Helena Area Resource Office
930 Custer Avenue W
Helena, MT 59620 March 6, 2006

TO: Governor's Office, Mike Volsesky, Room 204, State Capitol, P.O.200801, Helena, MT 59620-0801
Environmental Quality Council, Capitol Building, Room 106, P.O Box 201704, Helena, MT 59620
Dept. Environmental Quality, Metcalf Building, P.O. Box 200901, Helena, MT 59620-0901
Montana Fish, Wildlife & Parks
- Director's Office
- Parks Division
- Fisheries Division
- Wildlife Division
- Enforcement Division
- Lands Section
- Design & Construction Bureau
- Legal Unit
- FWP Commissioners

MT Historical Society, State Historic Preservation Office, P.O. Box 201202 Helena, MT 59620-1202
MT State Parks Association, P.O. Box 699, Billings, MT 59103
MT State Library, 1515 E. Sixth Ave., P.O. Box 201800, Helena, MT 59620
James Jensen, Montana Environmental Information Center, P.O. Box 1184, Helena, MT 59624
Janet Ellis, Montana Audubon Council, P.O. Box 595, Helena, MT 59624
George Ochenski, P.O. Box 689, Helena, MT 59624
Jerry DiMarco, P.O. Box 1571, Bozeman, MT 59771
Paul Backlund, Bureau of Reclamation, 7661 Canyon Ferry Rd., Helena, MT 59602
Montana Wildlife Federation, P.O. Box 1175, Helena, MT 59624
Wayne Hurst, P.O. Box 728, Libby, MT 59923
Glen Hockett, 745 Doane Road, Bozeman, MT 59715
Tom Sathers, Headwaters Fish & Game Assoc., P.O. Box 1941, Bozeman, MT 59771-1941
Broadwater County Commissioners, County Courthouse, Townsend, MT 59644

Ladies and Gentlemen:

The enclosed Environmental Assessment (EA) has been prepared for evaluating a mosquito control program on the Canyon Ferry Wildlife Management Area near Townsend, MT.

Comments will be accepted until 5:00 pm, April 5, 2006. If you have questions, feel free to contact me at 495-3269. All comments should be sent to: Montana Fish, Wildlife & Parks, P.O. Box 998, Townsend, MT 59644. Thank you for your interest.

Sincerely,

Michael Korn
Helena Area Coordinator

## PART I. PROPOSED ACTION DESCRIPTION

1. Type of Proposed State Action: Develop a long-term mosquito control program on the Canyon Ferry Wildlife Management Area, near Townsend, MT.

2. Agency Authority for the Proposed Action: Montana Fish, Wildlife and Parks has management authority to on the Canyon Ferry WMA under the terms of Cooperative Agreement No. 98-FC-60-09540 with the Bureau of Reclamation.

3. Name of Project: Canyon Ferry Wildlife Management Area Mosquito Control Program

4. Name, Address and Phone Number of Project Sponsor (if other than the agency) Program would be implemented in coordination with the Broadwater Mosquito Control District.

5. If Applicable:

   Estimated Construction/Commencement Date – Monitoring of mosquito larvae would begin April 15 annually.

   Estimated Completion Date: - Program would terminate August 30 each year.

   Current Status of Project Design (% complete) – N/A

6. Location Affected by Proposed Action (county, range and township): Canyon Ferry WMA, north of Townsend (see attached map).

7. Project Size: Estimate the number of acres that would be directly affected that are currently:

| | Acres | | Acres |
|---|---|---|---|
| (a) Developed: | | (d) Floodplain | 150- |
| Residential | 0 | | |
| Industrial | 0 | (e) Productive: | |
| | | irrigated cropland | 0 |
| (b) Open Space/Woodlands/Recreation | 0 | dry cropland | 0 |
| | | forestry | 0 |
| (c) Wetlands/Riparian Areas | 0 | rangeland | 0 |
| | | other | 0 |

8. Map/site plan: attach an original 8 1/2" x 11" or larger section of the most recent USGS 7.5' series topographic map showing the location and boundaries of the area that would be affected by the proposed action. A different map scale may be substituted if more appropriate or if required by agency rule. If available, a site plan should also be attached.

