by any method within 1/2 mile of burrowing owl nests until birds have left the area.²² This includes the following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 2_{sp} or Class 3_{sp}) in the

²¹ Recommended buffer zones for protection of nesting areas of wading birds are based on disturbance factors.

²² The recommended buffer zone for protection of burrowing owl nests is based on foraging distance.

Predatory Avian or Small Mammal toxicity groups. Prairie dog colonies should be monitored over a period of several days prior to treatment to detect the presence of burrowing owls.

brodifacoum	diphacinone	zinc phosphide
chlorophacinone	sodium cyanide	

4. To protect falcons, kites, ospreys, owls (other than burrowing owls), and small hawks (Cooper's hawk, sharp-shinned hawk, Swainson's hawk, etc.), the Service recommends —

- a. Pesticides that rate as Class 0 or Class 1 in the Predatory Avian toxicity group should not be applied by any method within 300 feet of active nests of these birds-of-prey until juveniles have left the nest.²³ The 300-foot buffer zone is unnecessary for spot or mechanized ground applications in existing rights-of-way adjacent to nests of these birds-of-prey if pesticide toxicity does not exceed Class 1 in the Predatory Avian toxicity group.
- b. Pesticides that rate as Class 2 or Class 3 pesticide in the Predatory Avian toxicity group should have the following buffer zones near active nests of these birds-of-prey until juveniles have left the nest.²⁴

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations	300 feet	300 feet	1/8 mile	1/8 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

²³ The recommended buffer zone for protection of nests of these birds-of-prey is based on disturbance factors.

²⁴ The recommended buffer zone for protection of nests of these birds-of-prey is based on disturbance factors and spray drift.

5. To protect golden eagles, the Service recommends —

- a. When golden eagles are present in an area, the following predator/rodent control agents or any Class 2_{sp} or Class 3_{sp} pesticide that can cause secondary poisoning in the Predatory Avian toxicity group should not be used within normal flying distances of the species.

brodifacoum	diphacinone *	sodium cyanide	strychnine
chlorophacinone *	famphur (e.g., Warbex7) †	sodium fluoroacetate	zinc phosphide
<p>Alternative Buffer Zones:</p> <p>* Chlorophacinone or diphacinone may be applied below ground for control of rodents in areas where golden eagles are present if (1) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony and (2) all tunnel entrances of the colony are covered up.</p> <p>H Animal carcasses with famphur-treated hides should be removed, buried, or otherwise covered in areas where golden eagles are present.</p>			

- b. Pesticides (except for predator/rodent control agents as indicated above or any Class 2_{sp} or Class 3_{sp} pesticide that can cause secondary poisoning in the Predatory Avian toxicity group) should not be applied by any method within 1/4 mile of active nests of golden eagles until juveniles have left the nest.²⁵ The 1/4-mile buffer zone is unnecessary for spot or mechanized ground applications in existing rights-of-way adjacent to golden eagle nests if pesticide toxicity does not exceed Class 1 in the Predatory Avian toxicity group. Aerial pesticide applications should be made in swaths parallel to the nest and its aerial buffer zone.

6. To protect large hawks (red-tailed hawk, red-shouldered hawk, etc.) and other birds that eat carrion (caracaras, ravens, vultures, etc.), the Service recommends —

- a. When carrion-eating birds are present, the following predator/rodent control agents or any Class 2_{sp} or Class 3_{sp} pesticide that can cause secondary poisoning in the Predatory Avian toxicity group should not be used within normal flying distances of these birds.

brodifacoum	diphacinone *	sodium cyanide	strychnine
chlorophacinone *	famphur (e.g., Warbex7) †	sodium fluoroacetate	zinc phosphide
<p>Alternative Buffer Zones:</p> <p>* Chlorophacinone or diphacinone may be applied below ground for control of rodents in areas where carrion-eating birds are present if (1) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony and (2) all tunnel entrances of the colony are covered up.</p> <p>H Animal carcasses with famphur-treated hides should be removed, buried, or otherwise covered in areas where carrion-eating birds are present.</p>			

- b. Pesticides (except for predator/rodent control agents as indicated above or any Class 2_{sp} or Class 3_{sp} pesticide that can cause secondary poisoning in the Predatory Avian toxicity group)

²⁵ The recommended buffer zone for protection of golden eagle nests is based on disturbance factors.

should not be applied by any method within 1/8 mile for active nests of carrion-eating birds-of-prey (caracaras, hawks, and vultures) until juveniles have left the nest.²⁶ The 1/8-mile buffer zone is unnecessary for spot or mechanized ground applications in existing rights-of-way adjacent to nests of these birds-of-prey if pesticide toxicity does not exceed Class 1 in the Predatory Avian Group. Aerial pesticide applications should be made in swaths parallel to the nest and its aerial buffer zone.

7. To protect shorebirds (avocets, plovers, sandpipers, terns, etc.), the Service recommends —

The following buffer zones should be used near shorebird nesting areas for all pesticide applications until juveniles have abandoned the area.²⁷ Aerial pesticide applications should be made in swaths parallel to the nesting area and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations other than ULV or dust formulations	300 feet	300 feet	300 feet	1/8 mile
ULV or dust formulations ⁴	300 feet	300 feet	500 feet	1/4 mile
Notes: 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones. 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank. 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high. 4 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.				

²⁶ The recommended buffer zone for protection of nests of these birds-of-prey is based on disturbance factors.

²⁷ Recommended buffer zones for protection of shorebird nesting areas are based on disturbance factors or spray drift.

8. To protect small migratory birds that may eat granular, pellet, or treated seed formulations (seed-eating or grit-eating species such as doves, finches, meadowlarks, sparrows, etc.), the Service recommends —

- a. Applicators should not use the following avian toxicants/deterrents or any other avian toxicant/deterrent in areas where migratory birds (other than pest species) may be affected.

aminopyridine (e.g., Avitrol⁷)
 chloro-p-toludine hydrochloride (e.g., CPTH, DRC-1339, Starlicide⁷)
 fenthion (e.g., Rid-A-Bird⁷)
 polybutene adhesive (e.g., Tanglefoot Bird Repellent⁷)

- b. For applications of pesticides (except for avian toxicants/deterrents as indicated above) that rate as Class 2 or Class 3 in the Small Avian or Gallinaceous Avian toxicity groups, the following buffer zones should be used near species habitat of seed-eating or grit-eating migratory birds until the birds have abandoned the area.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	30 feet	60 feet	60 feet	60 feet
Liquid formulations ⁵	30 feet	30 feet	150 feet *H	1/8 mile
ULV or dust formulations ⁶	80 feet *	80 feet *	500 feet *	1/4 mile

Alternative Buffer Zones:

* These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application.

H These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

9. To protect small migratory birds that will not eat granular, pellet, or treated seed formulations (insect-eating species such as flycatchers, swallows, warblers, woodpeckers, wrens, etc.), the Service recommends —

- a. Applicators should not use the following avian toxicants/deterrents or any other avian toxicant/deterrent in areas where migratory birds (other than pest species) may be affected.

aminopyridine (e.g., Avitrol⁷)
 chloro-p-toluidine hydrochloride (e.g., CPTH, DRC-1339, Starlicide⁷)
 fenthion (e.g., Rid-A-Bird⁷)
 polybutene adhesive (e.g., Tanglefoot Bird Repellent⁷)

- b. For applications of pesticides (except for avian toxicants/deterrents as indicated above) that rate as Class 2 or Class 3 in the Small Avian toxicity group, the following buffer zones should be used near species habitat of insect-eating migratory birds until birds have abandoned the area.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	none	none	None	none
Liquid formulations ⁵	none	30 feet *	150 feet H§	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile

Alternative Buffer Zones:

- * A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.
- H These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application.
- ' These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

10. To protect geese, the Service recommends —

Applicators should adjust seasonal use of pesticides that rate as Class 2 or Class 3 in the Waterfowl Avian toxicity group in areas where geese concentrate and avoid using these pesticides in these areas until birds have migrated for the season. Applications with Class 2 or Class 3 pesticides near nests of geese should have the following buffer zones until nests have been abandoned.²⁸

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none

²⁸ Recommended buffer zones for protection of nests of geese are based on foraging distances and/or spray drift.

All formulations other than insect baits, ULV formulations, or dust formulations	300 feet	300 feet	300 feet	300 feet
ULV or dust formulations ⁴	300 feet	300 feet	1/4 mile *	1/4 mile *
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 300 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

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11. To protect waterfowl (ducks, grebes, loons, mergansers, etc.) other than geese, the Service recommends —

Applicators should adjust seasonal use of pesticides that rate as Class 2 or Class 3 in the Waterfowl Avian toxicity group in areas where waterfowl concentrate and avoid using these pesticides in these areas until birds have migrated for the season. Applications with Class 2 or Class 3 pesticides near waterfowl nests should have the following buffer zones until nests have been abandoned.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
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Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	60 feet	60 feet	60 feet	60 feet
Liquid formulations ⁵	30 feet	60 feet	200 feet *H	1/8 mile
ULV or dust formulations ⁶	100 feet *	100 feet *	500 feet *	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

4.3.3 Proposed or listed species

12. To protect species with proposed or designated critical habitat, the Service recommends —

Pesticide use within critical habitat should be kept to a minimum and restricted to areas that do not serve as habitat for proposed or listed species. For locations of critical habitat, pesticide users can (a) check 50 CFR (Code of Federal Regulations) § 17.95-17.96 which can be found at <http://www.gpo.gov> or (b) contact the nearest Service field office. Federal agencies proposing to authorize, fund, or carry out pesticide applications that can adversely modify critical habitat (brush control, removal of prey species, etc.) must consult with the Service. The county extension service, state agricultural department, or nearest Service field office should be consulted for information on alternative protection measures for pesticide use inside or adjacent to critical habitat when protection measures as specified in the RPR cannot be implemented.

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13. To protect species on refuges, preserves, or public lands that are not part of the Service refuge system, the Service recommends —

Applicators or relevant agencies using pesticides in refuges, preserves, or public lands should identify areas where proposed or listed species and critical habitat may be affected by pesticide applications. If a proposed or listed species or critical habitat is present, the nearest Service field office should be consulted prior to pesticide application for information on appropriate protection measures and any necessary incidental take permit or authorization. Federal land managers must consult with the Service before application of pesticide on Federal lands that may adversely affect proposed or listed species or adversely modify critical habitat.²⁹

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14. To protect species inside or adjacent to rights-of-way, the Service recommends —

Applicators or relevant agencies using pesticides in right-of-way corridors should identify areas where proposed or listed species and critical habitat may be affected. If a proposed or listed species or critical habitat is present, the nearest Service field office should be consulted for information on appropriate protection measures and for any necessary incidental take permit or authorization. To determine locations of critical habitat, applicators can (a) check 50 CFR (Code of Federal Regulations) § 17.94 -17.96 which can be found at <http://www.gpo.gov> or (b) contact the nearest Service field office. Pesticide users should determine where proposed or listed species or parts of their habitat (e.g., border areas such as fence lines or hedgerows) still occur along rights-of-way and implement pesticide protection measures for these areas. Applicators using mechanized equipment in right-of-way corridors should use either liquid streams or relatively coarse sprays to minimize spray drift into species habitat.

²⁹ Unless more restrictive protection measures are necessary for resident proposed or listed species on a facility, pesticide applications at the boundary of these facilities should be made according to protection measures given for Service facilities in Section 4.3.1 above.

15. To protect species inside or adjacent to municipal parks, golf courses, or other managed areas, the Service recommends —

Applicators or relevant agencies using pesticides on managed areas (golf courses, municipal parks, etc.) in close proximity to proposed or listed species or critical habitat should identify areas on the facility where these species or critical habitat may be affected by facility operations. When pesticides and fertilizers can be transported into species habitat by spray drift or surface runoff, use of pesticides and fertilizers on the facility should be minimized and an integrated pest management (IPM) plan should be developed for the facility. Water quality in habitat of aquatic listed species should be monitored for habitat adjacent to managed areas, and water quality monitoring should also be part of the IPM plan. Pesticide users may contact the county extension service for assistance in developing an IPM plan.

16. To protect below ground or spring-dependent species from aquifer contamination, the Service recommends —

- a. Pesticides with the least acute toxicity and persistence should be selected for use near open waterbodies or sensitive geologic features such as caves, sinkholes, crevices, etc. A pesticide's potential for inducing chronic toxicity in below ground or spring-dependent animal species should be considered if (1) treatment involves repeated applications, (2) the pesticide is persistent, or (3) a chronic condition may occur in these species by a single application of pesticide. The ability of a pesticide to leach through the soil should also be considered, and highly soluble pesticides should be avoided. Nontoxic carrier materials or adjuvants (drift retardants, surfactants, etc.) should be used for any application. A determination of toxicity should be made for carrier materials or adjuvants through informational sources such as container labels or MSDSs (material safety data sheets) or by contacting the manufacturer.
 - b. Use of pesticides in watersheds with below ground or spring-dependent species should be minimized including both ground water and surface water. Pesticides should be applied at minimal rates without repeated applications. Pesticide operations such as loading, storing, mixing, and rinsing of containers should be conducted away from springs, wells, and sensitive geologic features. Applicators should prevent pesticides from entering (1) ground water of the aquifer via percolation or leaching or (2) surface water that flows into storm drains or aquifer recharge features such as caves, sinkholes, crevices, etc. Pesticide spray drift should be confined to areas of treatment and not be allowed to move into nontarget areas. Where possible, pesticide applications should have a vegetated buffer strip of at least 30 feet in drainage areas of the treated area to minimize pesticide residues in surface runoff.
 - c. A comprehensive watershed analysis should be conducted by Federal, state, or local agencies before implementing pesticide programs for control of pests or invasive species in watersheds that potentially involve below ground or spring-dependent species. After the watershed analysis has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the pesticide control program will not impact these species. If a pesticide control program can affect underground or spring-dependent species, the Service should be consulted for appropriate protection measures and for any necessary incidental take authorization or permit.
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17. To protect species with experimental populations, the Service recommends —

Populations of listed species with experimental status should be located in areas of release before application of pesticides that can affect these species. Pesticide users should contact the nearest Service field office for applications involving (a) essential experimental populations on either public or private lands or (b) nonessential experimental populations in National Parks or National Wildlife Refuges. The Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit. Additional special rules may also apply (see 50 CFR [Code of Federal Regulations] § 17.8 which can be found at <http://www.gpo.gov>).

18. To protect cat species (e.g., Gulf Coast jaguarundi, jaguar, or ocelot), the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of any predator/rodent control agent inside or close to species habitat.³⁰ Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. The following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp} or 2_{sp}) in the Predatory Mammal toxicity group should not be used within 3 miles of occupied habitat as defined by a Service-approved survey.

brodifacoum	diphacinone *	sodium fluoroacetate	zinc phosphide
chlorophacinone *	sodium cyanide	strychnine	
Alternative Buffer Zones: * Chlorophacinone or diphacinone may be applied below ground for control of rodents inside occupied habitat or the 3-mile buffer zone if (1) treatment is approved by the Service, (2) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony, and (3) all tunnel entrances of the colony are covered up.			

19. To protect insect-eating bat species (e.g., gray bat, Indiana bat, or Ozark big-eared bat), the Service recommends —

- a. Pesticide users should contact the nearest Service field office for information on the species before application of pesticide in the immediate vicinity of potential bat roosting sites in caves or mines. If a survey for the species is necessary, survey protocols and a scientific permit should be obtained from the Service. Further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. If a roosting

³⁰ A survey for the jaguar is recommended only if there has been a sighting in an area within the last year.

site is occupied, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.

b. For pesticide applications involving species habitat, measures to protect the species are:

- ◆ Buffer zones are usually unnecessary for pesticides that are rated as Class 0 or Class 1 in the Small Mammal toxicity group. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ Pesticides rated as Class 2 in the Small Mammal toxicity group should have the following buffer zones from (1) any entrance of an occupied roost or (2) a potential roost site that has not been surveyed.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	10 feet *	60 feet *	60 feet	60 feet
Liquid formulations ⁵	10 feet *	60 feet *	300 feet H§	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 1½-inch depth.</p> <p>H These applications and formulations can have a buffer zone of 60 feet at the edge of the roosting site if a strong, steady wind of at least 3 miles per hour is blowing directly away from the roosting site during the time of application.</p> <p>' These applications and formulations can have a buffer zone of 60 feet at the edge of the roosting site if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

20. To protect nectar-eating bat species (e.g., lesser (Sanborn=s) long-nosed bat or Mexican long-nosed bat), the Service recommends —

- a. Pesticide users should contact the nearest Service field office for information on the species before application of pesticide in the immediate vicinity of potential bat roosting sites in hollow trees, caves, mines, or culverts. If a survey for the species is necessary, survey protocols and a scientific permit should be obtained from the Service. Further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. If a roosting site is occupied, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. For pesticide applications involving species habitat, measures to protect the species are:
 - ◆ Pesticide users applying herbicides (Class D, M, or NS) on rangeland areas with agave, century plants, or columnar cacti that are within 40 miles of a known bat roosting site should contact the Service for information on appropriate protection measures if the area of application is greater than five acres. Spot or mechanized ground applications of herbicides in existing rights-of-way ordinarily do not require protection measures unless agave, century plants, or columnar cacti are substantially involved.
 - ◆ Buffer zones are usually unnecessary for pesticides that are rated as Class 0 or Class 1 in the Small Mammal toxicity group. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
 - ◆ Pesticides rated as Class 2 in the Small Mammal toxicity group should have the following buffer zones from (1) any entrance of an occupied roost or (2) a potential roost site that has not been surveyed.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	None	none	none
Solid formulations other than insect baits ⁴	10 feet *	60 feet *	60 feet	60 feet
Liquid formulations ⁵	10 feet *	60 feet *	300 feet H§	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 1½-inch depth.</p> <p>H These applications and formulations can have a buffer zone of 60 feet at the edge of the roosting site if a strong, steady wind of at least 3 miles per hour is blowing directly away from the roosting site during the time of application.</p> <p>' These applications and formulations can have a buffer zone of 60 feet at the edge of the roosting site if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

21. To protect small mammal species (e.g., Hualapai Mexican vole or Mount Graham red squirrel), the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of pesticide inside or adjacent to species habitat. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. For pesticide applications involving occupied habitat or species habitat that has not been surveyed, measures to protect the species are:
 - ◆ Buffer zones at the edge of species habitat are usually unnecessary for non-herbicidal pesticides (e.g., fungicides) rated as Class 0 in the Small Mammal toxicity group. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
 - ◆ The following buffer zones should be implemented at the edge of species habitat for (1) herbicides that rate as either Class 0 or Class 1 in the Small Mammal toxicity group and (2) any non-herbicidal pesticides that rate as Class 1 in the Small Mammal toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations other than ULV or dust formulations	1/8 mile	1/8 mile	1/8 mile	1/8 mile
ULV or dust formulations ⁴	1/8 mile	1/8 mile	1/8 mile	1/4 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 in the Small Mammal toxicity group should have the following buffer zones from the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations other than ULV or dust formulations	1/4 mile	1/4 mile	1/4 mile	1/4 mile
ULV or dust formulations ⁴	1/4 mile	1/4 mile	1/4 mile	1/2 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

22. To protect bird species that may eat granular, pellet, or treated seed formulations, the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of pesticide inside or adjacent to species habitat. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. Applicators should use at least a 1-mile buffer zone at the edge of species habitat when applying the following avian toxicants/deterrents or any other avian toxicant/deterrent.

aminopyridine (e.g., Avitrol⁷)
 chloro-p-toluidine hydrochloride (e.g., CPTH, DRC-1339, Starlicide⁷)
 fenthion (e.g., Rid-A-Bird⁷)
 polybutene adhesive (e.g., Tanglefoot Bird Repellent⁷)

- c. Applicators should use the following buffer zones for application of pesticides other than avian toxicants/deterrents as indicated above. Recommended buffer zones should be implemented for areas that are (1) adjacent to (but not within) occupied habitat or (2) species habitat that has not been surveyed.

- ◆ Buffer zones are usually unnecessary for pesticides (except for avian toxicants/deterrents) that are rated as Class 0 in the species' toxicity group. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ Pesticides (except for avian toxicants/deterrents) that rate as Class 1 in the species' toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	30 feet *	60 feet *	60 feet	60 feet
Liquid formulations ⁵	none	30 feet *	150 feet H§	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile

Alternative Buffer Zones:

* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.

H Applications using these formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.

¹ These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides (except for avian toxicants/deterrents) that rate as Class 2 in this species' toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	40 feet *	90 feet *	90 feet	90 feet
Liquid formulations ⁵	10 feet *	60 feet *	300 feet H§	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

- * A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth. Applicators should make sure that granules, pellets, or treated seeds are completely covered by soil for up to 60 feet from the edge of the area to be protected.
- H These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.
- ¹ These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides (except for avian toxicants/deterrents) that rate as Class 3 in this species' toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	50 feet *	100 feet *	100 feet	100 feet

Liquid formulations ⁵	20 feet *	90 feet *	450 feet H§	1/2 mile
ULV or dust formulations ⁶	250 feet H	250 feet H	1/4 mile H	3/4 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth. Applicators should make sure that granules, pellets, or treated seeds are completely covered by soil for up to 100 feet from the edge of the area to be protected.</p> <p>H These applications and formulations can have a buffer zone of 90 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.</p> <p>† These applications and formulations can have a buffer zone of 90 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

23. To protect bird species that will not eat granular, pellet, or treated seed formulations (e.g., black-capped vireo, golden-cheeked warbler, or southwestern willow flycatcher), the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of pesticide inside or adjacent to species habitat. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs

that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.

- b. Applicators should use at least a 1-mile buffer zone at the edge of species habitat when applying the following avian toxicants/deterrents or any other avian toxicant/deterrent.

aminopyridine (e.g., Avitrol⁷)
 chloro-p-toludine hydrochloride (e.g., CPTH, DRC-1339, Starlicide⁷)
 fenthion (e.g., Rid-A-Bird⁷)
 polybutene adhesive (e.g., Tanglefoot Bird Repellent⁷)

- c. Applicators should use the following buffer zones for application of pesticides other than avian toxicants/deterrents as indicated above. Recommended buffer zones should be implemented for areas that are (1) adjacent to (but not within) occupied habitat or (2) species habitat that has not been surveyed.

- ◆ Buffer zones are usually unnecessary for pesticides (except for avian toxicants/deterrents) that are rated as Class 0 in the species' toxicity group. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ Pesticides (except for avian toxicants/deterrents) that rate as Class 1 in the species' toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	none	30 feet *	30 feet	30 feet
Liquid formulations ⁵	none	30 feet *	150 feet H§	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile

Alternative Buffer Zones:

- * A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 1½-inch depth.
- H These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.
- ' These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides (except for avian toxicants/deterrents) that rate as Class 2 in this species' toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	10 feet *	60 feet *	60 feet	60 feet

Liquid formulations ⁵	10 feet *	60 feet *	300 feet H§	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 1½-inch depth.

H These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.

† These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.

2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.

3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.

5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.

6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides (except for avian toxicants/deterrents) that rate as Class 3 in this species' toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none

Solid formulations other than insect baits ⁴	20 feet *	90 feet *	90 feet	90 feet
Liquid formulations ⁵	20 feet *	90 feet *	450 feet H§	1/2 mile
ULV or dust formulations ⁶	250 feet H	250 feet H	1/4 mile H	3/4 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 1½-inch depth.</p> <p>H These applications and formulations can have a buffer zone of 90 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.</p> <p>† These applications and formulations can have a buffer zone of 90 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

24. To protect habitat-restricted animal species (e.g., Kanab ambersnail), the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of pesticide inside or adjacent to species habitat. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been

conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.

b. For pesticide applications adjacent to (but not within) occupied habitat or species habitat that has not been surveyed, measures to protect the species are:

- ◆ Buffer zones are usually unnecessary for non-herbicidal pesticides (e.g., fungicides) that are rated as Class 0 in the species' toxicity group and are also rated as Class 0 or Class 1 in the food toxicity group(s) of the species. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ Pesticides that rate as Class 1 in the species' toxicity group should have the following buffer zones when applied at the edge of species habitat. The buffer zones should also be used for pesticides that rate as (1) Class D, (2) Class M, (3) Class NS, or (4) either Class 2 or Class 3 in the food toxicity group(s) of the species but are not rated higher than Class 1 in the species' toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	none	30 feet *	30 feet	30 feet
Liquid formulations ⁵	none	30 feet *	150 feet H§	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile

Alternative Buffer Zones:

* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.

