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ENVIRONMENTAL ASSESSMENT

Sunriver Vector Control Project

SUMMARY

The Bend/Ft. Rock Ranger District proposes to continue a Special Use Permit issued to Four Rivers Vector Control District (FRVCD) for treatment of mosquitoes on federally owned land near Sunriver, Oregon. The proposed action is to reissue the Special Use permit with modifications to the existing guidance and terms of the agreement. The purpose of the project is to reduce the potential of disease transmission to humans and reduce nuisance from mosquitoes to residents and visitors to the Sunriver area. Treatments of mosquitoes would be accomplished through the use of the U.S. Environmental Protection Agency (EPA) registered bacterial pesticide *Bacillus thuringiensis israelensis* (Bti). Bti is a microbial larvicide, attacking the larval stage of the mosquito before they emerge as the biting adult form. No treatments of adult mosquitoes would occur under this project. Four Rivers Vector Control District (FRVCD), under contract to the Sunriver Owners Association, would apply Bti liquid form with hand crews and Bti granules by hand crews or with a combination of hand crews and a small helicopter. Targeted areas would be aquatic areas along the river containing mosquito larvae, the application season generally running from April until mid-September each year.

Based upon the effects of the alternatives and public input, the responsible official (District Ranger) will decide whether or not to continue the existing special use permit or modify the permit for Four Rivers Vector Control to perform mosquito abatement on Forest Service lands in the Sunriver area. All activities would occur adjacent to the Deschutes River near Sunriver, Oregon.

DOCUMENT STRUCTURE

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental effects that would result from the proposed action and other alternatives. The document is organized into FIVE parts:

- **Introduction:** Includes information on the history of the project proposal, the purpose of and need for the project, the agency's proposal for achieving that purpose and need, and public involvement.
- **Alternatives Considered:** Provides a detailed description of the alternatives considered that would meet the stated purpose and need for action. Besides the No Action/No Change alternative that would continue the currently permitted activities of the Four Rivers Vector Control District under slightly modified conditions; and the Proposed Action which would extend the permitted activities under more substantially modified conditions, one Alternative that would not allow any of the currently permitted activities were considered in detail. This section includes detailed descriptions of project design criteria and mitigation measures that would prevent or reduce environmental effects of the proposed action and alternatives.
- **Existing Conditions and Environmental Consequences:** Describes the existing condition of each resource and the effects each alternative would have on the environment. The effects of the No Action alternative (Alternative 1) provide a baseline for evaluation and comparison of the other alternatives.

- **Preparers and Agencies and Persons Consulted:** Provides a list of preparers and agencies consulted during the development of the environmental assessment.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the environmental assessment.

INTRODUCTION

The Bend-Ft. Rock Ranger District of the Deschutes National Forest has completed an analysis for the application of the insecticide Bti to aquatic areas adjacent to the Deschutes River on Forest Service lands in the proximity of Sunriver, Oregon, for the purpose of controlling nuisance mosquito populations and decreasing the potential for transmission of diseases to humans. All treatments would be undertaken by the Four Rivers Vector Control District, under contract with the Sunriver Owners Association.

The proposed project area is located approximately 15 miles southwest of Bend, Oregon (Figure 1, page 5), and is within the corridor for the Upper Deschutes Wild and Scenic River and State Scenic Waterway. The legal description is Township 19 South, Range 11 East, Sections 20, 29, 30, and 31, Township 20 South, Range 10 East, Sections 2, 26, and 35, and Township 20 South, Range 11 East, Sections 6 and 18.

The project area is outside the boundaries of the Northwest Forest Plan and spotted owl habitat. There are no inventoried (RARE II) roadless areas. There is one Threatened species, the northern bald eagle, and one Candidate species, the Oregon Spotted Frog that inhabit the project area. The project area is located within Riparian Habitat Conservation Areas (RHCAs) designated under the Inland Native Fish Strategy (INFISH). Riparian-dependent resources receive primary emphasis within RHCAs.

WATERSHED OVERVIEW

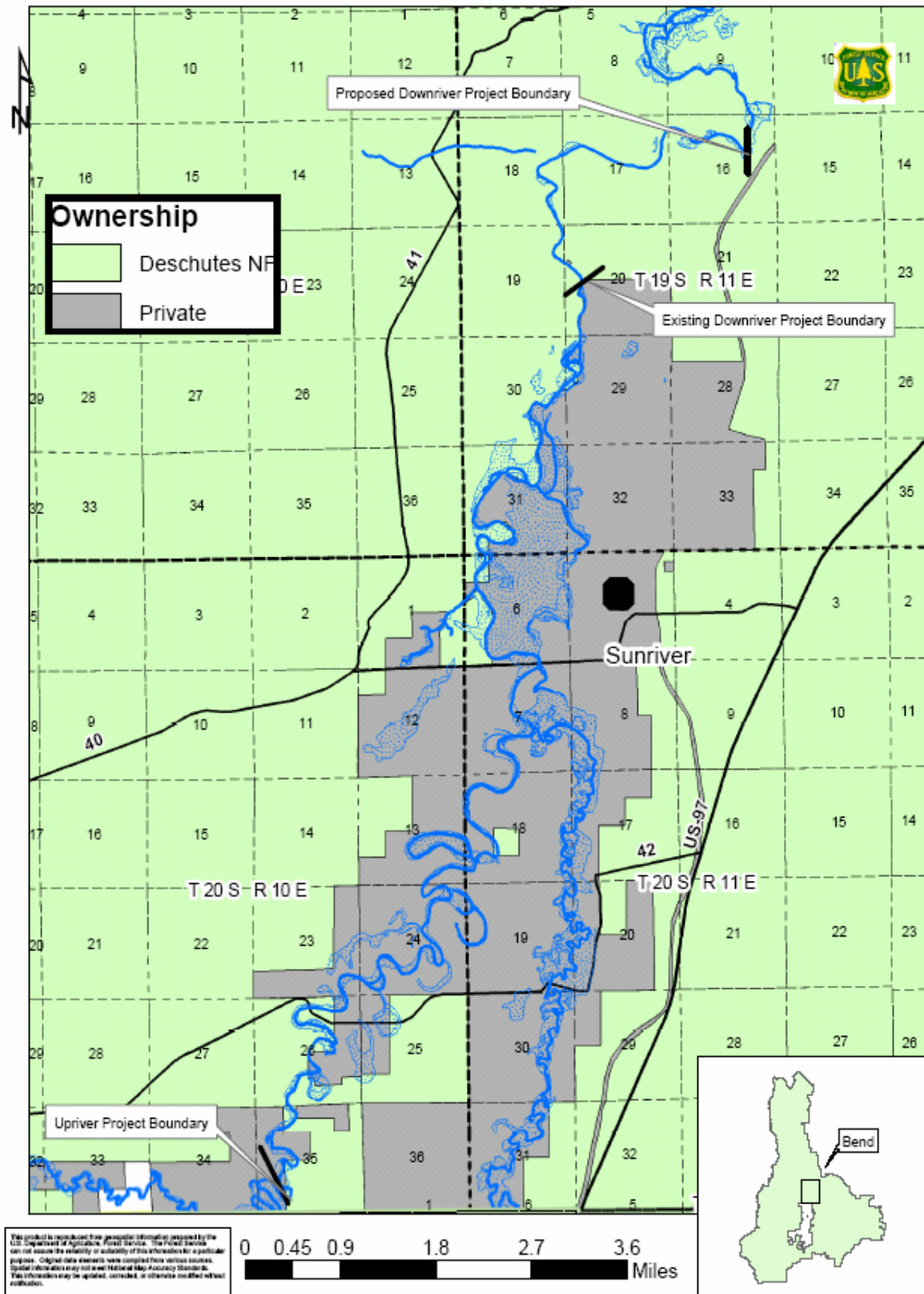
The proposed project area is located adjacent to the Deschutes River, with treatment areas located intermittently between river mile 181.7 and 202.5, and is a mixture of privately-owned and Forest Service lands. Upriver and downriver of the project area, the Upper Deschutes Basin is dominated by Forest Service land. Most of the project area lies within the 5th field Pilot Butte watershed (147, 978 acres), which is located on the eastern slope of the Cascade Mountain Range, and encompasses the city of Bend. The most upriver portion of the project area is within the 5th field Fall River watershed (116,477 acres). Past impacts to the landscape have occurred from road construction, timber harvest, recreational activities, private land development, and wildfire. Roads and trails currently provide access to much of the area. Urban development adjacent to the river, primarily private residences and golf courses, is extensive from Sunriver upriver to La Pine State Park. Land in private ownership comprises 3,969 acres, or 23% of the 16,995 acres within the Upper Deschutes Wild and Scenic River corridor (USDA, Deschutes NF 1996a), which begins at Wickiup Dam (river mile 226.7) approximately 25 miles upstream of the project area and ends near Bend, approximately 12 miles downriver of the project area.

The Upper Deschutes Wild and Scenic River and State Scenic Waterway corridor consists of 4 major segments, further divided into sub-segments. Numbering of segments (2-4) begins at Wickiup Dam and proceeds downriver. The project area is within portions of sub-segments 3B, 3C, 3D and sub-

segments 4A and 4B. Segment 3B begins near the mouth of Fall River at approximately river mile 204, and sub-segment 4B ends near Slough Camp Picnic Area at approximately river mile 180. The section of the Deschutes River from the headwaters of the Deschutes River at Little Lava Lake to Crane Prairie Reservoir was identified as Segment 1 in the Resource Assessment, but was not included in the final designation of Wild and Scenic status. This section is however recognized as a State Scenic Waterway, and is eligible for consideration as a Wild and Scenic River.

Riparian conditions along the Deschutes River within and adjacent to the project area vary from good to poor depending upon the degree of conifer encroachment, recreational use (dispersed and developed), private land development, and road density. Some riparian areas have a high degree of conifer encroachment and compaction, while others are functioning well. The controlled flow regime upriver at Wickiup Dam is the predominate source of hydrologic disturbance.

Figure 1. Sunriver Vector Control Project Area



PURPOSE OF AND NEED FOR ACTION

Purpose and Need: The purpose of the proposed action is to reduce a source of potential disease transmission and nuisance to residents and visitors of the affected area by reducing mosquito populations. West Nile Virus (WNV), transmitted by mosquitoes, is a disease especially of concern, having spread westward across the nation after first being detected in New York state in 1999. The first reported human cases occurred in Oregon during 2004. In 2006, 70 people were infected statewide as of November and the first evidence of the virus was detected in Deschutes County in a bird sample. The most serious cases of WNV in humans can result in serious illness or even death. Mosquitoes can also transmit several forms of encephalitis to humans. There is a need to respond quickly and effectively to population increases of disease-carrying mosquito larvae. There is a need to increase the range of the treatment area to reduce populations of disease carriers in the north end of Sunriver.

Existing Condition: WNV has recently spread into Oregon and Deschutes County, and is potentially a health threat to humans, birds, and other animals. A spike in the number of humans sickened by WNV was observed in the state in 2006, and the first human death attributed to WNV occurred in Oregon in the fall of 2006 (ODHS, 2006). Known species of mosquitoes capable of transmitting the disease occupy habitats within the project area. From April through September each year, large hatches of mosquitoes inhabit the project area, creating a nuisance to forest users and Sunriver residents and guests, and potentially transmitting disease to humans, pets, and birds. In a typical year, most complaints to FRVCD of adult mosquito populations come from residents of the north end of Sunriver (Landolt, personal communication 2006). FRVCD attempts to control populations with the use of larvicides first, including Bti on national forest lands, but uses adulticides (private land only) as a last resort. Under existing conditions, the vector control program reduces mosquito populations and the associated health risks on both private and national forest lands. Forest management direction has changed and the number of specially designated wildlife and plant species has increased in recent years.

Desired Condition: The desired condition is to reduce the likelihood of disease transmission to humans, especially WNV, and maintain an environment for humans relatively free of nuisance from mosquitoes, while minimizing impacts to forest resource values. A quicker response time and overall more effective control to growing larval populations of mosquitoes would be accomplished. Complaints of abundant adult mosquito populations from residents of FRVCD would be reduced, especially at the north end of Sunriver. The use of adult mosquito fogging agents (adulticides) applied on private land, including the north end of Sunriver, would be reduced. Standards and Guidelines from the Forest Plan, Upper Deschutes Wild and Scenic River Plan, Newberry National Volcanic Monument Plan, and the Inland Native Fish Strategy would be met. Threatened, Candidate, Sensitive, and other specially designated fish, wildlife, and plant species and their habitat would be protected.

DECISION TO BE MADE

Based on this analysis, the District Ranger, Bend-Ft. Rock Ranger District, Deschutes National Forest, will decide whether to:

- 1) Allow continued treatment of mosquitoes along the Deschutes River on Forest Service land near Sunriver Oregon with Bti, by the FRVCD, as described in the existing Special Use Permit, or:
- 2) Modify Special Use permit to expand the treatment area upriver to Benham Falls Day Use area and allow the use of a small helicopter for aerial application of Bti, or:
- 3) Discontinue issuance of Special Use Permit for application of Bti on Forest Service lands.

AVAILABILITY OF PLANNING RECORD

The Official Planning Record, titled *2006 Sunriver Vector Control Environmental Assessment Planning Record*, is on file at the Bend/Fort Rock Ranger District office located at 1230 NE 3rd Street, A-262, Bend, Oregon.

MANAGEMENT DIRECTION

This analysis was guided by management direction found in: (1) 1990 Record of Decision for Deschutes National Forest Land and Resource Management Plan (**Forest Plan**) and Final Environmental Impact Statement as amended by the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Eastside Screens); (2) 1994 Newberry National Volcanic Monument (NNVM) Record of Decision for the Final Environmental Impact Statement and NNVM Comprehensive Management Plan; (3) 1996 Record of Decision for the Final Environmental Impact Statement for the Upper Deschutes Wild and Scenic River and the accompanying Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan (River Plan); and (4) 1995 Decision Notice and Finding of No Significant Impact for the Inland Native Fish Strategy Environmental Assessment. INFISH replaced the Riparian Screen of the Eastside Screens.

Forest Plan: Forest-wide Standards and Guidelines (S & Gs) within the Forest Plan include: provide for maintenance or enhancement of riparian areas and riparian-dependent resources (RP-2, RP-3), maintenance of the needs of riparian-dependent resources while managing for multiple uses (RP-4), protection of riparian resources through measures prescribed in Special Use permits (RP-41), correct management practices that will significantly reduce the potential production of the Forest's fishery resources (FI-7), and meet state water quality standards through application of Best Management Practices (BMPs) (RP-7). A publication, *General Water Quality Best Management Practices*, was developed by the Pacific Northwest Region of the Forest Service to be used as guidance in conducting land management activities, and is tiered to the Soil and Water Conservation Practices Handbook (Forest Service Handbook 2509.22), which contains conservation practices that have proven effective in protecting soil and water resource values. A BMP applicable to this project is W-6. Control of Activities Under Special Use Permit: The objective is to protect surface and subsurface water quality from pollutants. The permittee is required to conform to all applicable state and local regulations governing water quality and sanitation. Failure of the permittee to meet conditions of the special use permit may result in permit being revoked. Per commercial product labels, Bti is not to be applied to drinking water sources.

River Plan: The management area allocation in the Forest Plan for the project area is Wild and Scenic River (Management Area 17). The River Plan replaced interim management direction described in the

Forest Plan for this management area. Primary objectives are to maintain and enhance the outstandingly remarkable values (ORVs) identified and maintaining the free-flow nature of the river. ORVs for Segment 3 of the Deschutes River are Geologic, Fishery, Vegetation, Cultural, and Recreation. Segment 4 ORVs include the above with the addition of Hydrologic and Scenic. Standard (pg. 38) from the River plan states “Special uses that are consistent with, complement, or support the goals of the river plan and would not adversely impact other river uses may be considered. They may be appropriate if they promote stewardship, protect resources, aid in controlling use, and respond to demonstrated needs”.

NNVM Plan: A small portion of the project area (approximately 2 acres) is within the Lava Butte Zone of the NNVM. There are no specific S & Gs regarding riparian-dependent species included in the NNVM Plan for this zone. Monument-wide S & Gs include M-38 and M-49, which have objectives of protecting Threatened, Endangered, and Sensitive Wildlife species and protection of water quality through the application of BMPs, respectively.

INFISH: Management direction within INFISH requires Riparian Habitat Conservation Areas (RHCAs) to be delineated for watersheds. They are portions of watersheds where riparian-dependent resources receive primary emphasis, and management activities are subject to specific S & Gs, which include RA-3 and RA-4. RA-3 states “Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of the Riparian Management Objectives and avoids adverse effects on inland native fish”. RA-4 states “Prohibit storage of fuels and other toxicants within RHCAs”.

RHCAs include riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. Management of RHCAs are intended to achieve Riparian Management Objectives (RMOs), described by habitat features indicating “good” watershed health and inland native fish habitat. Interim RHCA standard widths apply where watershed analysis has not been completed, which applies to the project area. Standard widths are defined by INFISH, page E-5 and E-6. Interim widths that are pertinent to the project area are as follows:

- Category 1 areas (fish-bearing streams) will consist of a riparian area that incorporates the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.
- Category 3 areas (ponds, lakes, reservoirs, and wetlands greater than 1 acre) will have a riparian area that consists of the body of water or wetland and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.
- Category 4 areas (seasonally flowing or intermittent streams, wetlands less than one acre, landslides, and landslide-prone areas) will consist of a riparian area that includes the extent of

landslides and landslide-prone areas, or the intermittent stream channel and the area to the top of the inner gorge, or the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation, or one half site potential tree, or 50 feet slope distance whichever is greatest.

Other Summarized Pertinent Direction Provided For By Law Or Agreements

- **Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands):** Direct Federal agencies to avoid, to the extent possible, both short-term and long-term adverse impacts associated with the modifications of floodplains and wetlands.
- The Fisheries and Wildlife Biological Evaluations document the review and review findings of Forest Service planned programs and activities for possible effects on species (1) listed or proposed for listing by the USDI Fish and Wildlife Service (USFWS) as Endangered or Threatened; (2) designated by the Pacific Northwest Regional Forester as Sensitive. It is prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, FSM 10/89 R-6 Supplement 47 2670.44, and the Endangered Species Act (ESA) of 1973 (Subpart B; 402.12, Section 7 Consultation).
- Proposed Endangered, Threatened, or Sensitive (PETS) plant and animal species considered in this evaluation are those listed in the Region 6 Regional Foresters Sensitive Species List, updated October 2006, for species suspected or documented to occur on the Deschutes National Forest.

PUBLIC INVOLVEMENT/SCOPING PROCESS USED

A Forest Service letter requesting public involvement was provided in March 2006 to 88 individuals, businesses, and organizations that have expressed an interest in the project development process. Included in the mailing was The Bulletin, the local newspaper. The scoping letter was also placed on the United States Forest Service (USFS) web site. The proposed Vector Control project was included in the Central Oregon Schedule of Projects in the 2006 spring, summer, and fall editions. This notification, through quarterly mailings, reaches approximately 3,200 interested individuals and groups. The Oregon Department of Fish and Wildlife and the U.S. Fish and Wildlife were conferred.

Comments Received

Six letters, e-mails, or phone calls were received in response to the public scoping that was made available to the public in March 2006.

All comments received have been assessed as to their relevance to each of the resources being addressed within the project area. Some comments have been addressed in the proposed action and analysis of the effects of actions. Forest Service personnel comments and analysis were also used in the development of alternatives. The following summarizes comments received:

- Glad to see Bt used for pest control – practically no toxicity to humans or animals. Bt is specific to Order, but may have non-target impacts to Odonata larvae (damselflies and dragonflies).
- Approves of plan. Other agencies may wish to be advised of plan.
- Supports the proposed purpose and need and proposed action as described in the scoping letter.
- Questioned effects Bti would have on available food for fish and how other invertebrates would be affected. If concluded to have minimal effects to food web dynamics, then good project. Notices a lack of mosquitoes in Harper Bridge area compared to Benham Falls area during summer months.
- Does not oppose mosquito control efforts if they are conducted carefully and in a manner consistent with good integrated pest management protocols, and keeping pesticide use to a minimum. Expects to receive more questions from public if treatment area expands, so would like to keep well informed on developments of this project to respond to inquiries. The scoping letter did not state which commercial product of Bti to be used. Thought the application rate of Bti was perhaps exceeding the product label recommendation. Thought that treatments made as frequently as every 7 days as stated in the scoping letter may be more frequent than needed. Mechanisms should be in place to ensure that treatments are only made when larvae are present and at an appropriate stage of development. Expects FRVCD personnel to make informed decisions on applications. Rate of application should similarly reflect the stage of development of larvae being treated and the water quality. Expect application rates of 1-2 ounces active ingredient appropriate when treating first and second instars of mosquitoes. Experience and search of literature suggests that the proposed action will not result in negative impacts on local wildlife, including Oregon spotted frog. From their literature review, some articles suggest indirect impacts to food webs from long-term use of Bti, but they do not object to proposed action.
- FRVCD has gained tremendous experience over the years to obtain maximum mosquito control while minimizing control agents and area applied. Bti is the preferred treatment method while adult mosquito treatment the last resort. For larval treatments to be effective must be applied to breeding areas in a timely manner, so supports the aerial treatment. Also supports expanding the treatment area – control of adult mosquitoes on north end of Sunriver is continual problem. Should minimize control of adults because pesticides used to control adults are of greater environmental concern than Bti.

ISSUES

Issues identified during scoping are used to generate alternatives to the proposed action. Issues identified during scoping are:

- Potential direct and indirect effects from treatment with Bti to other invertebrates, the prey base for fish including the sensitive species redband trout, and food webs important to threatened, candidate, sensitive, and other specially designated wildlife species.

- Potential disturbance to and safety concerns for forest visitors if aerial applications of Bti are allowed on national forest land, especially users of developed sites.
- Disturbance to existing and potential new nest sites for osprey and northern bald eagles.

ALTERNATIVE DISCUSSION

This section presents a detailed description of the alternatives responding to the “Purpose and Need” that are considered to be reasonable and viable by the Decision Maker (District Ranger, Bend-Fort Rock Ranger District). There were no alternatives developed that were dropped from further consideration. The discussion that describes the affected environment and resources of the area are summaries of detailed specialist reports found in the Appendices. Alternative 2 (Proposed Action) is designed to move towards the desired condition consistent with the standards and guidelines of management direction. This section provides discussion of a no action alternative and two (2) action alternatives. The alternatives listed below provide a range for environmental effects comparison of treatment options.

ALTERNATIVES DISCUSSED IN DETAIL

Alternative 1 (No Action)

Alternative 1 provides a baseline, which compares relative changes and their effects that would occur with implementation of proposed activities in Alternative 2 (Proposed Action) and Alternative 3 (No treatment). Current conditions and trends would likely remain unchanged with selection of the No Action Alternative.