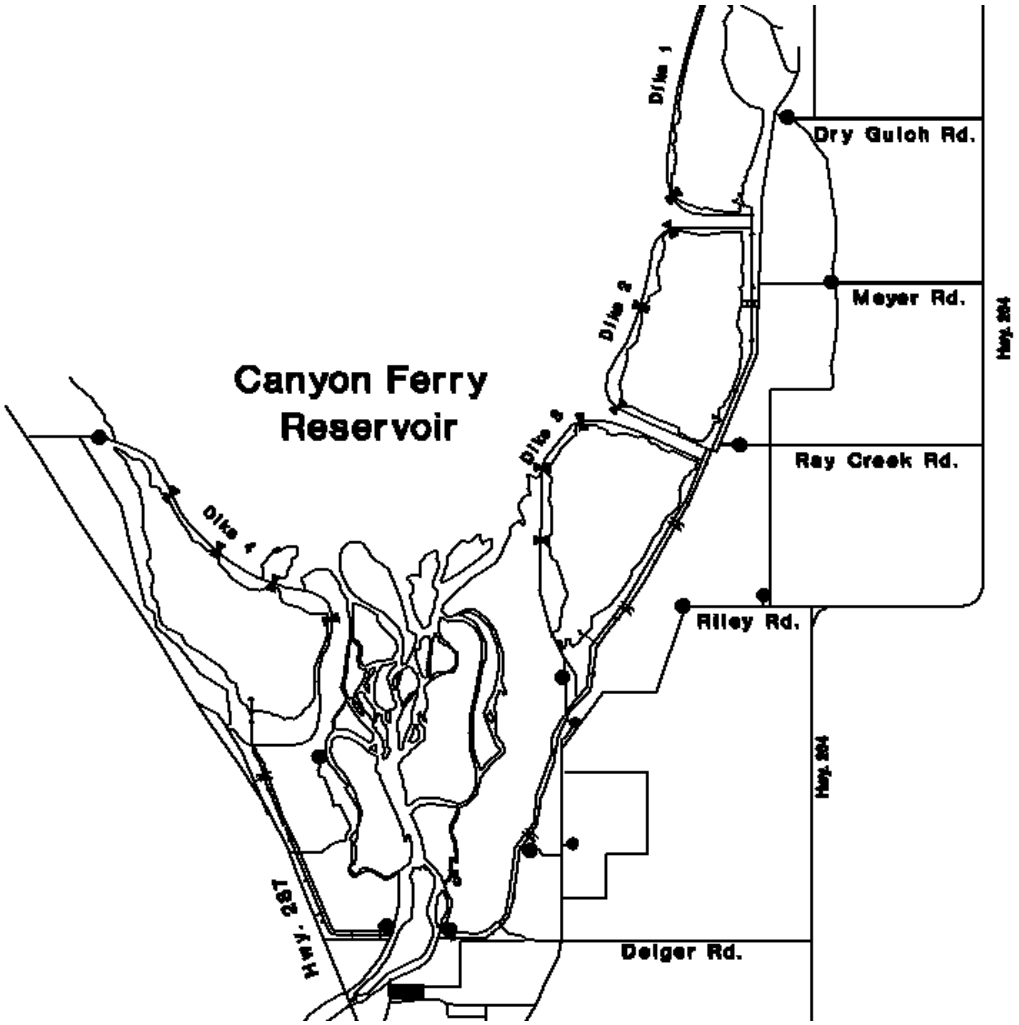


Figure 1. Canyon Ferry Wildlife Management Area, north of Townsend, MT.

9. Listing of any other Local, State or Federal agency that has overlapping or additional jurisdiction.

(a) Permits:

| Agency Name | Permit | Date Filed |
|---|---|---|

N/A

(b) Funding:

| Agency Name | Funding Amount |
|---|---|
| Bureau of Reclamation | $4,000 - $8,000 |

(c) Other Overlapping or Additional Jurisdictional Responsibilities:

| Agency Name | Type of Responsibility |
|---|---|
| Bureau of Reclamation | Land Managing Agency |

10. Narrative summary of the proposed action or project including the benefits and purpose of the proposed action:

The primary objective in developing a mosquito management plan for CFWMA is to identify how, where and when mosquito control will occur on the area. Control efforts can occur that are environmentally friendly and take into consideration the ecology and sensitivity of the many wildlife species that occur on the area. The draft plan describes those control efforts. Because Broadwater County has an on-going mosquito control program the intent is to work in conjunction with the county and more specifically with the Broadwater Mosquito Control District (BMCD), which manages their control program.

There are two primary reasons to control mosquitoes: to preclude the spread of mosquito-borne disease, and to avoid nuisance biting. In the United States, encephalitis and dog heartworm are the primary mosquito-borne diseases. In Montana, Western Equine, St. Louis, and West Nile virus have all been recorded. Encephalitis is an inflammation of the brain and central nervous system, and is characterized by a high to moderate mortality rate, with some survivors having permanent physical and mental disabilities. A 1973 blood-screening clinic determined that 12.19% of the Broadwater County residents showed a positive reaction for HAI titers for the Western Equine and St. Louis strains of encephalitis, indicating exposure to the viruses.

Disease concerns are certainly not the only reason to control mosquitoes. Mosquitoes can be annoying enough to make an area uninhabitable or unsuitable for recreational or industrial development. Economic losses can also be considerable in resort areas and at local tourist attractions.

## SELECTED CONTROL STRATEGY (PROPOSED ACTION)

Achieving good larval control is environmentally friendly and the Center for Disease Control (CDC) has stated that larvicidal applications in catch basins and standing water is an essential component to a mosquito management program and is the most successful method to eliminate mosquitoes over time. In addition, the CDC recommends larvicidal applications rather than spraying for both efficacy in reducing mosquito populations, environmental factors and cost effectiveness. Adulticiding only kills mosquitoes that are flying and remains effective for only a few hours. The efficacy of adulticiding is open for debate and is not considered an effective tool for mosquito management or control through

only one application, or, over time, as shown through scientific research. Reapplications of adulticide may compound negative human health effects of pesticide usage. In addition, adulticide chemicals are not selective for mosquitoes but affect non-target insects, many which are beneficial and essential components of wildlife diets. Some adulticides are also toxic to fish.

For the above stated reasons, it is recommended that mosquito control efforts on the CFWMA consist of timely application of larvicidal agents. Application will be done by licensed applicator ideally from fixed-winged aircraft due to the inaccessible nature of the area where mosquito habitat occurs. Some ground or water (backpack or boat) application of larvicide agents may occur at the discretion of FWP. Application will also be based on agreed upon systematic and scheduled monitoring and only when agreed upon thresholds of larval presence are reached.

Specific larvicides that will be used for controlling mosquito production include Methoprene (Altocid), *Bacillus sphaericus, Bacillus thurigensis israelensis* (Bti). Larvicides are more effective and less toxic than adult mosquito sprays, and the applications are unlikely to result in human exposure. The preferred larvicide will actually be a mixture od Altocid and Bti.

Unlike conventional pesticides, each Altocid formulation contains methoprene, an insect growth regulator (IGR) that stops mosquitos from becoming breeding, biting adults. Methoprene is target-specific, and will not affect fish, waterfowl, mammals or beneficial predatory insects.

Bti or *Bacillus sphaericus* products are recommended due to their low toxicity to non-target organisms, (Washington Department of Ecology 2002). Federal laws prohibit the application of Bti to reservoirs that contain drinking water, (EPA 1998). *B. sphaericus* has very few environmental risks associated with its use. *B. sphaericus* is both non-toxic and non-pathogenic for a variety of species tested, (Washington Department of Ecology 2002). When used according to label rates, *B. sphaericus* does not appear to harm mammals, birds, fish, or most non-target invertebrates (insects and worms). Since *B. sphaericus* is primarily used in contained waters, the potential for contact among certain terrestrial and aquatic species is further limited. Bti is very specific for mosquitoes and black flies, and has some toxicity toward certain other dipterans (including midges). Bti is the primary material used for mosquito control because of its low toxicity to non-target species.

Details as to the monitoring efforts, timing of application, larvicide's to applied, record keeping, public outreach efforts, and other aspects of the mosquito control program on CFWMA will be documented in a Memorandum of Understanding (MOU) between Montana Fish, Wildlife and Parks and Broadwater County. The county will be responsible for all aspects of the control program as outlined below. Surveillance, mapping and monitoring of potential mosquito sites will be done by the Broadwater County mosquito contractor and/or qualified county personnel and will occur at the following periodic intervals and application of any larvicide will be by properly licensed personnel.