H These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.

' These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 in this species= toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	10 feet *	60 feet *	60 feet	60 feet
Liquid formulations ⁵	10 feet *	60 feet *	300 feet H§	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.

H These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.

' These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 3 in this species= toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	20 feet *	90 feet *	90 feet	90 feet
Liquid formulations ⁵	20 feet *	90 feet *	450 feet H§	1/2 mile
ULV or dust formulations ⁶	250 feet H	250 feet H	1/4 mile H	3/4 mile

Alternative Buffer Zones:

- * A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.
- H These applications and formulations can have a buffer zone of 90 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) proposed or listed species or their habitat components (nests, roosting sites, etc.) have not been sighted or documented in the area.
- ' These applications and formulations can have a buffer zone of 90 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

25. To protect habitat-unrestricted animal species (e.g., New Mexican ridge-nosed rattlesnake), the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of pesticide inside or adjacent to species habitat. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
 - b. For pesticide applications inside occupied habitat or species habitat that has not been surveyed, measures to protect the species are:
 - ◆ Protection measures are usually unnecessary for pesticides rated as Class 0 in the species' toxicity group when these pesticides are applied inside occupied habitat or un-surveyed habitat. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
 - ◆ A pesticide should not be used inside occupied or un-surveyed habitat if the pesticide rates as Class 1, Class 2, or Class 3 in the species' toxicity group. A possible exception is the use of fire ant bait formulations which may be applied inside or adjacent to occupied or un-surveyed habitat of proposed or listed species. Fire ant formulations may be used if (1) the proposed or listed species are not arthropods or mollusks and (2) prey or pollinators of proposed or listed species will not be impacted.
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26. To protect animal species in small aquatic habitat or shallows of large waterbodies, the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of pesticide inside or adjacent to waterbodies and wetlands that serve as species habitat. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species within 1 mile of aquatic habitat of the species.
- b. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside waterbodies or wetlands serving as species habitat unless approved by the Service. This includes (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. Downstream from the habitat area, these aquatic pesticides should not be applied any closer than 300 feet.

acrolein	2, 4-D (e.g., Aqua-Kleen ⁷)	glyphosate (e.g., Rodeo ⁷)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat ⁷)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

- c. Applicators should use the following buffer zones for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should be used for (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Pesticides that rate as either Class 0 or Class 1 in either the species' toxicity group or food toxicity group(s) of the species should have the following buffer zones when applied at the edge of the waterbody or wetland to be protected.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	30 feet *	300 feet	300 feet	300 feet
Liquid formulations ⁵	30 feet *	350 feet H§	450 feet H§	1/8 mile
ULV or dust formulations ⁶	400 feet §	400 feet §	1/8 mile §	1/4 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 10 feet at the edge of the waterbody or wetland to be protected if (1) the application is approved by the Service and (2) the pesticide is applied by hand-operated equipment.
- † These applications and formulations can have a buffer zone of 300 feet at the edge of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or wetland during the time of application.
- § These applications and formulations can have a buffer zone of 300 feet at the edge of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 in either the species' toxicity group or in the food toxicity group of the species should have the following buffer zones when applied at the edge of the waterbody or wetland to be protected.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	50 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	50 feet	350 feet	1/8 mile	1/4 mile
ULV or dust formulations ⁶	450 feet	450 feet	1/4 mile	1/2 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 3 in either the species' toxicity group or in the food toxicity group of the species should have the following buffer zones when applied at the edge of the waterbody or wetland to be protected.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	100 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	100 feet	400 feet	1/8 mile	1/2 mile
ULV or dust formulations ⁶	500 feet	500 feet	1/4 mile	3/4 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

27. To protect animal species in large aquatic habitat, the Service recommends —

- a. A survey should be conducted for the species in accordance with Service protocols before application of pesticide inside or adjacent to waterbodies and wetlands that serve as species habitat. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species within 1 mile of aquatic habitat of the species.
- b. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside waterbodies or wetlands serving as species habitat unless approved by the Service. This includes (1) all of the habitat area and (2) at least 1/2 mile upstream from the habitat area in any contributing channel, tributary, or spring run. Downstream from the habitat area, these aquatic pesticides should not be applied any closer than 300 feet.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

- c. Applicators should use the following buffer zones for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should

be used for (1) all of the habitat area and (2) at least 1/2 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Buffer zones are usually unnecessary for pesticides rated as Class 0 in this species= toxicity group when these pesticides are applied at the edge of the waterbody or wetland to be protected. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ Pesticides that rate as Class 1 in this species= toxicity group should have the following buffer zones when applied at the edge of the waterbody or wetland to be protected.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	10 feet	50 feet	50 feet	50 feet
Liquid formulations ⁵	10 feet	80 feet *H	200 feet *H	1/8 mile
ULV or dust formulations ⁶	150 feet *	150 feet *	500 feet *	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or wetland during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 or Class 3 in this species= toxicity group should have the following buffer zones when applied at the edge of the waterbody or wetland to be protected.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	20 feet	80 feet	80 feet	80 feet
Liquid formulations ⁵	20 feet	100 feet	350 feet *H	1/4 mile
ULV or dust formulations ⁶	200 feet *	200 feet *	1/4 mile *	1/2 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 100 feet at the edge of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or wetland during the time of application.
- H These applications and formulations can have a buffer zone of 100 feet at the edge of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

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28. To protect Comal River species (Comal Springs riffle beetle and fountain darter), the Service recommends —

Application of pesticide inside the following Pesticide Sensitive Area should have the protection measures indicated below. If protection measures for a pesticide application within the Pesticide Sensitive Area cannot be implemented, the pesticide user should contact the Austin field office of the Service at 512-490-0057 for appropriate protection measures and for any necessary incidental take authorization or permit. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species inside the Pesticide Sensitive Area.

County	Pesticide Sensitive Area
Comal County, Texas	The area within 1/8 mile of Landa Lake, Blieders Creek, Dry Comal Creek, Panther Canyon draw, and all of the Comal River to the Guadalupe River confluence

- a. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside species habitat unless approved by the Service. This includes any tributary or spring run within 1/2 mile of the Pesticide Sensitive Area defined above.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

- b. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones

should be used for (1) all of the habitat area and (2) at least 1/2 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Pesticides that rate as Class 0 or Class 1 in the Cold Water Fish or Aquatic Arthropod toxicity groups should have the following buffer zones when applied at the edge of any waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	None	none
Solid formulations other than insect baits ⁴	10 feet	50 feet	50 feet	50 feet
Liquid formulations ⁵	10 feet	80 feet *H	200 feet *H	1/8 mile
ULV or dust formulations ⁶	150 feet *	150 feet *	500 feet *	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, etc.) to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 or Class 3 in either the Cold Water Fish or Aquatic Arthropod toxicity groups should have the following buffer zones when applied at the edge of any waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	None	none
Solid formulations other than insect baits ⁴	20 feet	80 feet	80 feet	80 feet
Liquid formulations ⁵	20 feet	100 feet	350 feet *H	1/4 mile
ULV or dust formulations ⁶	200 feet *	200 feet *	1/4 mile *	1/2 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 80 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.
- H These applications and formulations can have a buffer zone of 80 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, etc.) to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

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29. To protect Diamond Y Draw species (Leon Springs pupfish, Pecos gambusia, and Pecos sunflower), the Service recommends —

Application of pesticide inside the following Pesticide Sensitive Area should have the protection measures indicated below. If protection measures for a pesticide application within the Pesticide Sensitive Area cannot be implemented, the pesticide user should contact the Austin field office of the Service at 512-490-0057 for appropriate protection measures and for any necessary incidental take authorization or permit. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species inside the Pesticide Sensitive Area.

County	Pesticide Sensitive Area
Pecos County, Texas	The area covered by Leon Creek, Diamond Y Draw, Diamond Y Spring, Gonzalez Spring, and their associated wetlands or spring runs up to 2 miles east of the crossing of State Highway 18 over Diamond Y Draw.

- a. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside

species habitat unless approved by the Service. This includes any waterbody or wetland within 1 mile of the Pesticide Sensitive Area defined above.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

- b. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should be used for (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Pesticides (except for Class D herbicides) that rate as either Class 0 or Class 1 in both the Warm Water Fish toxicity group and Aquatic Arthropod toxicity group should have the following buffer zones when applied at the edge of any waterbody or wetland within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	30 feet	300 feet	300 feet	300 feet
Liquid formulations ⁵	30 feet	350 feet	450 feet	1/8 mile
ULV or dust formulations ⁶	400 feet	400 feet	1/8 mile	1/4 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 in the Warm Water Fish toxicity group or Aquatic Arthropod toxicity group should have the following buffer zones when applied at the edge of any waterbody or wetland within the Pesticide Sensitive Area defined above. The buffer zones should also be used for pesticides that rate as Class D, M, or NS but are not rated higher than Class 2 in the Warm Water Fish toxicity group or Aquatic Arthropod toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	50 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	50 feet	350 feet	1/8 mile	1/4 mile
ULV or dust formulations ⁶	450 feet *	450 feet	1/4 mile	1/2 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 3 in the Warm Water Fish toxicity group or Aquatic Arthropod toxicity group should have the following buffer zones when applied at the edge of any waterbody or wetland within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	100 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	100 feet	400 feet	1/8 mile	1/2 mile

ULV or dust formulations ⁶	500 feet	500 feet	1/4 mile	3/4 mile
Notes: 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones. 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank. 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high. 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts. 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations. 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.				

30. To protect San Marcos River species (Comal Springs riffle beetle, fountain darter, San Marcos gambusia, San Marcos salamander, and Texas wild-rice), the Service recommends —

Application of pesticides inside the following Pesticide Sensitive Area should have the protection measures indicated below. If protection measures for a pesticide application within the Pesticide Sensitive Area cannot be implemented, the pesticide user should contact the Austin field office of the Service at 512-490-0057 for appropriate protection measures and for any necessary incidental take authorization or permit. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species inside the Pesticide Sensitive Area.

County	Pesticide Sensitive Area
Hays County, Texas	The area within 1/8 mile of Spring Lake, Purgatory Creek, Sessom Creek, Sink Creek, and all of the upper San Marcos River to the Blanco River confluence.

- a. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, and mosquito control agents, etc.) inside species habitat unless approved by the Service. This includes any tributary or spring run within 1/2 mile of the Pesticide Sensitive Area defined above.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

- b. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should be used for (1) all of the habitat area and (2) at least 1/2 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Pesticides (including Class D herbicides) that rate as Class 0 or Class 1 in the Aquatic Amphibian, Cold Water Fish, Warm Water Fish, or Aquatic Arthropod toxicity groups should have the following buffer zones when applied at the edge of any waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	None	none
Solid formulations other than insect baits ⁴	10 feet	50 feet	50 feet	50 feet
Liquid formulations ⁵	10 feet	80 feet *H	200 feet *H	1/8 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	500 feet H	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as (1) Class 2 or Class 3 in any of the Aquatic Amphibian, Cold Water Fish, Warm Water Fish, or Aquatic Arthropod toxicity groups, (2) Class M, or (3) Class NS should have the following buffer zones when applied at the edge of any waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	None	none
Solid formulations other than insect baits ⁴	20 feet	80 feet	80 feet	80 feet
Liquid formulations ⁵	20 feet	100 feet	350 feet *H	1/4 mile
ULV or dust formulations ⁶	200 feet H	200 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 80 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.
- H These applications and formulations can have a buffer zone of 80 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

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31. To protect Toyah Creek species (Comanche Springs pupfish, Pecos gambusia, and Pecos sunflower), the Service recommends —

Application of pesticides inside the following Pesticide Sensitive Areas should have the protection measures indicated below. If protection measures for a pesticide application within a Pesticide Sensitive Area cannot be implemented, the pesticide user should contact the Austin field office of the Service at 512-490-0057 for appropriate protection measures and for any necessary incidental take authorization or permit. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species inside a Pesticide Sensitive Area.

County	Pesticide Sensitive Area
Jeff Davis County, Texas	The area within 1/2 mile of the spring outlet for Phantom Lake Spring (N30°56'06", W103°50'58").
Reeves County, Texas	The area within 1/2 mile of the spring outlets for San Solomon Spring (N30°56'40", W103°47'08"), Giffin Spring (N30°56'45", W103°47'23"), and East Sandia Spring (N30°59'28", W103°43'44").

- a. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside species habitat unless approved by the Service. This includes any waterbody or wetland within 1 mile of the Pesticide Sensitive Area defined above.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

- b. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should be used for (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Pesticides (except for Class D herbicides) that rate as either Class 0 or Class 1 in both the Warm Water Fish toxicity group and Aquatic Arthropod toxicity group should have the following buffer zones when applied at the edge of any waterbody or wetland within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	30 feet	300 feet	300 feet	300 feet
Liquid formulations ⁵	30 feet	350 feet	450 feet	1/8 mile
ULV or dust formulations ⁶	400 feet	400 feet	1/8 mile	1/4 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 in the Warm Water Fish toxicity group or Aquatic Arthropod toxicity group should have the following buffer zones when applied at the edge of any waterbody or wetland within the Pesticide Sensitive Area defined above. The buffer zones should also be used for pesticides that rate as Class D but are not rated higher than Class 2 in the Warm Water Fish toxicity group or Aquatic Arthropod toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	50 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	50 feet	350 feet	1/8 mile	1/4 mile
ULV or dust formulations ⁶	450 feet	450 feet	1/4 mile	1/2 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 3 in the Warm Water Fish toxicity group or Aquatic Arthropod toxicity group should have the following buffer zones when applied at the edge of any waterbody or wetland within the Pesticide Sensitive Area defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	100 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	100 feet	400 feet	1/8 mile	1/2 mile
ULV or dust formulations ⁶	500 feet	500 feet	1/4 mile	3/4 mile

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

32. To protect cave-dwelling arthropod species, the Service recommends —

Application of pesticides in areas of limestone rock outcrop inside the following Pesticide Sensitive Areas should have the protection measures indicated below. Preserve areas for cave-dwelling species that are located inside a Pesticide Sensitive Area have specific restrictions on pesticide applications, and the Austin field office of the Service should be consulted at 512-490-0057 for information on applications involving these preserves. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species inside the Pesticide Sensitive Areas.

County	Pesticide Sensitive Area
Bexar County, Texas	The area in the county that lies north of State Highway 90.
Travis County, Texas	The area in the county that lies (1) west of Interstate Highway 35 and (2) north of William Cannon Road and the part of State Highway 71 that extends west from William Cannon Road to the county boundary.
Williamson County, Texas	All of the area in the county that lies west of Interstate Highway 35 for up to 20 miles.

- a. A survey should be conducted in accordance with Service protocols for species habitat (limestone rock outcrop with caves, sinkholes, or crevices) within the Pesticide Sensitive Areas defined above before application of any pesticide. Pesticide users should contact the Austin field office of the Service at 512-490-0057 for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. A follow-up survey may be necessary if

the initial survey indicates the possible presence of species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.

- b. Pesticides that rate as Class 2 or Class 3 in the Terrestrial Arthropod toxicity group should have the following buffer zones when applied at the edge of (but not within) a local drainage basin or subsurface basin that drains into species habitat (caves, sinkholes, or crevices) as defined by a Service-approved survey.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	10 feet	50 feet	50 feet	50 feet
Liquid formulations ⁵	10 feet	80 feet	200 feet *H	1/8 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	500 feet H	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 50 feet at the edge of the local drainage basin or subsurface basin if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area to be protected during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 50 feet at the edge of the local drainage basin or subsurface basin if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

- c. Pesticides should not be used within 170 feet of species habitat of caves, sinkholes, or crevices as defined by a Service-approved survey. Pesticides should also not be allowed to drift or be

moved by surface runoff into the 170-foot protected area. For fire ant control within the 170-foot protected area, 1 to 4 gallons of boiling water may be poured over individual fire ant mounds in the early morning to achieve adequate control.

- d. For pesticide applications adjacent to (but not within) a 170-foot protected area around species habitat of caves, sinkholes, or crevices as defined by a Service-approved survey, measures to protect the species are:

- ◆ Pesticides that rate as Class 0 or Class 1 in the Terrestrial Arthropod toxicity group should have the following buffer zones when applied at the edge of the 170-foot protected area.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	30 feet	150 feet	1/8 mile
Solid formulations other than insect baits ⁴	none	none	None	none
Liquid formulations ⁵	none	30 feet	150 feet *H	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile

Alternative Buffer Zones:

* These applications and formulations can have a buffer zone of 30 feet at the edge of the 170-foot protected area if a strong, steady wind of at least 3 miles per hour is blowing directly away from the 170-foot protected area during the time of application.

H These applications and formulations can have a buffer zone of 30 feet at the edge of the 170-foot protected area if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 or Class 3 in the Terrestrial Arthropod toxicity group should have the following buffer zones when applied at the edge of the 170-foot protected area.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	10 feet	60 feet	300 feet	1/4 mile
Solid formulations other than insect baits ⁴	none	none	none	none
Liquid formulations ⁵	10 feet	60 feet	300 feet *H	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 60 feet at the edge of the 170-foot protected area if a strong, steady wind of at least 3 miles per hour is blowing directly away from the 170-foot protected area during the time of application.
- H These applications and formulations can have a buffer zone of 60 feet at the edge of the 170-foot protected area if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

33. To protect dicot plant species in plant communities with closed or dense canopies, the Service recommends —

- a. Federal agencies should either conduct a survey for the species in accordance with Service protocols or otherwise require a Service-approved survey before application of herbicide inside or adjacent to species habitat. For all other applicators or relevant agencies, a survey is recommended prior to herbicide application inside or adjacent to species habitat on non-Federal land. Pesticide users should contact the nearest Service field office for information on survey protocols. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary authorization.
- b. For pesticide applications adjacent to (but not within) occupied habitat or species habitat that has not been surveyed, the following protection measures should be used:
 - ◆ Buffer zones are usually unnecessary for herbicides rated as Class M. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
 - ◆ The following buffer zones should be used when applying a pesticide that rates as either Class D or Class NS.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (non-pollinator insect baits only)	10 feet	30 feet	150 feet	1/8 mile
Solid formulations other than non-pollinator insect baits ⁴	10 feet	30 feet	30 feet	30 feet
Liquid formulations ⁵	10 feet	30 feet	150 feet *H	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile

Alternative Buffer Zones:

* These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application.

H These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

34. To protect dicot plant species in plant communities with open to semi-open canopies, the Service recommends —

- a. Federal agencies should either conduct a survey for the species in accordance with Service protocols or otherwise require a Service-approved survey before application of herbicide inside or adjacent to species habitat. For all other applicators or relevant agencies, a survey is recommended prior to herbicide application inside or adjacent to species habitat on non-Federal land. Pesticide users should contact the nearest Service field office for information on survey protocols. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary authorization.
- b. For pesticide applications adjacent to (but not within) occupied habitat or species habitat that has not been surveyed, the following protection measures should be used:
 - ◆ Buffer zones are usually unnecessary for herbicides rated as Class M. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
 - ◆ The following buffer zones should be used when applying a pesticide that rates as either Class D or Class NS.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (non-pollinator insect baits only)	20 feet	60 feet	300 feet	1/4 mile
Solid formulations other than non-pollinator insect baits ⁴	20 feet	60 feet	60 feet	60 feet
Liquid formulations ⁵	20 feet	60 feet	300 feet *H	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile
Alternative Buffer Zones: * These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application. H These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.				

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

35. To protect dicot plant species in relatively small aquatic habitat, the Service recommends —

- a. Federal agencies should either conduct a survey for the species in accordance with Service protocols or otherwise require a Service-approved survey before application of herbicide inside or adjacent to aquatic habitat of the species. For all other applicators or relevant agencies, a survey is recommended prior to herbicide application inside or adjacent to aquatic habitat of the species on non-Federal land. Pesticide users should contact the nearest Service field office for information on survey protocols. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary authorization.
- b. Applicators should not use the following aquatic herbicides (or any other herbicide formulation labeled for aquatic use) inside species habitat unless approved by the Service. This includes (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. Downstream from the habitat area, these aquatic herbicides should not be applied any closer than 300 feet.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	fluridone	simazine
copper chelate	diquat	glyphosate (e.g., Rodeo®)	terbutryn
copper sulfate	endothall	imazapyr (e.g., Habitat®)	

- c. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should be used for (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Buffer zones are usually unnecessary for herbicides rated as Class M. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ The following buffer zones should be used at the edge of the waterbody or wetland to be protected if the pesticide rates either as Class D or Class NS.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	50 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	50 feet	350 feet	1/8 mile *H	1/4 mile
ULV or dust formulations ⁶	450 feet H	450 feet H	1/4 mile H	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 350 feet at the edge of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or wetland during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 350 feet at the edge of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

36. To protect monocot plant species in plant communities with closed or dense canopies, the Service recommends —

- a. Federal agencies should either conduct a survey for the species in accordance with Service protocols or otherwise require a Service-approved survey before application of herbicide inside or adjacent to species habitat. For all other applicators or relevant agencies, a survey is recommended prior to herbicide application inside or adjacent to species habitat on non-Federal land. Pesticide users should contact the nearest Service field office for information on survey protocols. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary authorization.
- b. For pesticide applications adjacent to (but not within) occupied habitat or species habitat that has not been surveyed, the following protection measures should be used:
 - ◆ Buffer zones are usually unnecessary for herbicides rated as Class D. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
 - ◆ The following buffer zones should be used when applying a pesticide that rates as either Class M or Class NS.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (non-pollinator insect baits only)	10 feet	30 feet	150 feet	1/8 mile
Solid formulations other than non-pollinator insect baits ⁴	10 feet	30 feet	30 feet	30 feet
Liquid formulations ⁵	10 feet	30 feet	150 feet *H	1/8 mile
ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile

Alternative Buffer Zones:

* These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application.

H These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

37. To protect monocot plant species in plant communities with open to semi-open canopies, the Service recommends —

- a. Federal agencies should either conduct a survey for the species in accordance with Service protocols or otherwise require a Service-approved survey before application of herbicide inside or adjacent to species habitat. For all other applicators or relevant agencies, a survey is recommended prior to herbicide application inside or adjacent to species habitat on non-Federal land. Pesticide users should contact the nearest Service field office for information on survey protocols. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary authorization.
- b. For pesticide applications adjacent to (but not within) occupied habitat or species habitat that has not been surveyed, the following protection measures should be used:
 - ◆ Buffer zones are usually unnecessary for herbicides rated as Class D. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
 - ◆ The following buffer zones should be used when applying a pesticide that rates as either Class M or Class NS.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
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Bait formulations (non-pollinator insect baits only)	20 feet	60 feet	300 feet	1/4 mile
Solid formulations other than non-pollinator insect baits ⁴	20 feet	60 feet	60 feet	60 feet
Liquid formulations ⁵	20 feet	60 feet	300 feet *H	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

38. To protect monocot plant species in relatively small aquatic habitat, the Service recommends —

- a. Federal agencies should either conduct a survey for the species in accordance with Service protocols or otherwise require a Service-approved survey before application of herbicide inside

or adjacent to aquatic habitat of the species. For all other applicators or relevant agencies, a survey is recommended prior to herbicide application inside or adjacent to aquatic habitat of the species on non-Federal land. Pesticide users should contact the nearest Service field office for information on survey protocols. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary authorization.