Under current conditions, FRVCD applies Bti on national forest lands with hand crews, while on private land, treatments are applied with a combination of hand crews and a small helicopter. FRVCD annual operating plans for private land are reviewed by the Oregon Department of Fish and Wildlife and the Oregon Health Department, and authority to treat is granted by Deschutes County. The Oregon Department of Agriculture grants operating licenses to individuals working for FRVCD.

This is a No Change alternative - this alternative would continue the existing Special Use Permit to treat for mosquitoes on Forest Service lands, with one exception. Permission for the application of the insecticide *Aerosurf* would be discontinued on Forest Service lands. FRVCD is presently not applying this product. FRVCD determined this product was not effective or economical to use. The existing permit allows treatment adjacent to or near approximately 6.3 miles of the Deschutes River under Forest Service jurisdiction between river miles 185.7 and 201.4, which is from near the north boundary of Sunriver to areas south of General Patch Bridge, within T. 19 S., R. 11 E., Sections 20, 29, 30, and 31, T. 20 S., R 10 E., Sections 1, 26 and 35, and T. 20 S., R. 11 E., Sections 6 and 18. (Refer to maps on page 6 and Appendix E). Treatments would also occur along Spring River on national forest lands within the Upper Deschutes Wild and Scenic River corridor, and on private lands adjacent to the national forest lands treated under the existing Special Use Permit. Treatments of mosquitoes would be accomplished through the use of the bacterial pesticide *Bacillus thuringiensis israelensis* (Bti). Bti

is a microbial larvicide, attacking the larva stage of the mosquito before they emerge as the biting adult form. Bti is a naturally occurring soil bacterium that is a registered insecticide with the Environmental Protection Agency. **No treatments of adult mosquitoes would occur on Forest Service lands.**

Miles of river frontage and area of floodplains and wetlands treated on private lands within the project area are similar to national forest totals listed above, as national forest lands are primarily on the west side of the Deschutes River and private land on the east side.

Under this alternative, FRVCD personnel would continue to apply Bti in liquid and granular form to specific wetland and aquatic areas along the river on Forest Service lands known to harbor mosquito larvae. Nearly all the wetland areas adjacent to the river on national forest land within the proposed project area would potentially be treated with Bti (150 acres under this alternative). Only still water areas or areas with little current would be targeted for treatment, as this type of habitat is required for larvae to grow and survive. No areas with significant current, such as the Deschutes River or Spring River would be targeted. However, areas immediately adjacent to the rivers that have slight current as it passes through aquatic vegetation would be treated. The treatment areas on federal land comprise approximately 150 acres and 6.3 miles of Deschutes River frontage (both banks) and 0.5 miles of Spring River frontage.

Applications would be administered by hand crews with backpack applicators. Liquid form (VectoBac 12 AS), applied by hand crews with backpack sprayers, would be used early in the season, at a rate of 8 to 16 ounces product/acre (.93 to 1.86 ounces active ingredient). The product label suggests a range of 4 – 32 ounces product/acre. When foliage increases as the season progresses, liquid form becomes less effective as less material reaches the water, therefore granular form (VectoBac CG) would be applied at a rate of approximately 7 pounds product/acre (5.5 ounces active ingredient). The product label suggests a typical range of 2.5 – 10 pounds product/acre (1.98 to 7.92 ounces active ingredient), and up to 20 pounds product/acre under certain circumstances. Prior to application, dip tests by FRVCD personnel would determine mosquito locations, species, and concentrations to target specific locations and formulate the proportion of pesticide needed. FRVCD only initiates treatments when species that feed on humans are detected in the sampling. Mosquito densities are tested by dipping a cup into known habitat. Treatments with Bti for most mosquito species are initiated if one larval per dip is consistently found. For proven high risk disease carriers, treatments will be initiated if any larvae are present.

Treatments would be applied after field tests determined the need. Treatments could occur as frequently as every 14 days as needed. Approximately 4-5 treatments would occur annually on Forest Service lands, based on what has occurred in the past 15 years. The season of application would run from approximately April 1 to September 15th. An annual operating plan would be submitted to the Bend/Ft. Rock District Ranger by the vector control district for approval prior to application of Bti.

FRVCD would provide public service announcements on a minimum of two radio stations and in the local newspaper (The Bulletin) prior to aerial larvicide drops and adulticide fogging treatments on private land.

Alternative 2 (Proposed Action)

The following proposed activities were developed to satisfy the stated purpose and need for action, while meeting applicable standards and guidelines that apply to planning on the Deschutes National Forest. The proposed action is to modify the terms and conditions of the Special Use permit to expand the treatment area downriver to Benham Falls Day Use area at river mile 181.7. The proposed project area would be adjacent to or near 11.25 river miles and project activities would include the use of a small helicopter to apply pesticide granules. The additional areas proposed for treatment would be within T. 19 S., R. 11 E., Sections 16, 17, 18, and 19. (Refer to map on page 6 and in Appendix E).

Four Rivers Vector Control District personnel would apply Bti in liquid and granular form to specific aquatic areas along the river known to harbor mosquito larvae. Nearly all the wetland areas adjacent to the river on national forest land within the proposed project area would potentially be treated with Bti (170 acres under this alternative). Only still water areas or areas with little current would be targeted for treatment, as this type of habitat is required for larvae to grow and survive. No areas with significant current, such as the Deschutes River or Spring River would be targeted. However, areas immediately adjacent to the rivers that have slight current as it passes through aquatic vegetation would be treated. These areas comprise approximately 170 acres, 10.75 miles of Deschutes River frontage (both banks) and 0.5 miles Spring River frontage. Applications would be administered through a combination of spreading by hand and dropping from a small helicopter. The helicopter would be a Hiller 12E Soloy, net weight of 1900 pounds, or a model of similar weight and size.

The helicopter would be used to apply granular form of Bti to targeted areas on Forest Service lands. Helicopter treatments would be limited to three times annually. The helicopter would begin operations at 6 am and be completed no later than 2 p.m. Most of the operating time would be on private land, with only about 1 hour air time necessary for national forest lands. The helicopter would apply Bti with a bucket suspended below the aircraft, and would employ a GPS tracking system to increase accuracy of applied material. The helicopter would make applications from elevations anywhere from 50 feet to approximately 500 feet above the targeted areas.

Treatment methods for Bti on private land would be identical to Alternative 1. Application rates, testing methods, treatment rationale, and treatment frequencies would be identical to Alternative 1. Treatments would be limited to 5 times annually on Forest Service lands, a combination of not more than three aerial applications and the remainder hand crew treatments.

Alternative 3 (No Treatment)

This alternative would discontinue the application of Bti on Forest Service lands in the existing project area, as presently allowed under the Special Use Permit. The existing permit allows treatment on Forest Service lands through 12/31/2006. Treatments with insecticides would continue on private lands. No new treatment areas on Forest Service lands, nor any other pesticide use for control of mosquitoes, are proposed under this alternative.

MITIGATION MEASUREMENTS AND MONITORING REQUIREMENTS

Alternatives are designed to be consistent with the S & G's of management direction described

previously. Mitigation measures are specific actions that can minimize, avoid, or eliminate impacts on the resources that would be affected by the action alternatives. They include some S & Gs from the Forest Plan and INFISH.

Mitigation Measures

Fisheries/Water Resources

1. To limit drift, aerial application of Bti over Forest Service lands within 100 feet of the Deschutes River and Spring River will not be allowed when constant wind speed exceeds 5 mph. Potential impacts to non-target invertebrates and associated food webs would be reduced.
2. Treatments will be limited to 5 times annually and must be a minimum of 14 days apart to limit potential impacts to food webs that support fish and wildlife species.
3. To limit the possibility of accidental concentrated spills and potential effects to non-target invertebrate species, Bti will be stored outside of Riparian Habitat Conservation Areas (consistent with INFISH S & G RA-4). Short term storage (< 1 day) while conducting treatments is permitted. Locations for short term storage are to be approved by Forest Service.
4. The terms and conditions of the Special Use permit may be modified in the event of the discovery of a listed fish species (Proposed, Endangered and Threatened) in the project area, or in the event of proposed or designated Critical Habitat. A fisheries biologist would review new information and evaluate the need for seasonal restrictions and/or consultation requirements if needed.

Wildlife

1. The terms and conditions of the Special Use permit may be modified in the event of the discovery of a listed wildlife species (Proposed, Endangered and Threatened) in the project area, or in the event of proposed or designated Critical Habitat. A wildlife biologist would review new information and evaluate the need for seasonal restrictions and/or consultation requirements if needed.
2. No human disturbance within ¼ mile non line-of-sight or ½ mile line-of-sight (1/2 mile for helicopter) of known bald eagle nests between January 1 and August 31. This condition may be waived in a particular year if nesting or reproductive success surveys reveal that bald eagles are non-nesting or that no young are present that year. Waivers are valid only until January 1 of the following year. There are currently no nesting sites within ½ mile line-of-sight of the project area (Forest Plan S & G M3-15)
3. No aerial treatment within ¼ mile of active osprey nest sites between April 1 – August 31. There is currently one known nest site in the project area. A site may be considered inactive for the year if there is no nesting activity by May 15. The Forest Service will make the

determination if nest site(s) are active (Forest Plan S & G M5-12). This mitigation would eliminate approximately 7 acres of mosquito treatment sites from aerial treatments.

4. No Bti treatments on 5 acre oxbow area adjacent to the Deschutes River within Township 20 South, Range 10 East, Southeast ¼ of Section 26, to eliminate potential impacts to the prey base of Oregon Spotted Frog located on private land within the same oxbow.
5. In the event a new active raptor nest is located within ¼ mile of project activities, work should immediately stop and the seasonal operating restriction applied:

January 1 - August 31:northern bald eagle

April 1 – August 31: osprey

March 1 - August 31: red-tailed hawk & northern goshawk

April 15 – August 31: Cooper’s hawk & sharp-shinned hawk

6. If an active great gray owl nest is located within 0.25 mile of the project activity with the potential for disturbance, a limited operating period would be placed on all activities through August 31 of the year the nest(s) are active.

Recreation

1. No aerial treatments on weekends or holidays, which have the greatest number of forest visitors, to reduce potential disturbance. No aerial treatments beyond 2 p.m. when recreation activity is generally higher. No aerial treatment within a 100 yard radius of Besson Camp, Big River Campground, Big River Group Camp or the Sunriver Horse Trail loop near Cardinal Landing Bridge on Forest Service lands to reduce disturbance and maintain visitor safety. This mitigation would eliminate 37 acres of potential mosquito treatment sites from aerial application.
2. Public notice in local media about all applications prior to treatment to inform and educate the recreating public. Notice should also be posted at recreation sites along the river (Big River, Besson Camp, Cardinal Landing Bridge, and Besson Camp Day Use). Remove notices after applications are completed.
3. Helicopter will maintain a distance of 100 yards from forest visitors while conducting aerial treatments to maintain safety and reduce disturbance.
4. Helicopter will not be allowed to land on national forest lands (except in the case of emergencies) to maintain forest visitor safety and reduce disturbance.

Monitoring Requirements

1. Monitor project area annually for nesting status of bald eagles and ospreys prior to aerial treatment. If new nesting activity is discovered, establish flight restrictions around active nest sites until after the appropriate nest restriction periods (See Wildlife Mitigations 2 and 3 above) to avoid specific nesting and fledging periods if appropriate.

2. An aquatic benthic macroinvertebrate riffle sample will be collected in the Deschutes River at a Forest Service established sampling station every 2 years beginning in the fall of 2007. The information will be used to monitor invertebrate populations, including chironomids (midges).
3. FRVCD personnel monitor any effects to vegetation after Bti treatments, even if there are no apparent effects.
4. FRVCD will provide to the Forest Service annually a year-end report of operations on national forest land, including records of areas treated, volumes of products applied, when and where products applied, effects to vegetation, effectiveness of larval mosquito kill, results of monitoring requirements 1-3 above, and any other information FRVCD may desire to convey about operations.
5. Monitor treatment areas for presence of Oregon spotted frogs if local population becomes established in the project area, e.g., if major changes to hydrologic patterns occur that are favorable to the Oregon spotted frog, then potential suitable sites would be resurveyed. If individuals are discovered in the project area, then restrictions would apply and the Special Use permit would be modified as necessary, i.e., no application of insecticide near spotted frogs. The applicable restrictions would be consistent with the *Joint Aquatic and Terrestrial Programmatic Biological Assessment (BA) for Fiscal Years 2006-2009*.

EXISTING CONDITIONS AND ENVIRONMENTAL CONSEQUENCES

The Existing Condition and Environmental Consequences section provides the scientific and analytical basis for alternative comparison. Probable effects are discussed in terms of environmental changes from the current condition and include qualitative as well as quantitative assessments of direct, indirect, and cumulative effects. This section describes the beneficial and/or adverse effects to the environment that would occur if the various alternatives were implemented.

Topics briefly discussed in this section include background information on mosquito species, their life cycles, and product descriptions for the two proposed forms of Bti. Also included are brief existing condition and environmental effects discussions for resources that may be affected by the proposed action or alternatives. These include: human health and safety, water resources, fisheries, wetlands and floodplains, wildlife, botany, and recreation. Because this project does not treat timber stands or vegetation, disturb the ground, or alter the landscape, no silviculture, vegetation, cultural resource, geologic, scenic, or soils analyses were conducted. Roadless areas (RARE II) and late old structure (LOS) areas are also not affected by any alternative.

For more detailed and supporting documentation, please refer to the following specialist reports in the Appendices in this document.

Appendix A: Fisheries and Water Report and
Biological Evaluation

Appendix B: Wildlife Report and Biological
Evaluation

EXISTING CONDITIONS

Mosquito Habitat and Life Cycle

Mosquitoes inhabit a wide range of habitat. Virtually anywhere water collects, even temporarily, is a potential breeding site for production of larval mosquitoes. Common habitats in the project area are snow melt pools, marshes, backwater areas along the rivers, springs, and puddles. On adjacent private land, breeding sites may include bird baths, discarded tires, buckets and other containers, and clogged rain gutters. Adult mosquitoes seek refuge from heat and other elements by seeking refuge in areas of vegetative cover, or in culverts, hollow logs, garages, or other areas of shade (OtterTail Environmental, 2003).

Mosquitoes belong to the Order Diptera, Suborder Nematocera, and Family Culicidae (mosquitoes, chironomids). The mosquito life cycle is composed of 4 stages: egg, larvae, pupae, and adult. Eggs are laid in water or moist environments soon to receive water. They hatch into larvae within days, then undergo 4 growth stages, called instars, before reaching the pupae stage. The larval stage is the targeted stage for treatment with Bti. The late 4th instar and the pupae do not feed, as the mosquito is undergoing transformation into the adult stage, so would not be susceptible to Bti. After the adult has fully matured, it breaks out of the pupal skin and rests temporarily before seeking a mate. After mating, females seek a blood meal to provide the necessary nutrients for egg development to start the life cycle over again. Males feed strictly on nectar (AMCA, 2005).

Mosquitoes of the genus *Culex* (including *tarsalis* and *pipiens*) generally only live a few weeks. They breed several generations per year (Crans and McNelly). Those born late in the season overwinter as egg bearing females. Females overwinter in protected places, including caves, abandoned mines, and cellars (Harmston and Lawson 1963, in Ottertail Environmental, 2003). Mosquito life cycles vary from 4 days to 30 days, depending on species and environmental conditions. Mosquitoes within the project area typically exhibit a life cycle of 2-3 weeks early in the season, but as temperatures warm, the life cycle may take only 1 week, and under ideal conditions as little as 4 days (Landolt, personal communication, 2006). *C. tarsalis* and *C. pipiens* prefer to feed on birds, the latter takes blood meals from birds more than 95 percent of the time. Mammals constitute the rest, with humans representing less than 1 percent of the total (Nielsen et al. 2002, in OtterTail Environmental, 2003).

Mosquito Species in Project Area

There are 45 species of mosquitoes in Oregon, most of which are found in Central Oregon (Conlon, personal communication 2006). The two species inhabiting Central Oregon of most concern because of potential disease transmission, including West Nile Virus (WNV), include *Culex tarsalis* and *Culex pipiens*. *Aedes vexans* and *Culex restuans* are two other species found in Central Oregon that may play a role in WNV transmission (Conlon, personal communication 2006).

The larvae of *C. tarsalis* and *C. pipiens* are found in somewhat different habitats. *C. tarsalis* larvae are found in a wide variety of semi-permanent and permanent sources of water in both rural and urban areas (Nielsen et al. 2002, in OtterTail Environmental, 2003). They occupy a wide variety of either fresh or polluted water habitats, usually in open, sunlit locations (Harmston and Lawson 1963, in Ottertail Environmental, 2003). In contrast, *C. pipiens* larvae are found in a wide variety of natural and artificial sources of water that often are highly polluted with organic wastes (Nielsen et al. 2002, Harmston and Lawson 1963, in Ottertail Environmental, 2003). They have been found in containers of various types, catch basins, ornamental pools, cesspools, swimming pools that are not completely drained, ditches, and tree holes (Nielsen et al. 2002, in Ottertail Environmental, 2003).

Product Description

Bti is a subspecies of the common soil bacterium *Bacillus thuringiensis* (Bt) found throughout the world. Subspecies of Bt share common characteristics. Bti works by producing toxins that causes the larval stage of the mosquito and black fly larvae to stop feeding and die. Bti is ineffective on non-feeding larvae, pupae and adult insects. Bti is the most widely used agricultural microbial pesticide in the world (FCCMC, 1998). Two Bti products that would be used for this project are Vectobac 12AS and Vectobac CG. Vectobac 12 AS is a liquid form that can be undiluted or diluted with water. For mosquito control, the product label suggests a dosage range of 0.25 to 2 pints/acre (4 – 32 ounces) if undiluted. This product contains 11.61% active ingredient and the remainder is other inert ingredients, primarily water and EPA approved food grade additives (Krause, personal communication 2006). In past operations, FRVCD has applied 8 to 16 ounces of this product/acre (Landolt, personal communication 2006). This product would only be applied by hand crews with backpack sprayers.

Vectobac CG is a dry, granular form of Bti, containing 4.95% active ingredient and 95.05% other ingredients. For mosquito control, the product label suggested application rate is 2.5 – 10 lbs./acre. FRVCD has applied 7-10 lbs./acre in the past (Landolt, personal communication 2006). This product would be applied by hand crews and by helicopter. Inert ingredients are composed of corn cob grit and vegetable oil (Krause, personal communication 2006).

Bt is less likely than chemical pesticides to form field resistance in target species (Exttoxnet 1996). There are no examples of full-scale resistance to Bti being developed in wild mosquito populations. Only low-level resistance or tolerance has been observed. (Stark, 2005). The persistence of Bti in the environment is short, with toxicity lasting only a few days at most, and efficacy can be reduced within 24 hours (Stark, 2005).

Public Health and Safety

Existing Conditions

There are approximately 6,000 year round residents in the FRVCD (Landolt 2006, personal communication). The population of the area may temporarily rise an additional 10,000 during the peak of tourist visitations at Sunriver Resort in July and August (Chapman 2006, personal communication).

The discovery and spread of WVN in the United States has reawakened the appreciation of mosquitoes as vectors of disease, after epidemics from past generations of Dengue Fever, Yellow Fever, and malaria claimed hundreds of thousands of victims (AMCA, 2006). Every state in the continental U.S. has tested positive for the virus. The virus is closely related to the St. Louis encephalitis virus, also

found in the United States (CDC, 2005). WNV first appeared in the United States in 1999 in New York City with the discovery of infected birds. Sixty-two people were confirmed to have been infected that year in New York City, with 7 deaths (CDC, 2005). The virus has spread quickly across the nation, with over 15,700 cases and 650 fatalities as of September, 2004 (AMCA, 2006). The virus first appeared in both birds and humans in Oregon in 2004. During 2005, 8 human cases were reported in Oregon. In 2006, as of late November, West Nile virus has been detected in 70 people, 26 birds, and 34 horses within the state (Deschutes County, 2006). The first human death in Oregon (WNV thought to be contracted in state) occurred in November, 2006 (ODHS, 2006). Mosquitoes from selected sites in Deschutes County are sampled for the presence of WNV, Western Equine Encephalitis, and St. Louis Encephalitis each year. WNV was first detected in Deschutes County in 2006, from a dead bird (Deschutes County, 2006). Surrounding counties have tested positive for WNV in the past.

Most people who are infected with WNV do not develop any disease (CDC, 2005). Approximately 20% of infected people will develop West Nile Fever, with symptoms of fever, headache, fatigue, and body aches, which may last several days to several weeks (AMCA, 2006). Less than 1% of people who become infected with WNV will develop severe illness (CDC, 2005).

The WNV cycle is transmitted by 24 different species of mosquitoes and many birds (OSU, 2004). Mosquitoes become infected when they feed on infected birds, passing the virus on to humans and other animals while biting to take blood. Most infections have been discovered in birds, but other documented infected animals include horses, cats, bats, chipmunks, skunks, squirrels, and domestic rabbits (CDC, 2005). Over 200 avian species and 30 mammalian species have been found infected with WNV (AMCA, 2005). In New York, the most heavily infected area showed 2.6% of the mosquito population was infected with WNV (OSU, 2004). There is no evidence the virus is transmitted from person to person contact, or from handling live or dead birds (CDC, 2005).

Some of the scientific findings during a literature review refer to Bti specifically, while others lump all sub-species together (Bt), as they exhibit common characteristics. Bt is practically non-toxic to humans. Humans exposed to 1000 mg/day of Bt showed no adverse effects (EPA, 1986, 2002). Bti poses little threat to human health through either handling the product directly, or being exposed to it indirectly, such as during a municipal mosquito control program. There is minimal concern for human health effects from Bti when used according to labeled directions (EPA 2002). The most likely routes of exposure for the general public to Bti are oral, dermal, and inhalation. Slight to moderate skin irritation and eye irritation has occasionally been observed in product tests, which may be attributed to other ingredients in the product formulation (EPA 1998). Observed eye irritation is often associated with dry, anhydrous forms of the product and may be due to physical irritation effects as might be caused by sand or drying agents rather than toxicity of the product. Product labeling requirements regarding these effects are in place to minimize the risk of skin or eye irritations. The acidic conditions in human stomachs do not activate Bti toxins. Studies have shown that even if Bti spores are ingested or inhaled by humans, they are eliminated without any adverse health effects (Health Canada 2001, in OtterTail Environmental, 2003). To date, no known mammalian health effects have been demonstrated in any infectivity/pathogenicity study of Bt-based products (EPA 1998). Thirty years of widespread Bt use has produced no confirmed reports of immediate or delayed allergic responses toxin produced by Bt despite significant oral, dermal, and inhalation exposure to the product (EPA, 1998).