- April 15 to May 16
    - Initial survey of entire area (this will be coordinated with the adjoining mosquito district land)
    - Follow up survey two weeks later
    - Submit survey reports for the period to Montana Fish, Wildlife and Parks office in Townsend.
- May 15 to May 30
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Pre aerial survey of the area
    - Monitor adult populations and set up light traps placed at appropriate locations
    - Apply larvicide products if action thresholds exceed 5 larvae ($1^{st}$ to $4^{th}$ instars) per dip, notify FWP prior to application
    - Post aerial survey of the area
    - Submit reports of all activities for the period to Montana Fish, Wildlife and Parks office in Townsend.
- June 1 to June 15
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Monitor adult populations via CDC light traps placed at appropriate locations
    - Apply larvicide products if action thresholds exceed 5 larvae ($1^{st}$ to $4^{th}$ instars) per dip, notify FWP prior to application
- June 15 to July 15
    - Pre aerial survey
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Monitor adult populations via CDC light traps and landing/bite counts
    - Apply larvicide products to sites if action thresholds exceed 5 larvae ($1^{st}$ to $4^{th}$ instars) per dip, notify FWP prior to application
    - Post aerial survey of the area
    - Submit reports of all activities for the period to Montana Fish, Wildlife and Parks office in Townsend.
- July 15 to August 30
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Monitor adult populations via CDC light traps and landing/bite counts (action threshold is 5 bites per 10 minutes)
    - Apply larvicide products to sites if action thresholds exceed 5 larvae ($1^{st}$ to $4^{th}$ instars) per dip, notify FWP prior to application
    - Submit reports of all activities for the month of July and August to Canyon Ferry BOR office and Tom Carlsen, FWP.
    - Submit reports of all activities for the period to Montana Fish,

Wildlife and Parks office in Townsend.

Year-end reports summarizing the season's results and activities with recommendations for the following year's program will be submitted to Montana Fish, Wildlife and Parks office in Townsend. Additionally, copies of all maps, records, logs, complaints and correspondence will be available to FWP upon request. Year-end reports will include a description of the activities, methods and materials to be used including but not limited to:

- Pesticides with EPA Establishment Number and Registration Numbers
- Requirements to use pesticides consistent with FIFRA
- Application rate
- GPS technology may be used to track application of larviciding
- Acreage covered with application of larvicide on Canyon Ferry WMA
- Times of larvicide application
- Monitoring data
- Methods used for surveillance
- Control methods
- Evaluation plan

11. List of agencies consulted during preparation of the EA:

    A. Bureau of Reclamation
    B. Broadwater County Commission
    C. Montana Fish, Wildlife and Parks

## PART II. ENVIRONMENTAL REVIEW

1. Evaluation of the impacts of the Proposed Action including secondary and cumulative impacts on the Physical and Human Environment.

### A. PHYSICAL ENVIRONMENT

| **1. LAND RESOURCES**<br>**Will the proposed action result in:** | **IMPACT ∗** | | | | **Can Impact Be Mitigated∗** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown ∗** | **None** | **Minor ∗** | **Potentially Significant** | | |
| a. ∗∗Soil instability or changes in geologic substructure? | | X | | | | |
| b. Disruption, displacement, erosion, compaction, moisture loss, or over-covering of soil which would reduce productivity or fertility? | | X | | | | |
| c. ∗∗Destruction, covering or modification of any unique geologic or physical features? | | X | | | | |
| d. Changes in siltation, deposition or erosion patterns that may modify the channel of a river or stream or the bed or shore of a lake? | | X | | | | |
| e. Exposure of people or property to earthquakes, landslides, ground failure, or other natural hazard? | | X | | | | |
| f. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

1a. *Bacillus thuringiensis* occurs naturally in soils worldwide. Applications of *B. thuringiensis* formulations do not increase levels of B.t. in soil, and *B. thuringiensis* spores and crystals persist for a relatively short time. As all soil microbes, *B. thuringiensis* does not percolate through the soil and its presence is confined to the top 10 inches of soil (EPA 1998).

There are no cumulative or secondary effects on land resources.

| **2. AIR**<br>**Will the proposed action result in:** | **IMPACT ∗** | | | | **Can Impact Be Mitigated∗** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown ∗** | **None** | **Minor ∗** | **Potentially Significant** | | |
| a. ∗∗Emission of air pollutants or deterioration of ambient air quality? (also see 13 (c)) | | X | | | | |
| b. Creation of objectionable odors? | | X | | | | |
| c. Alteration of air movement, moisture, or temperature patterns or any change in climate, either locally or regionally? | | X | | | | |
| d. Adverse effects on vegetation, including crops, due to | | X | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| increased emissions of pollutants? | | | | | | |
| e. ***For P-R/D-J projects, will the project result in any discharge, which will conflict with federal or state air quality regs? (Also see 2a) | | X | | | | |
| f. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Air Resources (Attach additional pages of narrative if needed):**

2a. Larvicides will applied using fixed winged aircraft and will not remain in the air for any appreciable time and therefore will not have an affect on air quality.

There are no cumulative or secondary effects on air resources.

| **3. WATER**<br>**Will the proposed action result in:** | **IMPACT *** | | | | **Can Impact Be Mitigated*** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown *** | **None** | **Minor *** | **Potentially Significant** | | |
| a. *Discharge into surface water or any alteration of surface water quality including but not limited to temperature, dissolved oxygen or turbidity? | | X | | | | |
| b. Changes in drainage patterns or the rate and amount of surface runoff? | | X | | | | |
| c. Alteration of the course or magnitude of floodwater or other flows? | | X | | | | |
| d. Changes in the amount of surface water in any water body or creation of a new water body? | | X | | | | |
| e. Exposure of people or property to water related hazards such as flooding? | | X | | | | |
| f. Changes in the quality of groundwater? | | X | | | | |
| g. Changes in the quantity of groundwater? | | X | | | | |
| h. Increase in risk of contamination of surface or groundwater? | | X | | | | |
| i. Effects on any existing water right or reservation? | | X | | | | |
| j. Effects on other water users as a result of any alteration in surface or groundwater quality? | | X | | | | |
| k. Effects on other users as a result of any alteration in surface or groundwater quantity? | | X | | | | |
| l. ****For P-R/D-J, will the project affect a designated floodplain? (Also see 3c) | | X | | | | |
| m. ***For P-R/D-J, will the project result in any discharge that will affect federal or state water quality regulations? (Also see 3a) | | X | | | | |
| n. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Water Resources (Attach additional pages of narrative if needed):**