- b. Applicators should not use the following aquatic herbicides (or any other herbicide formulation labeled for aquatic use) inside aquatic habitat of proposed or listed plant species. This includes (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. Downstream from the habitat area, these aquatic herbicides should not be applied any closer than 300 feet.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	fluridone	simazine
copper chelate	diquat	glyphosate (e.g., Rodeo®)	terbutryn
copper sulfate	endothall	imazapyr (e.g., Habitat®)	

- c. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should be used for (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Buffer zones are usually unnecessary for herbicides rated as Class D. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ The following buffer zones should be used at the edge of the waterbody or wetland to be protected if the pesticide rates either as Class M or Class NS.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	50 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	50 feet	350 feet	1/8 mile *H	1/4 mile
ULV or dust formulations ⁶	450 feet H	450 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 350 feet at the edge of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or wetland during the time of application.
- H These applications and formulations can have a buffer zone of 350 feet at the edge of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

39. To protect plant species with small pollinating insects, the Service recommends —

Pesticides that rate as Class 2 or Class 3 in the pollinating toxicity group (Bee and/or Terrestrial Arthropod) of a proposed or listed plant species should have the following buffer zones for applications at the edge of sites occupied by the species throughout the year. Applicators should apply insecticides in swaths parallel to habitat of proposed or listed plant species and avoid flying directly over the habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (non-pollinator insect baits only)	none	none	none	none

All formulations other than non-pollinator insect bait formulations	300 feet *	1/2 mile *H	1/2 mile §	1/2 mile §
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for these formulations in non-habitat areas (e.g., cropland) if the pesticide is placed into the soil below a 12-inch depth.</p> <p>H Mechanized ground applications of these pesticides in non-habitat areas (e.g., cropland) can have a buffer zone of 80 feet from occupied species habitat during the flowering period if the application is made in early dawn (no later than one hour after sunrise) or early evening (6:00 p.m. or later).³¹ For applications made in non-habitat areas outside the flowering period, the pesticide may be applied beyond the 80-foot buffer zone at any time during the day.</p> <p>§ Aerial applications of these pesticides in non-habitat areas (e.g., cropland) can have a buffer zone of 1/4 mile from occupied species habitat during the flowering period if the application is made in early dawn (no later than one hour after sunrise) or early evening (6:00 p.m. or later).³⁰ For applications made in non-habitat areas outside the flowering period, the pesticide may be applied beyond the 1/4-mile buffer zone at any time during the day.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p>				

40. To protect plant species with large pollinating insects, the Service recommends —

Pesticides that rate as Class 2 or Class 3 in the pollinating toxicity group (Bee and/or Terrestrial Arthropod) of a proposed or listed plant species should have the following buffer zones for applications at the edge of sites occupied by the species throughout the year. Applicators should apply insecticides in swaths parallel to habitat of proposed or listed plant species and avoid flying directly over the habitat.

³¹ See Table 3 in Section 4.3.2 for flowering periods of proposed or listed plant species.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (non-pollinator insect baits only)	none	none	none	none
All formulations other than non-pollinator insect bait formulations	1/8 mile *	2 miles *H	2 miles §	2 miles §
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for these formulations in non-habitat areas (e.g., cropland) if the pesticide is placed into the soil below a 12-inch depth.</p> <p>H Mechanized ground applications of these pesticides in non-habitat areas (e.g., cropland) can have a buffer zone of 80 feet from occupied species habitat during the flowering period if the application is made in early dawn (no later than one hour after sunrise) or early evening (6:00 p.m. or later). ³² For applications made in non-habitat areas outside the flowering period, the pesticide may be applied beyond the 80-foot buffer zone at any time during the day.</p> <p>§ Aerial applications of these pesticides in non-habitat areas (e.g., cropland) can have a buffer zone of 1/4 mile from occupied species habitat during the flowering period if the application is made in early dawn (no later than one hour after sunrise) or early evening (6:00 p.m. or later). ³¹ For applications made in non-habitat areas outside the flowering period, the pesticide may be applied beyond the 1/4-mile buffer zone at any time during the day.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p>				

³² See Table 3 in Section 4.3.2 for flowering periods of proposed or listed plant species.

41. To protect the black-footed ferret, the Service recommends —

- a. Populations (experimental or unknown) of the black-footed ferret should be located before using rodent control agents in prairie dog colonies:
- ◆ Applicators or relevant agencies should contact the Arizona field office of the Service at 602-242-0210 to determine the current location of experimental ferret populations in Yavapai County, Arizona.
 - ◆ A ferret survey is recommended for prairie dog colonies in locations other than Yavapai County, Arizona. Colonies to be surveyed should be sufficiently large to support a small population of black-footed ferrets (i.e., black-tailed prairie dog colonies greater than 80 acres; white-tailed prairie dog colonies greater than 200 acres). A copy of survey guidelines for black-footed ferrets may be obtained from the regional pesticide coordinator in Austin at 512-490-0057. A scientific permit should be obtained from the Service before conducting a ferret survey. If a prairie dog colony is occupied by black-footed ferrets, the Service should be contacted.
 - ◆ The Service should be notified before treatment of prairie dog complexes larger than 1,000 acres. Control agents for prairie dogs should not be used in such a complex until the complex has been (1) systematically surveyed for black-footed ferrets and (2) evaluated by appropriate state and Federal agencies for its potential as a ferret recovery site. Additional surveys for the complex are recommended after an extended period of time.
- b. Applicators should not use the following rodent control agents in a prairie dog colony or any pesticide that can cause either secondary poisoning (Class 1_{sp} or Class 2_{sp}) or burrow fumigation (Class 2_b) in the Predatory Mammal toxicity group when black-footed ferrets are present.

acrolein	chlorophacinone	magnesium phosphide	sodium nitrate
aluminum phosphide	diphacinone	potassium nitrate	zinc phosphide

42. To protect the gray wolf, the Service recommends —

- a. Pesticide users should contact the Service field office in Albuquerque at 505-346-2525 for information on the Mexican gray wolf before application of any predator/rodent control agent inside or adjacent to currently occupied habitat in chaparral, woodland, or forest. The Service should be consulted for appropriate protection measures in using these pesticides and for any necessary incidental take authorization or permit.
- b. The following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp} or Class 2_{sp}) in the Predatory Mammal toxicity group should not be used inside or close to occupied habitat.

brodifacoum	diphacinone	sodium fluoroacetate	zinc phosphide
chlorophacinone	sodium cyanide	strychnine	

43. To protect the Louisiana black bear, the Service recommends —

- a. Pesticide users should contact the nearest Service field office for information on the Louisiana black bear before application of any predator/rodent control agent inside or adjacent to species habitat of forest and woodland. If a survey for the species is necessary, survey protocols and a scientific permit should be obtained from the Service. Further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. The following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp} or Class 2_{sp}) in the Predatory Mammal toxicity group should not be used inside or close to occupied habitat.

brodifacoum	diphacinone	sodium fluoroacetate	zinc phosphide
chlorophacinone	sodium cyanide	strychnine	

44. To protect the Attwater's greater prairie-chicken, the Service recommends —

Application of pesticides inside the following Pesticide Sensitive Areas should have the protection measures indicated below.

County	Pesticide Sensitive Area
Austin County, Texas	The area bounded on the north side by Interstate Highway 10, on the east side by State Highway 36, on the south side by Porter Chapel Road which is extended westward by a straight line to Bernard Creek and then southward along the creek to the San Bernard River, and on the west side by the San Bernard River.
Colorado County, Texas	The area bounded on the north side by Interstate Highway 10; on the east side by the San Bernard River; on the south side by FM 3013; and on the west side by County Roads 96, 101, 253, 172, and 218.
Galveston County, Texas	The area bounded on the west side by State Highway 146, on the south side by Dickinson Bayou and Dickinson Bay, and on the north side by Moses Lake.

- a. For pesticide applications in grassland, pasture, or rights-of-way inside the Pesticide Sensitive Areas defined above, measures to protect the species are:

- ◆ Applicators using a pesticide that rates as Class 1, Class 2, or Class 3 in the Gallinaceous Avian toxicity group on grassland, pasture, or rights-of-way within a Pesticide Sensitive Area should contact the Clear Lake Field Office of the Service at 281-286-8282 for appropriate protection measures before pesticide treatment. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species inside a Pesticide Sensitive Area.
 - ◆ Application of zinc phosphide or any other rodenticide in grassland, pasture, or rights-of-way inside the Pesticide Sensitive Areas defined above should be restricted to tamper-resistant bait boxes.
- b. For pesticide applications adjacent to (but not within) grassland, pasture, or rights-of-way inside the Pesticide Sensitive Areas defined above, measures to protect the species are:
- ◆ Buffer zones are usually unnecessary for pesticides rated as Class 0 in the Gallinaceous Avian toxicity group. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside grassland, pasture, or rights-of-way as a result of pesticide application.
 - ◆ Pesticides that rate as Class 1 in the Gallinaceous Avian toxicity group should have the following buffer zones when applied at the edge of grassland, pasture, or rights-of-way with grass that is least 6 inches in height. These buffer zones apply for Class 1 pesticides only during the months of May through July.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	60 feet *	300 feet *	300 feet	300 feet
Liquid formulations ⁵	60 feet *	350 feet *H§	450 feet H§	1/8 mile
ULV or dust formulations ⁶	400 feet H	400 feet H	1/8 mile H	1/4 mile

Alternative Buffer Zones:

* A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth. Applicators should make sure that granules, pellets, or treated seeds are completely covered by soil for up to 300 feet from the edge of the area to be protected.

H These applications and formulations can have a buffer zone of 300 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) Attwater's prairie-chickens or their nests have not been sighted in the area.

' These applications and formulations can have a buffer zone of 300 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 or Class 3 in the Gallinaceous Avian toxicity group should have the following buffer zones when applied at the edge of grassland, pasture, or rights-of-way with grass that is least 6 inches in height. The buffer zones should be applied throughout the year for these pesticides.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Solid formulations ⁴	300 feet *	350 feet *	350 feet	350 feet
Liquid formulations ⁵	300 feet *	350 feet *	1/8 mile H§	1/4 mile
ULV or dust formulations ⁶	450 feet H	450 feet H	1/4 mile H	1/2 mile

Alternative Buffer Zones:

- * A buffer zone is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth. Applicators should make sure that granules, pellets, or treated seeds are completely covered by soil for up to 350 feet from the edge of the area to be protected.
- H These applications and formulations can have a buffer zone of 350 feet at the edge of the area to be protected if the following three conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application, (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event, and (3) Attwater's prairie-chickens or their nests have not been sighted in the area.
- ¹ These applications and formulations can have a buffer zone of 350 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

45. To protect the bald eagle, the Service recommends —

- a. Pesticide users should contact the nearest Service field office for information on the bald eagle before application of pesticide inside or adjacent to forest or woodland areas with large waterbodies (rivers, lakes, reservoirs, etc.). If a survey for the species is necessary, survey protocols and a scientific permit should be obtained from the Service. Further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. The following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp}, Class 2_{sp}, or Class 3_{sp}) in the Predatory Avian toxicity group should not be

used within 3 miles of (1) currently occupied territory as determined by a Service-approved survey, (2) wintering areas, or (3) species habitat that has not been surveyed.

brodifacoum	diphacinone *	sodium cyanide	strychnine
chlorophacinone *	famphur (e.g., Warbex7) †	sodium fluoroacetate	zinc phosphide
<p>Alternative Buffer Zones:</p> <p>* Chlorophacinone or diphacinone may be applied below ground for control of rodents inside occupied habitat or the 3-mile buffer zone if (1) treatment is approved by the Service, (2) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony, and (3) all tunnel entrances of the colony are covered up.</p> <p>H Animal carcasses with famphur-treated hides that are within 3 miles of areas where bald eagles are present should be removed, buried, or otherwise covered.</p>			

c. For applications near bald eagle nests that involve pesticides other than predator/rodent control agents or any pesticide that can cause secondary poisoning as indicated above, measures to protect the species are:

- ◆ Pesticides (except for predator/rodent control agents or any pesticide that can cause secondary poisoning) that rate as Class 0 or Class 1 in the Predatory Avian toxicity group should have a 1/4-mile buffer zones from currently occupied nests during the breeding season of October 1 to June 30.³³ The buffer zone is unnecessary outside of the breeding season. Aerial pesticide applications should be made in swaths parallel to a nest and its aerial buffer zone. If aerial flight over a nest site is necessary, an elevation of 500 feet should be maintained over the nest.
- ◆ Pesticides (except for predator/rodent control agents or any pesticide that can cause secondary poisoning) that rate as either Class 2 or Class 3 in the Predatory Avian toxicity group should have the following buffer zones from currently occupied nests during the breeding season of October 1 to June 30.³⁴ Buffer zones are unnecessary for nonpersistent pesticides outside of the breeding season. Aerial pesticide applications should be made in swaths parallel to a nest and its aerial buffer zone. If aerial flight over a nest site is necessary, an elevation of 500 feet should be maintained over the nest.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations	1/4 mile	1/4 mile	1/4 mile	1/4 mile

³³ Recommended buffer zones for protection of bald eagle nests against Class 0 or Class 1 pesticides are based on disturbance factors.

³⁴ Recommended buffer zones for protection of bald eagle nests against Class 2 or Class 3 pesticides are based on disturbance factors and/or spray drift.

All formulations other than bait formulations	1/4 mile *	1/2 mile *†	1/2 mile	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for application of pesticides inside existing rights-of-way (paved or gravel-base roadways only) near eagle nests. Pesticides applied along existing rights-of-way should not exceed Class 1 in the Predatory Avian toxicity group.</p> <p>H A buffer zone is unnecessary at the edge of the territory to be protected if the pesticide is placed into the soil below a 12-inch depth.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by hand-operated equipment only.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p>				

- d. Pesticides (except for predator/rodent control agents or any pesticide that can cause secondary poisoning) that rate as Class 2 or Class 3 in either the Cold Water Fish toxicity group or the Warm Water Fish toxicity group should have the following buffer zones when applied at the edge of the closest large waterbody (rivers, lakes, etc.) to an occupied eagle nest during the breeding season of October 1 to June 30. The buffer zones apply only to (1) lakes or reservoirs less than 100 surface acres and (2) rivers and streams that are less than 300 feet wide.³⁵ The buffer zones should extend for 1 mile both upstream and downstream from the nest=s closest point to the waterbody.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none

³⁵ The limits on waterbody size (100 acres for lakes and reservoirs, 300 feet for rivers) are used to exclude relatively large waterbodies (large rivers, coastal bays, etc.) where pesticide concentrations will not ordinarily impact fish resources for the bald eagle.

Solid formulations other than insect baits ⁴	10 feet	50 feet	50 feet	50 feet
Liquid formulations ⁵	10 feet	80 feet *H§	200 feet H§	1/8 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	500 feet H	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* These formulations can be applied up to 50 feet from the edge of the waterbody to be protected if the pesticide is placed into the soil below a 12-inch depth.</p> <p>H These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody during the time of application.</p> <p>† These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

46. To protect the California condor, the Service recommends —

- a. Pesticide users should contact the Service field office in Flagstaff, Arizona, at 928-226-0614 for information on the California condor before application of pesticide near release sites, nest sites, or known communal roost sites in species habitat of canyon lands and mountain ridges. If a survey for the species is necessary, survey protocols and a scientific permit should be obtained from the Service. Further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat

that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.

- b. The following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp}, Class 2_{sp}, or Class 3_{sp}) in the Predatory Avian toxicity group should not be used within (1) currently occupied territory as determined by a Service-approved survey or (2) species habitat that has not been surveyed.

brodifacoum	diphacinone *	sodium cyanide §	strychnine
chlorophacinone *	famphur (e.g., Warbex7) †	sodium fluoroacetate	zinc phosphide
<p>Alternative Buffer Zones:</p> <p>* Chlorophacinone or diphacinone may be applied below ground for control of rodents inside occupied habitat if (1) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony and (2) all tunnel entrances of the colony are covered up. Below ground treatment with chlorophacinone or diphacinone on Federal lands should be approved by the Service.</p> <p>H Animal carcasses with famphur-treated hides that are within one hundred miles of areas where California condors are present should be removed, buried, or otherwise covered.</p> <p>§ Sodium cyanide may be used in M-44 devices within ranges occupied by the California condor if the wrapped capsule holder is kept out of sight of condors by placing the holder below the surface of the ground and covering it with a protective cover such as a cow chip, flat rock, or tree bark. M-44s should not be placed closer than 30 feet to any livestock carcass. In setting up M-44s, the devices should not be used in pairs or groups at a single location but may be placed as a single set such that the devices are no closer than 1,000 feet to each other. Treatment on Federal lands with M-44 devices should be approved by the Service.</p>			

- c. Pesticides applications (except for predator/rodent control agents or any pesticide that can cause secondary poisoning as indicated above) should have the following buffer zones from currently occupied nests, roosts, or release sites.³⁶ Aerial pesticide applications should be made in swaths parallel to a nest site and its aerial buffer zone. If flight over a nest is necessary, applicators should maintain a minimal altitude of 3,000 feet and make sure that shutoff of pesticide sprayers or spreaders has occurred.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations	1/4 mile *	1/4 mile *	1 1/2 mile	1 1/2 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for application of pesticides inside existing rights-of-way (paved or gravel-base roadways only) through condor habitat. Pesticides applied along existing rights-of-way should not exceed Class 1 in the Predatory Avian toxicity group.</p>				

³⁶ Recommended buffer zones for protection of nests or roosts of the California condor are based on disturbance factors.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by hand-operated equipment only.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

47. To protect the interior least tern, the Service recommends —

- a. Pesticide users should contact the nearest Service field office for information on the interior least tern before application of pesticide near sandbars, beaches, or other bare areas close to wide, shallow waterbodies. If a survey for the species is necessary, survey protocols and a scientific permit should be obtained from the Service. Further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. For pesticide applications involving occupied nesting colonies, measures to protect the species are:
 - ◆ The following buffer zones should be used around nesting colonies of interior least terns for application of pesticides that rate as Class 0 or Class 1 in the Small Avian toxicity group.³⁷ Aerial pesticide applications should be made in swaths parallel to a colony and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations	300 feet	300 feet	1/4 mile	1/4 mile

³⁷ Recommended buffer zones for protection of interior least tern colonies against Class 0 or Class 1 pesticides are based on disturbance factors.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.

- ◆ The following buffer zones should be used around nesting colonies of interior least terns for application of pesticides that rate as Class 2 or Class 3 in the Small Avian toxicity group.³⁸ Aerial pesticide applications should be made in swaths parallel to a colony and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations other than ULV or dust formulations	300 feet	300 feet	1/4 mile	1/4 mile
ULV or dust formulations ⁴	300 feet	300 feet	1/4 mile	1/2 mile

³⁸ Recommended buffer zones for protection of interior least tern colonies against Class 2 or Class 3 pesticides are based on disturbance factors and/or pesticide drift.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- c. Pesticides that rate as Class 2 or Class 3 in the Warm Water Fish toxicity group should have the following buffer zones when applied at the edge of the closest waterbody (stream, river, lake, reservoir, etc.) to a colony of interior least terns. The buffer zones apply only to standard weather conditions for pesticide applications involving (1) lakes or reservoirs less than 100 surface acres and (2) streams or rivers that are less than 300 feet wide.³⁹ The buffer zones should extend for 2 miles both upstream and downstream from the colony=s closest point to the waterbody.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	10 feet	50 feet	50 feet	50 feet
Liquid formulations ⁵	10 feet	80 feet *H§	200 feet H§	1/8 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	500 feet H	1/4 mile

³⁹ The limits on waterbody size (100 acres for lakes and reservoirs, 300 ft. for rivers) are used to exclude relatively large waterbodies (large rivers, coastal bays, etc.) where pesticide concentrations will not ordinarily impact fish resources for the interior least tern.

Alternative Buffer Zones:

- * These formulations can be applied up to 50 feet from the edge of the waterbody to be protected if the pesticide is placed into the soil below a 12-inch depth.
- H These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody during the time of application.
- ' These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

48. To protect the masked bobwhite, the Service recommends —

Application of pesticide involving the following Pesticide Sensitive Area should have the protection measures indicated below.

County	Pesticide Sensitive Area
Pima County, Arizona	Buenos Aires National Wildlife Refuge

- a. The Service should be consulted before implementation of a pesticide program for control of pests or invasive species inside or adjacent to the Pesticide Sensitive Area above. Applicators or relevant agencies should contact the Arizona field office of the Service at 602-242-0210 for appropriate protection measures and for any necessary incidental take authorization or permit before pesticide treatment.
- b. Application of zinc phosphide or any other rodenticide in species habitat that is inside or adjacent to the Pesticide Sensitive Area defined above should be restricted to tamper-resistant bait boxes.

49. To protect the Mexican spotted owl, the Service recommends —

- a. Pesticide users should contact the nearest Service field office for information on the Mexican spotted owl before application of pesticide in mountains or canyon lands with mixed conifer forest that has (1) at least 70 percent canopy cover, (2) downed woody material, and (3) 40 percent slopes or greater. If surveys for the species are necessary, survey protocols and a scientific permit should be obtained from the Service. A Service-approved survey will be accepted for up to one year if the survey does not detect the presence of Mexican spotted owls in areas targeted for pesticide application. Further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. Pesticides should ordinarily not be applied inside or adjacent to protected activity centers of Mexican spotted owls. A protected activity center is an area of approximately 600 acres established around an owl activity center for conservation purposes. An “activity center” is defined as (1) the nest site, (2) the roost grove commonly used during the breeding season in absence of a verified nest site, or (3) the best roosting/nesting habitat if nesting and roosting information are lacking. For control of pest or invasive plant species along existing rights-of-way (paved or gravel-base roadways only) inside protected activity centers of the Mexican spotted owl, a non-persistent herbicide with a vegetable oil carrier may be used if the herbicide does not exceed Class 0 or Class 1 in the Predatory Avian toxicity group. Applicators should make sure that pesticide spray drift does not occur beyond the right-of-way by using pesticide sprays with (1) coarse droplet sizes or (2) nontoxic drift retardants. Applicators may conduct spot applications with Class 0 or Class 1 herbicides in protected activity centers away from existing rights-of-way if (1) treatment is approved by the Service, (2) a backpack sprayer or other hand-operated equipment is used for the application, and (3) the pesticide is applied outside the general breeding season of March 1 through August 31.
- c. The following predator/rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp}, Class 2_{sp}, or Class 3_{sp}) in the Predatory Avian toxicity group should not be used within 1 mile of (1) currently occupied protected activity centers as determined by a Service-approved survey or (2) species habitat that has not been surveyed.

brodifacoum chlorophacinone *	diphacinone * sodium cyanide	sodium fluoroacetate strychnine	zinc phosphide
Alternative Buffer Zones: * Chlorophacinone or diphacinone may be applied below ground for control of rodents inside occupied protected activity centers if (1) treatment is approved by the Service, (2) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony, and (3) all tunnel entrances of the colony are covered up.			

- d. For applications of pesticides other than predator/rodent control agents or any pesticide that can cause secondary poisoning as indicated above, measures to protect the species are:

- ◆ Pesticides (except predator/rodent control agents or any pesticide that can cause secondary poisoning) that rate as Class 0 or Class 1 in the Predatory Avian toxicity group should have the following buffer zones when applied outside (1) the perimeter of a protected activity center as determined by a Service-approved survey or (2) species habitat that has not been surveyed.⁴⁰ Aerial pesticide applications should be made in swaths parallel to a protected activity center and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations	80 feet *	300 feet *	300 feet	300 feet
<p>Alternative Buffer Zones:</p> <p>* A buffer zone is unnecessary for application of these pesticides in existing rights-of-way (paved or gravel-base roadways only) through owl habitat. Applicators should make sure that pesticide spray drift does not occur beyond the right-of-way by using pesticide sprays with (1) coarse droplet sizes or (2) nontoxic drift retardants.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by hand-operated equipment only.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p>				

- ◆ Pesticides (except predator/rodent control agents or any pesticide that can cause secondary poisoning) that rate as Class 2 or Class 3 in the Predatory Avian toxicity group should have the following buffer zones when applied outside (1) the perimeter of a protected activity center as determined by a Service-approved survey or (2) species habitat that has not been surveyed.⁴¹ Aerial pesticide applications should be made in swaths parallel to a protected activity center and its aerial buffer zone.

⁴⁰ Recommended buffer zones for protection of protected activity centers of the Mexican spotted owl against Class 0 or Class 1 pesticides are based on disturbance factors.