Water Resources

Existing Conditions

Surface water drainages are uncommon in the Pilot Butte and Fall River watersheds because of the highly permeable volcanic landscape. The average annual precipitation measures about 15 inches. The existing treatment area includes the west bank of the Deschutes River from river mile 185.7 to 191.5 (primarily the west bank), a 0.1 mile stretch of both banks near river mile 195.0, and areas near General Patch Bridge from river mile 198.7 to river mile 201.4 (primarily both banks).

The flow of the Deschutes River is regulated at Wickiup Dam, approximately 25 miles upriver of the project area. The flow regime was historically very stable, with a mean flow of about 1190 cubic feet/second (cfs) and an annual range from approximately 1000 - 1600 cfs measured at Benham Falls (USDA, Deschutes NF, 1996b). Bankfull discharge, historic and present, are significantly less than would be expected for a basin this size (Rosgen, 1998), indicating significant infiltration to groundwater. Large flood events were uncommon, even prior to regulation. The river now experiences a large swing in flow with storage practices for irrigation needs. Flow is reduced in the winter, as low as 20 cfs released upriver at Wickiup Reservoir during low precipitation years, and then is elevated in the summer, with releases at Wickiup typically 1600-1700 cfs to meet irrigation demands. This results in a range of flows from approximately 700 cfs to 2500 cfs measured at Benham Falls. The altered flow regime has led to increased riverbank erosion, widening of the channel, and reduced water quality and fish habitat (USDA, Deschutes NF, 1996b). These effects are most evident in the river upstream of the confluence with Fall River, which is approximately 3.5 miles upriver of the southern end of the project area. The additional discharge provided by Fall River, Spring River, Little Deschutes River, and several small springs tempers the effects of the modified flow regime in downriver reaches. The elevated flows have increased inundation of floodplains and likely increased mosquito breeding habitat.

The regulated flows at Wickiup Dam is the largest influence on water quality of the Deschutes River, and has likely led to the status as a water quality impaired waterbody under the Clean Water Act . Other factors that may contribute to water quality impairment are private land development and associated septic drainfields, which are considered to be a source of oxygen demanding bacteria (USDA, Deschutes NF, 1996b), developed and dispersed recreational sites, and recreational activities including motorized boating. These activities have resulted in elimination or reduction in shade, large wood recruitment, riparian vegetation, riverbank stability, and increase in nutrient and sediment loading, all which can influence water quality and fish habitat. Impacts from recreational sites are generally at a localized scale. Agricultural land use is rare along the Upper Deschutes River.

The 2004-6 Oregon Department of Environmental Quality (ODEQ) list of water quality impaired water bodies (303(d) list) includes the Deschutes River within the Sunriver Vector Control Project area (ODEQ river reaches RM 168.2 – 189.4 and RM 189.4 to 222.2). The parameters for which standards are not met within one or both of these river reaches include dissolved oxygen all year, turbidity spring and summer, chlorophyll *a* June 1 – September 30, high water temperatures year-round, and sedimentation, undefined season. This 2004-6 ODEQ 303(d) list, finalized by ODEQ but currently under review by the Environmental Protection Agency, is identical to the EPA approved 2002 list for these reaches with the exception of extending the violation of the water temperature standard to year-round. The presence of Wickiup Dam and the modification of natural flow provides some explanation for these 303(d) listings.

Beneficial uses are documented according to criteria in the Oregon Department of Environmental Quality, (ODEQ, 1998). A beneficial use is a resource or activity that would be directly affected by a change in water quality or quantity. The beneficial uses of the Deschutes River are public and private domestic water supply, industrial water supply, irrigation, livestock watering, anadromous fish passage, salmonid fish rearing and spawning, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, and aesthetic quality (Wild and Scenic). Beneficial uses are designated for entire basins, hence these beneficial uses are for the Deschutes Basin (approximately 6.9 million acres).

Water quality for beneficial uses is maintained and protected through the implementation of the Deschutes National Forest Plan Standards and Guidelines including Best Management Practices, INFISH, the Upper Deschutes Wild and Scenic River and State Scenic Waterway Management Plan, and the Newberry National Volcanic Monument Comprehensive Management Plan (1994).

Fisheries Resource

Existing Conditions

Fish and Aquatic Invertebrates:

There are no known threatened, endangered, proposed, or candidate fish and aquatic invertebrate species within the Sunriver Vector Control project area. Redband trout (*Oncorhynchus mykiss gairdneri*), a Forest Service Region 6 Sensitive Species, inhabit the Deschutes River and possibly Spring River within the project area.

Historic fish populations in the Deschutes River within the project area included redband trout, bull trout (*Salvelinus confluentus*), mountain whitefish (*Prosopium williamsoni*), and sculpin (*Cottus* sp.). There are no records of anadromous species in the project area, as upriver migratory fish passage is considered to be restricted to below Big Falls on the Deschutes River downriver of Bend (ODFW, 1996). Over the last 100 years, several other fish species have been introduced into the basin, considerably altering the fish community. In addition, the federally threatened species bull trout is considered to be extirpated from the Deschutes River above Bend (ODFW, 1996).

Fish species that have either been introduced into the Deschutes River or move into the river through the unscreened outlet at Wickiup Dam include rainbow trout (*Onchorhynchus mykiss*), kokanee salmon (*Oncorhynchus nerka kennerlyi*), largemouth bass (*Micropterus salmoides*), eastern brook trout (*Salvelinus fontinalis*), three-spined stickleback (*Gasterosteus aculeatus*), tui chub (*Gila bicolor*), brown bullhead (*Ictalurus nebulosus*), coho salmon (*Oncorhynchus kisutch*), and brown trout (*Salmo trutta*). Fisheries is regarded as an Outstandingly Remarkable Value (ORV) of the Upper Deschutes Wild and Scenic River in segment 3 because of the trophy brown trout fishery. Determination of the value of redband trout in Segment 4 has been deferred until a review of the genetic status has been completed. Until that time, the redband population is to be treated as an ORV (USDA, Deschutes NF, 1996b). The Federal Wild and Scenic River and State Scenic Waterway Acts established an overriding goal to maintain and enhance the ORVs for which the river was designated (USDA, Deschutes NF, 1996b). Species considered to be resident fish are the redband trout, rainbow trout, mountain whitefish, sculpin, brook trout, and brown trout.

The native redband trout have interbred with various introduced hatchery stocks of rainbow trout over the last several decades. The genetic make-up of the rainbow in the project area was studied a decade ago. Samples collected downriver of Benham Falls revealed 7.2% hatchery rainbow genetic contribution, i.e., on average, the fish were 92.8% pure redband (Phelps et al, 1996).

The redband trout population is considered low abundance, and the brown trout estimated at moderate abundance within the project area, although data is limited (Marx 2006, personal communication). The mountain whitefish population is considered abundant from Wickiup Dam to Benham Falls (ODFW, 1996). Possible limiting factors to trout populations are the lack of clean spawning gravels, fluctuating flows with the altered flow regime, and low numbers of large woody material. Hatchery rainbows are stocked in the Deschutes River within and upriver of the project area annually by ODFW.

The altered flow regime below Wickiup Dam has affected fish habitat. Analysis of aerial photographs and channel morphology data indicates the channel is becoming wider and shallower, reducing maximum and average depths. The effects to fish habitat within the project area are reduced from that observed in upriver reaches because of the flow contribution of the tributary streams (Fall River, Little Deschutes River, and Spring River). The channel width has increased approximately 20% since the inception of Wickiup Dam (USDA, Deschutes NF, 1996). Aggradation (filling with sediment) in pools has reduced their effectiveness as fish habitat. River bottom substrates have high volumes of sand and silt. These fine sediments plug the interspaces of substrate gravels, reducing the survival rates of developing fish embryos buried within, and limiting habitat for aquatic invertebrates (Meehan, 1991).

Log drives down the river in the 1930's damaged riverbanks and reduced instream large wood that fish depend on for cover from predators and as velocity breaks for resting. The endpoint for the river log drives was near the Benham Falls footbridge, where logs were loaded onto railroad cars and delivered to the mills in Bend. There is excellent fish hiding cover at this site due to the large accumulation of instream wood. The Sunriver Fish Habitat Restoration Project (1998) and the Kelsey Fish Habitat Project 2003 restored over 450 trees to the Deschutes River within the project area. Recent projects upriver of the project area have also re-introduced large wood. Due to limitations of equipment, large wood introductions are limited primarily to trees less than 20" diameter at breast height. Historically, abundant large ponderosa pines up to 4' diameter were likely found within the channel to provide fish habitat.

Private land development, primarily in segment 3, has reduced riparian vegetation and overhead hiding cover. Riverbank protection measures such as wooden planks and concrete retaining walls have reduced fish and aquatic invertebrate habitat.

Habitat type of the Deschutes River within the project area is dominated by long pools. Although there are only between 2.9 to 3.9 pools/mile by reach, the % pool habitat ranges from 44.3% to 79.9%. Side channel habitat is nearly non-existent. The channel is generally wide and shallow, with width/depth ratios ranging from 20.9 to 64.4. Residual pool depths range from 3.4 to 6.3 feet. Large woody material (minimum 12" diameter and 35' length) is uncommon, ranging from 7.6 to 21.9 pieces/mile (Dachtler, 2005).

For more information on the fisheries resource see the Upper Deschutes Wild and Scenic River Environmental Impact Statement (1996) and the ODFW Upper Deschutes River Sub-basin Plan (1996).

Aquatic macroinvertebrate sampling was conducted by the Deschutes National Forest within the project area at approximately river mile 189 in the years 1991, 1993, and 1996 (near Sunriver horse stables), and at approximately river mile 199 in 1993 and 1996 (at General Patch Bridge). Samples were collected in riffle habitat during fall months when the flow is decreased. Results are available in the analysis file. Biotic indices reflect moderately degraded conditions. Generally, the aquatic invertebrate community was considered to be of low to moderate biotic diversity and impaired by fine sediment (Wissman 1991, Wissman 1993), and organic enrichment (Vinson 1997). Black fly larvae (Simuliidae family) which are vulnerable to Bti, are present in very low numbers within the Deschutes River, based on sampling discussed above.

Wetlands and Floodplains

Existing Conditions

Wetland and floodplains vary greatly in width along the river within the project area, from less than 10 feet width up to approximately 750 feet. The vegetation is composed of various sedges intermixed with willow species and other shrubs, or stands of lodgepole and ponderosa pine. There has been some development within the wetlands/floodplains, primarily on private land in the form of river access, boat slips, and docks. On Forest Service lands, there are four developed recreation sites within the floodplain, Besson Camp, Benham Falls Day Use area, and Big River Campground and group camp. There is also scattered recreational dispersed and day use within the floodplain which has led to some vegetation trampling and soil compaction. The altered flow regime downriver of Wickiup Dam has accelerated river morphological changes, which in turn have altered wetland and floodplain conditions. In some areas, bank erosion has been accelerated which undercuts riparian vegetation, and in others deposition and associated spread of riparian vegetation has been increased (USDA, Deschutes NF 1996a). The controlled flow regime alternately inundates and dessicates floodplains and wetlands, including ponds, pools, and other wet areas.

Wildlife Resource

Existing Conditions

This project falls within the boundaries of the former Kelsey and East Tumbull vegetation management projects; the species addressed in this analysis are similar to those that were addressed in those projects. A wide variety of wildlife species utilize the habitat within and adjacent to the proposed project area. Because riparian areas provide three essential survival elements for wildlife (food, cover, and water) nearly 80% of terrestrial wildlife species are either associated or dependent upon these areas to meet their habitat needs. The project area provides a high level of habitat diversity for wildlife, with the Deschutes River providing the richest habitat. Seasonal ponds are adjacent to the river in old oxbows. There are a number of springs adjacent to the river as well. Mule deer are the dominant big game species and are distributed across the area throughout the year. Small and medium mammal species inhabiting the project area include: beaver, river otter, weasels and fishers. There are several known raptor nest sites within or adjacent the project area including osprey and Cooper's hawks. The project area also provides potential nesting and foraging habitat for the bald eagle, sharp-shinned hawk, northern goshawk and great gray owl. The riparian area provides habitat for numerous resident and neotropical migratory birds (NTMB's), waterfowl, shorebirds and wetland associated species e.g.,

great blue herons.

Dry, even-aged ponderosa pine forest dominates the upland area, but there are significant inclusions of lodgepole pine along the river corridor. The majority of the ponderosa pine stands are classified as “black bark” which are generally 50-60 years old with one canopy layer. The relatively low elevation and limited precipitation of the area likely limit the site capability to develop multi-stratum late and old structure (LOS) forest, except on the northern aspects adjacent to the project area.

Several specially designated wildlife species or their habitats are applicable to the proposed project area. Designations include Threatened, Candidate, Sensitive, Management Indicator Species (MIS), Focal Species, Birds of Conservation Concern (BCC), and Ecological Indicators. Management indicator species were identified in the Forest Plan as a group of species representative of other species with similar habitat requirements. This group of species can be used to assess the impacts of management activities for a wide range of wildlife species with similar habitat needs (Forest Service Manual 2620.5). Birds of Conservation Concern identifies species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973. Ecological indicator species were selected to represent habitat conditions and species requirements that were not covered by the MIS or focal species. Focal species were identified in the Conservation for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington.

The project area lies outside of the range of the northern spotted owl, i.e., outside the Northwest Forest Plan Boundary. There is one Threatened species, the northern bald eagle, and one Candidate species, the Oregon Spotted Frog, within the project area.

Species and Habitats Evaluated

The following species and their habitats were considered in the preparation of this document. Those with bolded type are known, suspected or have some potential to occur within the project boundary and are further evaluated in this analysis. There are no known current sites occupied, no known historic sites, and no current or potential habitats for those species that have not been designated. All species on the 2004 R6 TES Species List that have potential habitat on the Bend/Ft. Rock Ranger District were considered.

Table 1. R6 Threatened, Endangered, Sensitive Species (TES) List

SPECIES	COMMON NAME	FEDERAL & FOREST CLASSIFICATION
<i>Birds</i>		
<i>Haliaeetus leucocephalus</i>	Northern bald eagle	T, MIS
<i>Strix occidentalis caurina</i>	Northern spotted owl	T, MIS
<i>Falco peregrinus anatum</i>	American peregrine falcon	S, MIS
<i>Bucephala albeola</i>	Bufflehead	S
<i>Histrionocus histrionicus</i>	Harlequin duck	S
<i>Centrocercus urophasianus</i>	Greater sage-grouse	S
<i>Podiceps auritus</i>	Horned grebe	S
<i>Podiceps grisegena</i>	Red necked grebe	S
<i>Coturnicops noveboracensis</i>	Yellow rail	S

<i>Agelaius tricolor</i>	Tricolored blackbird	S
Mammals		
<i>Lynx canadensis</i>	Canada lynx	T
<i>Martes pennanti</i>	Pacific fisher	C, S
<i>Gulo gulo luteus</i>	California wolverine	S, MIS
<i>Sylvilagus idahoensis</i>	Pygmy rabbit	S
Amphibians		
<i>Rana pretiosa</i>	Oregon spotted frog	C
Mollusks		
<i>Pristiloma arcticum crateris</i>	Crater Lake tightcoil snail	S&M
Note: E = Endangered, T = Threatened, C = Candidate for Federal listing, S = USFS Region 6 Sensitive, S&M Survey and Manage Species (Northwest Forest Plan), MIS = LRMP Management Indicator Species		

The northern bald eagle (threatened) and Oregon spotted frog (candidate) are the only two T & E species with *potential* habitat and occupancy within the project’s boundaries. Bald eagles use the river corridor for foraging but none are known to nest or use winter roosts within the project’s area. There have been documented sightings of Oregon spotted frogs, primarily in old oxbows of the Deschutes River. However, these sightings are located on private land near Sunriver, adjacent the project boundary (USDA 2005 a, Bowerman and Flowerree 2000 in USFWS 2006). This project is not within the administrative boundary of the Northwest Forest Plan, nor are there any known populations of the Crater Lake Tightcoil snail in the project area. The project area is at least 10 miles from nearest known northern spotted owl site, and there is no current or potential habitat in the project area. There is no classified habitat or any other evidence of Canada lynx on the Deschutes National Forest.

The 2004 revised Forest Service Region 6 Sensitive Animal list was reviewed for species that may be present on the Deschutes National Forest. After a review of records, habitat requirements and existing habitat components, it was determined that the following sensitive animal species have suitable habitat present, are known to occur, or have the *potential* to occur in the project area: American peregrine falcon, Pacific fisher, horned grebe, red necked grebe, bufflehead duck, harlequin duck, and yellow rail.

The following *sensitive* species are *not* known to occur in the project area or do not have habitat present: California wolverine, greater sage grouse, tri-colored blackbird or pygmy rabbit. Implementation of this project would have “**No Impact**” on these species. No further analysis is needed.

The following wildlife/habitats (table 2) have been reviewed to determine if the project/activity will have any negative effects on them; only those species indicated below could be potentially affected by the project/activity.

Table 2 Management Indicator Species, Focal Species, Birds of Conservation Concern and High Priority Shorebirds.

Species	Status ¹	Habitat or Species Present?	NatureServe ranking in Oregon ²	Possibly Limiting Habitat Feature ³	Will Project Potentially Impact Species of Habitat?
BIRDS					
Golden eagle	MIS, BCC	N	S4	(6)	N
Red-tailed hawk	MIS	Y	S5	Large trees for nesting	Y
Northern goshawk	MIS	Y	S3	(1)	Y

Species	Status ¹	Habitat or Species Present?	NatureServe ranking in Oregon ²	Possibly Limiting Habitat Feature ³	Will Project Potentially Impact Species of Habitat?
BIRDS					
Cooper's hawk	MIS	Y	S4	Dense forest canopy	Y
Sharp-shinned hawk	MIS	Y	S4	(4)	Y
Ferruginous hawk	BCC, Focal	N	S3	Open sagebrush flats	N
Swainson's hawk	BCC	N	S3	Open country	N
Prairie falcon	BCC, Focal	N	S4	6-rimrock and open country	N
Osprey	MIS	Y	S4	Large trees for nesting, waterbody	Y
Great Gray Owl	MIS	Y	S3	1, 4-LPP, PP, 5	Y
Flammulated owl	BCC, Focal	Y	S3	1, 2, 4, 5 PP	Y
Pileated woodpecker	MIS	N	S4	1, 2, moist mixed conifer	N
Common flicker	MIS	Y	S5	2	Y
Hairy woodpecker	MIS	Y	S4	2	Y
Northern 3-toed woodpecker	MIS	N	S3	2, LPP	N
Lewis's woodpecker	MIS, BCC, Focal	N	S2	2-large snags, 7-burns	N
White-headed woodpecker	MIS, BCC, Focal	N	S2	1-PP, 2, 7-sugar pine	N
Black-backed woodpecker	MIS, Focal	Y	S3	1-LPP, 7-burns	Y
Williamson's sapsucker	MIS, BCC, Focal	Y	S4	2-large snags	Y
Red-naped sapsucker	MIS, Focal	N	S4	2, aspen & riparian woodland	N
Pygmy nuthatch	Focal	Y	S4	1-PP, 2, 7-large trees	Y
Brown creeper	Focal	Y	S4	1-MC, 7-large trees	Y
Olive-sided flycatcher (NTMB)	Focal	Y	S3	1, 2, 7 -burns, clearings, edges	Y
Hermit thrush	Focal	Y	S4	1-MC, 7-dense, multi-canopy conifers	Y
Chipping sparrow (NTMB)	Focal	Y	S4	7- open understory w/regen.	Y
Nashville warbler (NTMB)	Focal	Y	S4	Riparian, deciduous woodland	Y
Ash-throated flycatcher	Focal	N	S4	Scrub, juniper	N
Sage thrasher (NTMB)	Focal	N	S4	Sage and mt. mahogany	N
Gray flycatcher (NTMB)	Focal	N	S4	3	N
Clark's nutcracker	Focal	N	S4	High elevation forest	N
Loggerhead shrike	BCC, Focal	N	S3	Open habitats with scattered shrubs and trees	N
Sage sparrow	BCC, Focal	N	S4	3-sagebrush habitats	N
Brewer's sparrow	BCC, Focal	N	S4	Sagebrush	N
Virginia's Warbler	BCC, Focal	N	S4	6-Mountain mahogany	N
Great blue heron	MIS	Y	S4	Wetland, marsh	Y
Waterfowl	MIS	Y		Lakes, streams, rivers	Y
Wilson's Phalarope	BCC, HPSB	N	S4	Seasonally wet playa, lake, pond and marsh shorelines	N
Sandhill crane	Focal	N	S3	Wetlands, meadows	N
MAMMALS					
Rocky Mt. elk	MIS	Y	S5	(7-grass, shrubs winter rng.)	Y
Mule deer	MIS	Y	S5	(7-shrubs winter rng.)	Y
American marten	MIS	N	S3	X (1-MC, LPP, 7-CWM)	N
Western big-eared bat	MIS	Y	S2	(3-foraging, 6-caves)	Y
SURVEY AND MANAGE SPECIES					
Crater Lake Tightcoil (See BE)	S&M			Riparian	

NTMB = Neotropical Migratory Bird

¹ Status: MIS – Management Indicator Species, BCC - USFWS Birds of Conservation Concern (USDI 2002), HPSB - USFWS High Priority Shore Birds (USDI 2004), Focal – Species identified in the Conservation for Landbirds of the East-Slope of the Cascade Mountains in OR and WA (Altman 2000) and the Conservation Strategy for Landbirds in the Columbia Plateau of Eastern OR and WA (Altman and Holmes 2000), S&M – Northwest

Forest Plan Survey and Manage Species. ² Oregon Sensitive Species determined from the NatureServe database for Oregon: S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure

³ Habitat feature codes: 1 = late and old successional forest (LOS), 2 = snags, 3 = mature shrubs, 4 = dense conifers for nesting/foraging, 5 = meadows or grassy openings for foraging, 6 = special/unique habitats (rock, cliffs, caves, etc.), 7 = other, noted. Abbreviations: LPP = lodgepole pine, PP = ponderosa pine, MC = mixed conifer, CWM = coarse woody materials (logs and limbs > 3" in diameter).

Bald Eagle (Threatened species)

There are currently 21 bald eagle nesting territories on the Bend/Ft. Rock Ranger District. Nesting surveys are conducted annually. There is currently one bald eagle nesting territory *near* the project area; the Bates Butte bald eagle nest is located approximately 0.7 miles from the southern end of the proposed project area. The Bates Butte pair successfully brought up young the last 9 out of 10 years; historically, they have been successful 25 of the past 30 years. It is assumed that bald eagles use the river corridor for foraging but no eagles are known to nest within the project area itself. At the present time there are no known winter roosts on the Bend/Ft. Rock Ranger District although bald eagles typically roost in or very near their nest stands (Isaacs, personal communication 2003). Bald eagle use in the project area is considered incidental foraging habitat.