3a,e,f,h,j. The areas where larvicide's will be applied consists of isolated pools of water or contained pond systems without connections to flowing water systems nor are these bodies of water a source for drinking water. Additionally, Methoprene (Altocid) breaks down quickly in water and soil and will not leach into groundwater. Also, *Bacillus thuringiensis* occurs naturally in soils worldwide. Applications of *B. thuringiensis* formulations do not increase levels of B.t. in soil, and *B. thuringiensis* spores and crystals persist for a relatively short time. As all soil microbes, *B. thuringiensis* does not percolate through the soil and its presence is confined to the top 10 inches of soil. Thus no ground water contamination concerns are present (EPA 1998).

There are no cumulative or secondary effects on water resources.

| **4. VEGETATION**<br>**Will the proposed action result in:** | **IMPACT *** | | | | **Can Impact Be Mitigated *** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown *** | **None** | **Minor *** | **Potentially Significant** | | |
| a. Changes in the diversity, productivity or abundance of plant species (including trees, shrubs, grass, crops, and aquatic plants)? | | X | | | | |
| b. Alteration of a plant community? | | X | | | | |
| c. Adverse effects on any unique, rare, threatened, or endangered species? | | X | | | | |
| d. Reduction in acreage or productivity of any agricultural land? | | X | | | | |
| e. Establishment or spread of noxious weeds? | | X | | | | |
| f. ****For P-R/D-J, will the project affect wetlands, or prime and unique farmland? | | X | | | | |
| g. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

4a. In order for *B. thuringiensis* delta-endotoxin to have a toxic effect, it must be ingested by an organism and exposed to appropriate digestive enzymes at a pH of 9.0 to 10.5. Therefore terrestrial, semi-aquatic or aquatic plants are unaffected by *Bacillus thuringiensis* delta-endotoxin because plants have no mechanism for its ingestion. In addition, the Agency has found no reports of any adverse plant effects caused by any other toxins that might be produced by strains of *Bacillus thuringiensis* despite the extensive pesticidal use of *Bacillus thuringiensis* on plants. An indirect beneficial effect on plants exists as a result of reduction in plant damaging insect populations (EPA 1998).

There are no cumulative or secondary effects on vegetation resources.

| ** 5. FISH/WILDLIFE<br>Will the proposed action result in: | IMPACT * | | | | Can Impact Be Mitigated * | Comment Index |
|---|---|---|---|---|---|---|
| | Unknown * | None | Minor * | Potentially Significant | | |
| a. Deterioration of critical fish or wildlife habitat? | | X | | | | |
| b. Changes in the diversity or abundance of game animals or bird species? | | X | | | | |
| c. Changes in the diversity or abundance of nongame species? | | X | | | | |
| d. Introduction of new species into an area? | | X | | | | |
| e. Creation of a barrier to the migration or movement of animals? | | X | | | | |
| f. Adverse effects on any unique, rare, threatened, or endangered species? | | X | | | | |
| g. Increase in conditions that stress wildlife populations or limit abundance (including harassment, legal or illegal harvest or other human activity)? | | X | | | | |
| h. ****For P-R/D-J, will the project be performed in any area in which T&E species are present, and will the project affect any T&E species or their habitat? (Also see 5f) | | X | | | | |
| i. ***For P-R/D-J, will the project introduce or export any species not presently or historically occurring in the receiving location? (Also see 5d) | | X | | | | |
| j. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

5b,c,g. Due to the relatively short insecticidal half-life of *B. thuringiensis* spores and crystals, the exposure and subsequent risk to nontarget wildlife is limited to the time immediately after application. *B. thuringiensis* deltaendotoxin has a direct adverse effect on the target insect orders (Lepidoptera, Coleoptera, Diptera), but susceptibility varies widely among individual species. Any one registered product has a narrow susceptible insect range. In general, published literature shows a temporary reduction in susceptible insect populations during the use period. Beneficial insects and avian and mammalian predators are slightly impacted because of reduced food source. Unlike with alternative chemical pesticides, however, no significant population impact from the use of *B. thuringiensis* products is noted. Furthermore, alternative chemical pesticides may have additional direct adverse effects on birds, mammals, and nontarget insects that are not observed with the use of *B. thuringiensis* products (EPA 1998).

Any effects of *B. thuringiensis* delta-endotoxin on insectivorous birds is due to a reduction of food supply. No toxicity or pathogenicity to avian species was seen in the studies to date and based on these studies, no unreasonable risk to avian species is expected from the label uses of the registered *B. thuringiensis* products as long as the production process is properly controlled to prevent nontarget effects due to exotoxins (EPA 1998).

Field studies on *B. thuringiensis* delta-endotoxin contaminated water found no observable effects on resident fish behavior and reproduction. Consumption of delta-endotoxin treated insects has not affected fish to any noticeable degree. Fish that feed on susceptible insects may be affected indirectly by reductions in food abundance. While no toxicity data are available on reptiles and amphibians, *B. thuringiensis* delta-endotoxin is not believed to pose a hazard to these organisms. No toxicity or pathogenicity was seen in studies. As a result, no unreasonable risk to freshwater fish is expected from the label uses of registered *B.thuringiensis* products as long as the production process is properly controlled to prevent nontarget effects due to exotoxins (EPA 1998).

There are no cumulative or secondary effects on fish and wildlife resources.