⁴¹ Recommended buffer zones for protection of protected activity centers of the Mexican spotted owl against Class 2 or Class 3 pesticides are based on disturbance factors and/or pesticide drift.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations other than ULV or dust formulations	300 feet	1/4 mile	1/4 mile	1/4 mile
ULV or dust formulations ⁴	300 feet	1/4 mile	1/4 mile	1/2 mile
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

50. To protect the Northern aplomado falcon, the Service recommends —

- a. A survey should be conducted for falcon nesting sites and territories in accordance with Service protocols before application of pesticide inside or adjacent to coastal prairie, salt flats, or open woodland intermixed with grassland. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. Cooperators with the Safe Harbor Program of the U. S. Department of the Interior may contact the Peregrine Fund (ph: 208-362-3811) for survey work on nest sites. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. The following rodent control agents or any pesticide that can cause secondary poisoning (Class 1_{sp}, Class 2_{sp}, or Class 3_{sp}) in the Predatory Avian toxicity group should not be used within 2 miles of (1) the Laguna Atascosa National Wildlife Refuge, (2) the edge of currently occupied territory of Northern aplomado falcons as determined by a Service-approved survey, or (3) species habitat that not been surveyed.

brodifacoum	diphacinone *
chlorophacinone *	zinc phosphide
<p>Alternative Buffer Zones:</p> <p>* Chlorophacinone or diphacinone may be applied below ground for control of rodents inside occupied habitat or the two-mile buffer zone if (1) treatment is approved by the Service, (2) the pesticide is applied on bait sticks inside heavily used burrows of the rodent colony, and (3) all tunnel entrances of the colony are covered up.</p>	

c. For applications of pesticides other than predator/rodent control agents or any pesticide that can cause secondary poisoning as indicated above, measures to protect the species are:

- ◆ Pesticides (except for rodent control agents or any pesticide that can cause secondary poisoning) that rate as Class 0 or Class 1 in the Predatory Avian toxicity group should have the following buffer zones near a currently occupied nest of Northern aplomado falcons.⁴² Applicators should watch for Northern aplomado falcons in areas of application and not apply any pesticide until the falcons have left. Aerial pesticide applications should be made in swaths parallel to a falcon nest and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations	1/8 mile *	1/4 mile *	1/4 mile	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* A 1/8-mile buffer zone is unnecessary for application of these pesticides in existing rights-of-way (paved or gravel-base roadways only) through a falcon territory. Applicators should make sure that pesticide spray drift does not occur beyond the right-of-way by using pesticide sprays with (1) coarse droplet sizes or (2) nontoxic drift retardants.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by hand-operated equipment only.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p>				

⁴² Recommended buffer zones for protection of Northern aplomado falcon nests against Class 0 or Class 1 pesticides are based on disturbance factors.

- ◆ Pesticides (except for rodent control agents or any pesticide that can cause secondary poisoning) that rate as Class 2 or Class 3 in the Predatory Avian toxicity group should only be used outside of species territory and should have the following buffer zones when applied at the edge of (1) currently occupied territory of Northern aplomado falcons as determined by a Service-approved survey or (2) species habitat that has not been surveyed.⁴³ Applicators should watch for Northern aplomado falcons in areas of application and not apply any pesticide until the falcons have left. Aerial pesticide applications should be made in swaths parallel to a falcon nest and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
All formulations	1/4 mile	1/2 mile	1/2 mile	1/2 mile
Notes: 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones. 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank. 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.				

51. To protect the red-cockaded woodpecker, the Service recommends —

- A survey should be conducted for red-cockaded woodpecker (RCW) clusters in accordance with Service protocols before application of pesticide inside or adjacent to pine or pine-hardwood forest. A cluster is defined as one or more cavity nest trees with a 200-foot buffer (200 feet = 3 chains). Single clusters have a minimum of 10 acres with at least one cavity tree. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. A Service-approved survey will be accepted for up to one year if the survey does not detect the presence of active RCW clusters in areas targeted for pesticide application; however, areas with abandoned clusters must be re-surveyed before pesticide application can occur. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment

⁴³ Recommended buffer zones for protection of Northern aplomado falcon nests against Class 2 or Class 3 pesticides are based on pesticide drift.

for appropriate protection measures and for any necessary incidental take authorization or permit.

- b. Pesticides should not be applied inside or adjacent to active RCW clusters or clusters that have not been determined by the Service to be abandoned. For control of pest or invasive plant species along existing rights-of-way (paved or gravel-base roadways only) inside RCW clusters, a non-persistent herbicide with a vegetable oil carrier may be used if the herbicide does not exceed Class 0 or Class 1 in the Small Avian toxicity group. Applicators should make sure that pesticide spray drift does not occur beyond the right-of-way by using pesticide sprays with (1) coarse droplet sizes or (2) nontoxic drift retardants. Applicators may conduct spot applications for selective control of mid-story hardwoods inside an RCW cluster away from existing rights-of-way by using a triclopyr pesticide (e.g., Garlon⁷ 4) and a carrier material of diesel or sunflower oil. Treatment with the triclopyr pesticide should be made only if (1) treatment is approved by the Service, (2) a backpack sprayer is used to apply the pesticide in a basal streamline spray, and (3) the pesticide is applied outside the general breeding season of March 1 through July 31.
- c. For pesticide applications adjacent to (but not within) clusters of the red-cockaded woodpecker, measures to protect the species are:
 - ◆ Buffer zones are usually unnecessary for pesticides that are rated as Class 0 in the Small Avian toxicity group and Class 0 or Class 1 in the Terrestrial Arthropod toxicity group when these pesticides are applied outside the perimeter of an RCW cluster as determined by a Service-approved survey. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside the perimeter of the RCW cluster as a result of pesticide application.
 - ◆ Pesticides that rate as Class 1 in the Small Avian toxicity group should have the following buffer zones when applied outside the perimeter of an RCW cluster as determined by a Service-approved survey. The buffer zones should also be used for pesticides that rate as Class 2 or Class 3 in the Terrestrial Arthropod toxicity group but are not rated higher than Class 1 in the Small Avian toxicity group. Aerial pesticide applications should be made in swaths parallel to an RCW cluster and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	none	30 feet *	30 feet	30 feet
Liquid formulations ⁵	none	30 feet *	150 feet H§	1/8 mile

ULV or dust formulations ⁶	80 feet H	80 feet H	500 feet H	1/4 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone at the cluster=s perimeter is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.</p> <p>H These applications and formulations can have a buffer zone of 30 feet at the cluster=s perimeter if a strong, steady wind of at least 3 miles per hour is blowing directly away from the cluster=s perimeter during the time of application.</p> <p>' These applications and formulations can have a buffer zone of 30 feet at the cluster=s perimeter if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

- ◆ Pesticides that rate as Class 2 or Class 3 in the Small Avian toxicity group should have the following buffer zones when applied outside the perimeter of an RCW cluster as determined by a Service-approved survey. Aerial pesticide applications should be made in swaths parallel to an RCW cluster and its aerial buffer zone.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	10 feet *	60 feet *	60 feet	60 feet

Liquid formulations ⁵	10 feet *	60 feet *	300 feet H§	1/4 mile
ULV or dust formulations ⁶	150 feet H	150 feet H	1/4 mile H	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* A buffer zone at the cluster=s perimeter is unnecessary for these formulations if the pesticide is placed into the soil below a 12-inch depth.</p> <p>H These applications and formulations can have a buffer zone of 60 feet at the cluster=s perimeter if a strong, steady wind of at least 3 miles per hour is blowing directly away from the cluster=s perimeter during the time of application.</p> <p>' These applications and formulations can have a buffer zone of 60 feet at the cluster=s perimeter if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

52. To protect the whooping crane, the Service recommends —

Application of pesticide involving the following Pesticide Sensitive Areas should have the protection measures indicated below. In areas outside the Pesticide Sensitive Areas, applicators should watch for whooping cranes in fields or wetlands within a 150-mile wide migration corridor that is centered on a line stretching between the following cities: (1) the city of Rockport on the Texas Gulf Coast, (2) the city of Wichita Falls in north-central Texas, and (3) the city of Woodward in northwest Oklahoma. The two periods for crane migration from Texas to Canada and back occur from March to June and from September to November, respectively. Pesticides should not be applied in an area with cranes until after the cranes have left.

County	Pesticide Sensitive Area
Alfalfa County, Oklahoma	Salt Plains National Wildlife Refuge
Aransas County, Texas	Aransas National Wildlife Refuge and the critical habitat area for whooping cranes (see 50 CFR [Code of Federal Regulations] § 17.95 in http://www.gpo.gov or contact the Corpus Christi field office of the Service at 361-994-9005).
Calhoun County, Texas	Aransas National Wildlife Refuge and the critical habitat area for whooping cranes (see 50 CFR [Code of Federal Regulations] § 17.95 in http://www.gpo.gov or contact the Corpus Christi field office of the Service at 361-994-9005).
Clay County, Texas	Byers Lake
Refugio County, Texas	Aransas National Wildlife Refuge and the critical habitat area for whooping cranes (see 50 CFR [Code of Federal Regulations] § 17.95 in http://www.gpo.gov or contact the Corpus Christi field office of the Service at 361-994-9005).

- a. The Service should be consulted before implementation of a pesticide program for control of pests or invasive species involving the Pesticide Sensitive Areas defined above. Applicators or relevant agencies should contact a Service field office for appropriate protection measures and for any necessary incidental take authorization or permit before pesticide treatment. For Texas counties, the Corpus Christi Field Office of the Service can be contacted at 361-994-9005. The Oklahoma Field Office of the Service can be contacted at 918-581-7458.
- b. Application of zinc phosphide or any other rodenticide within the Pesticide Sensitive Areas defined above should be restricted to tamper-resistant bait boxes.

53. To protect the desert tortoise, the Service recommends —

- a. A survey should be conducted for the desert tortoise in accordance with Service protocols before implementation of a pesticide program for control of pests or invasive species inside desert scrubland. Pesticide users should contact the nearest Service field office for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. Applicators or relevant agencies should not use the following burrow fumigants or any other burrow fumigant unless they have previously been trained to distinguish burrows of target species from burrows used by the desert tortoise. Individuals with adequate training to distinguish tortoise-inhabited burrows potentially include certified applicators and biologists of

county extension services, state agricultural departments, or state/Federal wildlife management agencies.

acrolein	magnesium phosphide	sodium nitrate
aluminum phosphide	potassium nitrate	

c. For application of pesticides (except for burrow fumigants as indicated above) inside occupied habitat or species habitat that has not been surveyed, measures to protect the species are:

- ◆ Non-herbicidal pesticides (e.g., fungicides) rated as Class 0 in the Reptile toxicity group do not ordinarily require protection measures when these pesticides are applied inside occupied habitat or un-surveyed habitat. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ A pesticide should not be used inside or adjacent to occupied habitat if the pesticide rates as (1) Class D, (2) Class M, (3) Class NS, or (4) any class higher than Class 0 in the Reptile toxicity group. An exception is application of herbicides (Classes D, M, or NS) that rate no higher than Class 1 in the Reptile toxicity group. These pesticides may be applied in existing rights-of-way through desert tortoise habitat. Applicators should make sure that pesticide spray drift does not occur beyond the right-of-way by using pesticide sprays with coarse droplet sizes from a spray gun or boom on a spray tank.

54. To protect the Barton Springs salamander, the Service recommends —

Application of pesticides inside the following Pesticide Sensitive Areas should have the protection measures indicated below. The Service should be consulted before application of pesticide within 500 feet of species habitat in Main Springs, Eliza Springs, Sunken Garden Springs, or Upper Barton Springs inside Zilker Park in the city of Austin. The Service should also be consulted before implementation of a pesticide program for control of pests or invasive species inside a Pesticide Sensitive Area where pesticide residues may occur in runoff into the Edwards Aquifer.

County	Pesticide Sensitive Area
Hays County, Texas	The watersheds of Barton Creek, Bear Creek, Little Barton Creek, Little Bear Creek, and Onion Creek.
Travis County, Texas	The watersheds of Barton Creek, Bear Creek, Little Bear Creek, Slaughter Creek, and Williams Creek. Also, the part of the Onion Creek watershed that is west of Interstate Highway 35.

a. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside or adjacent to species habitat unless approved by the Service.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

b. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that contribute ground water or surface water to species habitat.

- ◆ Pesticides that rate as Class 0 or Class 1 in the Aquatic Amphibian toxicity group should have the following buffer zones when applied at the edge of any waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) within the Pesticide Sensitive Areas defined above. The buffer zones should also be used for pesticides that rate as Class 2 or Class 3 in the Aquatic Arthropod toxicity group but are not rated higher than Class 1 in the Aquatic Amphibian toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	10 feet	50 feet	50 feet	50 feet
Liquid formulations ⁵	10 feet	80 feet *H	200 feet *H	1/8 mile
ULV or dust formulations ⁶	150 feet *	150 feet *	500 feet *	1/4 mile

Alternative Buffer Zones:

* These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.

H These applications and formulations can have a buffer zone of 50 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 or Class 3 in the Aquatic Amphibian toxicity group should have the appropriate buffer zone when applied at the edge of any waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) within the Pesticide Sensitive Areas defined above.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	20 feet	80 feet	80 feet	80 feet
Liquid formulations ⁵	20 feet	100 feet	350 feet *H	1/4 mile
ULV or dust formulations ⁶	200 feet *	200 feet *	1/4 mile *	1/2 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 80 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.
- H These applications and formulations can have a buffer zone of 80 feet at the edge of the waterbody or aquifer recharge feature (cave, sinkhole, crevice, etc.) to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

55. To protect the Chiricahua leopard frog, the Service recommends —

- a. A survey should be conducted for Chiricahua leopard frogs in accordance with Service protocols before application of pesticide adjacent to cienagas (desert marshes), ponds, livestock tanks, and shallow areas of lakes, reservoirs, streams, and rivers. Pesticide users should contact either the New Mexico Field Office of the Service at 505-346-2525 or the Phoenix Field Office of the Service at 602-242-0210 for information on survey protocols and the likelihood of Chiricahua leopard frogs occurring in the area of pesticide application. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or potentially occupied habitat (i.e., suitable habitat that has not been surveyed or suitable habitat for which surveys were inconclusive), the Service should be consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside occupied or potentially occupied aquatic habitat unless approved by the Service.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

c. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that (1) are occupied by the species, (2) have not been surveyed, or (3) have inconclusive surveys. Recommended buffer zones should be used at the edge of the estimated annual high water line of the waterbody or wetland to be protected. The buffer zones should also be applied for (1) at least 1/2 mile upstream from the habitat area in any ephemeral to perennial contributing channel, tributary, or spring run and (2) at least 300 feet downstream from species habitat.

- ◆ Pesticides rated as Class 0 in the Aquatic Amphibian, Aquatic Arthropod, and Terrestrial Arthropod toxicity groups may be applied on land below or above the high water line of species habitat. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ Pesticides that rate as Class 1 in the Aquatic Amphibian toxicity group should not be applied on land below the high water line of species habitat and should have the following buffer zones when applied on land above the high water line of species habitat. The buffer zones should also be used for pesticides that rate as Class 2 or Class 3 in either the Aquatic Arthropod or Terrestrial Arthropod toxicity groups but are not rated higher than Class 1 in the Aquatic Amphibian toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	30 feet *	100 feet	100 feet	100 feet
Solid formulations other than insect baits ⁴	30 feet *	300 feet	300 feet	300 feet
Liquid formulations ⁵	30 feet *	350 feet H§	450 feet H§	1/8 mile
ULV or dust formulations ⁶	400 feet H	400 feet H	1/8 mile H	1/4 mile

Alternative Buffer Zones:

- * These applications and formulations do not require a buffer zone above the high water line of the waterbody or wetland to be protected if (1) the application is approved by the Service and (2) the pesticide is applied by hand-operated equipment.
- † These applications and formulations can have a buffer zone of 300 feet above the high water line of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.
- § These applications and formulations can have a buffer zone of 300 feet above the high water line of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 in the Aquatic Amphibian toxicity group should not be applied below the high water line of species habitat and should have the following buffer zones when applied above the high water line of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	50 feet	200 feet	200 feet	200 feet
Solid formulations other than insect baits ⁴	50 feet	350 feet	350 feet	350 feet

Liquid formulations ⁵	50 feet	350 feet	1/8 mile *H	1/4 mile
ULV or dust formulations ⁶	450 feet *	450 feet *	1/4 mile *	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 350 feet above the high water line of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 350 feet above the high water line of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

- ◆ Pesticides that rate as Class 3 in the Aquatic Amphibian toxicity group should not be applied below the high water line of species habitat and should have the following buffer zones when applied above the high water line of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	100 feet	300 feet	300 feet	300 feet

Solid formulations other than insect baits ⁴	100 feet	350 feet	350 feet	350 feet
Liquid formulations ⁵	100 feet	400 feet *†	1/8 mile *H	1/2 mile
ULV or dust formulations ⁶	500 feet *	500 feet *	1/4 mile *	3/4 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 350 feet above the high water line of the waterbody or wetland to be protected if a strong, steady wind of at least 3 miles per hour is blowing directly away from the waterbody or recharge feature during the time of application.</p> <p>H These applications and formulations can have a buffer zone of 350 feet above the high water line of the waterbody or wetland to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

56. To protect the Houston toad, the Service recommends —

- a. A survey should be conducted for the Houston toad in accordance with Service protocols before application of pesticide inside or adjacent to pine or oak woodland with pockets of deep sand. Pesticide users should contact the Austin field office of the Service at 512-490-0057 for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be

consulted prior to pesticide treatment for appropriate protection measures and for any necessary incidental take authorization or permit.

- b. Applicators should not use the following aquatic pesticides or any other pesticide formulations labeled for aquatic use (piscicides, aquatic herbicides, mosquito control agents, etc.) inside waterbodies or wetlands that serve as species habitat unless approved by the Service.

acrolein	2, 4-D (e.g., Aqua-Kleen7)	glyphosate (e.g., Rodeo7)	terbutryn
antimycin A	diquat	imazapyr (e.g., Habitat7)	
copper chelate	endothall	rotenone	
copper sulfate	fluridone	simazine	

- c. Applicators should use the following protection measures for application of pesticides on land adjacent to waterbodies and wetlands that serve as species habitat. Recommended buffer zones should be used for (1) all of the habitat area and (2) at least 1 mile upstream from the habitat area in any contributing channel, tributary, or spring run. The buffer zones should also be applied for at least 300 feet downstream from species habitat.

- ◆ Buffer zones are usually unnecessary for pesticides rated as Class 0 in the Terrestrial Amphibian toxicity group when these pesticides are applied at the edge of species habitat. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.
- ◆ Pesticides that rate as Class 1 in the Terrestrial Amphibian toxicity group should have the following buffer zones when applied at the edge of species habitat. The buffer zones should also be used for pesticides that rate as Class 2 or Class 3 in either the Aquatic Arthropod or Terrestrial Arthropod toxicity groups but are not rated higher than Class 1 in the Terrestrial Amphibian toxicity group.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	10 feet	30 feet	30 feet	30 feet
Liquid formulations ⁵	10 feet	30 feet	150 feet *H	1/8 mile
ULV or dust formulations ⁶	80 feet *	80 feet *	500 feet *	1/4 mile

Alternative Buffer Zones:

- * These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the following two conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application and (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event.
- H These applications and formulations can have a buffer zone of 30 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

- ◆ Pesticides that rate as Class 2 or Class 3 in the Terrestrial Amphibian toxicity group should have the following buffer zones when applied at the edge of species habitat.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	none	none	none	none
Solid formulations other than insect baits ⁴	20 feet	60 feet	60 feet	60 feet
Liquid formulations ⁵	20 feet	60 feet	300 feet *H	1/4 mile

ULV or dust formulations ⁶	150 feet *	150 feet *	1/4 mile *	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the following two conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application and (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event.</p> <p>H These applications and formulations can have a buffer zone of 60 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				
<p>Notes:</p> <p>1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.</p> <p>2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.</p> <p>3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.</p> <p>4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.</p> <p>5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.</p> <p>6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.</p>				

57. To protect the American burying beetle, the Service recommends —

- a. A survey should be conducted for the American burying beetle in accordance with Service protocols before application of an insecticide inside or adjacent to open grassland, oak-pine woodland, oak-hickory forest, or pasture. Pesticide users should contact the Oklahoma Field Office of the Service at 918-581-7458 for information on survey protocols. A scientific permit should be obtained from the Service before conducting a species survey. After a survey has been conducted, further restrictions on pesticide application are unnecessary if the Service concurs that the habitat is unoccupied by the species. For occupied habitat or habitat that has not been surveyed, the Service should be consulted prior to treatment for appropriate protection measures and for any necessary incidental take authorization or permit.
- b. For pesticide applications adjacent to (but not within) occupied habitat or species habitat that has not been surveyed, measures to protect the species are:
 - ◆ Buffer zones are usually unnecessary for pesticides rated as Class 0 or Class 1 in the Terrestrial Arthropod toxicity group when these pesticides are applied at the edge of species

habitat. Applicators using these pesticides should make sure that adverse effects for proposed or listed species will not occur inside species habitat as a result of pesticide application.

- ◆ Pesticides that rate as Class 2 or Class 3 in the Terrestrial Arthropod toxicity group should have the following buffer zones when these pesticides are applied at the edge of species habitat. When possible, applicators should not apply pesticide in cropland adjacent to occupied species habitat earlier than one hour after sunrise.

Buffer Zones ¹	Spot applications ²	Mechanized ground applications	Low aerial applications ³	High aerial applications ³
Bait formulations (insect baits only)	70 feet	100 feet	350 feet	1/4 mile
Solid formulations other than insect baits ⁴	70 feet	100 feet	100 feet	100 feet
Liquid formulations ⁵	70 feet	100 feet	350 feet *H	1/4 mile
ULV or dust formulations ⁶	200 feet *	200 feet *	1/4 mile *	1/2 mile
<p>Alternative Buffer Zones:</p> <p>* These applications and formulations can have a buffer zone of 100 feet at the edge of the area to be protected if the following two conditions are met: (1) a strong, steady wind of at least 3 miles per hour is blowing directly away from the area during the time of application and (2) pesticide residues in surface runoff cannot drain into the area after a precipitation event.</p> <p>H These applications and formulations can have a buffer zone of 100 feet at the edge of the area to be protected if the pesticide is applied by a sprayer with low pressure nozzles that deliver a spray ranging from coarse to very coarse in droplet size.</p>				

Notes:

- 1 A buffer zone is the distance between the boundary of the area requiring protection and the closest point of the last spot application or application swath. Border areas (roadways, fence lines, canal dikes, etc.) may be used as part of a buffer zone if the border area itself does not involve species habitat or a sensitive area. Standard weather conditions for pesticide application (i.e., no temperature inversions, wind speeds between 3 to 10 miles per hour, and no rainfall for 48 hours) should be followed when implementing recommended buffer zones.
- 2 Spot applications include pesticide applications by (1) hand-operated equipment or (2) a spray gun that discharges pesticide in liquid streams from a spray tank.
- 3 Low and high aerial applications (respectively, aerial applications either less than 10 feet or greater than 10 feet) are relative to the height of the nozzles or spreaders above (1) the canopy of the field crop or native plant community or (2) a bare ground surface. In grassland or semi-open plant communities (shrubland, woodland, etc.) with more than 40 percent grass cover, the top of the grass canopy should be used to determine whether an aerial application is low or high. For forested lands or dense shrubland with less than 40 percent grass cover, the tops of trees or shrubs should be used in determining whether applications are low or high.
- 4 Solid formulations include baits, granules, pellets, and treated seed but do not include dusts.
- 5 Liquid formulations include any type of liquid-based formulation other than ULV formulations.
- 6 ULV (ultra low volume) refers to liquid formulations applied at a rate of 1/2 gallon or less per acre.