The Deschutes National Forest Land and Resource Management Plan (LRMP 1990) designated Bald Eagle Management Areas (BEMA's) to maintain and enhance habitat for bald eagles. There are 2 BEMA's associated with this nest territory, one 64 acres and the other 73 acres. The closest BEMA (73 acres) is located approximately 1 mile from the southern end of the proposed project area. The Bates Butte bald eagle pair is located outside of the BEMA's. This project would not impact the BEMA's.

Oregon Spotted Frog (Candidate species)

The Oregon spotted frog (OSF) is currently listed as a federal candidate species by the USFWS. OSF have a historic distribution that covers a small portion of western North America from southern British Columbia to northeastern California, and from the west side of the Willamette Valley to the east side of the Klamath Basin in Oregon. OSF has been extirpated from much of their range and possible reasons for this decline include the introduction of the bullfrog (*Rana catesbeiana*), general habitat alteration and loss through intensified agriculture, grazing and urbanization (USGS 2003 in USDA 2006). In addition the USFWS (2003) has identified threats to the species including development, livestock grazing (in some circumstances), introduction of exotic plant species, plant successional changes, changes in hydrology due to construction of dams and alterations to seasonal flooding, poor water quality, and water contamination.

Other probable causes for decline are pesticides, fertilizers and other chemicals, which find their way into spotted frog habitat. In recent years there have been many studies of the effects of these agents on amphibians, however most have been lab experiments, and many focus on high doses and direct mortality (USFWS 2003 in USDA 2006). Direct mortality from DDT was implicated in a mass die-off of *R. luteiventris* in Umatilla County, Oregon in 1974 (Kirk 1988 in USDA 2006). However, the doses necessary for direct mortality are often higher than usually present in field situations. Mortality from most environmental stressors is subtle. For example, there are likely to be synergistic interactions with pathogens in which the immune system is compromised by pollution or environmental changes (Bridges and Semlitsch 2000; Morell 1999 in USDA 2006), pesticides (Lowcock et al. 1997 in USDA 2006) or UV-B (Morell 1999; Kiesecker and Blaustein 1995; Blaustein et al. 1995; Blaustein et al. 1994 in USDA 2006). Bridges and Semlitsch (2000, in USDA 2006) state that: "multiple factors rather than single-factor

hypotheses may be necessary to adequately describe the potential effects of chemicals on natural amphibian populations”.

OSF are associated with relatively large wetland complexes with breeding occurring in shallow, mostly un-shaded emergent wetlands. Ponds range from 2-14” in depth during the breeding season and are vegetated by low-growing emergent species such as grasses, sedges, and rushes. Oviposition usually occurs in mid-February through mid-April depending on water temperatures. The diet of adult OSF include: slugs, arthropods, crickets, ants, true bugs, dragonflies, damselflies, grasshoppers, beetles, flies, arachnids, crustaceans, earthworms, and other invertebrate prey (Licht 1986a and NatureServe 2006, in USDA 2006). OSF’s appear to display opportunistic feeding behavior, individual frogs have been observed specifically feeding on aphids and bees; stomach content analysis has also revealed a diverse diet (Bowerman, personal communication, 2006). Immature frogs are primarily herbivores, they consume: algae, organic debris, plant tissue and minute organisms in water (NatureServe 2006). OSF are also prey for mink, river otter, herons, bitterns, crows, ravens, and garter snakes.

OSF have been documented to occur on the Bend/Ft. Rock Ranger District at several locations including the Wickiup Reservoir area (includes Dilman Meadow), ‘Lakes north of Crane Prairie’ (Little Cultus, Cultus Creek Gravel Pit, Winopee, Lava Lake and Little Lava Lake, Hosmer Lake and Sunriver ‘ponds’ (private land), one of the largest remaining populations in Central Oregon (USFWS 2006). There are documented populations of Oregon spotted frogs in the Deschutes and Little Deschutes Rivers, upstream of Sunriver south of the project’s boundary (USDA 2005 and Bowerman and Flowerree 2000 in USFWS 2006). OSF occur in the Deschutes River but are limited to a few isolated off channel sites along the river on private land upriver of Sunriver; there are no other known sites along the Deschutes River. There are also established populations of OSF adjacent the predominantly private land along the Little Deschutes River, above the confluence of the mainstem Deschutes River. It is believed that OSF distribution is limited by poor habitat, specifically, the availability of breeding and overwintering habitat.

The altered hydrology of the Deschutes River severely limits available habitat in the Deschutes River below Wickiup Dam. The mainstem Deschutes River flows at about 20-100 cfs during the low water period, approximately mid-October through mid-April (see Water Resources section for more discussion). Most off-channel areas are also dry during the water storage period. It is believed that this fluctuation in water levels limits the OSF from occupying these habitats. This dry period coincides with the breeding season that can occur as early as February but more typically in April at higher elevations (Jones et al 2005). Conversely, the water abruptly recedes in mid-October and may affect the fall migration to deeper water. *OSF’s are not currently known to occur on Forest Service land within the project area*; both the USFS and personnel from the Sunriver Nature Center have conducted recent surveys in the project area and concluded that no OSF were present and only very marginal, if any, habitat is available (USFS 2006 and Bowerman, personal comm. 2006). Refer to district files for a record of surveys in and near the project area.

From 2006 US Fish and Wildlife Service Species Assessment

The Sunriver site consists of an extensive complex of wetland habitat ranging from wet meadows and vernal pools to marshes and oxbows (Bowerman and Flowerree 2000). Surveys of known and suspected Oregon spotted frog habitat were conducted in 1999 in the Sunriver area along the Deschutes and Little Deschutes Rivers from Sunriver south to La Pine. This survey was largely qualitative, noting presence and absence, while documenting 400 to 700 egg masses from 2 locations and an additional 100 egg masses widely scattered along a 3 km waterway that extends between these two major oviposition sites

(Bowerman and Flowerree 2000). Subsequent surveys conducted by Bowerman utilized a fall capture and spring movement methodology, as well as surveying for egg masses (J. Bowerman, personal communication 2006). Fall/spring movement data represent the frogs captured moving through a major over-wintering site to a major breeding and foraging site and returning. This information does not represent all survey information, but has been consistently collected from 1999 through 2005. For two consecutive years (2000 and 2001) two weirs alternately failed, leading to a sudden drop in water levels in the middle of fall migration and the breeding season respectively. This led to low recruitment as can be seen in the survey numbers in the fall of 2001 (J. Bowerman, email comm. 2006). The data indicate that overall numbers have declined steadily during the survey time frame and have not returned to the high numbers observed in 1999.

American peregrine falcon, Red-necked Grebe, Horned Grebe, bufflehead, harlequin duck, Pacific fisher, and the yellow rail (Sensitive, MIS species)

There is a historic peregrine nest site located on the cliff near Benham Falls at the northern end of the project area, but it has not been occupied for many years. There is also a considerable amount of recreation use occurring along the Deschutes River corridor near the nest site. Other potential nesting habitat (Cutsi et al. 2001; Johnson and O'Neil, 2001) in the area is extremely limited, the few rocky outcroppings are likely not high enough or sheer enough for adequate security for peregrines to nest. There have been past observations of peregrine falcons near the project area, as they are occasionally observed in flight over forested areas. However, there is the potential for migrating birds to pass through the area though sightings are not common.

In Central Oregon, Red-necked grebes are a rare spring and fall transient at larger lakes and reservoirs in the region. Spring records from late February through mid-May, and fall sightings from early August through mid-December. They breed annually on Upper Klamath Lake, and bred successfully in 1997 at Lava Lake (DNF 2006). Many larger lakes could be used during migration (e.g., Wickiup Reservoir). There are no known records of red necked grebes nesting in the project area.

Red necked grebe's are classified as invertivores and piscivores. Red necked grebes feed on small fish where available, but also eat aquatic and land insects, crustaceans, mollusks, aquatic worms, tadpoles, salamander eggs and some vegetable matter. A visual predator, this species pursues fish and other swimming prey underwater and plucks items off the bottom and off vegetation. Fish may be the principle food item in winter (Stout and Neuchterlein 1999 in DNF 2006). Surveys were not conducted for this species.

In Central Oregon, Horned grebes are uncommon spring and fall migrants at larger lakes and reservoirs throughout the region, and are regularly found at Wickiup and Tumalo reservoirs and Hatfield Lake. Spring passage occurs from early March through mid-May, with fall birds seen from mid-August through mid-December (DNF 2006). Horned grebes are invertivores and piscivores, with a diet that mainly consists of small fishes, crustaceans and aquatic insects; also amphibians and leeches; aquatic insects predominate in summer, crustaceans and fishes in winter. Forages by diving in shallow water, often near emergent vegetation; also picks food from surface or from vegetation (Terres 1980, Johnsgard 1987, in DNF 2006). There are no known sightings of horned grebes in the project area; however, there is *potential* habitat along sections of the Deschutes River in and adjacent to the project area. Surveys were not conducted for this species.

Bufflehead population numbers are generally low in Oregon and a shortage of natural cavities has brought attention to the breeding segment of the population (Cutsi et al, 1997). In Central Oregon, the bufflehead is a common permanent resident, breeding at mountain lakes and dispersing widely at lower elevations in winter. Numerous confirmed breeding records from Cascade lakes wherever suitable nest cavities exist, with regular breeding occurring at Hosmer Lake and Meadow Lakes Basin. It is often observed in migration and winter at Mirror Pond in Bend, as well as Hatfield Lake and smaller irrigation reservoirs (DNF, 2006). No surveys have been conducted for this species. Potential habitat exists along the open slack water and off channel areas along the Deschutes River. This duck eats both animal and plant material. However, during the breeding season, aquatic insects and larvae are the most important item in their diet.

Harlequins are very rare in the region. They breed mostly in the West Cascades, but spontaneous individual records on the Upper Deschutes and Metolius rivers may indicate possible nesting in the future. No surveys have been conducted for this species. Potential habitat exists in the project area along the Deschutes River.

Yellow rails were confirmed in Oregon in 1926 (Marshall 1993). Nesting habitat for the yellow rails in Oregon has been described as marshes or wet meadows which have an abundance of thin-leaved sedges, a layer of senescent vegetation to conceal nests, and an average water depth of 7 cm. (Popper 2001). Rails feed on a variety of food including seeds, insects and aquatic invertebrates (NatureServe 2006). No surveys have been conducted for this species. Potential habitat exists along the open slack water and off channel areas along the Deschutes River.

The USFWS conducted a 12 month study beginning in April 2003 of the Pacific fisher's status in response to a petition for federal listing. In April 2004, the USFWS determined that the fisher in Washington, Oregon and California is a "distinct population segment" of the entire fisher species. The USFWS also determined that the fisher faces significant biological threats that are sufficient to warrant listing but is precluded by other higher priority listing actions. In Oregon, the fisher apparently has been extirpated from all but two portions of its historical range (Aubrey and Lewis 2003). Within Oregon the two known extant populations are in the southwestern portion of the state, one in the southern Cascade Range that was established through reintroductions of fishers from British Columbia and Minnesota that occurred between 1961 and 1981, and one in the northern Siskiyou Mountains of southwestern Oregon that is presumed to be an extension of the population in northern California. Genetic testing has revealed the populations are isolated from each other (Aubrey et al 2003). The same study revealed juvenile male fishers are capable of long distance dispersal.

Though the fisher is not likely to inhabit the project area, it is possible that an animal could potentially occupy or forage through the project area. The project area is characterized primarily by 'blackbark' ponderosa pine and lodgepole pine but there are pockets of mid-seral mixed conifer and downed wood accumulations on the adjacent uplands which the fisher tends to select for (Aubrey and Houston 1992).

Wildlife species not listed as TES or Candidate (MIS, Focal, BCC, HPSB species)

Raptors (MIS)

Most raptor species are known or suspected to utilize the project area, especially osprey. There are several known osprey nests near the project area and one Cooper's hawk nest. There are also several known

osprey nests adjacent to the project area on private land. There are no known nests for the golden eagle (MIS), red tailed hawk (MIS), northern goshawk (MIS), or sharp-shinned hawk (MIS). Surveys were not conducted for these species, for this project. However, raptor surveys were conducted for other projects in the vicinity of this project that included areas along the Deschutes River. These surveys and historical information identified these nest sites.

Cavity nesters, MIS, associated Focal Species, and cavity-nesting Birds of Conservation Concern

Lewis' (MIS), Pileated (MIS), Black-backed (MIS), White-headed (MIS), Northern three-toed (MIS) and Hairy woodpeckers (MIS), Williamson's Sapsuckers (MIS), Common Flicker (MIS), flammulated owls (Focal Species & BCC) and pygmy nuthatches (Focal Species) fall under this category. These species associate with snags for nesting, roosting, and foraging habitat.

Pileated woodpeckers are not suspected to be found within the project area due to the dominant stand types - the pileated rarely uses pure ponderosa pine habitats, but instead prefers mixed conifer. Lewis' prefer more open ponderosa pine stands and are more common east of the Deschutes River, primarily in burned forests and open juniper woodlands (Marshall, D. B. 1997). Lewis' and pileated woodpeckers are normally absent from the area. Three-toed woodpeckers, a species associated with higher elevations and lodgepole pine habitat (Goggans, et al 1988), are not likely to be found within the project area because the elevations in the project are lower than those commonly reported for this species. White-headed woodpeckers, primarily inhabit open ponderosa pine forests, but prefer forests with large trees and 40 to 70 percent canopy cover. Black-backed woodpecker's normal habitat is closely associated with lodgepole pine with a preference for LOS stands. Ponderosa pine is not their preferred habitat type (Marshall et al. 2003; Altman, 2000). The project area is considered suitable habitat for a number of other MIS woodpecker species including: Hairy woodpeckers (MIS), Williamson's Sapsuckers (MIS), flammulated owls (Focal Species) and pygmy nuthatches (Focal Species) and the Common Flicker (MIS).

Neotropical Migratory Birds (Birds of Conservation Concern), Focal Species, and Ecological Indicators (covered as Focal species)

Neotropical migratory birds have become species of concern recently, due to the downward trend of landbirds in the west. There is currently an Executive Order (131186) that provides for enhanced cooperation between the Forest Service and USFWS in regards to addressing impacts to neotropical migratory birds. Specific activities are identified where cooperation between the parties will substantially contribute to conservation and management of migratory birds, their habitat, and associated values, and thereby advances many of the purposes of the Executive Order. The USFWS Director's Order No. 131 makes clear the requirements for obtaining permits from the USFWS for activities involving the intentional take of birds. There is no mechanism currently in place to authorize or exempt the unintentional take of migratory birds by federal agencies.

The Deschutes National Forest is currently following guidelines from the "Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington" (Altman 2000). This conservation strategy addresses key habitat types as well as biological objectives and conservation strategies for these habitat types found in the East-Slope of the Cascade Mountains, and the 'Focal Species' that are associated with these habitats. The conservation strategy lists four priority habitats: 1) ponderosa pine, 2) mixed conifer (late-successional), 3) oak-pine woodland, and 4) unique habitats including lodgepole pine (mature/old growth), whitebark pine, meadows, aspen, or subalpine fir. Below

is a list of species found within the project area that may be impacted by the project. Ponderosa pine is the only habitat type within or affected by the project area though there are some inclusions of lodgepole in these stands.

The following species are found or have the potential to reside, forage or migrate through the project area: Nashville warbler, hermit thrush, chipping sparrow, gray flycatcher and olive-sided flycatcher. The following focal species were addressed earlier: white-headed woodpecker, pygmy nuthatch, and black-backed woodpecker. The following species are not found within the project area and will not be further analyzed: Virginia's warbler, ash-throated flycatcher, sandhill crane, Clark's nutcracker, loggerhead shrike, sage sparrow, Brewer's sparrow and sage thrasher.

Great gray owl (MIS)

Habitat exists along the Deschutes River and associated meadows and wetlands. No nests were found in field surveys, however one audio detection was noted within the project area near the Deschutes River around Cardinal Patch Bridge. This species depends upon lodgepole pine forest habitat in proximity to meadows and other forest openings with good pocket gopher populations (Marshall et al. 2003). This project will not affect any physical habitat characteristics.

Great blue heron (MIS)

These birds are known to occur within the project area. Great blue herons feed on a variety of animal food including: small fishes, frogs, salamanders, lizards, snakes, shrimp, crabs, crayfish, aquatic and terrestrial insects, leeches, and small mammals (NatureServe 2006). No rookeries are known to occur within the project's boundaries.

Big Game (deer (MIS) and elk (MIS))

Deer and elk utilize the project area. The LRMP has a special allocation (LRMP 4-56, Standard and Guideline, S&G, WL-43 and Appendix 16) for areas across the Forest that provide critical elk habitat. The northwest portion of the project area borders the Ryan Ranch Key Elk area.

Townsend's big-eared bat (MIS)

There is no known roosting or maternity habitat for these bats (i.e. caves or lava tubes) in the project area. The Townsend's big-eared bat is not riparian associated, however, it is assumed that the species may utilize riparian areas occasionally for foraging. The Townsend's big-eared bat will forage in a broad range of forested conditions, from open savanna to fully stocked conifer stands. The bat feeds on flying insects (primarily moths) near the base of trees or shrubs (NatureServe 2006). The presence of suitable roost sites is more important than the vegetations type in determining the distribution of this bat. It roosts in buildings, caves, mines and bridges (Cutsi 2001). There is a limited amount of roosting habitat in the project area; 4 known bridges and potentially some buildings on adjacent private land. Most foraging is *suspected* to occur within five miles of their day roosts.

Pine (American) marten (MIS)

There is no habitat or occupancy in the project area for pine marten. There are no recorded observations sites in or near the project for marten. Marten generally use higher elevation lodgepole pine and mixed conifer habitat types with a preference for mesic, late successional forests. Heavy canopy cover is also important in marten habitat (Ruggiero et al. 1994). Since this species is not found in the project area, no further analysis is needed.

Botany Resource

Existing Condition

The project area is characterized by riparian vegetation which includes moist hairgrass and bluegrass meadows, adjacent to lodgepole pine plant associations. Soils are sandy, pumiceous volcanic ash and pumice lapilli; alluvium; and glacial outwash. The elevation is approximately 4100 feet.

There has not been a comprehensive survey of the project area since 1993, when a sensitive plant survey by canoe located a population of *Artemisia ludoviciana* ssp. *estesii* (Estes' wormwood) in the project area; this population has been in the zone where Bti treatment has been occurring since 1990. However, during a survey for the East Tumbull project in 2003, several populations of *Carex lasiocarpa* (Slender Sedge) were found in the vicinity of Cardinal Bridge. While this species is not officially on the Deschutes National Forest's sensitive list, it is considered "imperiled in Oregon" by the Oregon Natural Heritage Program and will be considered in this document as such. These populations also lie within an area that has been in the zone where Bti application has occurred since 1990.

It is possible that, in addition to *C. lasiocarpa*, two other *Carex* (sedge) species, *C. hystericina* and *C. livida*, may also have habitat within the project area, though the area was covered by the 1993 canoe survey and not located (13 other *Carex* species were found).

Because the nature of the project is of low impact to vegetation (see Environmental Effects section following), no further field reconnaissance for sensitive plants was necessary.

The project area contains scattered invasive plant populations, introduced and spread by the high level of recreation activity in the area, and proximity to Bend and its many invasive plants. Currently, no treatments, manual or otherwise, are occurring on these weed sites; herbicides are not presently authorized. The invasive plant, cheatgrass, is present essentially at all sites; invasive plant, mullein, is present in small numbers at many locations. The invasive plants are located at these sites within the proposed project area:

1. *Benham Falls Day Use Area and campground*. Mainly spotted knapweed.
2. *Section 18*. This site is spotted knapweed, so dense it nearly forms sod.
3. *Meadow near Cardinal Bridge, Section 29*. Canada thistle.
4. *Meadow just north of Besson Camp, west side of river*. Spotted knapweed, mostly associated with the road but venturing into the meadow.

Invasive Plants of Concern For the Project Area:

Spotted knapweed, *Centaurea maculosa*, is a very aggressive plant that grows along most major highways in Central Oregon. It is a perennial forb in the sunflower family that lives for 3-5 years. It is

very competitive on disturbed dry to mesic sites because it is able to germinate in a wide range of conditions and it grows early in spring before many native plants. Seeds may be dispersed on animals and humans, and by being caught up in vehicles. Distribution over large areas is linked to transportation systems. Known sites along Highway 97, among other places, are currently being treated under the Deschutes National Forest Noxious Weed Control Environmental Assessment (1998).

Canada thistle, *Cirsium arvense*, is a colony-forming aggressive perennial from deep and extensive horizontal roots. The stems can range from 1-4 feet tall. Its leaves are stiff, spine-tipped, and frilly. Through its rhizomatous nature, it easily spreads.

A Record of Decision for Preventing and Managing Invasive Plants was signed in October 2005, and incorporates its standards into the Forest Plan of the Deschutes National Forest. Because of the low-risk nature of the Sunriver Vector Control Project, none of these standards, which were designed for higher risk scenarios, can be readily applied to this project.

Recreation Resource

Existing Conditions

Developed

No camping, developed or dispersed, is allowed on national forest lands within the Wild and Scenic River corridor from Harper Bridge north to Inn of the 7th Mountain, incorporating most of the project area. Developed recreation sites within the project area and adjacent to the Deschutes River include Besson Camp, Benham Falls Day Use Area, Big River Campground, and Big River Group Camp, the former two being day use areas and the latter two being adjacent to General Patch Bridge where overnight camping is permitted. All these sites have a boat ramp. These sites are fully developed with designated parking, toilets, bulletin boards, and picnic tables. There is also an undeveloped boat ramp at Harper Bridge. The Deschutes River Trail passes through the Benham Falls Day Use Area, connecting Lava Lands Visitor Center to the northern end of Sunriver. Canoe and other watercraft rentals are available at the Sunriver Marina, providing for a popular float of nearly 6 miles to the take-out above Benham Falls Day Use area. During the peak season of July and August, the Sunriver Marina rents approximately 150 watercraft per day with 2-3 people per craft. An additional 50 private craft/day utilize the boat ramp at the marina to float downriver (Hamilton 2006, personal communication). Sunriver Resort offers horseback rides on trails on national forest lands within the project area. Developed recreation activities have shown a trend of increasing use with the corresponding increase in the Central Oregon population.