## B. HUMAN ENVIRONMENT

| **6. NOISE/ELECTRICAL EFFECTS**<br>**Will the proposed action result in:** | **IMPACT ∗** | | | | **Can Impact Be Mitigated ∗** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown ∗** | **None** | **Minor ∗** | **Potentially Significant** | | |
| a. Increases in existing noise levels? | | X | | | | |
| b. Exposure of people to serve or nuisance noise levels? | | X | | | | |
| c. Creation of electrostatic or electromagnetic effects that could be detrimental to human health or property? | | X | | | | |
| d. Interference with radio or television reception and operation? | | X | | | | |
| e. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

There are no cumulative or secondary effects on the human environment in relation to noise or electrical effects.

| 7. LAND USE<br><br>Will the proposed action result in: | IMPACT * | | | | Can Impact Be Mitigated * | Comment Index |
|---|---|---|---|---|---|---|
| | Unknown * | None | Minor * | Potentially Significant | | |
| a. Alteration of or interference with the productivity or profitability of the existing land use of an area? | | X | | | | |
| b. Conflicted with a designated natural area or area of unusual scientific or educational importance? | | X | | | | |
| c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action? | | X | | | | |
| d. Adverse effects on or relocation of residences? | | X | | | | |
| e. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

There are no cumulative or secondary effects on land use in the area.

| 8. RISK/HEALTH HAZARDS<br><br>Will the proposed action result in: | IMPACT * | | | | Can Impact Be Mitigated * | Comment Index |
|---|---|---|---|---|---|---|
| | Unknown * | None | Minor * | Potentially Significant | | |
| a. Risk of an explosion or release of hazardous substances (including, but not limited to oil, pesticides, chemicals, or radiation) in the event of an accident or other forms of disruption? | | X | | | | |
| b. Affect an existing emergency response or emergency evacuation plan or create a need for a new plan? | | X | | | | |
| c. Creation of any human health hazard or potential hazard? | | X | | | | |
| d. ***For P-R/D-J, will any chemical toxicants be used? (Also see 8a) | | | X | | | 8d. |
| e. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

8c. The microbial pesticides have undergone extensive testing prior to registration. They are essentially nontoxic to humans, so there are no concerns for human health effects with *Bti* or *B. sphaericus* when they are used according to label directions. Methoprene, used for mosquito control according to its label directions, does not pose unreasonable risks to human health. In addition to posing low toxicity to mammals, there is little opportunity for human exposure, since the material is applied directly to ditches, ponds, marshes, or flooded areas that are not drinking water sources (EPA 1998).

8d. Contractor will use Integrated Mosquito Management control methods and materials sanctioned by EPA, CDC, USDA, and American Mosquito Control Association to control mosquito larvae. This will reduce the production of adult mosquitoes and the potential for contracting mosquito borne health hazards.

There are no cumulative or secondary effects in relation to Risk/Health Hazards.

| **9. COMMUNITY IMPACT**<br><br>**Will the proposed action result in:** | **IMPACT ∗** | | | | **Can Impact Be Mitigated ∗** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown ∗** | **None** | **Minor ∗** | **Potentially Significant** | | |
| a. Alteration of the location, distribution, density, or growth rate of the human population of an area? | | X | | | | |
| b. Alteration of the social structure of a community? | | X | | | | |
| c. Alteration of the level or distribution of employment or community or personal income? | | X | | | | |
| d. Changes in industrial or commercial activity? | | X | | | | |
| e. Increased traffic hazards or effects on existing transportation facilities or patterns of movement of people and goods? | | X | | | | |
| f. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

There are no cumulative or secondary effects in relation to impacts on the local community.

| **10. PUBLIC SERVICES/TAXES/UTILITIES**<br><br>**Will the proposed action result in;** | **IMPACT ∗** | | | | **Can Impact Be Mitigated ∗** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown ∗** | **None** | **Minor ∗** | **Potentially Significant** | | |
| a. Will the proposed action have an effect upon or result in a need for new or altered governmental services in any of the following areas: fire or police protection, schools, parks/recreational facilities, roads or other public maintenance, water supply, sewer or septic systems, solid waste disposal, health, or other governmental services? If any, specify: | | X | | | | |
| b. Will the proposed action have an effect upon the local or state tax base and revenues? | | X | | | | |
| c. Will the proposed action result in a need for new facilities or substantial alterations of any of the following utilities: electric power, natural gas, other fuel supply or distribution systems, or communications? | | X | | | | |
| d. Will the proposed action result in increased used of any energy source? | | X | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| e. **Define projected revenue sources | | X | | | | |
| f. **Define projected maintenance costs. | | X | | | | |
| g. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

There are no cumulative or secondary effects in relation to impacts on public services, taxes or utilities.

| ** 11. AESTHETICS/RECREATION<br>Will the proposed action result in: | IMPACT * | | | | Can Impact Be Mitigated * | Comment Index |
|---|---|---|---|---|---|---|
| | Unknown * | None | Minor * | Potentially Significant | | |
| a. Alteration of any scenic vista or creation of an aesthetically offensive site or effect that is open to public view? | | X | | | | |
| b. Alteration of the aesthetic character of a community or neighborhood? | | | X | | | 11b. |
| c. **Alteration of the quality or quantity of recreational/tourism opportunities and settings? (Attach Tourism Report) | | | X | | | 11c. |
| d. ***For P-R/D-J, will any designated or proposed wild or scenic rivers, trails or wilderness areas be impacted? (Also see 11a, 11c) | | X | | | | |
| e. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

11b & 11c. There will be a reduction in the production of adult mosquitos within the immediate vicinity of the CFWMA. This should improve the quality of recreational experiences in the area.

There are no cumulative or secondary effects on aesthetics/recreation.

| 12. CULTURAL/HISTORICAL RESOURCES<br>Will the proposed action result in: | IMPACT * | | | | Can Impact Be Mitigated * | Comment Index |
|---|---|---|---|---|---|---|
| | Unknown * | None | Minor * | Potentially Significant | | |
| a. **Destruction or alteration of any site, structure or object of prehistoric historic, or paleontological importance? | | X | | | | |
| b. Physical change that would affect unique cultural values? | | X | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| c. Effects on existing religious or sacred uses of a site or area? | | X | | | | |
| d. ****For P-R/D-J, will the project affect historic or cultural resources? Attach SHPO letter of clearance. (Also see 12.a) | | X | | | | |
| e. Other: | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources (Attach additional pages of narrative if needed):**

There are no cumulative or secondary effects on Cultural/Historical Resources.