4.4 Supplemental Information

4.4.1 Screening-level hazard assessment for pesticide ecotoxicity

Table 2. Ecotoxicity Ratings for Pesticide Active Ingredients and Various Formulations																						
Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
ABAMECTIN	AVERMECTIN	I, M	C, U	65195-55-3	1	1	2	0	0	0	0	0	0	3	3	3	3	3	2	3	3	
ACEPHATE (see note below)	e.g., ORTHENE	I, M	C, F, R/P, U	30560-19-1	2	2	2	3	3	3	3	3	3	1	1	1	1	3	2	3	3	
ACETAMIPRID		I	C	135410-20-7	1	1	1	1	1	1	1	1	1	0	0	0	0	1	2	3	1	
ACETOCHLOR		H	C	34256-82-1	1 _e	1 _e	1 _e	1	1	1	1	1	1	2	2	2	1	1	2	2	1	NS
ACIFLUORFEN		H	C	62476-59-9	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	NS
ACROLEIN (aquatic)	e.g., MAGNACIDE	H	W	107-02-8	2	2	2	2	3	2	2	3	2	3	3	3	3	2	1	2	2	NS _{aq}
ACROLEIN (nonaquatic)		R	U	107-02-8	2	2	2 _b	2	3	2	2	3	2	3	3	3	3	2	1	2	2	NS
ALACHLOR		H	C	15972-60-8	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	NS
ALDICARB (granular formulation only)		I, N	C	116-06-3	2	2 _{sp}	2	3	3	3 _{sp}	3	3	3	1	1	1	1	3	0	3	3	
ALDOXYCARB	ALDICARB SULFONE	I, N	C	1646-88-4	2	2	2	2	2	2	2	2	2	1	1	1	1	3	0	3	3	
ALLETHRIN		I	U	584-79-2	1	1	1	0	0	0	0	0	0	2	2	2	2	1	1	3	1	

* A-AM = Aquatic Amphibian A-AR = Aquatic Arthropod	CW-F = Cold Water Fish FW-M = Freshwater Mollusk	G-AV = Gallinaceous Avian L-AV = Large Avian	L-MA = Large Mammal P-AV = Predatory Avian	P-MA = Predatory Mammal REP = Reptile	S-AV = Small Avian S-MA = Small Mammal	T-AM = Terrestrial Amphibian T-AR = Terrestrial Arthropod	W-AV = Waterfowl Avian WW-F = Warm Water Fish
H Animal ecotoxicity classes: 0 = practically non-toxic, 1 = slightly to moderately toxic, 2 = highly toxic, 3 = very highly toxic; Plant ecotoxicity classes: D = dicot-specific, M = monocot-specific, NS = non-specific							
§ Subscripts: aq = aquatic formulation b = burrow fumigant e = eye irritation rating f = formulation-dependent L = Lepidopteran-specific s = skin irritation rating sp = secondary poisoning potential							

Table 2. Ecotoxicity Ratings for Pesticide Active Ingredients and Various Formulations

Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
ALLOXYDIM		H	C	66003-55-2	1	1	1	0		0	0		0	0	0	0	0		0			M
ALUMINUM PHOSPHIDE		R	F, R/P	20859-73-8	2 b	2 b	2 b	2 b	2 b	2 b	2 b	2 b	2 b		2 b					3 b		
AMETRYN		H	C	834-12-8	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	NS
AMICARBAZONE		H	C	1299090-90-6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
AMINOPYRALID		H	C, ROW, R/P, U	150114-71-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
AMINOPYRIDINE	e.g., AVITROL	A	C, U	504-24-5	2	2 sp	2	3	3	3 sp	3	3	3	1	1	1	1					
AMITRAZ		A, I	C	33089-61-1	1	1	1	1	0	1	1	0	1	1	1	1	1	3	0	3	3	
AMITROLE (see note below)		H	R/P	61-82-5	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
AMMONIUM CHLORIDE		F	C	1215-02-9	1	1	1										0	1		1	1	
AMS	AMMONIUM SULFAMATE	ADJ	F	7783-06-2	1e	1e	1e	1e	1e	1e	1e	1e	1e		1e							D
ANCYMIDOL		G	C, U	12771-68-5	1	1	1															NS
ANILAZINE		F	C	101-05-3	1	1	1	0	0	0	0	0	0	2	2	2	2	2	0	2	2	
ANTIMYCIN A (aquatic)		P	C, F, R/P	1397-94-0										3	3	3	3	3		3	3	
ARSENIC ACID		D	C	1327-53-3	2	2	2	2	1	2	2	1	2	1	1	1	1	1	1	1	1	

* A-AM = Aquatic Amphibian CW-F = Cold Water Fish G-AV = Gallinaceous Avian L-MA = Large Mammal P-MA = Predatory Mammal S-AV = Small Avian T-AM = Terrestrial Amphibian W-AV = Waterfowl Avian
A-AR = Aquatic Arthropod FW-M = Freshwater Mollusk L-AV = Large Avian P-AV = Predatory Avian REP = Reptile S-MA = Small Mammal T-AR = Terrestrial Arthropod WW-F = Warm Water Fish

H Animal ecotoxicity classes: 0 = practically non-toxic, 1 = slightly to moderately toxic, 2 = highly toxic, 3 = very highly toxic; Plant ecotoxicity classes: D = dicot-specific, M = monocot-specific, NS = non-specific

§ Subscripts: aq = aquatic formulation b = burrow fumigant D = Dipteran-specific e = eye irritation rating f = formulation-dependent L = Lepidopteran-specific s = skin irritation rating sp = secondary poisoning potential

Table 2. Ecotoxicity Ratings for Pesticide Active Ingredients and Various Formulations

Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
ASULAM		H	C	3337-71-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
ATRAZINE (see note below)		H	C, F, R/P	1912-24-9	1	1	1	0	0	0	0	0	0	3	3	1	1	1	0	1	1	NS f
AZADIRACTIN		G	C, R/P, U	1141-17-6	1	1	1							2	2	2	2	2	1	2	2	
AZAFENIDIN		H	C	68049-83-2	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS
AZINPHOS-METHYL	e.g., GUTHION	I	C	86-50-0	2	2	2	2	1	2	2	1	2	2	2	3	3	3	2	3	3	
AZOXYSTROBIN	e.g., QUADRIS	F	C	131860-33-8	1	1	1	0	1	0	0	1	0	3	3	3	2	2	0	2	2	
BACILLUS THURINGIENSIS SSP. ISRAELENSIS (Bti)		I, L	U		1e	1e	1e	1e	1e	1e	1e	1e	1e	0	1e	0	0	1	0	3D	1	
BACILLUS THURINGIENSIS SSP. KURSTAKI (Btk)		I, L	C, F	68038-71-1	1e	1e	1e	1e	1e	1e	1e	1e	1e	0	1e	0	0	1	0	3L	1	
BENALAXYL		F	C, U	71626-11-4	1	1	1							2	2	2	1	2	1	2	2	
BENDIOCARB		I	C, U	22781-23-3	2	2	2	2	3	2	3	3	2	2	2	2	2	3	2	3	3	
BENEFIN	BENFLURALIN	H	C	1861-40-1	0	0	0							2	2	2	2	1	1	1	1	NS
BENOMYL		F	C, F, U	17804-35-2	0	0	0	0	0	0	1	0	0	3	3	2	3	2	0	2	2	
BENOXACOR		S	C	98730-04-2	0	0	0	0	0	0	0	0	0	1	1	1	1	1		1	1	

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Table 2. Ecotoxicity Ratings for Pesticide Active Ingredients and Various Formulations

Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
BENSULFURON METHYL		H	C	83055-99-6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	D
BENSULIDE		H	C	741-58-2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	NS
BENTAZON		H	C	50723-80-3	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1	1	D
BIFENAZATE		M	C	1332-58-7	0	0	0	1	1	1	1	1	1	2	2	2	2	3	2	3	3	
BIFENOX		H	C	42576-02-3	0	0	0	0	0	0	0	0	0	2	2	2	2	1	1	1	1	NS
BIFENTHRIN		I, M	C, U	82657-04-3	1	1	1	1	1	1	1	1	1	3	3	3	3	3	2	3	3	
BISPYRIBAC-SODIUM		H	C	125401-75-4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
BORIC ACID		I, L	U	10043-35-3	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	3	0	
BOSCALID		F	C	188425-85-6	0	0	0	1	0	1	1	0	0	1	1	1	1	1		1	1	
BRODIFACUUM		R	F, R/P	56073-10-0	2	2 sp	2	3	3	3 sp	3	3	3	3	3	3	3	2		2	2	
BROMACIL		H	C, U	314-40-9	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS
BROMADIOLONE (0.005% concentration only)		R	F, R/P	28772-56-7	1	1 sp	2	1	1	1 sp	1	1	1	1	1	1	1	2	0	2	2	
BROMETHALIN		R	U	63333-35-7	2	2	2	3	3	3	3	3	3	3	3	3	3	3		3	3	
BROMOXYNIL		H	C	1689-99-2	1	1	1	1	1	1	1	1	1	3	3	3	3	3	0	3	3	D

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BUTACHLOR		H	C	23184-66-9	1	1	1	0	0	0	0	0	0	2	2	2	2	1	1	1	1	NS
BUTAFENACIL		D, H	C	134605-64-4	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	2	2	D
BUTYLATE		H	C	2008-41-5	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1 _e	1	1	1	0	1	1	NS
CACODYLIC ACID	DIMETHYLARSINIC ACID	H	C	75-60-5	1 _e	1 _e	1 _e	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
CAPTAN		F	C, R/P	133-06-2	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	3	3	3	3	1	0	1	1	
CARBARYL		I	C, F, R/P, U	63-25-2	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	3	3	
CARBENDAZIM	MBC	F	C, U	10605-21-7	0	0	0	0		0	0		0	2	2	2	2	1	0	1	1	
CARBOFURAN	e.g., FURADAN	I	C	1563-66-2	2	2 _{sp}	2	3	3	3 _{sp}	3	3	3	2	2	2	2	3	2	3	3	
CARBON DISULFIDE		F	C, U	75-15-0	1	1	1															
CARBOPHENOTHION		I, A	C	786-19-6	2	2	2	1	2	1	3	2	1	3	3	3	3	3	2	3	3	
CARBOXIN		F	C, U	5234-68-4	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	
CHLORAMBEN		H	C, F, U	133-90-4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
CHLORDANE		I	U	57-74-9	1	1	1	1	1	1	1	1	1	3	3	3	3	3	2	3	3	
CHLORINE		A, F	U	7782-50-5	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	3	3	3	3	3	2	3	3	

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
CHLOROBENZILATE		A, M	C	510-15-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	1		0	3		
CHLORONEB		F	C	2675-77-6	0	0	0							1	1	1	1	1	1	1	1	
CHLOROPHACINONE		R	F, R/P	3691-35-8	2	2 _{sp}	2	1	1	3 _{sp}	1	1	1	2	2	2	2	2		2	2	
CHLOROPICRIN		N, S	C, U	76-06-2	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	3	3	3	2	3	2	3	3	
CHLORO-P-TOLUIDINE HYDROCHLORIDE	DRC-1339/ e.g., STARLICIDE	A	C, R/P, U	7745-89-3	1	1	1	3	2	2	3	2	3					3		3	3	
CHLOROTHALONIL		F	C, F	1897-45-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	2	0	2	2	
CHLORPROPHAM	CIPC	G, H	C	101-21-3	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	NS
CHLORPYRIFOS		I	C, F, L, M, U	2921-88-2	1	1	1	2	2	2	2	2	2	3	3	3	3	3	2	3	3	
CHLORPYRIFOS-METHYL		I	U	5598-13-0	1	1	1	1	1	1	1	1	1	2	2	2	2	3	2	3	3	
CHLORSULFURON		H	C	64902-72-3	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
CHLOZOLINATE		F	U	72391-46-9	0	0	0															
CHOLECALCIFEROL		R	U	67-97-0	2	2	2															
CLETHODIM		H	C	99129-21-2	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	M
CLODINAFOP-PROPARGYL		H	C	105512-06-9	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	2	0	2	2	M

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
CLOFENTEZINE		M	C	74115-24-5	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e						0	3		
CLOMAZONE		H	C	81777-89-1	1	1	1	0	0	0	0	0	0	1	1	1	1	1		1	1	NS
CLOPYRALID		H	C, R/P, U	1702-17-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	D
CLORANSULAM-METHYL		H	C	147150-35-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
COPPER CHELATE (aquatic)	e.g., AQUATRINE	H	W	13426-91-0 or 31089-39-1	1	1	1	1	1	1	1	1	1	2	2	2	1	1		1	1	NS _{aq}
COPPER SULFATE (aquatic)	e.g., COPPER Z	Al, H, Mu	W	7758-99-8	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2	2 _e	2	2	2	2	2	2	NS _{aq}
COPPER SULFATE (nonaquatic)		F	C	7758-99-8	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2	2 _e	2	2	2	2	2	2	
COUMAPHOS		M, I	R/P	56-72-4	2	2	2	3	2	3	3	2	3	1	1	1	1	3	0	3	3	
CREOSOTE		Pr	U	8001-58-9	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	3		3	3	
CRYOLITE		I	C	15096-52-3	1	1	1	0	0	0	0	0	0	1	1	1	0	1	0	3	1	
CYANAZINE		H	C	21725-46-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
CYCLOATE		H	C	1134-23-2	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	NS
CYFLUTHRIN		I	C, U	68539-37-65	1	1	1	0	0	0	1	0	0	3	3	3	3	3	2	3	3	
CYHALOFOP-BUTYL		H	C	122008-85-9	0	0	0	0	0	0	0	0	0	2	2	2	2	1	0	1	1	M

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CYPERMETHRIN		I	C	52315-07-8	1	1	1	0	0	0	0	0	2	3	3	3	3	3	2	3	3	
CYROMAZINE		I	C	66215-27-8	1	1	1	1	0	1	1	0	1	1	1	1	1	3	1	3	3	
2, 4-D (acid formulations)	CHLOROPHENOXY- ACETIC ACID	H	C, R/P, U	94-75-7	1e	1e	1e	1e	1e	1e	1e	1e	1e	1	1	1	0	1	0	1	1	D
2, 4-D (aquatic amine salt formulations)		H	W	various CASRNs	1e	1e	1e	1e	1e	1e	1e	1e	1e	0	1e	0	0	2		2	2	Daq
2, 4-D (nonaquatic amine salt formulations)		H	C, R/P, U	various CASRNs	1e	1e	1e	1e	1e	1e	1e	1e	1e	0	1e	0	0	2		2	2	D
2, 4-D (aquatic ester formulations)	e.g., AQUA-KLEEN	H	W	various CASRNs	1	1	1	0	0	0	0	0	0	1	1	2	2	3		3	3	Daq
2, 4-D (nonaquatic ester formulations)		H	C, R/P, U	various CASRNs	1	1	1	0	0	0	0	0	0	1	1	2	2	3		3	3	D
2, 4-DB	2, 4-D BUTYRIC ACID	H	C, R/P, U	10433-59-7	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	D
DALAPON		H	C, R/P	75-99-0	1e	1e	1e	1e	1e	1e	1e	1e	1e	0	1e	0	0	1	0	1	1	M
DAMINOZIDE		G	C, U	1596-84-5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	
DAZOMET		B, F, H	C, U	533-74-4	1	1	1	1	1	1	1	1	1	2	2	2	2	2	0	2	2	NS
DCPA	CHLORTHAL	H	C	1861-32-1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NS
DELTAMETHRIN		I	C, U	52198-63-5	1	1	2	0	0	0	0	0	2	3	3	3	3	3	2	3	3	
DESMEDIPHAM		H	C	13684-56-5	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	D

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DIAZINON	PHOSPHORO- THIOATE	I, N	C, F, M	333-41-5	1	1	1	3	3	3	3	3	3	2	2	2	2	3	2	3	3	
DICAMBA	ANISIC ACID	H	C, R/P	1918-00-9	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	1	2 _e	1	1	1	0	1	1	D
DICHLORBENIL		H	C	1194-65-6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
DICHLONE		F	C	117-80-6	1	1	1							2	2	2	2	3	0	3	3	
DICHLORMID		G, S	C	37764-25-3	1	1	1															NS
DICHLOROPROPANE		Fm	C	78-87-5	1	1	1															
DICHLOROPROPENE		N, Fm	C	524-75-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	1	1	1	
DICHLOOP	2,4-DP	H	F, ROW	7547-66-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	D
DICHLORVOS	DICHLOROVINYL DIMETHYL PHOSPHATE	I	C, U	62-73-7	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	3	3	
DICLOFOP-METHYL		H	C	51338-27-3	1	1	1	0	0	0	0	0	0	2	2	2	2	1	1	1	1	M
DICLORAN	DCNA	F	C	99-30-9	0	0	0	1	1	1	1	1	1	2	2	2	2	1	0	1	1	
DICLOSULAM		H	C	145701-21-9	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	D
DICOFOL		M	C, U	115-32-2	1	1	1	1	1	1	1	1	1	3	3	3	2	3	0	3	3	
DICROTAPHOS		I	C	141-66-2	2	2	2	3	3	3	3	3	3	1	1	1	1	2	2	3	2	

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Table 2. Ecotoxicity Ratings for Pesticide Active Ingredients and Various Formulations

Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
DIENOCHLOR		M	U	2227-17-0	1	1	1	1	1	1	1	1	1	3	3	3	2	1	0	3	3	
DIETHOLATE		Mi	C	32345-29-2	1	1	1															
DIEFENOCONAZOLE		F	C	14214-32-5	1	1	1	1	0	1	1	0	1	2	2	2	1	2	0	2	2	
DIFENZOQUAT		H	C	43222-48-6	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	1	2 _e	1	1	1	1	1	1	M
DIFLUBENZURON (see note below)	DIMLIN	I	C, F, R/P	35367-38-5	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	3	3	
DIFLUFENICAN		H	C	83164-33-4	1	1	1	0	0	0	0	0	0	1	1	1	1	1		1	1	D
DIFLUFENZOPYR		H	C	109293-97-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
DIMETHENAMID		H	C	87674-68-8	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	D
DIMETHIPIN		D	C	55290-64-7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
DIMETHIRIMOL		F	C	5221-53-4	1	1	1							1	1	1	1	1	0	1	1	
DIMETHOATE		I, M	C, R/P, U	60-51-5	1	1	1	2	2	2	3	2	2	1	1	1	1	2	2	3	2	
DIMETHOMORPH		F	C, U	110488-70-5	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	
DINITRAMINE		H	C	29091-05-2	1	1	1							2	2	2	2					NS
DINOCAP		F, M	C	39300-45-3	1	1	1	1	1	1	1	1	1	3	3	3	3	3	0	3	3	

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DIPHACINONE		R	F, R/P	82-66-6	2	2 sp	2	2	2	3 sp	2	2	2	1	1	1	1	1	1	1		
DIPHENAMID		H	C	957-51-7	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	NS
DIQUAT (aquatic)	DIQUAT DIBROMIDE	H	W	85-00-7	2	1	1	1	1	1	1	1	1	1	1	1	1	2	0	2	2	NS _{aq}
DIQUAT (nonaquatic)	DIQUAT DIBROMIDE	D, H	C, U	85-00-7	2	1	1	1	1	1	1	1	1	1	1	1	1	2	0	2	2	NS
DISULFOTON		I	C, F	298-04-4	2	2	2	2	2	2	2	2	2	3	3	1	3	3	2	3	3	
DITHIOPYR		H	C	97886-45-8	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	1	0	1	1	NS
DIURON (see note below)		H	C	330-54-1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	0	2	2	NS
D-LIMONENE		I	U	5989-27-5	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	2		3	2	
DNOC		I, F, H	C	534-52-1	2	2	2							2	2	2	2	2	2	2	2	NS
DODINE		F	C	2439-10-3	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	3	0	3	3	
DSMA	DISODIUM METHANE- ARSONATE	H	C	144-21-8	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	NS
EMAMECTIN BENZOATE		I	C	137512-74-4	1	1	1	1	1	1	1	1	1	2	2	2	2	3	1	3 _L	3	
ENDOSULFAN		I	C	115-29-7	2	2	2	2	2	2	2	2	2	3	3	3	3	3	1	3	3	
ENDOTHALL (aquatic)	e.g., AQUATHOL	H	W	various CASRNs	1	1	1	1	1	1	1	1	1	1	1	2	2	3	0	3	3	NS _{aq}

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
ENDOTHALL (nonaquatic)		D, H	C	various CASRNs	1	1	1	1	1	1	1	1	1	1	1	2	2	3	0	3	3	NS
EPTC		H	C	759-94-4	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	NS
ESFENVALERATE		I	C	6623-04-4	1	1	1	1	1	1	1	1	1	3	3	3	3	3	2	3	3	
ETHALFLURALIN		H	C	55283-68-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	3	3	3	3	3	0	3	3	NS
ETHAMETSULFURON		H	C	97780-06-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
ETHEPHON		G	C	16672-87-0	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
ETHION		A, I	C	563-12-2	2	2	2	1	0	1	2	0	1	2	2	2	2	3	0	3	3	
ETHOFUMESATE		H	C, U	26225-79-6	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	NS
ETHOPROP		I, N	C	13194-48-4	2	2	2	3	2	3	3	2	2	2	2	1	2	3	2	3	3	
ETRIDIAZOLE		F	C, U	2593-15-9	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	
FAMPHUR	e.g., WARBEX	I	S	52-85-7	2	2 _{sp}	2	2	3	3 _{sp}	3	3	2	1	1	1	1			3		
FEBUCONAZOLE		F	C	114369-43-6	0	0	0	0	1	0	0	1	0	2	2	1	2	1	0	1	1	
FENAMIPHOS		I, N	C	22224-92-6	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	
FENARIMOL		F	C, U	60168-88-9	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	1	2	1	2	2	1	

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
FENBUTATIN-OXIDE		M	C, U	13356-08-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	3	3	3	3	3	0	3	3	
FENFURAM		F	C	24691-80-3	0	0	0							1	1	1	1	1	0	1	1	
FENITROTHION		I	C, F	122-14-5	1	1	1	2	1	2	2	1	2	1	1	1	1	3	2	3	3	
FENOXAPROP-ETHYL		H	C	66441-23-4	1	1	1	0	0	0	0	0	0	2	2	2	2	1	2	2	1	M
FENOXYCARB		G	C, U	72490-01-8	0	0	0	0	0	0	0	0	0	3	3	1	3	3	2	3	2	
FENPROPATHRIN		A, I	C	39515-41-8	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	3	3	3	3	3	2	3	3	
FENTHION		I	C, M	55-38-9	1	1	1	3	3	3 _{sp}	3	3	3	1	1	1	1	3	2	3	3	
FENURON		H	C, R/P	101-42-8	0	0	0							1	1	1	1	1	0	1	1	D
FENVALERATE		I	C	51630-58-1	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	3	3	3	3	3	2	3	3	
FERBAM		F	C	14484-64-1	0	0	0	1	0	1	1	0	1	2	2	2	2	1	0	1	1	
FIPRONIL		I	C	120068-37-3	1 _e	1 _e	1 _e	2	1 _e	2	2	1 _e	2	3	3	3	3	3	2	3	3	
FLUAZIFOP-P-BUTYL		H	C	79241-46-6	1 _s	1 _s	1 _s	0	0	0	0	0	0	2	2	1	2	1	0	1	1	M
FLUAZINAM		F	C	79622-59-6	1 _s	1 _s	1 _s	1	0	1	1	0	1	3	3	3	3	2	0	2	2	
FLUCARBAZONE-SODIUM		H	C	181274-17-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D

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FLUCYTHRINATE		I	C	70124-77-5	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	3	3	3	3	3	2	3	3	
FLUFENACET		H	C	142459-58-3	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	NS
FLUFENPYR-ETHYL		H	C	188489-07-8	0	0	0	0		0	0		0	1	1	1	1	1	0	1	1	D
FLUMETSULAM		H	C	98967-40-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
FLUMICLORAC-PENTYL		H	C	87546-18-7	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	D
FLUMIOXAZIN		H	C	103361-09-7	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	D
FLUOMETURON		H	C	2164-17-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NS
FLURIDONE (aquatic)	e.g., SONAR	H	W	5976-60-4	0	0	0	0	0	0	0	0	0	1	1	1	1	1		1	1	NS _{aq}
FLUROXYPYR (acid formulation)		H	C, P	69377-81-7	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	D
FLUROXYPYR-MEPTYL (ester formulation)		H	C, P	81406-37-3	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	D
FLUTHIACET-METHYL		D, H	C	117337-19-6	0	0	0	0	0	0	0	0	0	2	2	2	1	1	0	1	1	D
FLUTOLANIL		F	C	66332-96-5	0	0	0							1	1	1	1	2		2	2	
FLUVALINATE		I, M	C	69409-94-5	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	3	3	3	3	3	1	3	3	
FLUXOFENIM		S	C	88485-37-4	1	1	1	0	0	0	0	0	0	2	2	2	1	2	0	2	2	