Dispersed

Dispersed recreation activities include fishing, boating, hiking, cross-country skiing, and wildlife viewing. Floating the river, fishing, and hiking are the primary summer recreational uses of Forest Service lands in the project area. There are other user created trails near the river, and user created roads and campsites. Some forest visitors disregard the ban on overnight camping restriction in the designated day use area within the Wild and Scenic River corridor. Similar to developed recreation, dispersed recreation activities have increased with the growing Central Oregon population, resulting in the degradation of soils and vegetation in some areas.

Other

Special use permitted activities include power line and other utilities. There are no inventoried Roadless areas (RARE II) or Wilderness areas within the planning area.

ENVIRONMENTAL CONSEQUENCES

The discussion of Environmental Consequences is separated into individual resource areas. Estimated effects of the alternatives are discussed in terms of environmental changes from the existing conditions and include qualitative as well as quantitative assessments of direct, indirect, and cumulative effects. Important to the Cumulative Effects analysis included in the following Environmental Consequences for all resources is the consideration of Past, Present, and Reasonably Foreseeable Actions. Past and Present actions are discussed under the Existing Conditions section and summarized below.

Past Actions: The altered flow regime controlled at Wickiup Reservoir has altered water quality, fish habitat, floodplains and the wetland community along the river. Private land development has degraded riparian conditions along the river. These effects have been discussed under Existing Conditions for fisheries, water resources, wetlands and floodplains. Fish and amphibian populations have been altered by stocking of non-native fish and amphibian species in the basin. Large trees have been placed instream and willows have been planted along the banks in the last decade to improve fish habitat. Mosquito control has occurred for nearly two decades in the area.

Present Actions: See above for flow regime discussion. The Sunriver area is a popular year-round tourist destination, with many seeking outdoor activities within and adjacent to the project area. Three golf courses are located adjacent to the project area. A non-commercial airport and a marina with canoe rentals operate at Sunriver. Four Rivers Vector Control District treats for mosquitoes on private land and national forest land.

Reasonably Foreseeable Actions: The MYST Vegetation Management Project, Sunriver Hazardous Fuels Reduction Project, and the SET Vegetation Management Project have several vegetation and fuels treatment units planned on the west of the Deschutes River adjacent to the project area. A Record of Decision for Preventing and Managing Invasive Plants was signed in October 2005, and treatment of invasive plants with herbicides may occur within the project area.

Public Health and Safety

Alternative 1

Direct and Indirect Effects: Bti poses little threat to human health through either handling the product directly, or being exposed to it indirectly, such as during a municipal mosquito control program. There is minimal concern for human health effects from *Bti* when used according to labeled directions (EPA 2002). Use of Bti has shown to be safe with no adverse effects to humans when used properly, therefore there would be no direct effects to human health and safety. Inert ingredients of the two proposed Bti

products (Vectobac CG and 12AS) are not considered health risks (primarily corn cobs and water). Tests have not shown commercial formulations of Bti larvacides to be more toxic than the isolated active compound (WSDH, 2006). Treatment of mosquito populations would reduce the likelihood of disease transmission including WVN, which was first observed in Deschutes County near Bend during 2006 in a dead bird. Statewide, there were 64 human cases in 2006 as of October.

Use of Bti on forest lands would likely reduce the reliance on mosquito adulticides on private land within FRVCD, which have increased human health concerns over those of Bti.

Cumulative Effects: There would be no cumulative effects since there are no direct or indirect effects.

Alternative 2

Direct and Indirect Effects: Effects would be very similar to Alternative 1. The use of the helicopter would result in a quicker response to increasing mosquito larvae populations than hand crew treatments and results in a higher kill rate, and more acres are treated, therefore the potential for disease transmission from mosquitoes would be reduced. FRVCD can achieve close to 100% kill rate as opposed to 80-90% kill rate with hand treatments (Landolt 2006, personal communication). The use of adulticide on private land would likely be reduced, by an unknown amount, since more acres treated with larvacides on Forest Service land. This may result in benefits to human health and safety from slightly reduced risk of WNV and potentially less use of adulticides on private land, but may be immeasurable.

Cumulative Effects: Same as Alternative 1.

Alternative 3

Direct and Indirect Effects: There would be no potential for direct effects as no Bti would be used on Forest Service lands. Potential for disease transmission by mosquitoes would be increased. Adulticide use likely to increase measurably as mosquito populations would increase on Forest Service lands. There may be increased potential for adverse health effects from both disease transmission and exposure to adulticides from treatment on private land, but to what degree is unknown.

Cumulative Effects: Same as Alternatives 1 and 2.

Water Resources

Alternative 1

Direct and indirect Effects: There would be no direct or indirect effects to water resources. Bt does not naturally occur in aquatic environs, so would not persist in treated areas (EPA 1998), nor in the Deschutes River should drift occur. Bt gradually settles out or adheres to organic matter (Extoxnet, 1996). Bti is classified as immobile because of its inability to leach with groundwater (Extoxnet, 1996). Leaching of Bti into the Deschutes River is highly unlikely from the applied ponds and wetlands. Because of the rapid breakdown and low toxicity, Bt poses no threat to groundwater (Extoxnet, 1996). There are no EPA issued restrictions for use of Bt around bodies of water. There would be no effects to the ODEQ 303(d) water quality parameters, nor beneficial uses .

Cumulative Effects: Effects to water quality and quantity of the Deschutes River are largely a factor of the flow regulation upriver at Wickiup Dam. Private land development along the river is another significant factor that influences water quality. This alternative would have no cumulative effects to water quantity or water quality, including the 303(d) parameters, nor cumulative effects to beneficial uses.

Alternative 2

Direct, Indirect, and Cumulative Effects: Identical to Alternative 1.

Alternative 3

Direct and Indirect Effects: There would be no direct effects as no treatments of Bti would occur. No treatments on Forest Service land could result in more adulticides being used on private land, with increased potential for drift into waterbodies. These products are more toxic to humans and other organisms than Bti. However, additional drift as a result of implementing this project is expected to be minimal. Approximately 900-950 acres of private land are treated annually with adulticides by FRVCD. While the acreage of private land treated with adulticides is unlikely to change as a result of this alternative, the frequency of applications may increase. ODEQ 303(d) water quality parameters would not be affected, nor would beneficial uses.

Cumulative Effects: There would be no cumulative effects as no treatments of Bti would occur. Changes in water quality would be a result of climatic factors, natural occurrences, or from other anthropogenic sources.

Fisheries and Aquatic Invertebrates

Alternative 1

Direct and Indirect Effects: Bti application would occur predominately in areas unoccupied and inaccessible to fish, such as shallow off-channel ponds, puddles, and wetlands. Some of these areas are at times accessible to fish depending on summer flows, but warm temperatures are likely to limit use by coldwater salmonid species. However, river margins would be intentionally treated in some areas. Approximately 6.8 miles of river frontage on national forest out of 11.3 miles total (national forest land both sides of river in some areas) would be treated (60%). River margins are likely to be occupied by fish, especially young trout species that prefer shallow, slow areas. There would be drift of Bti into Spring River and the Deschutes River with treatments. For the purposes of this analysis, drift is defined as a combination of both intentional and inadvertent applications of product into river margins. The volume of drift applied by crews on foot would be unknown, and can only be estimated. Given the assumptions of any one Bti treatment at the maximum river frontage (6.8 miles), an average riparian strip adjacent to the river of 100 feet wide, the maximum dosage of 8 ounces liquid form of product per acre, and estimating 1% material drift into the river margins during application, about 6.6 ounces of product and 0.8 ounces active ingredient (AI) would enter the Deschutes and Spring rivers. For granular form under the same assumptions and applied at a rate of 10 pounds/acre, approximately 8.2 pounds of product and 6.5 ounces AI would enter the two rivers. However, any one treatment is expected to be less than the total project area (<150 acres and 6.8 river mile frontage), and the application rate may be less than the

maximum prescribed, therefore, the total drift of Bti would likely be considerably less than described above. Considering the flow of the Deschutes River through Sunriver during the summer months is approximately 2500 cfs (18,700 gallons/second), any Bti drift is expected to be highly diluted.

Even under the circumstances of application of Bti to areas occupied by fish, there would be no direct effect to fish, including redband trout. Bti is practically non-toxic to fish (EPA 1998, Exttoxnet, 1996). Rainbow trout and bluegill were exposed for 96 hours to Bti at concentrations of 560 and 1000 mg/L and did not show adverse effects (Exttoxnet, 1996). Wipfli exposed embryos of brook trout, brown trout and steelhead trout to high concentrations of Bti, but mortality was not observed until concentration were 70 times greater and exposure 192 times longer than that recommended for black fly control. Mortality was attributed to formulation components rather than Bti toxins (Lacey and Merritt 2004). *Anguilla anguilla*, a marine fish, was exposed to 1000 to 2000 times the level of *Bt* expected during spraying programs without negative effects (Exttoxnet, 1996). Mortalities did occur in fathead minnows when exposed to high concentrations of Bti, but was thought attributable to severe dissolved oxygen depletion from formulation ingredients rather than direct toxicity from Bti (Snarski, 1990). However, spores of Bti were found in minnow feces for over 2 weeks following exposure, suggesting that fish could influence the dissemination of Bti in the aquatic environment.

Effects to Non-target Invertebrates

The effects analysis to fisheries includes potential effects to the invertebrate species fish may feed upon. A literature review on the effects of Bti on non-target invertebrates found that results and conclusions differ between studies. Boisvert and Boisvert (2000 in Stark 2005) concluded that general predictions about the effects of Bti on non-target organisms may be difficult to make due to differences in the species evaluated, differences in laboratory and field methodology employed, and the different Bti formulations used in various studies.

Bti is highly specific to the targeted insects (mosquitoes and black flies) and is considered innocuous to a wide range of aquatic organisms (Snarski, 1990). However, over 150 insects, primarily in the Lepidopteran order (butterflies and moths), are in some way susceptible to Bt (Exttoxnet, 1996). Most Lepidopteran genera are terrestrial. Terrestrial genera could be exposed to liquid form of Bti when in the caterpillar stage feeding on vegetation in treated areas. Some Lepidopteran genera have aquatic or semi-aquatic life stages, and would potentially be impacted by Bti. Research and field experiments have shown that Bti has no toxic effects on beneficial and predacious arthropods or insects such as honeybees, beetles, mayflies, dragonflies, damselflies, stoneflies, caddisflies and true bugs (CMC 2003 in Ottetail Environmental 2003). Bti has been found to be moderately toxic to the freshwater invertebrate *Daphnia* (EPA 1998), and may adversely affect shrimp and mussels (Exttoxnet, 1996).

Lacey and Merritt 2004 concluded that a multitude of studies conducted in lentic (still water) and lotic (streams and rivers) habitats reveal little or no direct effect on Bti on most non-target organisms. Several researchers have reported on the susceptibility of some non-target Nematocera (suborder of Diptera that mosquitoes and chironomids belong to) but usually at concentrations of Bti much higher than applied for mosquito control (Wipfli and Merritt 1994 in Lacey and Merritt 2004). The largest family of susceptible aquatic non-target organisms is Chironomidae (chironomids), although several species show no susceptibility, even at high concentrations (Lacey and Merritt 2004). Chironomids occur in most types of aquatic ecosystems, and the range of conditions they are found in is more extensive than any other group of aquatic insects (Merritt and Cummins, 1984). Some species of chironomids burrow into bottom

sediments (Merritt and Cummins, 1984), reducing the likelihood of consumption of Bti. In lotic habitats, the most commonly affected group of non-target organisms are chironomids, most notably species of the genus *Rheotanytarsis*, which filter fine particulate matter from the current (Lacey and Merritt 2004). This species was not detected in Deschutes National Forest sampling conducted in the 1990's, although analysis sometimes was only to the family level. Reduced or negligible mortality has been reported in chironomid larvae treated with Bti concentrations used for operational control of black fly and mosquito larvae (Lacey and Merritt 2004). Bti has been proposed for control of nuisance chironomids, but concentrations required are several fold higher than that required for mosquito control (Lacey and Merritt 2004). As with the mosquito larvae, Bti must be consumed by the chironomid larvae to be affected.

Results of laboratory studies on susceptibility of chironomids to Bti have differed from field studies, indicating environmental factors influence the efficacy of Bti. Charbonneau et al. (1994) observed mortality of a non-target chironomid in laboratory tests, but not in the natural environment (Lacey and Merritt 2004). Other factors that could influence the susceptibility of both target and non-target organisms are the age of the organism, role in food web, feeding behavior, formulation constituents, concentration of bacteria, frequency of treatments, persistence of the toxin, and dilution in the river environment (Lacey and Merritt 2004).

In several laboratory studies, Bti was shown to be lethal to chironomid species but at concentrations significantly higher than what is applied for mosquito control. Species tested included *Glyptotendipes paripes*, *Chironomus decorus*, *Chironomus crassicaudatus*, *Tanytarsus spp.*, *Chironomus thummi*, and *Psectrocladius psilopterus* (Lacey and Merritt 2004). The Center for Mosquito Control (CMC 2003 in Ottertail Environmental 2003) reports that among Diptera (true flies and chironomids) *Chaoborus* species, *Ephydra riparia*, *Musca domestica*, *Odontomyia* species, and *Polypedilum* species demonstrated no susceptibility to Bti. Variable mortality did occur among *Chironomus pulmosus*, *Chironomus stigmaterus*, *Dixa* species, *Goeldchironomus holoprasinus* and *Palpomyia* species.

The potential impact that mosquito control agents might have on non-target chironomids was investigated by Laskowski et al. (1999 in Stark 2005). Bti did not have a negative impact in this study. The effects of granular Bti on aquatic nontarget invertebrates in Hong Kong were investigated by Dickman (2000 in Stark 2005). In 1998, pools along the Tai Tan River in the New Territories of Hong Kong were treated with Bti. The only organisms other than mosquitoes that appeared to be affected by the treatments were chironomids. A study was conducted to determine whether applications of Bti used to control the black fly, *Simulium pertinax* in two rivers in Brazil were having a negative impact on aquatic insects (deAraujo-Coutinho et al. 2003 in Stark 2005). Approximately 28,477 specimens of aquatic insects in the families, Hydropsychidae, Chironomidae, Bactidae, Simuliidae, Blephariceridae and Megapodagrionidae were collected during the study. Bti only affected blackflies. In another study, Bti was applied to a river in Michigan to control black flies (Simuliidae Family). The study concluded that there were no detectable non-target effects on other invertebrates, nor on fish numbers, survival, species composition, or growth. Mortality of chironomids was noted near the application site but was negligible further downriver. The study concluded there were no adverse effects to the chironomid population as there were no pronounced changes in the numbers of chironomids in macro-drift after application (Merritt, et al 1989).

Most studies, such as those mentioned above, have focused on the short term indirect effects of Bti on aquatic communities, but very few have targeted the long term impact of Bti applications. Mosquitoes, chironomids, and black flies often contribute significantly to aquatic food webs. Suppression of their

populations could lead to reductions in species that rely on them as a major food source (Lacey and Merritt 2004). A three year study in a Minnesota wetland observed a reduction in chironomids, concluded to be direct effects to Bti. The overall number of insect genera also decreased, and was presumed to be the effects Bti had on the invertebrate food web (Hershey, et al 1998). Minimal effects on non-insect invertebrates were observed. However, a subsequent study of invertebrates in the same wetland did not corroborate with the previous investigation, and concluded that there were no long-term effects on the insect community structure due to repeated Bti applications (Schude, et al 1997 and Balcer et al 1999 in Lacey and Merritt, 2004). Becker (1997 in Lacey and Merritt 2004) reported no long term adverse effects to non-target organisms for mosquito control with primarily Bti in the Rhine Valley of Germany.

Lacey and Merritt's 2004 review of the literature concluded that Bti appears to pose little direct or indirect toxic threat to non-target benthic invertebrate species or fish. The main negative effect of Bti in streams and rivers may be on predatory species that specialize in foraging on mosquitoes and chironomids. Most aquatic predators feed extensively on chironomids at some point in their life cycle (Merritt and Cummins, 1984). Generalist predators may be less affected if alternative prey species are present (Lacey and Merritt, 2004). Most predators are generalists, and it is unknown if there are any predators within the project area that are specialized in feeding on mosquitoes or chironomids. Dragonflies and damselflies (Order Odonata) feed significantly on mosquitoes and chironomids in both the larval and adult stages (Lambert, 1999). A reduction in the populations of mosquitoes and chironomids could potentially affect the food supply for species of this order.

Aquatic benthic macroinvertebrate sampling was conducted by the Deschutes National Forest in 1991, 1993, and 1996 in Deschutes River within the project area. Analysis revealed several dozen different invertebrate taxon that fish could potentially feed upon. The samples also included several different genera of chironomidae. *Polypedilum* was the only chironomid genera found from the list on page 39 summarizing results of susceptibility of chironomids to Bti. Again, this genera has not been found to be susceptible to Bti. However, analysis of Deschutes National forest samples did not always break down families into genera. Sampling was limited to just 5 samples, during just one time of the year (fall), and within only one type of habitat – mid-channel riffles. No sampling was done along river margins, pools, or off-channel sites. Limited sampling can result in high variability in results from year to year because of environmental and sampling factors, making conclusions about trends difficult. Nevertheless, a trend of increasing chironomid abundance was observed. The site at river mile 189 showed an increase in the chironomid population from 4%, 15.1%, to 40.3% of the total invertebrate population, for the years 1991, 1993, and 1996, respectively. The site at river mile 199 increased from 56.8% of the total invertebrate population in 1993 to 69.4% in 1996. For comparison, several samples taken both up and downriver of the project area in the early to mid 1990's ranged in chironomid abundance from 6.9% to 50.5% of the total invertebrate population. The number of chironomid species present in most aquatic systems accounts for 50% or more of the total macroinvertebrate species diversity, and the total number of species is usually greater than 50 and sometimes exceeds 100 (Merritt and Cummins, 1984). In summary, based on the limited analyses, there was no apparent adverse effect to the chironomid populations from the treatment with Bti within the project area, which has been an ongoing operation for over 15 years. It is not known how many, if any, of these are burrowing species, which would reduce their potential susceptibility to Bti.

Black flies are present in low numbers within the project area (0 – 2.9% of total numbers in 1991, 1993, and 1996 samples). Although Bti is used for black fly control, the areas treated under this alternative (off-channel areas and river margins) do not target typical black fly larvae habitats. Black fly larvae are

typically found where the current is fast (Merritt and Cummins, 1984). Bti would not readily be available for black fly larvae to ingest, so minimal impacts are anticipated to occur from treatments. Although some Lepidopteran genera have aquatic or semi-aquatic life stages, none were found in the 1991, 1993, or 1996 samples (Wissman, 1991, 1993 and Vinson, 1996).

In conclusion, a review of the literature for effects of Bti on non-target organisms varied between research projects, but most reported little to no effects to non-target species. Chironomids appeared to be the most affected aquatic non-target organism. The effects to chironomids within the project area have not been thoroughly studied, but from limited sampling conducted in the 1990's, no apparent adverse effects to chironomids within the project area had occurred.

Coldwater fish species that inhabit the project area (reband/rainbow trout, brown trout, whitefish) typically feed on a variety of invertebrates, including chironomids. The majority of the insects consumed by these species are typically made up of immature (aquatic) life forms. No fish diet studies have been conducted within the upper Deschutes River, but an ODFW study of rainbow trout in the lower Deschutes River (below Pelton Dam) determined that trout fed predominately on immature aquatic insects of the Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) orders. Trout also fed on newly hatched whitefish, sculpins, and fish eggs. Results of this study were similar to other studies in that food consumption was greatest in the spring and early summer, and decreased in late summer and fall (Schroeder and Smith, 1989). A stomach content study in the McCloud River, California (Tippets and Moyle, 1978) found that adult rainbow trout fed both on epibenthic (attached to the bottom) and drifting invertebrates. Larval insects in the orders of Ephemeroptera, Plecoptera, Trichoptera, and Diptera (true flies, which includes mosquitoes and chironomids) were the main prey for epibenthic feeding, while larval Ephemeropterans and Dipterans (including chironomids), and flying adult insects of both terrestrial and aquatic origin made up the drift. Juvenile rainbow relied predominately on drifting larvae of Trichoptera, Plecoptera, Ephemeroptera, Diptera, along with terrestrial insects.

Brown trout have similar feeding habits to rainbow as young fish, but after exceeding 25 cm (10 inches) length, fish and crustaceans become more important in the diet (Raleigh et al 1986). Brown trout have also been known to eat mollusks, salamanders, frogs, and rodents (Scott and Crossman, 1990).

Mountain whitefish are primarily bottom feeders, consuming aquatic insect larvae of mayflies, stoneflies, caddisflies, chironomids, small mollusks, and on occasion even small fish (Scott and Crossman, 1990).

Potential indirect effects could occur to the above mentioned fish species if Bti were to impact the food resource. Mosquito larvae do not usually make up a significant portion of these fishes diet in a lotic environment because of the off-channel slow or still water habitats occupied for larval growth and metamorphosis into the adult form. These types of habitats are generally not occupied by fish within the project area, especially coldwater salmonids. Some larvae at the river margin may be consumed by juvenile fish. Adult mosquitoes may occasionally be taken at the water surface while in search of food or resting areas, but are likely not a significant portion of the fishes diet. Impacting the chironomid populations, and to a lesser extent daphnia and black flies, could also affect the food resource of fish. The importance of chironomids, daphnia, and black flies in the diet of fish within the project area is not known. However, as young of the year fish increase in size, the reliance on chironomids decreases (Merritt and Cummins, 1984). From the limited invertebrate sampling conducted in the project area, chironomid species were relatively abundant, and there were numerous other invertebrate species present that fish could prey upon.

Cumulative Effects: There would be no cumulative direct effects from this alternative to fish from effects already occurring from treatments on private lands. Bti has no direct effects to fish as described previously. There is potential for direct effects to fish from the use of other insecticides applied on private lands. This alternative could add cumulatively to the adverse effects occurring to fish (indirect) and invertebrates (direct and indirect), however effects would likely be minimal. The altered flow regime, private land development, and past clearing of instream wood have contributed to degraded water quality and habitat conditions for both salmonid fish species and aquatic invertebrates. Adverse effects could also be occurring from mosquito abatement occurring on private lands within the project area and within the rest of the FRVCD treatment areas upriver of the project area. The effects to fish and invertebrates from these activities are unknown, but likely similar to effects occurring on national forest lands. The treatments on private lands involve many more acres and additional insecticides not used on Forest Service lands. Annually, approximately 500 acres of private land within the project area would be treated with larvacides and 900-950 acres would be treated with sprays targeting adult mosquitoes (Landolt 2006, personal communication). However, there is overlap in accounting for acres because of multiple annual treatments, which would overestimate total acres. Approximately 2/3 of the wetland acres on private land would be treated with insecticides including Bti (Landolt 2006, personal communication).