## SIGNIFICANCE CRITERIA

| **13. SUMMARY EVALUATION OF SIGNIFICANCE**<br>**Will the proposed action, considered as a whole:** | **IMPACT *** | | | | **Can Impact Be Mitigated *** | **Comment Index** |
|---|---|---|---|---|---|---|
| | **Unknown *** | **None** | **Minor *** | **Potentially Significant** | | |
| a. Have impacts that are individually limited, but cumulatively considerable? (A project or program may result in impacts on two or more separate resources that create a significant effect when considered together or in total.) | | X | | | | |
| b. Involve potential risks or adverse effects which are uncertain but extremely hazardous if they were to occur? | | X | | | | |
| c. Potentially conflict with the substantive requirements of any local, state, or federal law, regulation, standard or formal plan? | | X | | | | |
| d. Establish a precedent or likelihood that future actions with significant environmental impacts will be proposed? | | X | | | | |
| e. Generate substantial debate or controversy about the nature of the impacts that would be created? | | | X | | | |
| f. ***For P-R/D-J, is the project expected to have organized opposition or generate substantial public controversy? (Also see 13e) | | X | | | | |
| g. ****For P-R/D-J, list any federal or state permits required. | | X | | | | |

**Narrative Description and Evaluation of the Cumulative and Secondary Effects on Water Resources (Attach additional pages of narrative if needed):**

13e. There will probably be some individuals who feel Fish, Wildlife and Parks isn't doing enough to control mosquitoes on the CFWMA. Likewise, there will be the opposite view that FWP is doing too much. These opposing viewpoints are common throughout much of the United States where mosquitoes occur.

## PART II. ENVIRONMENTAL REVIEW, CONTINUED

1. Description and analysis of reasonable alternatives (including the no action alternative) to the proposed action whenever alternatives are reasonably available and prudent to consider and a discussion of how the alternatives would be implemented:

**ALTERNATIVE 1 (NO ACTION)**

In this Alternative there would be no program conducted to control the production of mosquitoes on the Canyon Ferry Wildlife Management Area.

**ALTERNATIVE 2 (PROPOSED ACTION)**

The Proposed Action is described in detail in Part 1 of the EA and consists of applying environmentally friendly larvicides in a timely manner to control the production mosquitoes on the Canyon Ferry Wildlife Management Area.

**ALTERNATIVE 3**

This Alternative would consist of applying adulticides or a combination of larvacides and adulticides to control mosquitoes. Adulticiding only kills mosquitoes that are flying and remains effective for only a few hours. The efficacy of adulticiding is open for debate and is not considered an effective tool for mosquito management or control through only one application, or, over time, as shown through scientific research. Reapplications of adulticide may compound negative human health effects of pesticide usage. In addition, adulticide chemicals are not selective for mosquitoes but affect non-target insects, many which are beneficial and essential components of wildlife diets. Some adulticides are also toxic to fish.

2. Evaluation and listing of mitigation, stipulation, or other control measures enforceable by the agency or another government agency: Not Applicable.

## PART III. NARRATIVE EVALUATION AND COMMENT

Montana Fish, Wildlife and Parks is sensitive to the health concerns shared by many of the residents of Broadwater County in relation the presence of mosquitoes. Realizing that in some high water years when the reservoir is full there can be significant production of mosquitoes on the WMA we are working with Broadwater County to develop a functional control program while also meeting

our mandate of managing the WMA for wildlife. We feel the Proposed Action as outlined in this Enviromental Assessment and further described in the "CANYON FERRY WILDLIFE MANAGEMENT AREA MOSQUITO MANAGEMENT PLAN", meets those needs.

Achieving good larval control, as described in the Proposed Action, is environmentally friendly and the Center for Disease Control (CDC) has stated that larvicidal applications in catch basins and standing water is an essential component to a mosquito management program and is the most successful method to eliminate mosquitoes over time. In addition, the CDC recommends larvicidal applications rather than spraying adulticides for both efficacy in reducing mosquito populations, environmental factors and cost effectiveness. For the above stated reasons, it is recommended that mosquito control efforts on the CFWMA consist of timely application of larvicidal agents. Application will be done by licensed applicator ideally from fixed-winged aircraft due to the inaccessible nature of the area where mosquito habitat occurs. Application will also be based on agreed upon systematic and scheduled monitoring and only when agreed upon thresholds of larval presence are reached. Details as to the monitoring efforts, timing of application, larvacides to applied, record keeping, public outreach efforts, and other aspects of the mosquito control program on CFWMA will be further documented in a Memorandum of Understanding (MOU) between Montana Fish, Wildlife and Parks and Broadwater County.

## PART IV. EA CONCLUSION SECTION

1. Based on the significance criteria evaluated in this EA, is an EIS required (YES/NO)? If an EIS is not required, explain why the EA is the appropriate level of analysis for this proposed action.

NO. Because there are no significant negative impacts caused by or through the method used in controlling mosquitoes.

2. Describe the level of public involvement for this project if any and, given the complexity and the seriousness of the environmental issues associated with the proposed action, is the level of public involvement appropriate under the circumstances?

This EA will go out for public comment through FWP's normal process. Additionally the Broadwater County Commission and the Broadwater Mosquito Control District will have the opportunity for reviewing the Canyon Ferry Wildlife Management Area Mosquito Management Plan and this Environmental Assessment and provide comments to Fish, Wildlife and Parks on these documents.

3. Duration of comment period, if any.

There will be a 30 day comment period beginning March 6, 2006 and ending April 5, 2006.

4. Name, title, address and phone number of the person(s) responsible for preparing the EA:

Thomas L. Carlsen
Wildlife Biologist – Montana Fish, Wildlife and Parks
P.O. Box 998
Townsend, MT 59644
406-266-3367

## REFERENCES

United States Environmental Protection Agency. Registration Eligibility Decision (RED): *Bacillus thuringiensis*, EPA-738-FR98-004. March 1998.

Washington Department of Ecology. Aquatic Mosquito Control, National Pollution Discharge Elimination System, Waste Discharge General Permit. Permit no: WAG – 992000. Effective Date: May 10, 2002.