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FOMESAFEN SALT		H	C	72178-02-0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
FONOFOS		I	C	944-22-9	2	2	2	2	2	2	2	2	2	3	3	3	3	3	2	3	3	
FORAMSULFURON		H	C	173159-57-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
FORMETANATE HYDROCHLORIDE		I, M	C	23422-53-9	2	2	2	2	2	2	2	2	2	1	1	1	1	3	1	3	3	
FORMOTHION		I	C	2540-82-1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	1	
FOSAMINE AMMONIUM SALT		H	C, R/P	25954-13-6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
FOSETYL-ALUMINUM		F	C	39148-24-8	0	0	0	0	0	0	0	0	0	1	1	1	0	0		0	0	
GLUFOSINATE AMMONIUM		H	C, R/P	77182-82-2	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	NS
GLYPHOSATE (aquatic)	e.g., RODEO	H	W	1071-83-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	NS _{aq}
GLYPHOSATE (nonaquatic)	e.g., ROUNDUP	H	C, R/P, U, W	1071-83-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	NS
HALOSULFURON		H	C	100784-20-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
HALOXYFOP	HALOXYFOP- METHYL	H	C	69806-40-2	1	1	1	1	0	1	1	0	0	2	2	1	2	1	0	1	1	M
HEPTACHLOR (see note below)		I	U	76-44-8	2	2	2	2	1	2	2	1	2	3	3	3	3	3	2	3	3	
HEXAZINONE		H	C, F, R/P	51235-04-2	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	1	0	1	1	NS _f

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HEXYTHIAZOX		A, I	C	78587-05-0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	0	3	2	
HYDRAMETHYLNON	e.g., AMDRO	I	R/P, U	67485-29-4	1	1	1	0	0	0	0	0	0	2	2	2	2	2	0	3	2	
IMAZALIL		F	C	35554-44-0	1	1	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	
IMAZAMETHABENZ		H	C	81405-85-8	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	0	2 _e	0	0	0	0	0	0	NS
IMAZAMOX		H	C	114311-32-9	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
IMAZAPIC		H	C	1928-43-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
IMAZAPYR (technical formulation)		H	C, ROW, R/P	81334-34-1	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
IMAZAPYR (aquatic)	e.g., HABITAT	H	W	81334-34-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NSaq
IMAZAPYR (nonaquatic)	e.g., ARSENAL	H	C, ROW, R/P	81334-34-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
IMAZAUIIN		H	C	81334-34-1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
IMAZETHAPYR		H	C	81335-77-5	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
IMIDACLOPRID		I	C	138261-41-3	1	1	1	1	0	1	2	0	0	0	0	0	0	1	2	3	1	
INDOXACARB		I	C	173584-44-6	2	2	2	1	0	1	1	0	0	2	2	2	2	2	2	3	2	
IPRODIONE		F	C	36734-19-7	1	1	1	1	0	1	1	0	0	1	1	1	1	2	0	2	2	

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Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
ISAZOFOS		I	C	42509-80-8	2	2	2	2	2	2	2	2	2	3	3	3	3	3	2	3	3	
ISOFENPHOS		I	C	2311-71-1	2	2	2	3	2	3	3	2	3	1	1	1	1	3	2	3	3	
ISOXABEN		H	C	82558-50-7	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	D
ISOXAFLUTOLE		H	C	141112-29-0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	0	2	2	NS
LACTOFEN		H	C	77501-63-4	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	1	0	1	1	D
LAMDA-CYHALOTHRIN		I	C	91465-08-6	1	1	1	1	1	1	1	1	1	3	3	3	3	3	2	3	3	
LINDANE		I	C	58-89-9	1	1	1	1	0	1	1	0	1	3	3	3	3	3	2	3	3	
LINURON		H	C	330-55-2		1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	NS
MAGNESIUM PHOSPHIDE		R, F	F, R/P	12057-74-8	2 _b	2 _b	2 _b	2 _b	2 _b	2 _b	2 _b	2 _b	2 _b		2 _b					3 _b		
MALATHION		I	C, F, L, R/P, U	121-75-5	1	1	1	1	1	1	1	1	1	1	1	3	3	3	2	3	3	
MALEIC HYDRAZIDE		G	C	123-33-1	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
MANCOZEB		F	C	8018-01-7	0	0	0	1	0	1	1	0	1	2	2	2	1	2	0	2	2	
MANEB		F	C	12427-38-2	0	0	0	0	0	0	1	0	0	2	2	2	2	2	0	2	2	
MCPA		H	C, R/P	94-47-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	D

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MCPB		H	C	94-81-5	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	D
MECOPROP		H	C, R/P, U	7085-19-0	1	1	1	1	0	1	1	0	1	0	0	0	0		0			D
MEFENPYR-DIETHYL		S	C	135591-00-3	0	0	0	0		0	0		0	0	0	0	0	1	0	1	1	
MEFLUIDIDE		H	C, U	53780-34-0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
MEPIQUAT CHLORIDE		G	C	24307-26-4	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	D
METALAXYL		F	C, U	57837-19-1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	1	
METALDEHYDE		Mu	C, U	9002-91-9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	3	
METAM-SODIUM	METHAM-SODIUM	F, I, H, N	C	137-42-8	1	1	1	1	1	1	1	1	1	2	2	2	2	1	0	3	1	NS
METHAMIDOPHOS		I	C	10265-92-6	2	2	2	3	3	3	3	3	3	1	1	1	1	3	2	3	3	
METHIDATHION		I, M	C	950-37-8	2	2	2	2	3	2	2	3	2	3	3	3	3	3	2	3	3	
METHIOCARB		A, I, Mu	U	2032-65-7	1	1	1	2	2	2	3	2	2	3	1	1	2	3	2	3	3	
METHOMYL		I	C, F, R/P	16752-77-5	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	3	3	
METHOPRENE		G	C, L, M, R/P, U	40956-69-8	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	3	3	
METHOXYCHLOR		I	C	72-43-5	1	1	1	0	0	0	0	0	0	3	3	3	3	3	2	3	3	

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
METHOXYFENOZIDE		I	C	161050-58-4	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	3 _L	1	
METHYL BROMIDE		Fm	C, U	74-83-9	1	1	1							1	1	1	1	1	0	1	1	NS
METHYL ISOTHIOCYANATE		Fm	C	556-61-6	1	1	1							2	2	3	2	3	0	3	3	
METHYL PARATHION		I	C, M	298-00-0	2	2	2	3	3	3	3	3	3	1	1	1	1	3	2	3	3	
METIRAM		F	C	9006-42-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	
METOLACHLOR (see note below)		H	C	5121845-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
METRIBUZIN		H	C, ROW	21087-64-9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
METSULFURON-METHYL (see note below)		H	C	74223-64-6	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1 _e	1	1	1	1	1	0	NS
MEVINPHOS		I	C	7786-34-7	2	2	2	3	3	3	3	3	3	1	1	3	3	3	2	3	3	
MOLINATE		H	C	2212-67-1	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	1	1	1	NS
MONOCROTOPHOS		I	C	2157-98-4	2	2	2	3	3	3	3	3	3	1	1	1	1	3	2	3	3	
MONOLINURON		H	C	1746-81-2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
MONURON		H	C	150-68-5	0	0	0	1	1	1	1	1	1			0			0			NS
MSMA	MONOSODIUM METHANE- ARSONATE	H	C	2163-80-6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
MYCLOBUTANIL		F	C	88671-89-0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	
NAA	1-NAPHTHALENE- ACETIC ACID	G	C	86-87-3	1	1	1												0			NS
NALED		I	C, L, R/P	300-76-5	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	3	3	3	2	3	2	3	3	
NAPROPAMIDE		H	C	15299-99-7	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS
NAPTALAM		H	C	132-66-1	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	0	0	0	0	0	NS
NAPHTHALENE		F, I	C	91-20-3	0	0	0	0					0	2	2	2	1	1	1	3	1	
NEBURON		H	C	555-37-3	0	0	0												0			NS
NICOSULFURON		H	C	111991-09-4	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
NITRAPYRIN		B, X	C	1929-82-4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	
NORFLURAZON		H	C	27314-13-2	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	NS
ORYZALIN		H	C	19044-88-3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
OXADIAZON		H	C	19666-30-9	0	0	0	0	1	0	0	1	0	2	2	1	2	2	2	2	2	NS
OXAMYL	e.g., VYDATE	I, N	C	23135-22-0	2	2	2	3	3	3	3	3	3	1	1	1	1	3	2	3	3	
OXYCARBOXIN		F	U	5259-88-1	1	1	1							1	1	1	1	1	0	1	1	

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OXYDEMETON-METHYL	e.g., METASYSTOX-R	I	C	301-12-2	2	2	2	2	1	2	2	1	2	2	2	2	1	2	2	3	2	
OXYFLUORFEN		H	C, F	42874-0303	1e	1e	1e	1e	1e	1e	1e	1e	1e	2	2	2	2	1	0	1	1	NS
OXYTHIOQUINOX		F, I, M	C	2439-01-2	1	1	1	1	0	1	1	0	1	3	3	2	3	2	0	3	2	
PACLOBUTRAZOL		G	C	76738-62-0	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	NS
PARAQUAT		H	C, R/P, U	4685-14-7	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	1	1	NS
PARATHION (ETHYL)		I	C, R/P	56-38-2	2	2	2	3	3	3	3	3	3	2	2	2	3	3	2	3	3	
PCNB	QUINTOZENE	F	C	82-68-8	1	1	1	1	0	1	1	0	1	2	2	2	2	2	0	2	2	
PEBULATE		H	C	1114-71-2	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	NS
PELARGONIC ACID		H	C, ROW, U	112-05-0	1e	1e	1e	1e	1e	1e	1e	1e	1e	0	1e	0	0	0	0	0	0	NS
PENDIMETHALIN	DINITROBENZEN-AMINE	H	C	40487-42-1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	0	2	2	NS
PENTACHLOROPHENOL	PCP	I, F	U	87-86-5	2	2	2	1	1	1	1	1	1	2	2	3	3	3	2	3	3	NS
PERFLUIDONE		H	C	37924-13-3	1	1	1															NS
PERMETHRIN		I	C, U	52645-53-1	1e	1e	1e	1e	1e	1e	1e	1e	1e	3	3	3	3	3	2	3	3	
PETROLEUM OILS		Adj, H, I, M	C, F, R/P, U	various CASRNs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	NS

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PHENMEDIPHAM		H	C	13681-63-4	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	D
PHENTHOATE		I	C	32597-03-7	1	1	1	0		0	0		0	1	1	1	1	2	2	3	2	
PHORATE	PHOSPHORO DITHIOATE	I	C	298-02-2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	
PHOSALONE		I	C	2310-17-0	1	1	1	1	1	1	1	1	1	3	3	2	3	3	0	3	3	
PHOSMET		I	C, F	732-11-16	1	1	1	1	1	1	2	1	1	3	3	2	3	3	2	3	3	
PHOSPHAMIDON		I	C, F	13171-21-6	2	2	2	3	3	3	3	3	3	2	2	2	2	3	2	3	3	
PICLORAM (see note below)	e.g., TORDON	H	C, R/P	1918-02-1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS
PIPERONYL BUTOXIDE		SY	C, R/P	51-03-6	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	2	2	
PRIMISULFURON-METHYL	PRIMISULFURON	H	C, R/P	113036-87-6	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	NS
PROCHLORAZ		F	C	67747-09-5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	
PROCYMIDONE		F	C	32809-16-8	0	0	0							1	1	1	1	1	0	1	1	
PRODIAMINE		H	C	29091-21-2	0	0	0	0	0	0	0	0	0	2	2	2	2	2	0	2	2	NS
PROFENOFOS		I, M	C	41198-08-7	1	1	1	1	1	1	1	1	1	3	3	3	3	3	2	3	3	
PROMECARB		I	C	2631-37-0	1	1	1							2	2	2	2	3	2	3	3	

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
PROMETON		H	C	1610-18-0	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	1	1	1	NS
PROMETRYN		H	C	7287-19-6	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS _f
PRONAMIDE	PROPYZAMIDE	H	C	23950-58-5	1	1	1	0	0	0	0	0	0	1	1	1	0	1	0	1	1	NS
PROPACHLOR		H	C, F, R/P	1918-16-7	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2	2	2	2	1	0	1	1	NS
PROPAMOCARB HYDROCHLORIDE		F	C	25606-41-1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
PROPANIL		H	C	709-98-9	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	NS
PROPARGITE		M	C	2312-35-8	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	3	0	3	3	
PROPAZINE		H	C	139-40-2	1	1	1	0	0	0	0	0	0	1	1	1	0	1	0	1	1	NS
PROPETAMPHOS		I	U	31218-83-4	1	1	1	1	1	1	1	1	1	2	2	2	2	3		3	3	
PROPHAM	IPC	H	C	122-42-9	0	0	0		0			0	0	1	1	1	1	1	1	1	1	NS
PROPICONAZOLE		F	C	60207-90-1	1	1	1	1	0	1	1	0	1	2	2	2	1	1	0	1	1	
PROPIONIC ACID		F	C, U	79-09-4	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e		2 _e					0		
PROPOXUR		I	C, U	114-26-1	2	2	2	3	3	3	3	3	3	1	1	1	1	3	2	3	3	
PROPOXYCARBAZONE		H	C	181274-15-7	0	0	0	0		0	0		0	1	1	1	1	0	0	0	0	NS

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Table 2. Ecotoxicity Ratings for Pesticide Active Ingredients and Various Formulations

Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
PROSULFOCARB		H	C	52888-80-9	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS
PYRACLOSTROBIN	HEADLINE	F	C	175013-18-0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	0	3	3	
PYRAZON		H	C	1698-60-8	1	1	1	0		0	0		0	1	1	1	1		0			D
PYRETHRINS	PYRETHRUM	I	C, L, U	various CASRNs	1	1	1	0	0	0	0	0	0	3	3	3	3	3	2	3	3	
PYRIDATE	PYRIDAZINE CARBOXYLIC ACID	H	C, R/P	55512-33-9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	D
PYRIPROXYFEN		G	C, U	95737-68-1	0	0	0	0	0	0	0	0	0	2	2	2	2	3	0	3	3	
PYRITHIOBAC		H	C	123343-16-8	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
QUINCLORAC		H	C	8408701-4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
QUINOXYFEN		F	C	124495-18-7	0	0	0	0	0	0	0	0	0	2	2	2	2	3	0	3	3	
QUIZALOFOP-P-ETHYL		H	C	76758-14-8	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	2	2	2	2	1	0	1	1	M
RESMETHRIN		I	C, U	10453-86-8	1	1	1	0	0	0	0	0	0	3	3	3	3	3	2	3	3	
RIMSULFURON		H	C	122931-48-0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
ROTENONE (aquatic)		I, P	W	83-79-4	1	1	1	1	0	1	1	0	1	2	2	3	3	3	0	3	3	
RYANIA		I	C	15662-33-6	1	1	1	2	2	2	3	2	2	1	1	1	1	3		3	3	

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
SETHOXYDIM		H	C	74051-80-2	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	M
SIDURON		H	C, U	1982-49-6	1 _s	1 _s	1 _s	0	0	0	0	0	0	2	2	1	2	1	0	1	1	M
SIMAZINE (aquatic) (see note below)	e.g., AQUAZINE	H	W	122-34-9	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	NS _{aq}
SIMAZINE (nonaquatic) (see note below)		H	C	122-34-9	2	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	NS _f
SODIUM CHLORATE		D, H	C	7775-09-9	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	NS
SODIUM CYANIDE	e.g., M-44	R	F, R/P	143-33-9	2	2 _{sp}	2	3	3	3 _{sp}	3	3	3	3	3	3	3	3		3	3	
SODIUM FLUOROACETATE	e.g., COMPOUND 1080	P	F, R/P	62-74-8	2	2 _{sp}	2	3	3	3 _{sp}	3	3	3									
SPINOSAD (see note below)		I	C, R/P, U	13929-60-7, 131928-63-0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2	3	1	
STREPTOMYCIN		B, X	C, U	57-92-1	0	0	0							1	1	1	1	0		0	0	
STRYCHNINE		R	F, R/P	57-24-9	2	2 _{sp}	2	3	3	3 _{sp}	3	3	3									
SULFENTRAZONE		H	C	122836-35-5	1	1	1	0	0	0	0	0	0	1	1	0	1	1		1	1	NS
SULFOMETURON-METHYL	SULFOMETURON	H	R/P, ROW	74222-97-2	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS
SULFUR		D	C	7664-93-9	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	NS
SULFURYL FLUORIDE (see note below)		Fm	U	2699-79-8	1	1	1															

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Pesticide					Species toxicity groups * H §																	
common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
SULPROFOS		I	C	35400-43-2	1	1	1	2	1	2	2	1	2	1	1	1	1	2		3	2	
TCA	SODIUM TRICHLORO- ACETATE	H	C	76-03-9	0	0	0										0	0	0	0	0	NS
TEBUCONAZOLE		F	C	107534-96-3	1	1	1							2	2	2	2	2		2	2	
TEBUFENOZIDE		I	C, F	11240-23-8	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	3 _L	1	
TEBUTHIURON		H	R/P, U	34104-18-1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	1	1	0	NS _f
TEFLUTHRIN		I	C	79538-32-2	1	1	1	0	0	0	0	0	0	3	3	3	3	3	2	3	3	
TEMEPHOS		L	C, L, M, R/P, U	3383-96-8	1	1	1	2	2	2	3	2	2	1	1	2	1	3	2	3	3	
TERBACIL		H	C	5902-51-2	1	1	1	0	0	0	0	0	0	1	1	1	0	1	0	1	1	NS
TERBUFOS		I, N	C	13071-79-9	2	2	2	2	2	2	2	2	2	3	3	3	3	3	0	3	3	
TERBUTRYN (aquatic)	e.g., CLAROSAN	H	W	886-50-0	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS _{aq}
TERBUTRYN (nonaquatic)		H	C	886-50-0	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	NS _f
TETRACHLORVINPHOS		I	C	22248-79-9	1	1	1	0	0	0	1	0	0	2	2	2	2	3	2	3	3	
THIABENDAZOLE		F	C, U	148-79-8	1	1	1	0	0	0	0	0	0	2	2	2	1	1	0	1	1	
THIAMETHOXAM		I	C	153719-23-4	0	0	0	1	1	1	1	1	1	0	0	0	0	1	2	3	1	

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common name/active ingredient	alternative name/ e.g., trade name®	type I	use **	CASRN	L-MA	P-MA	S-MA	G-AV	L-AV	P-AV	S-AV	W-AV	REP	A-AM	T-AM	CW-F	WW-F	A-AR	BEE	T-AR	FW-M	PLANT
THIAZOPYR		H	C	117718-60-2	0	0	0	1	0	1	1	0	0	1	1	1	1	1	0	1	1	NS
THIDIAZURON		D	C	51707-55-2	1	1	1	0		0	0		0	0	0	0	0	1	0	1	1	NS
THIFENSULFURON-METHYL	THIFENSULFURON	H	C	79277-27-3	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	D
THIOBENCARB		H	C	28249-77-6	1	1	1	0	0	0	0	0	0	2	2	2	2	3		3	3	NS
THIOCYCLAM HYDROGEN OXALATE		I	C	31895-22-4	1	1	1							3	3	3	2	3	1	3	3	
THIODICARB		I	C	59669-26-0	1	1	1	0	0	0	0	0	0	1	1	1	1	3	1	3	3	
THIOPHANATE-METHYL		F	C, F	23564-05-8	1	1	1	0	0	0	0	0	0	2	2	1	2	1	0	1	1	
THIRAM		F	C, U	137-26-8	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	3	3	2	3	3	0	3	3	
TOLCLOFOS-METHYL		F	C	57018-04-9			0															
TRALKOXYDIM		H	C	87820-88-0	1	1	1	0	0	0	0	0	0	1	1	1	1	0	2	2	0	D
TRALOMETHRIN		I	C	66841-25-6	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	3	3	3	3	3	2	3	3	
TRIADIMEFON		F	C	43121-43-3	1	1	1	0	0	0	1	0	0	1	1	1	1	1	0	1	1	
TRIADIMIENOL		F	C	55219-65-3	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	1	
TRIALATE		H	C	2303-17-5	1	1	1	0	0	0	0	0	0	2	2	2	1	3	0	3	3	M

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TRIASULFURON		H	C, P, R	82097-50-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
TRIBENURON-METHYL	TRIBENURON	H	C	101200-48-0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D
TRIBUFOS		D	C	78-48-8	2	2	2	1	1	1	1	1	1	2	2	2	2	3	0	3	3	D
TRIBUTYL TIN	TBT	B, X	U	56573-85-4	1	1	1	1	1	1	1	1	1	3	3	3	3	3		3	3	
TRICHLORFON		I	C, F, R/P	52-68-6	1	1	1	2	2	2	2	2	1	2	2	2	2	3	1	3	3	
TRICHLORONATE		I	C	327-98-0	2	2	2							0	0	0	0	3	1	3	3	
TRICLOPYR (amine salt formulations)	e.g., GARLON 3A	H	F, R/P, ROW	55226-06-3	1e	1e	1e	1e	1e	1e	1e	1e	1e	0	1e	0	0	0	0	0	0	D
TRICLOPYR (ester formulations)	e.g., GARLON 4	H	F, R/P, ROW	55335-06-3	1	1	1	0	0	0	0	0	0	2	2	2	2	1	0	1	1	D
TRICYCLAZOLE		F	C	41814-78-2	1	1	1															
TRIDIPHANE		H	C	58138-08-2	1	1	1	0	0	0	0	0	0	2	2	2	2	2	2	2	2	NS
TRIFLOXYSTROBIN		F	C	141517-21-7	0	0	0	0	0	0	0	0	0	3	3	3	3	3	0	3	3	
TRIFLOXYSULFURON-SODIUM		H	C	199119-58-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NS
TRIFLUMIZOLE		F	C	68694-11-1	1	1	1	0	0	0	0	0	0	2	2	2	1	1	0	1	1	
TRIFLURALIN		H	C, F	1582-09-8	0	0	0	0	0	0	0	0	0	3	3	3	3	2	0	2	2	NS

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TRIFLUSULFURON		H	C	126535-15-7	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	0	0	0	0	D
TRIFORINE		F	C	26644-46-2	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	0	1 _e	0	0	1	1	1	1	
TRIMETHACARB		I	C	2686-99-9	1	1	1	1	2	1	2	2	1	1	1	1	1	3		3	3	
VALIDAMYCIN		X	C	37248-47-8	0	0	0										1		0			
VERNOLATE		H	C	1929-77-7	1	1	1	0	0	0	0	0	0	1	1	1	1	2	0	2	2	NS
VINCLOZOLIN		F	C, U	50471-44-8	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1 _e	1	1	1	1	1	0	1	1	
WARFARIN		R	U	81-81-2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	0	1	1	
ZINC PHOSPHIDE (see note below)		R	F, R/P	1314-84-7	1	2 _{sp}	2	3	2	3 _{sp}	2	3	3	2	2	2	2					
ZINEB		F	C	12122-67-7	1	1	1	0	0	0	0	0	0	1	1	1	1		0			
ZIRAM		F	C	137-30-4	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	2 _e	3	3	2	3	3	0	3	3	

Classes:

Class 0 = Pesticides w/o toxicity

Class 1 = Pesticides w/ slight to moderate toxicity

Class 2 = Pesticides w/ high toxicity

Class 3 = Pesticides w/ very high toxicity

Class D = Dicot-specific

Class M = Monocot-specific

Class NS = Non-specific for dicots or monocots

*	A-AM = Aquatic Amphibian	CW-F = Cold Water Fish	G-AV = Gallinaceous Avian	L-MA = Large Mammal	P-MA = Predatory Mammal	S-AV = Small Avian	T-AM = Terrestrial Amphibian	W-AV = Waterfowl Avian
	A-AR = Aquatic Arthropod	FW-M = Freshwater Mollusk	L-AV = Large Avian	P-AV = Predatory Avian	REP = Reptile	S-MA = Small Mammal	T-AR = Terrestrial Arthropod	WW-F = Warm Water Fish
H	Animal ecotoxicity classes: 0 = practically non-toxic, 1 = slightly to moderately toxic, 2 = highly toxic, 3 = very highly toxic; Plant ecotoxicity classes: D = dicot-specific, M = monocot-specific, NS = non-specific							
§	Subscripts: aq = aquatic formulation b = burrow fumigant D = Dipteran-specific e = eye irritation rating f = formulation-dependent L = Lepidopteran-specific s = skin irritation rating sp = secondary poisoning potential							