The majority of proposed Bti treatments on national forest lands are within the Sunriver area, where generally national forest land is on the west side of the river and private land is on the east side. The acres of wetland and riparian areas adjacent to and near the river are similar on private land as on national forest land in the Sunriver area, although development such as golf courses, housing developments, and an airport on private land have diminished wetland acreage. The Sunriver site was also a former World War II training site (Camp Abbott), where activities also likely resulted in modifications to wetlands and riparian areas.

The miles of river frontage on private land treated would approximate what is treated on national forest in the Sunriver and General Patch Bridge areas. In these areas, approximately 13.5 miles of 22.5 miles of riverbank frontage would be treated under this alternative (private and national forest land combined). These river margins are likely to be occupied by fish, especially young trout species that prefer shallow, slow areas.

Additional river frontage treated on private land includes the reach between Harper Bridge and General Patch Bridge which is nearly all in private ownership, and the private land areas upriver of the project area (upriver of river mile 202.5). From Harper Bridge (south end of Sunriver) upriver 7.7 miles to General Patch Bridge (where additional treatments would occur on national forest land), the land ownership is composed of highly developed private residences. Riverbanks and wetlands in this section of the river have been altered and disturbed. Retaining walls and rip-rap with boulders are common along the riverbanks. Analysis of aerial photographs determined that of the 14.5 miles of riverbank in private ownership in this reach (both banks combined) approximately 7.9 miles is of wetland type vegetation that is treated with Bti and other insecticides. The percentage of riverbank treated (55%) in this area is similar to what would be treated on national forest lands and other areas of private ownership. The private lands FRVCD treats upriver of the proposed treatments on national forest lands (i.e., upriver of river mile 202.5) extend to the east boundary of La Pine State Park at river mile 207. An additional 4.1 miles of riverbank out of 9 total miles are estimated to be treated on private land in this area. Dilution of

drift is reduced upriver of the major tributaries Spring River and the Little Deschutes River, which includes much of the private land sections.

National forest river frontage that could potentially be treated for mosquitoes is 6.8 river miles and private land is 18.7 river miles, for a combined total of 25.5 miles out of 46 total miles or riverbank. The total treated (25.5) is nearly four times what is treated on national forest land only. **However, due to the scattered rise and fall of mosquito populations across the whole project area, and the time required to apply treatments, never would the entire project area be treated simultaneously.**

Potential drift of Bti is greater on private lands than national forest lands because of the extensive use of the helicopter to apply Bti. Assuming drift to be higher on private land with the use of the helicopter (assume 2% drift for helicopter instead of 1% and other assumptions described earlier) but otherwise using the same assumptions for private land as on public land, a maximum of 3.0 ounces AI per application in liquid form and about 42 ounces AI in granular form may be introduced into lotic environments from both private and national forest applications. The ongoing applications on private land could affect the prey base for fish similar to, but more than, national forest lands. Therefore, by continuing to treat national forest lands this alternative could potentially cumulatively affect fish (potential effects would be approximately one-quarter to one-third of what is occurring on private lands). Again, volumes of drift are based solely on assumptions, actual volumes are unknown. As discussed previously, the importance of chironomids, daphnia, and black flies in the diet of fish within the project area is not known. From the limited invertebrate sampling conducted in the project area, chironomid species were relatively abundant, and there were numerous other invertebrate species present that fish could prey upon.

The 2006 Four Rivers Vector Control District Operating Plan submitted to Deschutes County included the use of adult sprays *Scourge 18+54*, *Anvil 10+10*, *Permanone 31-66*, *Aqua-Kontrol*, *Aqua-Reslin*, and *Suspend SC*. The product labels all note that they are toxic to fish and most are toxic to many other invertebrates (some extremely toxic). *Altosid Briquets*, *Altosid XR Briquets*, and *ALL* are methoprene-based products and would be used in conjunction with Bti to target larvae, and *GB 1111* and *Agnique* would be used for pupae control. The methoprene-based products are safe to use where fish are present but are lethal to chironomids. *GB 1111* is a petroleum surface film and is toxic to fish and aquatic organisms. *Agnique* is a monomolecular film, is safe to fish and is approved for use in potable water systems. It is toxic to chironomids. Again, all the previously mentioned products above are only used on private lands. **Bti is the only product proposed for use on national forest lands.**

All the above mentioned products are all U.S. EPA approved pesticides. Such EPA approved products have undergone extensive testing and are designed to minimize risk of human exposure and adverse health and environmental effects, and pose no unreasonable risks when used according to the product label (EPA Website 2006). FRVCD applies these products according to label instructions (Landolt 2006, personal communication).

There is potential for direct effects to fish from these other products used on private land. The use of these products may be having effects to the prey base for fish by affecting non-target invertebrates, but the scale of effects is unknown.

Cumulative Effects to Fisheries from implementing this alternative would be limited by:

- availability of several other invertebrates for fish to prey upon
- uncertainty of effects to Bti on species of chironomids within the Deschutes and Spring rivers (potentially no effect to chironomids)
- low volume of drift of Bti into the Deschutes and Spring rivers and large dilution factor
- limited treatments annually on Forest Service lands (up to 5)
- other factors playing a larger role in limiting fish populations such as degraded habitat, flow regimes, interspecific competition.
- relatively small acreage compared to the rest of the vector control district (150 acres) and 6.8 miles of river frontage out of 25.5 total miles
- rapid breakdown of Bti in the aquatic environment

The Biological Evaluation for redband trout (Appendix A) found that this alternative **May Impact Individuals or Habitat (MIIH)** for redband trout due to indirect effects, but would not create a significant trend toward federal listing. The food resource could be affected for some individuals, especially juvenile fish that feed in shallow areas along the riverbanks, as less mosquito larvae and perhaps less chironomid larvae would be available. Effects would be limited using the same reasoning listed in the paragraph above.

Alternative 2

Direct and Indirect Effects: This project would have no direct effects to fish species as described previously under Alternative 1. Potential adverse indirect effects to fish and direct and indirect effects to aquatic invertebrates are similar to Alternative 1. This alternative would treat approximately 20 more acres than Alternative 1, an increase of 12%. Approximately 4.45 more river frontage habitats on national forest land (from an area of 8.2 miles of river frontage) would be treated as well. Under this alternative, approximately 11.25 river mile frontage out of 19.5 miles total (both banks some areas) on national forest land would be treated (58%). There is increased potential for drift into Spring River and the Deschutes River with aerial treatments over hand treatments, however the mitigation measure of no aerial treatments when constant wind speed exceeds 5 mph and the restriction of aerial treatments around developed sites and osprey nest sites would limit overall drift. Limiting aerial drift is an economic incentive for FRVCD. Annually, no more than 3 aerial treatments would be allowed on national forest lands. Additional treatments would be applied by hand crews only.

Drift of the liquid form of Bti is assumed to increase commensurate with the increase in river frontage treated, therefore the volume of drift, using same assumptions as described under Alternative 1, would be 65% more than Alternative 1 or 1.3 ounces AI of Bti. There is increased potential for drift into Spring River and the Deschutes River with aerial treatments of the granular form of Bti over hand treatments. Given the assumptions of any one Bti treatment at the maximum river frontage (11.25 miles), the maximum dosage of 7.9 ounces/acre active ingredient (AI), and estimating 2% material drift into the Deschutes River during application (twice as much drift as hand treatments applied under Alternative 1), approximately 21.4 ounces of AI would reach the Deschutes and Spring rivers when aerial treatments applied. However, because any one treatment is expected to be less than the total project area (<170 acres and 11.25 river miles), the application rate may be less than the maximum prescribed, and the mitigation of no aerial treatment around developed sites, the total drift of Bti would likely be less than 21.4 ounces. Considering the flow of the Deschutes River through Sunriver during the summer months is approximately 2500 cfs (18,700 gallons/second), any Bti drift is expected to be highly diluted.

This alternative is expected to have no measurable difference in direct effects to non-target invertebrates, especially chironomids and black fly larvae, from Alternative 1, which concluded that there are little direct effects on most non-target organisms (see pages 38-41). There is increased potential for indirect effects to food web dynamics as more mosquitoes would be killed, reducing the prey base for other invertebrates that prey upon them such as dragonflies, damselflies, and water boatmen. The degree to which the food web is affected would be unknown. A review of the literature revealed that information and understanding in this area is lacking.

Cumulative Effects: The same amount of private land acres and associated river frontage would be treated as Alternative 1. More acres (20) and more river frontage (over 4 miles) are treated under this alternative on national forest land than Alternative 1 and the potential for drift is increased because of the use of the helicopter, therefore increased potential to affect food for fish, food webs, and non-target organisms including chironomids. This alternative could potentially have cumulative effects to fish. There would be no cumulative direct effects to fish from additional applications of Bti on private lands. Bti has no direct effects to fish as described previously. There is potential for direct effects to fish from the use of other insecticides applied on private lands.

When combining private and national forest land, nearly 30 miles out of 54 miles river frontage (both riverbanks) would be treated within the entire area FRVCD treats adjacent to the Deschutes and Spring rivers. Potential drift of Bti would be similar on national forest as private lands because of the use of the helicopter. Using the same assumptions for drift on private land as on public land, a maximum of 3.5 ounces AI per application in liquid form and 51 ounces AI in granular form may drift into lotic environments. Applications on national forest land would affect the prey base for fish similar to private land. The use of other mosquito abatement products, including adulticides, would be used on private lands identical to described under Alternative 1, and the potential effects to fish and fish prey items from these products would be similar to described under Alternative 1. The increase in treated acres, and the efficiency of the use of the helicopter, may result in less adult mosquitoes invading the Sunriver area, especially the north end, and subsequently less adulticides needed, reducing potential adverse effects to fish from these products. In conclusion, Cumulative Effects to fish would be very similar to Alternative 1, differences would likely be immeasurable.

The Biological Evaluation (Appendix A) determined that this alternative **May Impact Individuals or Habitat (MIIH)** for redband trout due to indirect effects, but would not create a significant trend toward federal listing. The food resource could be affected for some individuals, especially juvenile fish that feed in shallow areas along the riverbanks, as less mosquito larvae and perhaps less chironomid larvae would be available. Effects would be limited using the same reasoning listed above.

Alternative 3

Direct and Indirect Effects: This alternative would have no potential for direct effects to fish, as no treatment of Bti would occur. Fish may be indirectly benefited as the prey base would be increased as more mosquitoes would become available, especially for juveniles. The benefit would likely be immeasurable as mosquitoes are typically not a major food item of trout in river habitats. A negligible increase in chironomids may also become available for fish food. The wetland food web, complex and not well understood, may benefit from an increased mosquito population. Dragonflies, damselflies, water boatmen, and other invertebrates that prey on mosquitoes would have an increased food resource, and they in turn would be fed on by organisms higher in trophic level.

The populations of mosquitoes in the project area would likely increase if Bti treatments were eliminated on national forest lands. This could result in increased insecticide use (adulticides) in the private land sector of the project area, including increased use of products other than Bti that are potentially more harmful to other organisms including fish.

Cumulative Effects: There would be no cumulative effects to the past, present, and reasonably foreseeable actions from implementing this alternative.

The Biological Evaluation (Appendix A) determined that this alternative would have **No Impact (NI)** to redband trout or its habitat.

Table 3. Comparison of Alternatives for Area Treated

Parameter	Alternative 1	Alternative 2	Alternative 3
Miles national forest river frontage treated	6.8	11.25	0
Miles private river frontage treated	18.7	18.7	18.7
Total miles river frontage treated	25.5	29.95	18.7
Total national forest acres treated	150	170	0
Estimated cumulative drift liquid Bti (oz.)*	3.0	3.5	2.2
Estimated cumulative drift granular Bti (oz.)*	42.3	51	35.8

**Based on assumptions, actual value unknown. All numbers above are approximate.*

Common to All Alternatives

Essential Fish Habitat/T and E Fish Species

There would be no adverse effects (NAE) to Essential Fish Habitat from any alternative. Although the Upper Deschutes 4th field watershed (17070301) is mapped by the National Marine Fisheries Service as Essential Fish Habitat for chinook salmon, there are no present or historical records of chinook populations above Big Falls on the Deschutes River, over 50 miles downriver from the project area. There would be no effect to bull trout from any alternative as there are no populations within the project. The nearest population is over 50 miles downriver. Bti would break down in the aquatic environment before reaching waters inhabited by bull trout or designated as EFH.

Wetlands and Floodplains

Consistency with Executive Order 11988 (Floodplains) and Executive Order 11990 (Wetlands)

Floodplains: Executive Order 11988 provides direction to avoid adverse impacts associated with the occupancy and modification of floodplains. Floodplains are defined by this order as, “. . . the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands,

including at a minimum, that area subject to a one percent [100-year recurrence] or greater chance of flooding in any one year.”

Wetlands: Executive Order 11990 is to avoid adverse impacts associated with destruction or modification of wetlands. Wetlands are defined by this order as, “. . . areas inundated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.”

None of the three alternatives would have any direct, indirect, or cumulative effects to wetlands and floodplains. Floodplains and wetlands would not be physically occupied, modified, or destructed.

Wildlife

Effects Defined

Three principal effects that will be analyzed for the three alternatives:

- 1) *Direct Effects*
Potential disturbances from hand and aerial application (helicopter) of insecticide.
- 2) *Direct Effects*
Direct toxicity to wildlife
- 3) *Indirect Effects*
 - a) The ingestion of ‘contaminated’ prey species by target wildlife.
 - b) Potential for reduction of prey (e.g., insects, fish, mammals and amphibians).

General Effects Summary

Based on the toxicity and exposure data for Bt, there should be no risk for endangered mammals, birds, and non-insect aquatic species (U.S. EPA 1998). Bt’s have been used for many years in agriculture and forestry situations with no reported problems (Glare and O’Callaghan 1998). A number of other studies in several countries have found no effect on warm-blooded mammals (Glare and O’Callaghan 1998). No new studies on mammalian toxicity published after the report by Glare and O’Callaghan (1998) were found in the literature (Stark 2005). Generally, Bti persists for days rather than months as reported for some of the more toxic chemicals for mosquito control (Glare and O’Callaghan 1998). Though no specific studies of the effects of Bti on the species evaluated in this analysis have been conducted; no effects have been found on other birds in laboratory and field studies. Lattin et al. (1990a and b) found no toxicity, pathogenicity or weight loss when Bti was administered orally in large doses to young brown quail (*Colinus virginianus*) and young mallards (*Anas platyrhynchos*). Extensive studies on birds and mammals with high doses of unsolubilised Bti spores and crystals have shown no effect (Meadows 1993).

Bti does not negatively affect frogs and salamanders (Exttoxnet 1996). The World Health Organization (1992) reviewed a number of laboratory and field studies that examined the impact of Bt on frogs, newts, salamanders and toads in which no adverse effects were recorded, no effect of Bti on amphibians has been reported (Glare and O’Callaghan 1998). CMC (2003) found no toxic effects occurring in crustaceans or amphibians. Bull and Wales 2001, suggest that spraying with biological microbial agents, like *Bt var. kurstaki*, is unlikely to be detrimental to amphibians because those agents do not affect most *aquatic*

insects.

No indirect effects to wildlife via effects to prey species are expected to occur. (Merritt et al. 1989) concluded that there were no detectable non-target effects on most invertebrates, or on fish numbers, survival, species composition, or growth. From a review of literature for effects of Bti on non-target organisms, Lacey and Merritt 2004, concluded that Bti appears to pose little direct or indirect toxic threat to non-target benthic invertebrate species. Research and field experiments have shown that *Bti* has no direct toxic effects on beneficial and predacious arthropods or insects such as honeybees, beetles, mayflies, dragonflies, damselflies, stoneflies, caddisflies and true bugs (Extonet 1996 & CMC 2003 in OtterTail Environmental, 2003 and U.S. EPA 1998). A study of *Bti* used to control mosquitoes in wetlands in Minnesota revealed no effect on red wing black bird populations (Hershey et al. 1998). Hanowski et al (1997) conducted a more detailed study on the effects of Bti on a bird community and determined the application of Bti (Vectobac-G granules) had no effect on the bird community or on 19 individual bird species.

None of the alternatives would affect road densities, shrub habitat, big game forage or hiding cover, late and old structure habitat (LOS), old-growth, connectivity, fragmentation, snags, green trees, or coarse woody materials habitat.

Cumulative Effects Summary

The following past, present, and reasonably foreseeable actions were considered in this analysis of wildlife effects:

Past Actions: The altered flow regime controlled at Wickiup Reservoir has altered water quality, fish habitat, floodplains and the wetland community along the river. Private land development has degraded riparian conditions along the river. The General Patch Bridge Fuels Reduction Project and Katalo Vegetation Management Project have been recently completed within and adjacent to the FRVCD project area. Both projects consisted primarily of thinning overstocked stands and were generally maintained a 300 ft. buffer from the riparian area. Some ‘hand thinning’ of small trees occurred in the General Patch Bridge Fuels Reduction Project within 100 ft. of the Deschutes River. Fish and wildlife populations have been altered by stocking of non-native fish and illegal introduction of amphibian species in the basin. Large trees have been placed instream and willows have been planted along the banks at various locations within the project in the last decade to improve fish habitat. FRVCD has been applying *Bti* on FS lands since 1990 and treating adjacent private lands with *Bti* and other insecticides since at least 1990. No effects to wildlife, positive or negative, have been noted in that area, although no ‘formal’ monitoring has occurred; the Sunriver Nature Center surveys periodically for the Oregon spotted frog.

Present Actions: See above for flow regime discussion. The Sunriver area is a popular year-round tourist destination, with many seeking outdoor activities within and adjacent to the project area. Three golf courses are located adjacent to the project area. A non-commercial airport and a marina with canoe rentals operate at Sunriver and general recreation use is moderately high in and adjacent to the project area on Forest Service lands. FRVCD treats for mosquitoes on private land and national forest land.

Reasonably Foreseeable Actions: The MYST Vegetation Management Project, Sunriver Hazardous Fuels Reduction Project, and the SET Vegetation Management Project have several vegetation and fuels treatment units planned on the west of the Deschutes River adjacent to the project area. These projects would propose reducing fuel loadings and green tree stand density reductions that may include areas

along side the Deschutes River. Generally, treatments are not currently planned to occur within the riparian zones. A Record of Decision for Preventing and Managing Invasive Plants was signed in October 2005, and treatment of invasive plants with herbicides *may* occur within the project area. There are a few areas where *Bti* application is proposed where there is also herbicide use (clopyralid) proposed (13.5 acres in Alt. 1 and 16 acres in Alt. 2), although a decision has not yet been made about that (see attached map in EA). There is little, if any, information relative to how these two might interact. However, information suggests that the interaction would be “minimal”. Refer to the botany resource report in the EA for more information. The Deschutes National Forest is currently analyzing potential herbicide treatments under the Draft DNF Invasive Weed EIS (USDA 2005, b).

Alternative 1

Bald Eagle (Threatened, MIS species)

Direct Effects: No direct effects to the bald eagle are expected to occur because bald eagle use in the project area is limited. Furthermore, Bti is not directly toxic to birds, nor would they be directly exposed to the substance. Based on the toxicity and exposure data for Bt, there should be no risk for endangered mammals, birds, plants and non-insect aquatic species (U.S. EPA 1998). Though no specific studies of the effects of Bti on raptors have been conducted, no effect has been found on other birds in laboratory studies and field studies. For example, Lattin et al. (1990a and b) found no toxicity, pathogenicity or weight loss when Bti was administered orally in large doses to young brown quail (*Colinus virginianus*) and young mallards (*Anas platyrhynchos*). Extensive studies on birds and mammals with high doses of unsolubilised Bti spores and crystals have shown no effect (Meadows 1993). Also see general effects summary on page 48.

Indirect effects: No indirect effects are anticipated for eagles as a result of spraying with Bti, i.e., reduction of prey base (fish, waterfowl and mammals). From a review of literature for effects of Bti on non-target organisms, Lacey and Merritt 2004 concluded that Bti appears to pose little direct or indirect toxic threat to fish. In another study, Bti was applied to a river in Michigan to control black flies (*Chironomidae* Family). The study concluded that there were no detectable non-target effects on other invertebrates, or on fish numbers, survival, species composition, or growth (Merritt et al. 1999). Bti is not toxic and does not appear to accumulate in the tissue of prey species. Bti failed to multiply in mammals and ingested cells were eliminated rapidly (Siegel and Shaddock 1990). The risk to mammalian wildlife should be minimal to nonexistent (U.S. EPA 1998). No new studies on mammalian toxicity published after the report by Glare and O’Callaghan (1998) were found in the literature (Stark 2005).

The amount, frequency of application and scope of application would determine effects to food webs and higher order animals. Approximately 150 acres of the existing 165 acres of wetlands (90%) in the project area would be treated. Approximately 6.8 miles of river margin out of 11.3 total miles of riverbank (60%) would be treated. Furthermore, because Bti applications will be limited to 5 per year, some recruitment and subsequent production of mosquitoes and midges would occur between treatments. The time between egg laying and hatching of mosquitoes occurs in as little as 4 days under optimal conditions and up to 3 weeks in colder weather. Since it is impossible to have 100% mortality at any given time, some mosquitoes and midges are expected to remain available as prey to insectivores and therefore, prey for eagles. Therefore, no substantial decrease in prey base (e.g., birds, mammals and fish) would be anticipated for eagles as a result of the project. This alternative would also incrementally reduce the likelihood of eagles to contracting the West Nile Virus (WNV), of which mosquitoes are disease vectors

for.

Cumulative effects: There would be no cumulative effects to these species as a result of this alternative. There are no measurable direct or indirect effects, therefore there are no cumulative effects. The proposed action would not have an additive impact on any past, present or reasonably foreseeable future projects.

Oregon Spotted Frog (Candidate species)

Direct Effects: No direct effects to the Oregon spotted frog are expected to occur. As previously stated, *Oregon spotted frogs are not currently known to occupy the project area*, therefore there would be no potential direct or indirect effects. Bti application would occur at current rates of application. Application would occur predominately in off-channel ponds, wetlands and along river banks. Application would likely occur late spring through summer, coinciding with peak mosquito production.

If OSF were found to occupy or recolonize the likely *historic* (prior to construction of Wickiup Dam) habitat on the river, there still would be no measurable direct or indirect effect on them because the literature demonstrates that Bti does not negatively affect frogs and salamanders (Extoxnet 1996). The World Health Organization (1992) reviewed a number of laboratory and field studies that examined the impact of Bt on frogs, newts, salamanders and toads in which no adverse effects were recorded, no effect of Bti on amphibians has been reported (Glare and O'Callaghan 1998). CMC (2003) found no toxic effects occurring in crustaceans or amphibians. See general effects summary on page 48 for additional information.