# CANYON FERRY WILDLIFE MANAGEMENT AREA
# MOSQUITO MANAGEMENT PLAN

**By**

**Tom Carlsen**
**March, 2006**

Montana Fish, Wildlife & Parks

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# CANYON FERRY WILDLIFE MANAGEMENT AREA
# MOSQUITO MANAGEMENT PLAN

## 1. INTRODUCTION

Canyon Ferry Reservoir, a Bureau of Reclamation (BOR) project, was formed by the construction of a dam on the Missouri River in 1954. Wildlife management responsibilities on certain areas administered by BOR surrounding the reservoir were transferred to Montana Fish, Wildlife and Parks (MFWP) by a Memorandum of Understanding (MOU) signed in 1957. Initially, MFWP management efforts dealt with agricultural leases on the south end of the reservoir and few intensive management activities were undertaken. As a result of flood control needs, water level management changed in 1966, resulting in an exposure of as much as 9100 acres of mud flats. Under the right conditions, these became a source of blowing dust (Childress and Eng 1979). Complaints from agricultural interests and citizens of Townsend prompted BOR to seek a solution. After a series of unsuccessful efforts, the decision was made to construct dikes and dredge silt from the mud flats into the dike system where the silt could be covered with water year-round. Biologists from MFWP and Montana State University were invited to provide input into the overall design of both the ponds and islands placed in the ponds. Construction was initiated in the early 1970s and completed in 1978. The end result was the four-pond system totaling 1925 acres and containing a total of 325 artificial islands, most of which were built by the dredge. The ponds and surrounding uplands were placed under the management of MFWP as Canyon Ferry Wildlife Management Area (CFWMA) (Figure 1). The management area is somewhat unique compared to the MFWP's other management areas in the fact that the Department does not own the land. The CFWMA is located on the south end of Canyon Ferry Reservoir (one and one-half miles north of Townsend, Montana and is in Broadwater County). The area encompasses approximately 5,000 acres at the Missouri River inlet to the reservoir.

CFWMA receives a tremendous amount of public use for its size. The management area is part of Montana's Watchable Wildlife Program. Sightseeing and bird watching have become more popular with increased diversity on the area. The entire area is open to hunting, beginning with the opening of archery and upland bird seasons. This continues through the waterfowl season, the pheasant season, and the general big game season.

While the initial intent of dike construction on CFWMA was dust abatement, the benefits to wildlife have been numerous (Carlsen 1984), (Martinka 2005). As the area matures, and habitats develop naturally or through management activities, it is expected to become attractive to an even more varied wildlife resource.

During the summer of 1979 and 1980 a graduate project was conducted on the pond system to look at community development and seasonal succession of aquatic

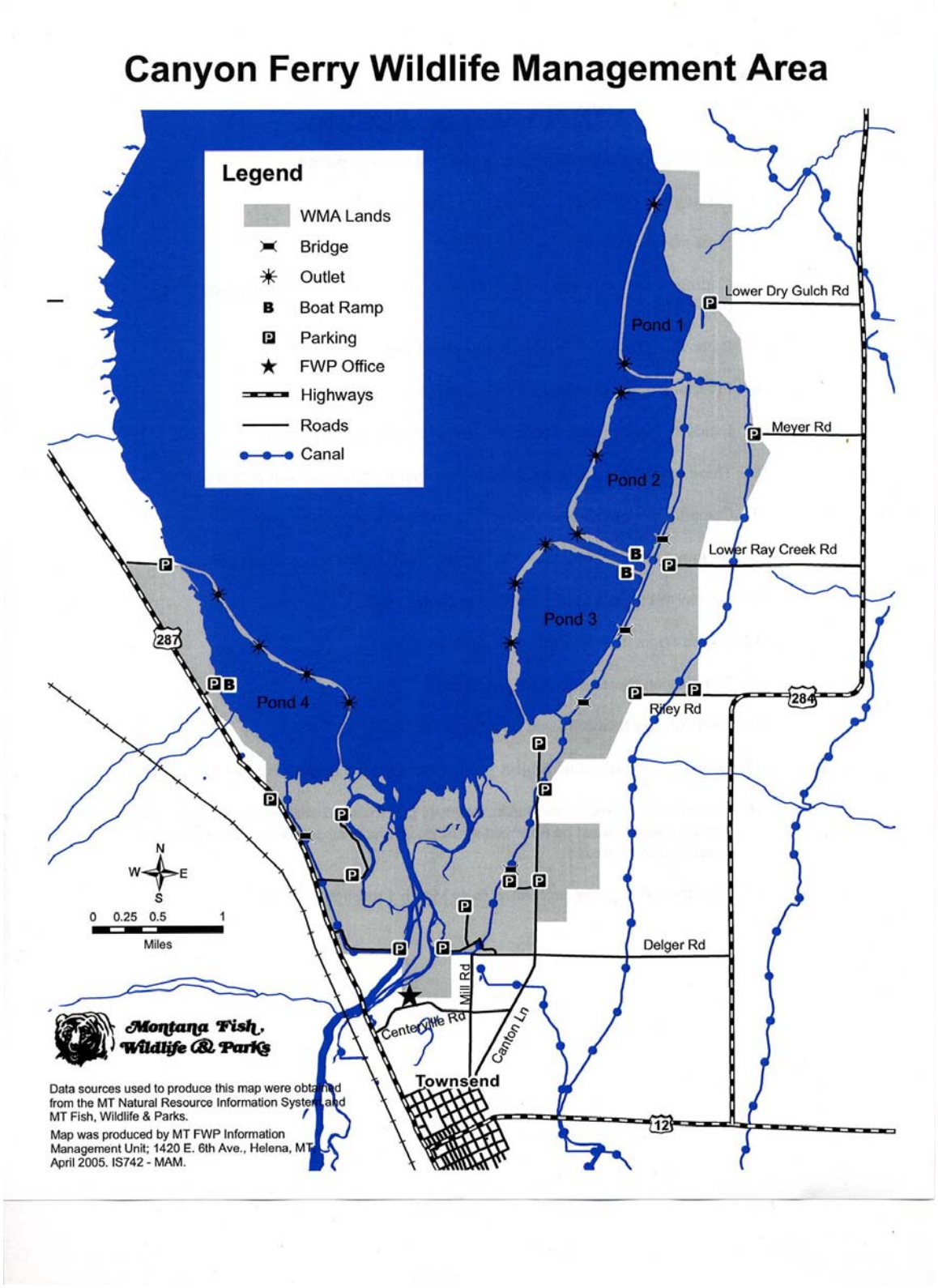


Figure 1. Canyon Ferry Wildlife Management Area, Townsend, Montana.

macroinvertebrates (McGuire 1984). A secondary aspect of that study was a survey of mosquito habitat and larval populations on the CFWMA. This survey found a wide variety of locations in and around the area provide habitat for mosquitoes. Most mosquito production on the CFWMA occurred in temporarily flooded regions of the river bottom. High water during runoff inundated large areas of vegetation resulting a tremendous number of ephemeral pools as water levels subsided, which were conducive to mosquito production.