Notes:

acephate = acephate is rated similar to highly toxic methamidophos since up to 10% of acephate residue is metabolized into methamidophos
 amitrole = amitrole is rated as Class 1 in toxicity groups for avians and reptiles due to reported mortality incidents not indicated by toxicity data
 atrazine = atrazine is rated as Class 3 for amphibians due to potential disruption of endocrine system
 diflubenzuron = diflubenzuron is rated as Class 2 for bees because of potential chitin inhibition but is otherwise nontoxic to bees
 diuron = herbicide may be released as urine into waterbodies by ungulates that have grazed on field-applied diuron
 heptachlor = the degradative metabolite heptachlor epoxide is potentially more toxic
 metolachlor = metolachlor is rated as Class 1 in toxicity groups for avians and reptiles due to reported mortality incidents not indicated by toxicity data
 metsulfuron = metsulfuron is rated as Class 1 in toxicity groups for fish and amphibians due to reported mortality incidents not indicated by toxicity data
 picloram = picloram is used mostly for broad-leaved plants but can harm some grasses and other monocots
 simazine = simazine is highly toxic to cattle and sheep
 spinosad = spinosad is formed from two active ingredients (CASRN 13929-60-7 and CASRN 131928-63-0)
 sulfuryl fluoride = chloropicrin (a strong eye and respiratory irritant) is usually combined with sulfuryl fluoride fumigants
 zinc phosphide = secondary poisoning potential is relatively low

I Type

Adj = Adjuvant
 A = Acaricide
 Al = Algicide
 B = Bactericide
 D = Desiccant
 Fm = Fumigant
 F = Fungicide
 G = Growth regulator
 H = Herbicide
 I = Insecticide
 L = Larvicide
 M = Miticide
 Mi = Microbial inhibitor
 Mu = Molluscicide
 N = Nematicide
 P = Piscicide
 R = Rodenticide
 S = Safener
 SY = Synergist

** Use

C =Cropland
 F = Forest
 M = Mosquito control

*	A-AM = Aquatic Amphibian	CW-F = Cold Water Fish	G-AV = Gallinaceous Avian	L-MA = Large Mammal	P-MA = Predatory Mammal	S-AV = Small Avian	T-AM = Terrestrial Amphibian	W-AV = Waterfowl Avian
	A-AR = Aquatic Arthropod	FW-M = Freshwater Mollusk	L-AV = Large Avian	P-AV = Predatory Avian	REP = Reptile	S-MA = Small Mammal	T-AR = Terrestrial Arthropod	WW-F = Warm Water Fish
H	Animal ecotoxicity classes: 0 = practically non-toxic, 1 = slightly to moderately toxic, 2 = highly toxic, 3 = very highly toxic; Plant ecotoxicity classes: D = dicot-specific, M = monocot-specific, NS = non-specific							
§	Subscripts: aq = aquatic formulation b = burrow fumigant D = Dipteran-specific e = eye irritation rating f = formulation-dependent L = Lepidopteran-specific s = skin irritation rating sp = secondary poisoning potential							

R/P = Rangeland and/or Pasture
 ROW = Right-of-way
 U = Urban
 W = Water

*	A-AM = Aquatic Amphibian	CW-F = Cold Water Fish	G-AV = Gallinaceous Avian	L-MA = Large Mammal	P-MA = Predatory Mammal	S-AV = Small Avian	T-AM = Terrestrial Amphibian	W-AV = Waterfowl Avian
	A-AR = Aquatic Arthropod	FW-M = Freshwater Mollusk	L-AV = Large Avian	P-AV = Predatory Avian	REP = Reptile	S-MA = Small Mammal	T-AR = Terrestrial Arthropod	WW-F = Warm Water Fish
H	Animal ecotoxicity classes: 0 = practically non-toxic, 1 = slightly to moderately toxic, 2 = highly toxic, 3 = very highly toxic; Plant ecotoxicity classes: D = dicot-specific, M = monocot-specific, NS = non-specific							
§	Subscripts: aq = aquatic formulation b = burrow fumigant D = Dipteran-specific e = eye irritation rating f = formulation-dependent L = Lepidopteran-specific s = skin irritation rating sp = secondary poisoning potential							

4.4.2 Biological information

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Large Mammal	Sonoran pronghorn	Plant (shrubs, forbs)	Arizona: desert grassland interspersed with shrubs (includes habitat on Cabeza Prieta National Wildlife Refuge)	year-round presence	R
Large Mammal	West Indian manatee	Plant (sea grasses)	Texas: coastal bays and waterways (includes habitat on national wildlife refuges)	rare visitor	none
Predatory Mammal	black-footed ferret	Small Mammal (prairie dogs)	Arizona, New Mexico, Oklahoma, and Texas: prairie dog colonies	year-round presence	R, S
Predatory Mammal	Gulf Coast jaguarundi	Small Mammal, Gallinaceous Avian, Small Avian	Texas: brushland thickets (includes habitat on national wildlife refuges)	year-round presence	R, S
Predatory Mammal	jaguar	Small Mammal, Large Mammal, Gallinaceous Avian, Small Avian	Arizona and New Mexico: brushland thickets (includes habitat on national wildlife refuges)	year-round presence	R, S
Predatory Mammal	Louisiana black bear	Small Mammal, Large Mammal, Plant (berries, acorns)	Texas: forest and woodland	year-round presence	C, F, P, S
Predatory Mammal	ocelot	Small Mammal, Gallinaceous Avian, Large Avian	Texas: brushland thickets (includes habitat on national wildlife refuges)	year-round presence	R, S
Predatory Mammal	Mexican gray wolf	Small Mammal, Large Mammal, Gallinaceous Avian, Small Avian	Arizona and New Mexico: chaparral, woodland, and forest	year-round presence	F, R, S
Small Mammal	gray bat	Terrestrial Arthropod	Oklahoma: summer caves near lakes or rivers and deep underground winter caves (includes habitat on Ozark Plateau National Wildlife Refuge)	forages from summer caves during March to November; hibernates in winter caves during November to March	C, F, P
Small Mammal	Hualapai Mexican vole	Plant (grasses, forbs)	Arizona: meadows within ponderosa pine forest in Hualapai Mountains	year-round presence	F, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Small Mammal	Indiana bat	Terrestrial Arthropod	Oklahoma: limestone caves, bridges, hollow trees, or old buildings near small to medium-sized streams	forages from summer roosts during March to October; hibernates in winter caves during October to March	C, F, P
Small Mammal	lesser (Sanborn's) long-nosed bat	Plant (monocot agave nectar and pollen)	Arizona and New Mexico: rangeland areas with hollow trees, caves, mines, or large culverts (includes habitat on national wildlife refuges)	forages from summer roosts in U.S. during spring through summer; winters in Central America and Mexico	R
Small Mammal	Mexican long-nosed bat	Plant (monocot agave nectar and pollen)	1) New Mexico, Hidalgo County: rangeland areas with hollow trees, caves, mines, or large culverts 2) Texas: rangeland areas with hollow trees, caves, mines, or large culverts in Big Bend region and Chisos Mountains	forages from summer roosts in U.S. during spring through summer; winters in Central America, Mexico, and possibly U.S.	R
Small Mammal	Mount Graham red squirrel	Plant (conifer seeds)	Arizona: spruce-fir or mixed forest in Coronado National Forest	year-round presence	F, ROW
Small Mammal	Ozark big-eared bat	Terrestrial Arthropod	Oklahoma: caves near forests of oak-hickory or beech-maple-hemlock (includes habitat on Ozark Plateau National Wildlife Refuge)	forages from summer caves during spring and summer; hibernates in winter caves during fall and winter	C, F, P
Gallinaceous Avian	Attwater's greater prairie-chicken	Terrestrial Arthropod, Plant (seeds, plant parts)	Texas: grassland, pastures, and cropland (includes habitat on Attwater Prairie Chicken National Wildlife Refuge)	year-round presence	C, R/P, ROW, S
Gallinaceous Avian	masked bobwhite	Terrestrial Arthropod, Plant (seeds, plant parts)	Arizona: desert grassland (includes habitat on Buenos Aires National Wildlife Refuge)	year-round presence	R, ROW
Large Avian	brown pelican	Warm Water Fish	Texas: coastal bays and waterways (includes habitat on national wildlife refuges)	year-round presence	M

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Large Avian	whooping crane	Aquatic Arthropod, Terrestrial Arthropod, Warm Water Fish, Terrestrial and Aquatic Amphibian, Plant (field grains, aquatic plants)	<p>1) Oklahoma and Texas, non-coastal counties: migratory roosting areas in wetlands within a 150 mile wide migration corridor that is centered on a line stretching between the following cities:</p> <p>a) the city of Rockport on the Texas Gulf Coast,</p> <p>b) the city of Wichita Falls in north-central Texas, and</p> <p>c) the city of Woodward in northwest Oklahoma</p> <p>(includes habitat on Salt Plains National Wildlife Refuge in Oklahoma and possibly other national wildlife refuges)</p> <p>2) Texas, coastal counties of Aransas, Calhoun, and Refugio: wintering areas in coastal wetlands (includes habitat on Aransas National Wildlife Refuge)</p>	migrates from Texas to Canada during March to June in spring migration; migrates from Canada to Texas during September to November in fall migration	C, R/P, S
Predatory Avian	bald eagle	Cold Water Fish, Warm Water Fish, Waterfowl Avian, Small Mammal, Reptile, carrion	<p>1) Arizona and New Mexico: cliffs, ledges, or trees near large waterbodies such as rivers, lakes, and reservoirs (includes habitat on national wildlife refuges)</p> <p>2) Oklahoma and Texas: trees in forest or woodland areas with large waterbodies such as rivers, lakes, and reservoirs (includes habitat on national wildlife refuges)</p>	nests from November to July; year-round presence but may migrate to higher elevations in summer and/or winter in flocks	C, F, R/P, ROW, S
Predatory Avian	California condor	various (carrion)	Arizona: canyon lands and mountain ridges	year-round presence	ROW, S
Predatory Avian	Mexican spotted owl	Small Mammal	Arizona, New Mexico, and Texas: mountains or canyons with mixed-conifer forest that has 70% canopy cover, downed woody material, and 40% slopes or greater	year-round presence	F, ROW
Predatory Avian	Northern aplomado falcon	Small Avian, Small Mammal, Reptile, Terrestrial Arthropod	Texas: coastal prairie, salt flats, or open woodland intermixed with grassland (includes habitat on national wildlife refuges)	year-round presence	C, R/P, ROW
Small Avian	black-capped vireo	Terrestrial Arthropod	<p>1) Oklahoma: shrubland or woodland with patches of grass (includes habitat on Wichita Mountains National Wildlife Refuge)</p> <p>2) Texas: shrubland or woodland with patches of grass (includes habitat on Balcones Canyonlands National Wildlife Refuge)</p>	present in breeding habitat from March through September; winters in Mexico	C, R/P, ROW, U
Small Avian	Eskimo curlew	Aquatic Arthropod, Terrestrial Arthropod (?)	Texas: coastal areas (includes habitat on national wildlife refuges)	winters in Texas; probably extinct	none

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Small Avian	golden-cheeked warbler	Terrestrial Arthropod	Texas: oak-juniper woodland (includes habitat on Balcones Canyonlands National Wildlife Refuge)	present in breeding habitat from March through August; winters in Central America	C, R/P, ROW, U
Small Avian	interior least tern	Warm Water Fish	Oklahoma, New Mexico, and Texas: colony nesting areas on sandbars, beaches, or other bare areas near wide, shallow waterbodies (includes habitat on national wildlife refuges)	present in breeding habitat from April through early September; winters in Central America and South America	C, R/P, ROW
Small Avian	pipin plover	Aquatic Arthropod, Terrestrial Arthropod, Marine Invertebrate	New Mexico, Oklahoma, and Texas: coastal shore areas and the mud flats on offshore coastal islands (includes habitat on national wildlife refuges)	winters along Texas Gulf Coast from September to March; migrates to Great Lakes or northern Great Plains for breeding season	ROW
Small Avian	red-cockaded woodpecker	Terrestrial Arthropod	Oklahoma and Texas: pine woodland	year-round presence	F, ROW
Small Avian	southwestern willow flycatcher	Terrestrial Arthropod, Plant (fruit)	Arizona, New Mexico, and Texas: willow-cottonwood bottomland along streams or rivers with a strip of shrubs or trees on one bank that is at least 30 feet wide (includes habitat on national wildlife refuges)	present in breeding habitat from May through mid-September; winters in Mexico, Central America, and South America	C, R, ROW
Small Avian	Yuma clapper rail	Aquatic Arthropod, Terrestrial Arthropod, Freshwater Mollusk, Plant (seeds)	Arizona: streams and marshlands of the lower Colorado River (includes habitat on national wildlife refuges)	present in breeding habitat from April through early September; winters along lower Colorado River, the Salton Sea in California, and possibly in Mexico	R, S
Reptile	Concho water snake	Warm Water Fish	Texas: streams, rivers, ponds, lakes, and reservoirs associated with the Concho and Colorado watersheds	active aboveground from March through October; usually hibernates belowground from November to March	C, R/P, ROW
Reptile	desert tortoise	Plant	Arizona: desert scrubland (includes habitat on national wildlife refuges)	year-round presence	R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Reptile	green sea turtle	Plant (sea grasses, algae)	Texas: coastal bays and waterways (includes habitat on national wildlife refuges)	year-round presence; may nest on beaches along Texas Gulf Coast	none
Reptile	hawksbill sea turtle	Plant (sea grasses, algae)	Texas: coastal bays and waterways (includes habitat on national wildlife refuges)	year-round presence; may nest on beaches along Texas Gulf Coast	none
Reptile	Kemp's ridley sea turtle	Marine Invertebrate, Plant (sea grasses, algae)	Texas: coastal bays and waterways (includes habitat on national wildlife refuges)	year-round presence; may nest on beaches along Texas Gulf Coast	none
Reptile	leatherback sea turtle	Marine Invertebrate, Plant (sea grasses, algae)	Texas: coastal bays and waterways (includes habitat on national wildlife refuges)	year-round presence	none
Reptile	loggerhead sea turtle	Marine Invertebrate, Plant (sea grasses, algae)	Texas: coastal bays and waterways (includes habitat on national wildlife refuges)	year-round presence; may nest on beaches along Texas Gulf Coast	none
Reptile	New Mexican ridge-nosed rattlesnake	Small Mammal, Small Avian, Reptile	New Mexico, Hidalgo County: pine-oak forest in mountains	active aboveground from April to November; hibernates belowground from November to April	F, ROW
Aquatic Amphibian	Barton Springs salamander	Aquatic Arthropod	1) Texas, Travis County: springflows from Main Springs, Eliza Springs, Sunken Garden Springs, and Upper Barton Springs of the Barton Springs complex within the Barton Creek drainage in the city of Austin 2) Texas, Travis County: Barton Springs Segment of the Edwards Aquifer	year-round presence	C, M, R/P, ROW, U
Aquatic Amphibian	Chiricahua leopard frog	Aquatic Arthropod, Terrestrial Arthropod	Arizona and New Mexico: cienagas (desert marshes), ponds, livestock tanks, and shallow areas of lakes, reservoirs, streams, and rivers (includes habitat on national wildlife refuges)	year-round presence	R, ROW
Aquatic Amphibian	San Marcos salamander	Aquatic Arthropod, Freshwater Mollusk	1) Texas, Hays County: San Marcos National Fish Hatchery & Technology Center 2) Texas, Hays County: Spring Lake, San Marcos River, and associated springs in the city of San Marcos	year-round presence	C, M, R/P, ROW, U

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Aquatic Amphibian	Sonoran tiger salamander	Aquatic Arthropod	Arizona: spring-fed wetland in desert scrubland	year-round presence	R, ROW
Aquatic Amphibian	Texas blind salamander	Aquatic Arthropod, Freshwater Mollusk	1) Texas, Hays County: San Marcos National Fish Hatchery & Technology Center 2) Texas, Hays County: springs and wells in the San Marcos River drainage within the city of San Marcos	year-round presence	C, R/P, ROW, U
Terrestrial Amphibian	Houston toad	Aquatic Arthropod, Terrestrial Arthropod	Texas: areas of deep sandy soil with pine or oak woodland	year-round presence but may hibernate belowground in summer	F, R/P, ROW, U
Cold Water Fish	Apache trout	Aquatic Arthropod, Terrestrial Arthropod	1) Arizona: mountain streams in Apache-Sitgreaves National Forest and Fort Apache Indian Reservation 2) Arizona, Navajo County: Alchesay - Williams Creek National Fish Hatchery	year-round presence	F, R, ROW
Cold Water Fish	fountain darter	Aquatic Arthropod, Terrestrial Arthropod	1) Texas, Comal County: Comal River and Landa Lake 2) Texas, Hays County: San Marcos National Fish Hatchery & Technology Center 3) Texas, Hays County: Spring Lake and San Marcos River above confluence with Blanco River 4) Texas, Uvalde County: Uvalde National Fish Hatchery	year-round presence	C, M, R/P, ROW, U
Cold Water Fish	Gila trout	Aquatic Arthropod, Terrestrial Arthropod	1) Arizona, Navajo County: Alchesay - Williams Creek National Fish Hatchery 2) Arizona: small mountain streams in Prescott National Forest 3) New Mexico: small mountain streams in the Gila River	year-round presence	F, ROW
Cold Water Fish	Ozark cavefish	Aquatic Arthropod, Aquatic Amphibian	Oklahoma: pools and streams in caves of Springfield Plateau	year-round presence	C, R/P, ROW, U

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Warm Water Fish	Arkansas River shiner	Aquatic Arthropod, Terrestrial Arthropod, Plant (seeds), detritus	1) Oklahoma: Canadian River upstream of the Indian Nation Turnpike Bridge (except for the North Canadian River watershed) and the Cimarron River upstream of the Highway 281 Bridge 2) Texas: Canadian River above and below Lake Meredith	year-round presence	C, R/P, ROW
Warm Water Fish	beautiful shiner	Aquatic Arthropod, Terrestrial Arthropod	1) Arizona: small to medium streams with sand, gravel, or rock bottoms (includes habitat on San Bernardino National Wildlife Refuge) 2) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center	year-round presence	R, ROW
Warm Water Fish	Big Bend gambusia	Aquatic Arthropod	1) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center 2) Texas, Brewster County: refugium in Big Bend National Park	year-round presence	C, R, ROW
Warm Water Fish	bonytail chub	Aquatic Arthropod, Terrestrial Arthropod, Plant (algae)	1) Arizona: Colorado River and its tributary rivers 2) Arizona, Mohave County: Willow Beach National Fish Hatchery 3) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Centers	year-round presence	R, ROW
Warm Water Fish	Chihuahua chub	Aquatic Arthropod, Terrestrial Arthropod, Plant	1) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center 2) New Mexico: Mimbres River	year-round presence	C, R, ROW
Warm Water Fish	Clear Creek gambusia	Aquatic Arthropod	Texas, Menard County: Clear Creek	year-round presence	ROW
Warm Water Fish	Colorado pikeminnow	Cold Water Fish, Warm Water Fish, Aquatic Arthropod	1) Arizona: Salt and Verde rivers 2) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center 3) New Mexico: San Juan River	year-round presence	C, R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Warm Water Fish	Comanche Springs pupfish	Aquatic Arthropod, Plant (algae)	1) Texas, Jeff Davis County: Phantom Lake Spring, Toyah Creek, and their associated wetland areas, spring runs, or irrigation canals 2) Texas, Reeves County: Balmorhea Lake, San Solomon Spring, Toyah Creek, and their associated wetland areas, spring runs, or irrigation canals 3) Texas, Uvalde County: Uvalde National Fish Hatchery	year-round presence	C, R, ROW
Warm Water Fish	desert pupfish	Aquatic Arthropod (?), Plant (?)	1) Arizona: desert springs, small streams, and marshes (includes habitat on national wildlife refuges) 2) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center	year-round presence	R, ROW
Warm Water Fish	Devils River minnow	Aquatic Arthropod, Plant (algae, aquatic plants?)	1) Texas, Hays County: San Marcos National Fish Hatchery & Technology Center 2) Texas, Kinney County: Las Moras Creek, Pinto Creek, and Sycamore Creek 3) Texas, Val Verde County: Devils River, Dolan Creek, Phillips Creek, San Felipe Creek, and Sycamore Creek	year-round presence	C, R/P, ROW
Warm Water Fish	Gila chub	Warm Water Fish, Terrestrial Arthropod, Aquatic Arthropod, Plant (algae)	1) Arizona: springs, streams, and cienegas in the watersheds of the Agua Fria, Gila River, San Carlos River, San Francisco River, San Pedro River, Santa Cruz River, and Verde River 2) New Mexico: Turkey Creek in the upper watershed of the Gila River	year-round presence	R, ROW
Warm Water Fish	Gila topminnow (includes Yaqui topminnow)	Aquatic Arthropod, Plant (aquatic plants?)	1) Arizona: springs, streams, cienegas, and rivers in the Gila and Santa Cruz watersheds (includes habitat on national wildlife refuges including the Buenos Aires, Leslie Canyon, and San Bernardino refuges) 2) New Mexico: Gila River and ponds in the Red Rock Wildlife Management Area	year-round presence	R, ROW
Warm Water Fish	humpback chub	Aquatic Arthropod, Plant (algae)	Arizona: Little Colorado River and Colorado River (includes habitat on national wildlife refuges)	year-round presence	R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Warm Water Fish	Leon Springs pupfish	Aquatic Arthropod, Plant (algae)	1) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center 2) Texas, Pecos County: springs and spring runs associated with Diamond Y Draw	year-round presence	C, R, ROW
Warm Water Fish	leopard darter	Aquatic Arthropod, Plant (algae)	Oklahoma: medium to large streams of the Little River, Glover River, and Mountain Fork River	year-round presence	C, R/P, ROW
Warm Water Fish	Little Colorado spinedace	Aquatic Arthropod	Arizona: small to medium-sized streams in canyons	year-round presence	R, ROW
Warm Water Fish	loach minnow	Aquatic Arthropod (?), Plant (?)	1) Arizona, Graham and Pinal counties: Aravapai Creek 2) Arizona, Greenlee County: Blue River 3) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center 4) New Mexico: streams and rivers associated with the Gila and San Francisco watersheds	year-round presence	C, R, ROW
Warm Water Fish	Neosho madtom	Aquatic Arthropod	Oklahoma: Neosho (Grand) River, Cottonwood River, and Spring River	year-round presence	C, R/P, ROW
Warm Water Fish	Pecos bluntnose shiner	Aquatic Arthropod, Terrestrial Arthropod (?)	New Mexico: Pecos River from Fort Sumner down into Brantley Reservoir (includes habitat on national wildlife refuges)	year-round presence in Pecos River; seasonally in Brantley Reservoir	R, ROW
Warm Water Fish	Pecos gambusia	Aquatic Arthropod	1) New Mexico, Chaves and Eddy counties: marshes, springs, sinkholes, and tributaries of the Pecos River 2) Texas, Jeff Davis County: Phantom Lake Spring, Toyah Creek, and their associated wetland areas, spring runs, or irrigation canals 3) Texas, Pecos County: springs and spring runs associated with Diamond Y Draw 4) Texas, Reeves County: Toyah Creek, Balmorhea Lake, San Solomon Spring, and their associated wetland areas, spring runs, or irrigation canals	year-round presence	C, R, ROW