Indirect effects: Invertebrates are prey species of OSF. Bull and Wales 2001, suggest that spraying with biological microbial agents, like *Bt var. kurstaki*, is unlikely to be detrimental because those agents do not affect most aquatic insects (USDA Forest Service 2000). From a review of literature for effects of Bti on non-target organisms, Lacey and Merritt 2004 concluded that Bti appears to pose little direct or indirect toxic threat to nontarget benthic invertebrate species. The main negative effect of Bti in streams and rivers may be on predatory species that specialize in foraging on mosquitoes and midges. Generalist predators may be less affected if alternative prey species are present (Lacey and Merritt 2004). Most predators, including the OSF, are generalists, and it is unknown if there are any predators within the project area that are specialized in feeding on mosquitoes or midges. Dragonflies and damselflies (Order Odonata) feed significantly on mosquitoes and midges in both the larval and adult stages (Lambert, 1999). A reduction in the populations of mosquitoes and midges could *potentially* affect the food supply for species of this order.

See the Fisheries section for a complete analysis of effects of Bti on invertebrates. In summary, mosquito and midge larvae constitute a very small portion of the OSF diet. Oregon spotted frogs are opportunistic feeders; their diet includes: slugs, arthropods, crickets, ants, true bugs, dragonflies, damselflies, grasshoppers, beetles, flies, arachnids, crustaceans, earthworms, and other invertebrate prey. Limited aquatic invertebrate sampling was conducted within the project area in recent years and analysis revealed several dozen different genera of chironomidae. Polypedilum was the only chironomid genera found during the sampling (see fisheries BE) and this species is not affected by Bti. Therefore, any potential loss of food resources is expected to be *very* minor, likely to be limited to mosquitoes and spatially limited to areas of direct treatment. Approximately 10% of wetlands and 40% of river margin would not be treated and therefore continue to produce a limited amount of mosquitoes. Furthermore, because Bti applications will be limited to five per year, some recruitment and subsequent production of mosquitoes and midges

would occur between treatments. The time between egg laying and hatching of mosquitoes occurs in as little as four days under optimal conditions and up to three weeks in colder weather. Since it is impossible to have 100% mortality at any given time, some mosquitoes and midges are expected remain available as prey to insectivores. No measurable decrease in prey base would be anticipated for OSF as a result of treatment with Bti.

Cumulative Effects: There would be no cumulative effects to the Oregon spotted frog as a result of insecticide treatments proposed under this alternative because the OSF is not known to occur on Forest Service lands within the project area. Furthermore, there are no measurable direct or indirect effects, therefore there are no cumulative effects. The proposed action would not have an additive impact on any past, present or reasonably foreseeable future projects.

American peregrine falcon (Sensitive, MIS species)

Direct Effects: No direct effects to the peregrine falcon are expected to occur. As previously stated, peregrine falcons are not currently known to occupy the project area; therefore there would be no potential direct or indirect effects. This determination is based upon: 1) no known occupancy, and 2) very limited nesting habitats (i.e., short cliffs) are present. Furthermore, Bti is not directly toxic to birds, nor would they be directly exposed to the substance. Based on the toxicity and exposure data for Bt, there should be no risk for endangered mammals, birds, plants and non-insect aquatic species (U.S. EPA 1998). No specific studies of the effects of Bti on peregrine falcons have been conducted. However, as discussed earlier, no effects to birds were observed from Bti.

Indirect effects: No indirect effects to the peregrine falcon are expected to occur, e.g. reduction of prey (birds, mammals and fish). As stated above, Bti has not been found to be toxic to birds and mammals. Bti is not toxic and does not appear to accumulate in the tissue of prey species and would therefore not present a risk if consumed as prey. Bti failed to multiply in mammals and ingested cells were eliminated rapidly (Siegel and Shadduck 1990). (Siegel and Shadduck 1990) conducted broad tests for mammalian toxicity of Bti on mice, rats and rabbits, only one route, intraperitoneal injection of Bti was the only route that led to significant mortality, but it only occurred at high concentrations, it was concluded that Bti was not a significant mammalian toxicity. A number of other studies in several countries have found no effect on warm-blooded mammals (Glare and O'Callaghan 1998). From a review of literature for effects of Bti on non-target organisms, Lacey and Merritt 2004 concluded that Bti appears to pose little direct or indirect toxic threat to fish. In another study, Bti was applied to a river in Michigan to control black flies (Chironomidae Family). The study concluded that there were no detectable non-target effects on other invertebrates, or on fish numbers, survival, species composition, or growth (Merritt et al. 1999). In a study of *Bti* used to control mosquitoes in Minnesotan wetlands, no effect on red wing black bird populations was determined (Hershey et al. 1998). Hanowski et al (1997) conducted a more detailed study on the effects of Bti on a bird community and determined the application of Bti (Vectobac-G granules) had no effect on the bird community or on 19 individual bird species. See effects discussion for OSF and bald eagle above for additional information.

The amount, frequency of application and scope of application would determine effects to food webs and higher order animals. Any loss of food resources is expected to be very minor, likely to be limited to mosquitoes and spatially limited to areas of direct treatment. Approximately 10% of wetlands and 40% of river margin would not be treated and therefore continue to produce a limited amount of mosquitoes. Furthermore, some recruitment and subsequent production of mosquitoes and midges would occur

between treatments. Since it is impossible to have 100% mortality at any given time, some mosquitoes and midges are expected remain available as prey to insectivores and therefore, prey for peregrine falcons. Therefore, no substantial decrease in prey base (e.g., birds, mammals and fish) would be anticipated for peregrine falcons as a result of this alternative. This alternative would also incrementally reduce the likelihood of peregrine falcons to contract WNV.

Cumulative Effects: There would be no cumulative effects to the peregrine falcon as a result of insecticide treatments. There are no measurable direct or indirect effects; therefore there are no cumulative effects. The proposed action would not have an additive impact on any past, present or reasonably foreseeable future projects.

Red necked grebe (Sensitive Species)

Direct Effects: No direct effects to the red necked grebe are expected to occur. As previously stated, red necked grebes are not currently known to nest in the project area, however there is the potential for individuals to occur in the project area during migration. If individuals were found to occupy or migrate through the project area, there still would be no measurable direct effect on them because Bti is not directly toxic to birds as discussed earlier. No specific studies have been conducted on red necked grebes, however, no effect has been found on birds, including waterfowl, in other laboratory studies.

Indirect effects: No indirect effects are anticipated to occur from implementation of the project, e.g. reduction of prey (insects, amphibians and fish). The red necked grebe is the most generalist predator of the waterbirds, therefore it will be the most thoroughly analyzed and the effects analysis for other waterbirds will be compared to it. Potential effects to the red necked grebe are similar to bald eagle and OSF as previously described previously. The main negative effect of Bti in streams and rivers may be on predatory species that specialize in foraging on mosquitoes and midges. Generalist predators may be less affected if alternative prey species are present (Lacey and Merritt 2004). Most predators are generalists, and it is unknown if there are any predators within the project area that are specialized in feeding on mosquitoes or midges. Dragonflies and damselflies (Order Odonata) feed significantly on mosquitoes and midges in both the larval and adult stages (Lambert, 1999). A reduction in the populations of mosquitoes and midges could potentially affecting the food supply for species of this order.

Bti does not negatively affect frogs and salamanders (Exttoxnet, 1996). The World Health Organization (1992) reviewed a number of laboratory and field studies that examined the impact of Bt on frogs, newts, salamanders and toads in which no adverse effects were recorded, (Glare and O'Callaghan 1998). CMC (2003) found no toxic effects occurring in crustaceans or amphibians. For a complete discussion of effects to aquatic invertebrates, amphibians and fish, see effects see effects discussion for OSF above and reference the fisheries section. Any loss of food resources is expected to be very minor, likely to be limited to mosquitoes and spatially limited to areas of direct treatment. Approximately 10% of wetlands and 40% of river margin would not be treated and therefore continue to produce a limited amount of mosquitoes. Furthermore, some recruitment and subsequent production of mosquitoes and midges would occur between treatments. Since it is impossible to have 100% mortality at any given time, some mosquitoes and midges are expected remain available as prey to insectivores and therefore, prey for the red necked grebe. No substantial decrease in prey base would be anticipated for as a result of the project. This project would also reduce the potential of red necked grebes to contract WNV.

Cumulative Effects: There would be no cumulative effects to the red necked grebe as a result of insecticide treatments. There are no measurable direct or indirect effects; therefore there are no cumulative effects. The proposed action would not have an additive impact on any past, present or reasonably foreseeable future projects.

Horned Grebe, Bufflehead, Harlequin duck, Yellow rail (Sensitive species)

No direct, indirect or cumulative impacts to these species are expected to occur. See effects discussion for the red necked grebe above.

Pacific Fisher (Sensitive Species)

Direct Effects: This alternative would not directly impact the Pacific Fisher. There are no known records of fishers nesting or occupying the project area and there is limited habitat available. It is possible that animals might move into and nest, or migrate through the project area. Therefore, there is the potential to disturb animals during *application* of the insecticide; any disturbance from bi-weekly hand application at sites would be negligible given the background of existing heavy recreation use in the project area. Bti is not directly toxic to mammals, nor would they be directly exposed to the substance. Based on the toxicity and exposure data for Bt, there should be no risk for endangered mammals, birds, plants and non-insect aquatic species (U.S.EPA 1998). Furthermore, the risk to mammalian wildlife should be minimal to nonexistent (U.S. EPA 1998). (Siegel and Shaddock 1990) conducted broad tests for mammalian toxicity of Bti on mice, rats and rabbits, only one route, intraperitoneal injection of Bti was the only route that led to significant mortality, but it only occurred at high concentrations, it was concluded that Bti was not a significant mammalian toxicity. A number of other studies in several countries have found no effect on warm-blooded mammals (Glare and O'Callaghan 1998). No new studies on mammalian toxicity published after the report by Glare and O'Callaghan (1998) were found in the literature (Stark 2005).

Indirect Effects: Bti is not toxic and does not accumulate in the tissue of prey species. Extensive studies on birds and mammals with high doses of unsolubilised Bti spores and crystals have shown no effect (Meadows 1993). As discussed earlier, no effect has been found on birds in other laboratory studies. Bti failed to multiply in mammals and ingested cells were eliminated rapidly (Siegel and Shaddock 1990). Generally, Bti persists for days rather than months as reported for some of the more toxic chemicals for mosquito control (Glare and O'Callaghan 1998). Nor substantial decrease in their forage base anticipated e.g., mammals and birds. Therefore, no measurable indirect effects are anticipated.

Cumulative Effects: There would be no cumulative effects to the Pacific fisher as a result of insecticide treatments proposed under this analysis. There are no measureable direct or indirect effects, therefore there are no cumulative effects. The proposed action would not have an additive impact on any past, present or reasonably foreseeable future projects.

Raptors (MIS)

Direct, Indirect and Cumulative Effects: No direct effects to raptors are expected to occur. There is the potential to disturb nesting raptors during *application* of the insecticide, however, any disturbance from bi-weekly hand application at sites would be negligible given the background of the existing high level of recreation use in the project area.

Bti is not directly toxic to birds as previously discussed, nor would they be directly exposed to the substance. Though no specific studies of the effects of *Bti* on raptors have been conducted, no effect has been found on other birds in laboratory studies. Extensive studies on birds and mammals with high doses of unsolubilised *Bti* spores and crystals have shown no effect (Meadows 1993).

No indirect effects to raptors are expected to occur. As stated previously, *Bti* is not toxic and does not appear to accumulate in the tissue of prey species and would therefore not present a risk if consumed as prey. *Bti* failed to multiply in mammals and ingested cells were eliminated rapidly (Siegel and Shaddock 1990). (Siegel and Shaddock 1990) conducted broad tests for mammalian toxicity of *Bti* on mice, rats and rabbits, only one route, intraperitoneal injection of *Bti* was the only route that led to significant mortality, but it only occurred at high concentrations, it was concluded that *Bti* was not a significant mammalian toxicity. From a review of literature for effects of *Bti* on non-target organisms, Lacey and Merritt 2004 concluded that *Bti* appears to pose little direct or indirect toxic threat to fish. In another study, *Bti* was applied to a river in Michigan to control black flies (Chironomidae Family). The study concluded that there were no detectable non-target effects on other invertebrates, or on fish numbers, survival, species composition, or growth (Merritt et al. 1999). See effects discussion for the OSF and the fisheries section for more information on effects to aquatic invertebrates.

The amount, frequency of application and scope of application would determine effects to food webs and higher order animals as described earlier. No substantial decrease in prey base (e.g., birds, mammals and fish) would be anticipated for raptors as a result of the project. This alternative would also incrementally reduce the potential of raptors to contract WNV.

There would be no cumulative effects to these species as a result of this alternative. There are no measurable direct or indirect effects, therefore there are no cumulative effects. The proposed action would not have an additive impact on any past, present or reasonably foreseeable future projects.

Cavity nesters, MIS, associated Focal Species, and cavity-nesting Birds of Conservation Concern

Direct, Indirect and Cumulative Effects: There will be no direct, indirect or cumulative effects to any of the MIS species known or suspected to occur in or adjacent to the project area as a result of this project. As previously stated, this project will not affect standing snags or down woody material. *Bti* is not directly toxic to birds, nor would they be directly exposed to the substance. These species are not riparian dependent; they would not be exposed to *Bti* because it is only being applied to wet areas. No indirect effects to prey species are expected to occur. Little or no toxicity was reported for *Bti* on honeybees, green wing lace larvae, parasitic wasps and predacious water beetles (U.S. EPA 1998). These species primarily consume animal food, including wood boring larvae of moths and beetles, other insects (caterpillar, ants) and fruits and seeds (NatureServe 2006). Given that *Bti*, does not affect terrestrial insects and only affects mosquitoes, *potentially* midges and some *aquatic* Lepidoptera (Order of moths and butterflies), the potential for negative effects to these species would be very minimal and not measurable. This is especially evident when considering the small scope of this project in relation to the range of these species. It is important to note that none of the potentially susceptible aquatic midges or Lepidoptera were identified in recent sampling of aquatic invertebrates on the Deschutes River—see fisheries section.

There would be no cumulative effects to these species as a result of this alternative. There are no measurable direct or indirect effects, therefore there are no cumulative effects. No previous, current or

reasonably foreseeable future projects would have an additive impact on the proposed action.

Neotropical Migratory Birds (Birds of Conservation Concern), Focal Species, and Ecological Indicators (covered as Focal species)

Direct, Indirect and Cumulative Effects: There will be no measurable direct, indirect or cumulative effects to any of the NTMB species known or suspected to occur in or adjacent to the project area as a result of this project. Bti is not directly toxic to birds, nor would they be directly exposed to the substance. Though no specific studies of the effects of Bti on raptors have been conducted, no effects have been reported on other birds in laboratory studies and field studies. None of these species are riparian dependent, however, several species will utilize riparian areas during migration e.g., the Nashville warbler and Gray flycatcher. Other species such as the olive sided flycatcher will occasionally forage near riparian areas (NatureServe 2006). Therefore, the amount of exposure to Bti would be *very* minimal.

No measurable decrease in prey base would be expected for NTMB's as a result of treatment with *Bti*. These species are generally insectivores (flycatchers and gleaners) but feed on a variety of plant and animal food including: moths, beetles, spiders, ants, earthworms, crickets, dragonflies, damselflies, grasshoppers, other insects and fruits and seeds (NatureServe 2006). It is assumed that the majority of the diets of these species are terrestrial insects and an unknown portion of their diet is derived from aquatic insects. The effects of *Bti* on terrestrial insects is negligible. Research and field experiments have shown that *Bti* has no direct toxic effects on beneficial and predacious arthropods or insects such as honeybees, beetles, mayflies, dragonflies, damselflies, stoneflies, caddisflies and true bugs (Extonet 1996 & CMC 2003 in OtterTail Environmental, 2003). Little or no toxicity was reported for Bti on honeybees, green wing lace larvae, parasitic wasps and predacious water beetles (U.S. EPA 1998).

Given that *Bti*, does not affect terrestrial insects and only mosquitoes, *potentially* midges and some *aquatic* Lepidopterans, the potential for negative effects to NTMB's would be very minimal and not measurable. This is especially evident when considering the small scope of this project in relation to the range of these species. It is important to note that none of the potentially susceptible aquatic midges or Lepidoptera were identified in recent sampling of aquatic invertebrates on the Deschutes River—see fisheries section. Also see general effects summary on page 48 and effects discussion for cavity nesters above for additional information.

Furthermore, any potential loss of mosquitoes as a food resource is expected to be spatially limited to areas of direct treatment. Bti applications would be limited spatially and temporally as described earlier. Since it is impossible to have 100% mortality at any given time, some mosquitoes and midges are expected to remain available as prey to insectivores.

There would be no cumulative effects to these species as a result of this alternative. There are no measurable direct or indirect effects, therefore there are no cumulative effects. No previous, current or reasonably foreseeable future projects would have an additive impact on the proposed action.

Great gray owl (MIS)

Direct, Indirect and Cumulative Effects: There will be no direct, indirect or cumulative effects to the great gray owl as a result of this alternative. The analysis of potential effects to the great gray owl are very similar to the effects on raptors (effects to prey base) as discussed above or on bald eagles or peregrine

falcons as discussed earlier.

Great blue heron (MIS)

Direct, Indirect and Cumulative Effects: There will be no direct, indirect or cumulative effects to the great blue heron as a result of this alternative. Though no specific studies of the effects of Bti on great blue herons have been conducted, no effect has been found on other birds in laboratory studies and field studies. For example, Hanowski et al (1997) conducted a detailed study on the effects of Bti on a wetland bird community and determined the application of Bti (Vectobac-G granules) had no effect on the bird community or on 19 individual bird species.

No measurable decrease in prey base would be expected for great blue herons as a result of treatment with Bti. This is especially evident when considering the small scope of this project in relation to the range of this species. As mentioned above, these species are generalist consumers and feed on a variety of animal food. The analysis of potential effects to the great blue heron are very similar to the effects on previously analyzed species, e.g., raptors, bald eagles, NTMB's and OSF. Also see general effects summary on page 48 for additional information.

Big Game (deer (MIS) and elk (MIS))

Direct, Indirect and Cumulative Effects: There will be no direct or indirect effects to deer and elk as a result of implementation of this project. *Bti* is not directly toxic to mammals, nor would they be directly exposed to the substance. The risk to mammalian wildlife should be minimal to nonexistent (U.S. EPA 1998). Based on the toxicity and exposure data for Bt, there should be no risk for endangered mammals, birds, plants and non-insect aquatic species (U.S. EPA 1998). (Siegel and Shadduck 1990) conducted broad tests for mammalian toxicity of *Bti* on mice, it was concluded that Bti was not a significant mammalian toxicity. A number of other studies in several countries have found no effect on warm-blooded mammals. No new studies on mammalian toxicity published after the report by Glare and O'Callaghan (1998) were found in the literature (Stark 2005). This project will not affect any habitat components of critical elk habitat including forage; there is no evidence that Bti causes any adverse effects to plants (U.S. EPA 1998).

There would be no cumulative effects to deer and elk as a result of this alternative. There are no measurable direct or indirect effects, therefore there are no cumulative effects. No previous, current or reasonably foreseeable future projects would have an additive impact on the proposed action.

Townsend's big-eared bat (MIS)

Direct, Indirect and Cumulative Effects: There will be no measurable direct, indirect or cumulative effects to the Townsend's big-eared bat as a result of this alternative. However, there may be a minor negative indirect effect to the preferred prey of the bat under this alternative. The potential for negative effects to these species would be very minimal and not measurable *because Bti* is only known to affect mosquitoes, *potentially* midges and some *aquatic* Lepidoptera (moths and butterflies). It is important to note that none of the potentially susceptible aquatic midges or Lepidoptera were identified in recent sampling of aquatic invertebrates on the Deschutes River—see fisheries section. The potential effects on the Townsend's big-eared bat are very similar to NTMB's and cavity nesters. See previous discussion on NTMB's and cavity nesters above and the general effects summary on page 48 for additional information.

Alternative 2

Northern Bald Eagle

Direct, Indirect, and Cumulative Effects: Effects from this alternative would be very similar to Alternative 1, though there would be an additional 20 acres treated and include aerial applications. Helicopter application would be limited to 126 acres of wetlands due to mitigations for wildlife and recreation. This project proposes to treat approximately 170 acres of the existing 190 acres of wetlands (90%) in the project area. Approximately 11.5 miles of riverbank out of 19.2 total miles of riverbank (60%) would be treated. No helicopter treatment would occur on 44 acres of wetlands to avoid conflicts with recreation and wildlife uses (37 acres recreation, 7 acres restricted for wildlife). Nearly 3.25 miles of riverbank would be excluded from aerial treatment due to restrictions. See wildlife report (Appendix B) for more information.

As previously stated, the Bates Butte bald eagle nest is located approximately 0.70 mile(s) from the southern end of the proposed project area boundary, 2 miles south of General Patch Bridge. Bald eagles likely utilize the riparian corridor throughout the spring and summer, foraging up and down the river through the project area (Popp and Isaccs et al, 1994, in USDA 2006). The proposed action *could* impact foraging bald eagles if aircraft were operating in the area. The helicopter would be used for aerial treatments no more than 2-3 times a year on FS lands during the operating season. Helicopter use on Forest Service land would be of short duration (approx. one hour), hovering temporarily over each treatment while discharging the granular form of insecticide. Therefore, these effects would be negligible given scope of the helicopter operations and the existing background air traffic and existing recreation use. It is important to consider that there is currently a high level of air traffic and recreation activity that occurs in the general vicinity as the proposed project is near the Sunriver Airport. In 2005, there were between 800-1000 take off and landings during July and August on average. No direct effects to the bald eagle are expected to occur because the helicopter would be operating outside of the ½ mile direct line of sight distance from the existing nest.

There would be no cumulative effects to the bald eagle as a result of this alternative. There are no measurable direct or indirect effects, therefore there are no cumulative effects. The proposed action would not have an additive impact on any past, present or reasonably foreseeable future projects.

Oregon Spotted Frog

Direct, Indirect, and Cumulative Effects: Effects from this alternative would be very similar to Alternative 1, differences would likely be immeasurable. There would be an additional 20 acres treated.

American peregrine falcon

Direct, Indirect, and Cumulative Effects: Effects from this alternative would be very similar to Alternative 1, differences would likely be immeasurable. There would be additional 20 acres treated. Helicopter application would occur on approximately 126 acres out of 170 total acres of wetlands due to mitigations for wildlife and recreation. See wildlife report (Appendix B) for additional information.