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t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Warm Water Fish	razorback sucker	Aquatic Arthropod, detritus, plankton	1) Arizona, Mohave County: Lake Mohave and Willow Beach National Fish Hatchery 2) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center	year-round presence	R, ROW
Warm Water Fish	Rio Grande silvery minnow	Plant (algae)	New Mexico: Rio Grande River	year-round presence	C, R, ROW
Warm Water Fish	San Marcos gambusia	Aquatic Arthropod	Texas, Hays County: Spring Lake and San Marcos River above confluence with Blanco River	year-round presence; may be extinct	C, M, R/P, ROW, U
Warm Water Fish	Sonora chub	Aquatic Arthropod, Terrestrial Arthropod, Plant (algae)	Arizona, Santa Cruz County: small to medium-sized streams in Sycamore Canyon	year-round presence	R, ROW
Warm Water Fish	spikedace	Aquatic Arthropod	1) Arizona: upper Verde Creek, Eagle Creek, and Aravapai Creek 2) New Mexico: Gila River system	year-round presence	R, ROW
Warm Water Fish	Virgin River chub	Aquatic Arthropod, Terrestrial Arthropod (?), Plant (?)	1) Arizona: Virgin River and its Moapa (= Muddy) River tributary 2) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center	year-round presence	R, ROW
Warm Water Fish	woundfin	Aquatic Arthropod, Plant (algae)	1) Arizona: Virgin River 2) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center	year-round presence	R, ROW
Warm Water Fish	Yaqui catfish	Aquatic Arthropod (?)	1) New Mexico: medium to large-sized streams in desert areas 2) New Mexico, Chaves County: Dexter National Fish Hatchery & Technology Center 3) Texas, Uvalde County: Uvalde National Fish Hatchery	year-round presence	C, R, ROW
Warm Water Fish	Yaqui chub	Aquatic Arthropod, Plant (algae)	Arizona: small streams in Leslie Canyon National Wildlife Refuge, San Bernardino National Wildlife Refuge, and the Coronado National Forest	year-round presence	F, R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Aquatic Arthropod	Comal Springs dryopid beetle	Plant (plant parts), detritus	1) Texas, Comal County: aquifer feeding into Comal Springs 2) Texas, Hays County: aquifer feeding into Fern Bank Springs	year-round presence	C, R/P, ROW, U
Aquatic Arthropod	Comal Springs riffle beetle	detritus	1) Texas, Comal County: springflows from Comal Springs 2) Texas, Hays County: springflows from San Marcos Springs	year-round presence	C, M, R/P, ROW, U
Aquatic Arthropod	Noel=s Amphipod	Plant (algae), detritus	New Mexico, Chaves County: springs, streams, and drainage canal in Bitter Lake National Wildlife Refuge	year-round presence	R, ROW
Aquatic Arthropod	Peck's cave amphipod	Aquatic Arthropod, Plant (plant parts), detritus	Texas, Comal County: aquifer feeding into Comal Springs and Hueco Springs	year-round presence	C, R/P, ROW, U
Aquatic Arthropod	Socorro isopod	Plant (algae)	New Mexico, Socorro County: thermal spring	year-round presence	R, ROW
Terrestrial Arthropod	American burying beetle	Small Mammal (carrion)	Oklahoma: open grassland, oak-pine woodland, oak-hickory forest, pasture, and cropland	year-round presence; may be buried belowground during daylight hours	C, F, P, ROW
Terrestrial Arthropod	Bone Cave harvestman	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Braken Bat Cave meshweaver	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Coffin Cave mold beetle	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Cokendolpher Cave Harvestman	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Government Canyon Bat Cave Meshweaver	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Government Canyon Bat Cave Spider	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Terrestrial Arthropod	Helotes mold beetle	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Kretschmarr Cave mold beetle	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Madla's Cave Meshweaver	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Reddell harvestman	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Rhadine exilis (no common name)	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Rhadine infernalis (no common name)	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Robber Baron Cave Meshweaver	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Tooth Cave ground beetle	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Tooth Cave pseudoscorpion	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Terrestrial Arthropod	Tooth Cave spider	Terrestrial Arthropod, Fungus	Texas: cave entrances, sinkholes, and crevices in limestone rock outcrop	year-round presence	C, R/P, ROW, U
Freshwater Mollusk	Alamosa springsnail	detritus	New Mexico, Socorro County: thermal spring complex	year-round presence	R, ROW
Freshwater Mollusk	Kanab ambersnail	detritus	Arizona: seeps, wetlands, seeps, and springs in bottomland of Colorado River in Grand Canyon National Park	year-round presence	R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	food toxicity group(s)	habitat/range	seasonality	pesticide uses *
Freshwater Mollusk	Koster=s tryonia snail	Plant (algae), detritus	New Mexico, Chaves County: springs and streams in Bitter Lake National Wildlife Refuge	year-round presence	R, ROW
Freshwater Mollusk	Ouachita rock pocketbook	detritus	Oklahoma: Little River, Ouachita River, and Kiamichi River	year-round presence	C, R/P, ROW
Freshwater Mollusk	Pecos assiminea snail	Plant (algae), detritus	1) New Mexico, Chaves County: springs, streams, and drainage canal in Bitter Lake National Wildlife Refuge 2) Texas, Pecos County: Diamond Y Draw 3) Texas, Reeves County: East Sandia Spring	year-round presence	R, ROW
Freshwater Mollusk	Roswell springsnail	Plant (algae), detritus	New Mexico, Chaves County: springs, streams, and drainage canal in Bitter Lake National Wildlife Refuge	year-round presence	R, ROW
Freshwater Mollusk	scaleshell mussel	detritus	Oklahoma: Kiamichi River and its Gates Creek tributary, Little River and its Mountain Fork River tributary, and Poteau River	year-round presence	C, R/P, ROW
Freshwater Mollusk	Socorro springsnail	detritus	New Mexico, Socorro County: thermal spring	year-round presence	R, ROW
Freshwater Mollusk	winged mapleleaf mussel	detritus	Oklahoma: Kiamichi River, Muddy Boggy River, Neosho River, and Little River	year-round presence	C, R/P, ROW

Table 3 continued for proposed or listed plant species –

Table 3. Biological Information for Proposed or Listed Species in Region 2								
t&e toxicity group	common name	class	flowering period	pollinator toxicity group(s)	pollinator size	habitat/range	seasonality	pesticide uses*
Plant	Arizona agave	monocot	May to July	Bee	large	Arizona: creek bottoms and steep rocky slopes with shrubland or woodland	year-round presence	R, ROW
Plant	Arizona Cliff-rose	dicot	late March to early May	Bee	small	Arizona: limestone outcrops	year-round presence	R, ROW
Plant	Arizona hedgehog cactus	dicot	late April to mid-May	Bee	small	Arizona: desert shrubland	year-round presence	R, ROW
Plant	Ashy dogweed	dicot	all year w/ rainfall	Terrestrial Arthropod	small	Texas: fine sandy loam in grassland or open brushland (includes habitat on national wildlife refuges)	year-round presence	R/P, ROW
Plant	Black lace cactus	dicot	April to June	Bee	large	Texas: sandy soils in grassland, mesquite, or thorn shrubland on coastal prairie	year-round presence	C, R/P, ROW
Plant	Brady pincushion cactus	dicot	summer	Bee	small	Arizona: desert scrubland	year-round presence	R, ROW
Plant	bunched cory cactus	dicot	April to September	Bee	small	Texas: rock outcrops in desert scrubland	year-round presence	R, ROW
Plant	Canelo Hills ladies'-tresses	monocot	summer	Bee	small	Arizona: spring-fed wetlands in desert scrubland	year-round presence	R, ROW
Plant	Chisos Mtn. hedgehog cactus	dicot	March to July	Bee	large	Texas: desert grassland and scrubland	year-round presence	R, ROW
Plant	Cochise pincushion cactus	dicot	March to May	Bee	small	Arizona: gray limestone in desert grassland	year-round presence	R, ROW
Plant	Davis green pitaya	dicot	February to May	Bee	small	Texas: rock outcrops in desert scrubland	year-round presence	R, ROW
Plant	eastern prairie fringed orchid	monocot	June to August	Terrestrial Arthropod	large	Oklahoma: moist to wet tall grass prairie	year-round presence; emerges in May and aboveground parts die back in winter	R/P, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	class	flowering period	pollinator toxicity group(s)	pollinator size	habitat/range	seasonality	pesticide uses*
Plant	Geocarpon minimum	dicot	January to May (variable)	Terrestrial Arthropod (?)	small	Texas: moist, sandy soils in glades or saline prairie	year-round presence but may be present as seed from June to December	R, ROW
Plant	gypsum wild-buckwheat	dicot	May to July; vegetative reproduction	Bee & Terrestrial Arthropod	small	New Mexico: desert scrubland with gypsic soils	year-round presence	R, ROW
Plant	Hinckley's oak	dicot	February to May	none (wind)		Texas: dry limestone slopes in desert scrubland	year-round presence	R, ROW
Plant	Holmgren milk-vetch	dicot	late April to June	Bee & Terrestrial Arthropod	small	Arizona, Mohave County: shallow, sparsely vegetated soils derived primarily from the Virgin limestone member of the Moenkopi Formation	year-round presence	R, ROW
Plant	Holy Ghost ipomopsis	dicot	July to September	Terrestrial Arthropod	small	New Mexico, San Miguel County: dry slopes and roadsides in open ponderosa pine or mixed conifer in one valley of upper Pecos River drainage	year-round presence	F, R, ROW
Plant	Huachucha water-umbel	dicot	summer	Bee & Terrestrial Arthropod	small	Arizona: river bottomland or spring-fed wetland in desert scrubland (includes habitat on San Bernardino National Wildlife Refuge)	year-round presence	R, ROW
Plant	Johnston's frankenia	dicot	all year w/ rainfall	Bee & Terrestrial Arthropod	small	Texas: openings in brushland with salty or gypsic soils	year-round presence	R/P, ROW
Plant	Jones Cycladenia	dicot	summer; vegetative reproduction	Bee & Terrestrial Arthropod	small	Arizona: salty, gypsic soils in desert scrubland or woodland	year-round presence	R, ROW
Plant	Kearney's bluestar	diact	April to June	Terrestrial Arthropod	small	Arizona: dry washes in desert scrubland or woodland	year-round presence	R, ROW
Plant	Knowlton cactus	dicot	April to mid-May	Bee & Terrestrial Arthropod	small	New Mexico: ridges with sagebrush-pinyon-juniper	year-round presence	R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	class	flowering period	pollinator toxicity group(s)	pollinator size	habitat/range	seasonality	pesticide uses*
Plant	Kuenzler hedgehog cactus	dicot	May to early June	Terrestrial Arthropod	small	New Mexico: limestone outcrops with pinyon-juniper (includes habitat on national wildlife refuges)	year-round presence	R, ROW
Plant	Lee pincushion cactus	dicot	April	Bee & Terrestrial Arthropod	small	New Mexico: semi-desert grassland in Chihuahuan Desert	year-round presence	R, ROW
Plant	Large-fruited sand-verbena	dicot	late March through December	Terrestrial Arthropod	large	Texas: sandy or grassy areas in post oak woodland	year-round presence	C, R/P, ROW
Plant	Little Aguja pondweed	monocot	March to April	Bee & Terrestrial Arthropod	small	Texas, Jeff Davis County: small pools and slow water areas in Little Aguja Creek and associated streams	year-round presence	R, ROW
Plant	Lloyd's Mariposa cactus	dicot	February to July	Bee	small	Texas: limestone outcrops in desert scrubland	year-round presence	R, ROW
Plant	Mancos milk-vetch	dicot	late April to mid-May	Terrestrial Arthropod	small	New Mexico: soil in shallow, bowl-like depressions within bedrock sandstone	year-round presence	R, ROW
Plant	Mesa Verde cactus	dicot	late April to early May	Bee & Terrestrial Arthropod	small	New Mexico: clay soils in drainages on eastern edge of Navajoan Desert	year-round presence	R, ROW
Plant	Navajo sedge	monocot	spring	none (wind)		Arizona: seeping springs on vertical cliffs of Navajo sandstone	year-round presence	R
Plant	Navasota ladies' -tresses	monocot	mid-October to late November	Bee	large	Texas: tree openings or lightly wooded areas along intermittent streams with post oak woodland	year-round presence; emerges in May and aboveground parts die back in winter	C, R/P, ROW
Plant	Nellie cory cactus	dicot	March to June	Bee	small	Texas: rock outcrops in desert scrubland	year-round presence	R, ROW
Plant	Nichol's Turk's head cactus	dicot	late April to mid-May	Bee & Terrestrial Arthropod	small	Arizona: desert scrubland	year-round presence	R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	class	flowering period	pollinator toxicity group(s)	pollinator size	habitat/range	seasonality	pesticide uses*
Plant	Pecos sunflower	dicot	August to November	Bee & Terrestrial Arthropod	large	1) New Mexico: wetland areas around desert springs (includes habitat in Bitter Lake National Wildlife Refuge) 2) Texas: wetland areas around desert springs	year-round presence but present during winter as seed only	R, ROW
Plant	Peebles Navajo cactus	dicot	summer	Bee & Terrestrial Arthropod	small	Arizona: gravelly soils in desert scrubland	year-round presence	R, ROW
Plant	Pima pineapple cactus	dicot	June to August	Bee & Terrestrial Arthropod	small	Arizona: valleys, mesas, and hillsides in desert scrubland, grassland, or woodland (includes habitat on national wildlife refuges)	year-round presence	R, ROW
Plant	Sacramento Mountains thistle	dicot	July to September	Small Avian, Bee & Terrestrial Arthropod	large	New Mexico: steep calcium carbonate deposits near springs or streams in the Sacramento Mountains	year-round presence	F
Plant	Sacramento prickly-poppy	dicot	May through fall	Bee & Terrestrial Arthropod	large	New Mexico: rocky canyons on the western slope of the Sacramento Mountains	year-round presence	F
Plant	San Francisco Peaks groundsel	dicot	summer; vegetative reproduction	Bee & Terrestrial Arthropod	small	New Mexico: alpine tundra	year-round presence	none
Plant	Sentry milk-vetch	dicot	late April to early May	Bee & Terrestrial Arthropod	small	Arizona: unshaded openings in pinyon-juniper-Cliff-rose areas on limestone outcrops	year-round presence	R, ROW
Plant	Siler pincushion cactus	dicot	spring	Bee & Terrestrial Arthropod	small	Arizona: gypsic clay and sandy soils in desert scrubland	year-round presence	R, ROW
Plant	Slender rush-pea	dicot	February to November	Terrestrial Arthropod	small	Texas: coastal prairie grassland with heavy clay soils	year-round presence	C, R/P, ROW
Plant	Sneed pincushion cactus	dicot	April; sometimes summer w/ rainfall	Bee	small	New Mexico and Texas: limestone ridges and rocky slopes in desert mountains (includes habitat on national wildlife refuges)	year-round presence	R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	class	flowering period	pollinator toxicity group(s)	pollinator size	habitat/range	seasonality	pesticide uses*
Plant	South Texas ambrosia	dicot	July to November	none (wind)		Texas: grassland and mesquite shrubland on coastal prairie	year-round presence	C, R/P, ROW
Plant	star cactus	dicot	March to June	Terrestrial Arthropod	small	Texas: mesquite grassland or mesquite-blackbrush shrubland	year-round presence	R, ROW
Plant	Terlingua Creek cat's-eye	dicot	March to May	Bee	small	Texas: gypsic soils or chalky shale on low hills or ridges	year-round presence	R, ROW
Plant	Texas ayenia	dicot	all year w/ rainfall	Bee	small	Texas: flood plains or terraces with brushland	year-round presence	C, R/P, ROW
Plant	Texas poppy-mallow	dicot	April to June	Bee	large	Texas: sandy soils in grassland invaded by brush	year-round presence	C, R/P, ROW
Plant	Texas prairie dawn-flower	dicot	March to early April	Terrestrial Arthropod	small	Texas: sparsely vegetated areas in coastal prairie	year-round presence	C, R/P, ROW
Plant	Texas snowbells	dicot	late March to mid-April	Bee & Terrestrial Arthropod	small	Texas: limestone bluffs along rivers, streams, and other drainages	year-round presence	R, ROW
Plant	Texas trailing phlox	dicot	March to May	Bee & Terrestrial Arthropod	large	Texas: grassy areas of longleaf pine or post oak woodland	year-round presence	C, R/P, ROW
Plant	Texas wild-rice	monocot	April to May	none (water)		1) Texas, Hays County: San Marcos National Fish Hatchery & Technology Center 2) Texas, Hays County: Spring Lake and San Marcos River above confluence with Blanco River	year-round presence	C, R/P, ROW, U
Plant	Tobusch fishhook cactus	dicot	late January to early April	Bee	small	Texas: rocky or grassy openings in live oak-juniper woodland	year-round presence	R/P, ROW
Plant	Todsen's pennyroyal	dicot	July to September; vegetative reproduction	Bee & Terrestrial Arthropod	large	New Mexico: steep north-facing limestone slopes with loose gypsic gravel	year-round presence	R, ROW

Table 3. Biological Information for Proposed or Listed Species in Region 2

t&e toxicity group	common name	class	flowering period	pollinator toxicity group(s)	pollinator size	habitat/range	seasonality	pesticide uses*
Plant	Walker's manioc	dicot	all year w/ rainfall	Terrestrial Arthropod	large	Texas: thorn shrubland or grassland with sandy loam soils (includes habitat on national wildlife refuges)	year-round presence	C, R/P, ROW
Plant	Welsh's milkweed	dicot	summer	Terrestrial Arthropod	large	Arizona: sand dunes	year-round presence	R, ROW
Plant	western prairie fringed orchid	monocot	late June to early July	Terrestrial Arthropod	large	Oklahoma: tall grass prairie	year-round presence; emerges in May and aboveground parts die back in winter	P, R, R/P, ROW
Plant	White bladderpod	dicot	late March to early June	Terrestrial Arthropod	small	Texas: seasonally wet, sandy soils in grassy areas or large openings inside pine-oak woodland	year-round presence but present during winter as seed only	C, R/P, ROW
Plant	Zapata bladderpod	dicot	all year w/ rainfall	Bee & Terrestrial Arthropod	small	Texas: open thorn shrubland on gravelly to sandy loams	year-round presence	C, R/P, ROW
Plant	Zuni fleabane	dicot	May to June; vegetative reproduction	Terrestrial Arthropod	small	Arizona and New Mexico: red clay soils in pinyon-juniper	year-round presence	R, ROW

* Pesticide Uses:

C = Cropland

F = Forest

M = Mosquito Control

P = Pasture

R = Rangeland

R/P = Rangeland/Pasture

ROW = Right-of-Way

S = Specialty (rodenticides, predator control agents, etc.)

U = Urban

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Appendix A. Pesticide Ecotoxicity Classes for Animals

Toxicity endpoints for animal ecotoxicity classes (Classes 0, 1, 2, and 3) are defined in the diagram below.⁴⁴ Hazard indicator categories for animals range from practically nontoxic to very highly toxic according to irritancy endpoints (eye, skin) or toxicity concentrations (LD₅₀s, LC₅₀s, or EC₅₀s). An LD₅₀ represents the lethal dosage for 50% of individuals of a given animal species during a toxicity trial. Similarly, an LC₅₀ is the lethal concentration reached in food or water for 50% of tested animals whereas an EC₅₀ is the environmental concentration at which an effect is observed for 50% of tested animals.

Pesticide ecotoxicity classes for animals	0	1		2	3
Hazard indicator categories	Practically non-toxic	Slightly toxic	Moderately toxic	Highly toxic	Very highly toxic
EPA toxicity categories	IV	III	II	I	
EPA signal words	Caution *	Caution	Warning	Danger	
Mammalian/avian acute eye irritation	No irritation	No corneal opacity; irritation reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	Corrosive; corneal opacity not reversible within 7 days	
Mammalian acute skin irritation	Mild or slight irritation at 72 hrs.	Moderate irritation at 72 hrs.	Severe irritation at 72 hrs.	Corrosive	
Mammalian acute oral LD ₅₀	> 5,000 mg/kg ^H (body wt.)	5,000 - 501 mg/kg	500 - 51 mg/kg	# 50 mg/kg	
Mammalian acute dermal LD ₅₀	> 20,000 mg/kg (body wt.)	20,000 - 2,001 mg/kg	2,000 - 201 mg/kg	# 200 mg/kg	
Mammalian acute inhalation LC ₅₀	> 20 mg/l ^H (air volume)	20 - 2.1 mg/l	2 - 0.21 mg/l	# 0.2 mg/l	
Avian acute oral LD ₅₀	> 2,000 mg/kg (body wt.)	2,000 - 501 mg/kg	500 - 51 mg/kg	50 - 11 mg/kg	# 10 mg/kg
Avian subacute dietary LC ₅₀	> 5,000 ppm [§] (food)	5,000 - 1,001 ppm	1,000 - 501 ppm	500 - 51 ppm	# 50 ppm
Aquatic organism acute LC ₅₀ or EC ₅₀	> 100 mg/l (water)	100 - 10.1 mg/l	10 - 1.1 mg/l	1 - 0.11 mg/l	# 0.1 mg/l
Bee acute LD ₅₀	> 11 Φg ai/bee [⊥]		11 - 2.1 Φg ai/bee	# 2 Φg ai/bee	
* Use of the signal word A Caution@ for Category IV pesticides is optional ^H mg/kg = milligrams per kilogram on wt/wt basis; mg/l = milligrams per liter on wt/vol basis [§] ppm = parts per million (equivalent to mg/kg or mg/l); ppm is used to indicate avian dietary toxicity [⊥] Φg ai/bee = micrograms of active ingredient per bee					

⁴⁴ Toxicity endpoints are derived from (1) EPA toxicity classifications and (2) Brooks, L. 1972. Insecticides - A handbook for use with insect control recommendations. No. Cc-375 (rev.). Coop. Exten. Serv., Kansas State Univ., Manhattan.

Appendix B. Calculated Buffer Zones Relative to Pesticide Ecotoxicity Classes

Buffer zone distances for terrestrial habitat	Indexed to habitat edge			Indexed with 30 ft. setback from habitat edge			Indexed with 60 ft. setback from habitat edge		
Ecotoxicity class	1	2 (& 3)	3	1	2 (& 3)	3	1	2 (& 3)	3
Spot applications w/ solid formulations	none	10 ft.	20 ft.	30 ft.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.
	30 ft.*	40 ft.*	50 ft.*	60 ft.*	70 ft.*	80 ft.*	90 ft.*	100 ft.*	100 ft.*
Spot applications w/ liquid formulations	none	10 ft.	20 ft.	30 ft.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.
Mechanized ground or aerial (low or high) applications w/ solid formulations	30 ft.	60 ft.	90 ft.	60 ft.	90 ft.	100 ft.	90 ft.	100 ft.	150 ft.
	60 ft.*	90 ft.*	100 ft.*	90 ft.*	100 ft.*	150 ft.*	100 ft.*	150 ft.*	200 ft.*
Mechanized ground applications w/ liquid formulations	30 ft.	60 ft.	90 ft.	60 ft.	90 ft.	100 ft.	90 ft.	100 ft.	150 ft.
Spot or mechanized ground applications w/ ULV or dust formulations	80 ft.	150 ft.	250 ft.	100 ft.	200 ft.	300 ft.	150 ft.	200 ft.	300 ft.
Low aerial applications w/ liquid formulations	150 ft.	300 ft.	450 ft.	200 ft.	350 ft.	500 ft.	200 ft.	350 ft.	500 ft.
Low aerial applications w/ ULV or dust formulations	500 ft.	1/4 mile	1/4 mile	500 ft.	1/4 mile	1/4 mile	500 ft.	1/4 mile	1/4 mile
High aerial applications w/ liquid formulations	1/8 mile	1/4 mile	1/2 mile	1/8 mile	1/4 mile	1/4 mile	1/8 mile	1/4 mile	1/2 mile
High aerial applications w/ ULV or dust formulations	1/4 mile	1/2 mile	3/4 mile	1/4 mile	1/2 mile	3/4 mile	1/4 mile	1/2 mile	3/4 mile
* Indexed with 30 ft. setback for applications of solid formulations in areas with seed-eating or grit-eating bird species present.									

Buffer zone distances for aquatic habitat	Indexed with 50 ft. setback from habitat edge (mechanized ground and aerial applications only)		Indexed with 300 ft. setback from habitat edge (mechanized ground and aerial applications only)		
Ecotoxicity class	1	2 & 3	1	2 (& 3)	3
Spot applications w/ solid, liquid, or dust formulations	10 ft.	20 ft.	30 ft.	50 ft.	100 ft.
Mechanized ground applications or aerial applications of solid formulations	50 ft.	80 ft.	300 ft.	350 ft.	350 ft.
Mechanized ground applications w/ liquid formulations	80 ft.	100 ft.	350 ft.	350 ft.	400 ft.
Spot or mechanized ground applications w/ ULV or dust formulations	150 ft.	200 ft.	400 ft.	450 ft.	500 ft.
Low aerial applications w/ liquid formulations	200 ft.	350 ft.	450 ft.	1/8 mile	1/8 mile
Low aerial applications w/ ULV or dust formulations	500 ft.	1/4 mile	1/8 mile	1/4 mile	1/4 mile
High aerial applications w/ liquid formulations	1/8 mile	1/4 mile	1/8 mile	1/4 mile	1/2 mile
High aerial applications w/ ULV or dust formulations	1/4 mile	1/2 mile	1/4 mile	1/2 mile	3/4 mile