As previously stated, peregrine falcons are not currently known to occupy the project area. Helicopter use

of the Benham Falls area (site of historic nest) would be restricted to avoid conflicts with recreationists. There is a limited chance that peregrine falcons might forage or migrate through the project area. Under this scenario, there could be some minor effects to roosting and foraging if aircraft were operating in the area. However, the helicopter would only be used for aerial treatments 2-3 times a year on FS lands during the operating season. Helicopter use would be of short duration (approximately 1 hour on national forest lands). Therefore, these effects would be negligible given scope of the helicopter operations and the existing background air traffic and existing recreation use. No additional direct, indirect or cumulative impacts are anticipated (see Alternative 1).

Red necked grebe

Direct, Indirect, and Cumulative Effects: Effects from this alternative would be very similar to Alternative 1, differences would likely be immeasurable. There would be additional 20 acres treated. Helicopter application would occur on approximately 126 acres out of 170 acres total of wetlands due to mitigations for wildlife and recreation. No direct, indirect or cumulative impacts to the red necked grebe are expected to occur.

Horned Grebe, bufflehead, harlequin duck, yellow rail

Direct, Indirect, and Cumulative Effects: No direct, indirect or cumulative impacts to these species are expected to occur. See effects discussion for the red necked grebe above.

Pacific Fisher

Direct, Indirect, and Cumulative Effects: Effects from this alternative would be very similar to Alternative 1, differences would likely be immeasurable.

Raptors

Direct, Indirect, and Cumulative Effects: Effects from this alternative would be very similar to Alternative 1, differences would likely be immeasurable. No direct effects to osprey and Cooper's hawks are expected to occur. Two osprey nests and one Cooper's hawk nest has been identified in the project area and mitigation actions would be applied (See mitigation measures section, page 15). Helicopter application would occur on approximately 126 acres of wetlands. No helicopter treatment would occur on 44 acres of wetlands to avoid conflicts with recreation and wildlife uses (37 acres recreation, 7 acres for wildlife). Nearly 3.25 miles of riverbank would be excluded from aerial treatment due to restrictions.

There is the potential for minor effects to roosting and foraging raptors if aircraft were operating in the area. However, the helicopter would only be used for aerial treatments 2-3 times a year on FS lands during the operating season. Helicopter use would be of short duration (approximately 1 hour). Therefore, these effects would be negligible given the scope of the helicopter operations and the existing background air traffic and existing recreation use. No additional direct, indirect or cumulative effects are anticipated.

Cavity nesters, MIS, associated Focal Species, cavity-nesting Birds of Conservation Concern, Neotropical Migratory Birds (Birds of Conservation Concern), Focal Species, Ecological Indicators

(covered as Focal species), Great Gray Owl, Great Blue Heron, Big Game (deer (MIS) and elk (MIS), Townsend's big-eared bat (MIS)

Direct, Indirect, and Cumulative Effects: Effects to all these species from this alternative would be very similar to Alternative 1, differences would likely be immeasurable. No additional direct, indirect or cumulative effects are anticipated.

Alternative 3

Northern Bald Eagle

Direct, Indirect, and Cumulative Effects: Implementation of this alternative *may* incrementally increase the insect prey population for prey (e.g., fish) of the bald eagle, but the effect would not be measurable. Mosquito treatments would continue on private land within the Four Rivers Vector Control District. This alternative would potentially increase the likelihood for bald eagles to contract WNV. No measurable direct, indirect or cumulative effects to the bald eagle are expected to occur.

Oregon Spotted Frog

Direct, Indirect, and Cumulative Effects: Implementation of this alternative *would* incrementally increase the insect prey population for OSF if they were found to occupy the site. No measurable direct or indirect effects to the Oregon spotted frog are expected to occur. No cumulative effects are expected because there are no direct or appreciable indirect effects.

American peregrine falcon

Implementation of this alternative *may* incrementally increase the insect prey population for prey (e.g., fish and birds) of the peregrine falcon, but the effect would not be measurable. This alternative would *potentially* increase the likelihood of peregrine falcons to contract WNV. No measurable direct, indirect or cumulative effects to the peregrine falcon are expected to occur.

Red necked grebe

Direct, Indirect, and Cumulative Effects: Implementation of this alternative *may* incrementally increase the insect prey population for the red necked grebe, but the effect would not be measurable. No measurable direct, indirect or cumulative impacts to the red necked grebe are expected to occur.

Horned Grebe, Bufflehead, Harlequin duck, Yellow rail

Direct, Indirect, and Cumulative Effects: No direct, indirect or cumulative impacts to these species are expected to occur. See effects discussion for the red necked grebe above.

Pacific Fisher

Direct, Indirect, and Cumulative Effects: Implementation of this alternative *may* incrementally increase the insect prey population for insectivorous birds or other potential prey of the fisher, but the effect would not likely be measurable. No measurable direct, indirect or cumulative effects to the Pacific fisher are

expected to occur.

Raptors

Direct, Indirect, and Cumulative Effects: Implementation of this alternative *may* incrementally increase the insect prey population for prey (e.g., fish and birds) for raptors, but the effect would not be measurable. This alternative would *potentially* increase the likelihood of raptors to contract WNV. No potential for harassment from helicopter operations would occur. No measurable direct, indirect or cumulative effects to raptors are expected to occur.

Cavity nesters, MIS, associated Focal Species, cavity-nesting Birds of Conservation Concern, Neotropical Migratory Birds (Birds of Conservation Concern), Focal Species, Ecological Indicators (covered as Focal species), Great Gray Owl, Great Blue Heron, Big Game (deer (MIS) and elk (MIS), Townsend's big-eared bat (MIS)

Direct, Indirect, and Cumulative Effects: No measurable direct, indirect or cumulative effects to any of these species are expected to occur.

Common to All Alternatives: In summary, there will be no measurable direct, indirect or cumulative effects to any of the wildlife species known or suspected to occur in or adjacent to the project area as a result of any of the three alternatives, with associated mitigation measures. There should be no risk for endangered mammals, birds, plants and non-insect aquatic species (U.S. EPA 1998). Bt's have been used for many years in agriculture and forestry situations with no reported problems (Glare and O'Callaghan 1998). Although no species analyzed in this report have been specifically studied for effects of *Bti*, no effect has been found on birds, mammals and fishes in other laboratory studies. *Bti* appears to pose little direct or indirect toxic threat to fish and most aquatic invertebrates. No measurable decrease in prey base would be anticipated for wildlife as a result of spraying with *Bti*, most wildlife are generalist, opportunistic feeders. Mosquito and midge larvae constitute a very small portion of the diet for insectivorous wildlife or for those species that prey on insectivores. This analysis has determined that any potential loss of food resources is expected to be *very* minor, likely to be limited to mosquitoes and spatially limited to areas of direct treatment. Some habitat within the project area would not be treated and therefore continue to produce a limited amount of mosquitoes. It is also impossible to have 100% mortality at any given time, therefore some mosquitoes and potentially midges are expected remain available as prey to insectivores. Furthermore, many species analyzed are also feeding on terrestrial insects which are not affected from *Bti* at the concentrations proposed for application within this project. There would be no cumulative effects to these species as a result of this alternative. There are no measurable direct or indirect effects, therefore there are no cumulative effects. None of the alternatives would have a cumulative effect on other past, present, or reasonably foreseeable future projects.

The Wildlife Biological Evaluation (Appendix B) concluded that the three alternatives would have “**No Effect**” to the northern bald eagle and the Oregon spotted frog, and “**No Impact**” to the bufflehead duck, horned grebe, western grebe, yellow rail, peregrine falcon and Pacific fisher

Botany

Proposed, Endangered, Threatened, or Sensitive Plants

Common to All Alternatives: The Botany BE determined there would be “**No Impact**” to sensitive plant species or their habitat.

Alternatives 1 and 2

Direct and Indirect Effects: These alternatives pose little identifiable direct or indirect effects to vegetation, including sensitive plants, according to a literature survey. No evidence of harmful effects to vegetation could be found; Bti is primarily targeted at insects and this comprises the vast majority of the literature surveyed. A Canadian publication states: “It is not poisonous to plants and has not shown any adverse effect upon seed generation or plant vigor.” (Agriculture Canada 1982).

In a Canadian document written by the Saskatchewan Environmental Society 2003 against the use of Bt in a spraying project, the only concern mentioned under the “Vegetation” section was that Bt spores have been found on the underside of leaves after spraying and could pose a threat to caterpillars.

Cumulative Effects: Bti application has been ongoing in the Sunriver area of the Deschutes River since at least 1990; no effects to sensitive plants, positive or negative, have been noted in that area, although no formal monitoring has occurred.

Alternative 3

There are no direct, indirect, or cumulative effects to TES plants as no treatments would occur.

Noxious Weeds (Invasive Plants)

Alternatives 1 and 2

Direct and Indirect Effects: There are no anticipated direct or indirect effects from implementation of these alternatives, because the Bti will be released by people on foot or by helicopter. The Bti itself is not known to injure plants. (Agriculture Canada, 1982).

Cumulative Effects: There are several places where Bti application is proposed where there is also herbicide use (clopyralid) proposed, although a decision has not yet been made about that. There is little, if any, information relative to how these two might interact. However, an e-mail exchange with David Bakke, Pesticide-Use Specialist and Invasive Plant Program Manager, State and Private Forestry, USFS, Vallejo, California, suggests that the interaction would be “minimal”. From the 2004 Forest Service risk assessment for clopyralid, Bakke notes McCall et al 1979, “which showed that soil processes (which are largely driven by bacteria) are not affected.” (Bakke personal communication, 2006). If clopyralid is approved for use within the riparian zone, it is likely that the timing of application of Bti will overlap in time, as well as space, with clopyralid. However, the use of the herbicide will be short-lived, as the target weed species are killed and depleted. This means that it is possible that the overlap might only occur from one to three years, depending on how soon the weed sites are eliminated or reduced. It also means that, as time progresses and the weed sites are reduced, less herbicide will be needed to treat them. It is also possible that only a subset of the weed sites will be given high enough priority for treatment that they would actually receive treatment.

Also relative to the temporal issue, the half-life of clopyralid is 21-48 days, so “if the two applications [Bti and clopyralid] are separated by several months, it is unlikely that there would be much clopyralid left to possibly interact with Bt in any case” (Bakke, personal communication 2006).

High levels of recreation will continue in the project area, bringing with it the possibility of new weed introductions and spread. The Forest Service is proposing to implement the MYST project near the south end of the project area sometime within the next year, as well as the Set timber sale adjacent to the project area, which involve heavy equipment and the attendant potential for weed introductions. There is always the risk that the public, entering the Forest in their vehicles (passenger, trucks, OHV’s, bicycles, etc) or pack animals will introduce new weed populations. This cannot be dealt with at the project level, but rather is being addressed through broader public education efforts. And, although vehicles will be used to transport the workers delivering the Bti to the site, the chance of them bringing weeds with them are relatively minor.

Alternative 3: There would be no direct, indirect, or cumulative effects as no treatments would occur. Introductions or reductions of invasive plant populations would be from other sources.

Recreation

Alternative 1

Direct and Indirect Effects: This alternative would have no direct or indirect effects to recreation. Bti is not harmful to humans when applied according to label instructions. Applications would be made by hand crews and would not disturb the recreational experience of forest visitors. Nuisance from mosquitoes and the potential for disease transmission from mosquitoes would continue to be reduced.

Cumulative effects: The project area receives significant recreational use. Crews applying Bti on foot within riparian areas would have minimal effects on the recreation experience of forest visitors.

Alternative 2

Direct and Indirect Effects: This alternative includes the occasional use of helicopter treatment of Bti (approximately 3 treatments annually for duration of 1 hour on national forest land). Air traffic is not uncommon in the area because of the presence of the Sunriver Airport. Approximately 800-1000 take-offs and landings occur during the peak season of July and August (Landsburgh 2006, personal communication). However, the helicopter flight path would typically be low elevation and potentially disturb some river visitors. The early operating hours (6 am – 12 or 2 pm) and other mitigation measures would limit some potential conflict with river users. The restriction of helicopter treatments from developed recreation sites and wildlife mitigations (see mitigation measures page 14-15) reduces the acreage on national forest land eligible to be treated aerially by approximately 44 acres, therefore approximately 126 acres would potentially be treated by helicopter. Since this alternative treats approximately 20 more acres than Alternative 2, nuisance from mosquitoes and the potential for disease transmission to recreationists would be reduced.

Cumulative Effects: Operation of the helicopter on national forest land would add approximately 3 hours of aircraft flight time each summer within the project area. Presently, there are thousands of hours

of flight time within the project area each summer season with the presence of the Sunriver Airport. The additional hours as a result of the helicopter use would have minimal disturbance to recreation from the perspective of the whole summer season, but disturbance would be more evident during the 2-3 days/summer season of operation coupled with the low elevation flights directly over and adjacent to the river.

Alternative 3

Direct and Indirect Effects: There would be no direct effects to forest visitors of the area as no treatments would occur. Indirect effects to visitors may result from increased nuisance from mosquitoes and increased potential for disease transmission.

Cumulative Effects: There would be no cumulative effects as no treatments would occur. Treatments would continue to occur on private land.

MANAGEMENT DIRECTION CONSISTENCY

Following is an assessment of the consistency of the three alternatives with current management direction for the project area.

Deschutes National Forest Plan Consistency

For a review of applicable Forest Plan S & Gs, see page 8. All alternatives are consistent with S & Gs RP-2, 3, 4 and 41 by maintaining and protecting riparian and riparian-dependent resources. A Special Use permit would be required should Alternative 1 or 2 be selected. Implementation of Best Management Practice W-6 would be consistent with S & G RP-7. None of the alternatives are inconsistent with S & G FI-7 as the potential production of the Forest's fishery resource is not significantly reduced.

Upper Deschutes Wild and Scenic River and State Scenic Waterway Plan Consistency

All the alternatives are consistent with S & Gs and direction of the River Plan. Geologic, Scenic, Vegetation, and Cultural Outstandingly Remarkable Values (ORVs) were not expected to be affected by any of the alternatives, therefore no effects analysis on these resources was undertaken. These resources would be maintained by all alternatives. Fishery, Recreation, and Hydrologic ORVs are maintained by all alternatives, as described in the Environmental Consequences section of this analysis. Potential adverse effects would be limited by mitigation measures and project design. All alternatives are consistent with the River Plan Standard for special uses (pg. 38 in River Plan). Alternatives 1 and 2 would result in the issuance of a special use permit that would be consistent with, complement, or support the goals of the river plan and would not adversely impact other river uses. These two alternatives promote stewardship, protect resources, and respond to a demonstrated need. Alternative 2 has more potential for short term adverse impacts to the recreation resource because of the use of a helicopter. Mitigation measures and alternative design would reduce impacts.

Newberry National Volcanic Monument (NNVM) Consistency

NNVM S & Gs are found on page 9. A small portion of the project area (approximately 2 acres) is within the Lava Butte Zone. There are no specific standards and guidelines regarding riparian-dependent species. All alternatives are consistent with the Monument wide standards and guidelines of the NNVM Management Plan, including M-38 and M-49, which have objectives of protecting Threatened, Endangered, and Sensitive Wildlife species and protection of water quality through the application of BMPs, respectively.

Inland Native Fish Strategy (INFISH) Consistency

Riparian Management Objectives Compliance

The Riparian Management Objectives (RMOs) from INFISH are listed below in Tables 4 and 5. According to INFISH, not all of the described features may occur within a specific stream segment of a stream within a watershed, but all generally should occur at the watershed scale for stream systems of moderate size. Components of what is considered good habitat can vary geographically, and site specific RMOs are encouraged to be established through watershed analysis or site-specific analysis. Latitude can be used for assessing the importance of an objective based on the condition of the other objectives. The RMOs applicable to a forested system include pool frequency, water temperature, large woody debris, and width/depth ratio. The analysis below is focused on the Deschutes River. Data is from a stream survey recently completed (Dachtler, 2005).

Pool frequency: Pool frequency is not being met within the project area. The average bankfull width of the Deschutes River in the project area is approximately 180 feet. According to Table 5 below from INFISH, there should be between 9 and 12 pools/mile. Under existing conditions there are only approximately 3.5 pools/mile. This value likely approximates the historic frequency. Spring-fed systems often have low pool frequencies, and are dominated by glide habitats.

Water temperature: This objective is not being met within the project area, and has been addressed under the Water Resources Existing Condition section. The water temperature standard is being met in some of the other reaches above and well below the project area.

Width/depth ratio: The existing width/depth ratio for the project area ranges from 20.9 to 64.4, far exceeding the <10:1 ratio objective listed in INFISH, but is typical for the Deschutes River from Wickiup Reservoir to Bend, a distance of 60 miles. This ratio has likely increased since flow regulation began more than 50 years ago at Wickiup Dam. Width has increased 20% during this time. However, the ratio was likely not under 10:1 prior to regulation. Spring-fed systems often have naturally high width/depth ratios.

Large Woody Debris: This objective is not being met. The stream survey documented about 14 pieces/mile. Recent habitat projects have added several hundred trees to the Deschutes River within the project area, however most of these were smaller than 12" diameter and 35' length.

Table 4. Interim Riparian Management Objectives (RMOs)

Habitat Feature	Interim Objectives
Pool Frequency	Varies by channel width (See Table below)
Water Temperatures	No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period.) Maximum water temperatures below 59° F within adult holding habitat and below 48° F within spawning and rearing habitats.
Large Woody Debris (forested systems)	East of Cascade Crest in Oregon, Washington, Idaho, Nevada, and western Montana: >20 pieces/mile; >12” diameter; >35’ length.
Bank Stability (non-forested systems)	>80 per cent stable.
Lower Bank Angle (non-forested systems)	>75 per cent of banks with <90° angle (i.e., undercut).
Width/Depth Ratio	<10, mean wetted width divided by mean depth

Table 5. Interim objectives for pool frequency

Wetted width (feet)	10	20	25	50	75	100	125	150	200
Pools per mile	96	56	47	26	23	18	14	12	9

Effects to RMOs and Consistency with INFISH S & Gs

Alternative 1 (No Action)

The No Action alternative would result in the continuation of the vector control program on Forest Service lands within the project area in accordance with the existing special use permit. There are no ground-disturbing activities, or other activities that have potential to affect the RMO’s. There would be no direct, indirect, or cumulative effects to the RMOs.

Alternative 2 (Proposed Action)

This alternative would modify the current vector control program to include an additional approximately 20 acres and allow aerial treatments on Forest Service lands. There would be no direct, indirect, or cumulative effects to the RMOs as no ground disturbance or other activities that have potential to affect the RMO’s would occur.

Alternative 3

This alternative would eliminate the treatment of mosquitoes on Forest Service lands within the project area. There would be no direct, indirect, or cumulative effects to the RMO's. This alternative is consistent with INFISH Standard and Guideline RA-3 as it does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.

Common to Alternatives 1 and 2

These alternatives are consistent with INFISH Standard and Guidelines RA-3 and RA-4 as they do not retard or prevent attainment of Riparian Management Objectives and avoid adverse effects on inland native fish. No Bti would be stored long term within RHCAs. There is potential for the prey base for native fish to be affected if chironomid populations were adversely affected in Alternatives 1 and 2, but the importance of chironomids in the fish diet is unknown. Several alternative food sources are available. In addition, limited sampling found that chironomid populations are abundant. The Fisheries Biological Evaluation concluded that some individual redband trout may be impacted if there are indirect effects to the prey base, but would not create a significant trend toward federal listing. Any adverse effects would be negligible and immeasurable. Similar effects would be expected for the native mountain whitefish.

Prime Lands

There are no lands within the planning area that are classified as prime farm or rangelands. Proposed activities in Alternative 2 (Proposed Action) would not change areas classified as prime forestland. There would be no direct, indirect, or cumulative adverse effect to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, "Land Use Policy".

Civil Rights and Environmental Justice

Civil Rights legislation and Executive Order 12898 (Environmental Justice) direct an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, disabled people, and low-income groups. The purpose of the analysis is to determine whether adverse civil rights impacts are anticipated on an underrepresented population. The analysis is to determine also whether disparate or disproportionate impacts associated with the alternatives are anticipated. The benefits from vector control does not discriminate between subsets of the general population. All alternatives are consistent with this Executive Order.

Compliance With State and Local Laws

Implementation of any of the alternatives would be consistent with relevant Federal, State and local laws, regulations, and requirements designed for the protection of the environment including the Clean Air and Clean Water Act. None of the alternatives establishes a precedent for future actions or a decision in principle about a future consideration.

Other Effects and Findings

No designated roadless areas, old growth stands, prime farmland, Wild and Scenic Rivers or parkland would be adversely affected by the proposed activities. No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Proposed Action).

Proposed vector control management activities are consistent with the Record of Decision for the Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation and the subsequent Mediated Agreement of 1989 (Refer to Appendix C of the project files at the Bend-Fort Rock Ranger

District office for further information and a discussion of other National Forest Management Act findings).

Alternative 2 (Proposed Action) is consistent with the goals, objectives and direction contained in the Deschutes National Forest Land and Resource Management Plan and accompanying Final Environmental Impact Statement and Record of Decision dated August 27, 1990 as amended by the Regional Forester's Forest Plan Amendment #2 (6/95) and Inland Native Fish Strategy.

A biological assessment (BA) is not required. A Level I team review is required.

Compliance with National Forest Management Act (NFMA) Requirements: Alternative 2 is consistent with Forest-wide standards and guidelines, Management Area prescriptions and general management requirements.

This document supports practices that are consistent with direction from the February 3, 1999 Executive Order on Invasive Species (Executive Order #13112). This order requires federal agencies to use relevant programs and authorities to prevent the introduction and spread of invasive species.

LIST OF PLANNING PARTICIPANTS

This section identifies the Forest Service personnel who participated in the analysis and the preparation of the EA. For a list of organizations and individuals contacted during the scoping process, refer to the Official Planning Record located at the Bend-Ft. Rock Ranger District.

Interdisciplinary Team

Tom Walker	District Fisheries Biologist/Team Leader/Writer
Mark Lehner	Wildlife Biologist
Charmane Powers	Botanist
Les Moscoso	Recreation/Special Uses
Linda Carlson	Special Uses
Mollie Chaudet	Reviewer

AGENCIES CONTACTED AND CONSULTATION WITH OTHERS

Agencies contacted were the Oregon Department of Fish and Wildlife, US Fish and Wildlife Service, Oregon Department of Human Services, and the Deschutes County Health Department. Bruce Landolt, Four Rivers Vector Control District Manager, provided technical information on operations of the vector control program.

All Project Design Criteria listed in the FY 2006-2009 Programmatic Biological Assessment have been met for northern bald eagle and consultation with U.S. Fish and Wildlife Service (USFWS) is not recommended.

All Project Design Criteria listed in the FY2003-2006 Programmatic Biological Assessment have been met for Oregon Spotted Frog. Communication with USFWS was initiated March 17, 2006. Formal consultation with USFWS is not required since it has Candidate status, rather than threatened or endangered.

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