Observations over the past 20 years by the author indicate that flows in the Missouri River during runoff are one variable in producing the above mentioned mosquito habitat. Equally important is the resulting water elevation in the reservoir due to the runoff and water level management at the Canyon Ferry Dam. At high water elevations in the reservoir (>3,696 feet) water begins to back up into vegetation in delta portion or south end of the reservoir. This also results in ephemeral pools forming and subsequently mosquitoes are abundant. In years when the reservoir doesn't reach the above elevation very few mosquitoes are produced on the CFWMA and adjacent areas.

Mosquitoes (Order Diptera, Family Culicidae) are some of the most adaptable and successful insects on earth and are found in some extraordinary places. Virtually any natural or man-made collection of water can support mosquito production. Mosquitoes can be distinguished from other flies by the fact that they have a long, piercing proboscis and scales on their bodies and wings. Approximately 45 different species belonging to 6 genera are found in Montana. The different species do not assume equal importance due to differences in abundance, distribution, and feeding habits. Some species can act as vectors (spread a disease); some are highly annoying to man and livestock; both groups are of economic importance in Montana. In sufficient numbers, mosquitoes and other blood-feeding insects can reduce the vigor of cattle and other animals, including wildlife. In addition, mosquitoes can impact tourism and recreation, industries upon which Montana is becoming more and more dependent.

There are two primary reasons to control mosquitoes: to preclude the spread of mosquito-borne disease, and to avoid nuisance biting. In the United States, encephalitis and dog heartworm are the primary mosquito-borne diseases. In Montana, Western Equine, St. Louis, and West Nile virus have all been recorded. Encephalitis is an inflammation of the brain and central nervous system, and is characterized by a high to moderate mortality rate, with some survivors having permanent physical and mental disabilities. A 1973 blood-screening clinic determined that 12.19% of the Broadwater County residents showed a positive reaction for HAI titers for the Western Equine and St. Louis strains of encephalitis, indicating exposure to the viruses.

Disease concerns are certainly not the only reason to control mosquitoes. Mosquitoes can be annoying enough to make an area uninhabitable or unsuitable for recreational or industrial development. Economic losses can also be considerable in resort areas and at local tourist attractions.

The overall Goal for the CFWMA as identified in the Management Plan written for CFWMA is as follows: "Provide productive habitat for the diversity of wildlife species that utilize the area and provide for consumptive and nonconsumptive use of those resources" (Carlsen and Northrup 1992).

The ***"primary objective"*** in developing a mosquito management plan for CFWMA is to identify how, where and when mosquito control will occur on the area. Control efforts can occur that are environmentally friendly and take into consideration the ecology and sensitivity of the many wildlife species that occur on the area. This plan will hopefully describe those control efforts. Because Broadwater County has an on-going mosquito control program the intent is to work in conjunction with the county and more specifically with the Broadwater Mosquito Control District (BMCD), which manages their control program.

## 2. MOSQUITO LIFE HISTORY

It is necessary to understand the life cycle and habits of mosquito species in order to effectively and efficiently control mosquito populations. Detailed surveys are essential for developing and implementing an effective integrated mosquito management strategy and for evaluation and improvement of control programs. Survey and evaluation are continuing processes that must accompany control.

The two major types of mosquitoes in Montana are the floodwater (including natural and artificial areas as well as floodwater) species, and the standing water (permanent and transient pools, as well as container) species. The major differences between the two types are in where the eggs are deposited by the females. However, there is considerable overlap between the groups.

The main pest species in Montana are floodwater species. These species have eggs that are highly resistant to desiccation, as well as cold and heat. The floodwater mosquitoes tend to appear in large numbers, exist as pests for a relatively short period of time, and then gradually disappear. Floodwater mosquitoes lay their eggs on damp soil in depressions that were previously filled with water. The eggs hatch in response to flooding, but may not necessarily hatch the first time they are flooded. If the area is not flooded the next spring, the eggs may hatch in subsequent years.

The major vector species are in the genus *Culex*, which are standing water mosquitoes, with *Culex tarsalis* (the Western Encephalitis mosquito) often playing a very important role in epidemics of both animal and human diseases. Their eggs are laid on the surface of the water, and are highly susceptible to desiccation. They go through several generations in the course of the summer, and may undergo changes in behavior that result in a higher probability of disease transmission.

Permanent water and standing water species deposit their eggs directly on the water surface, and these may hatch in one to four days depending on temperature. Female

mosquitoes have a tendency to oviposit (lay) eggs more readily where larval mosquitoes have developed before. This characteristic can be used to predict where mosquito larvae may occur in the future, allowing for the pretreatment of some areas, particularly floodwater mosquito habitats.

Mosquitoes undergo complete metamorphis, going through four life stages: in addition to the egg stages discussed above, there are the larva, pupa, and adult stages. The larvae and pupae of mosquitoes must be in water, while the eggs of some species can endure dry conditions.

Larvae (wigglers) of all mosquitoes live in the water. Mosquito larvae must be able to reach the water surface in order to breathe. Most larvae are filter feeders, feeding on suspended detritus, bacteria, and other materials in the water column. Depending on the species and environmental conditions, mosquitoes may take anywhere from three to four days up to several weeks to complete larval development. Mature larvae molt to the pupal stage.

Unlike most other insects, mosquito pupae can be very active and are often called "tumblers" because of their rapid tumbling like movement when disturbed. They do not feed and typically transform into adults in two or more days. Development through the larval and pupal stage generally takes from 14 to 21 days, although the time period varies with species and with temperature. At higher temperatures, the time is considerably less, and in fact, some species may go through their entire life cycle in less than a week.

Adult mosquitoes are terrestrial and capable of flight. Both sexes feed on a variety of materials, but only the female mosquitoes take a blood meal. The adults of some species remain within a few hundred feet of where they spend the larval stage, whereas others may migrate up to 50 miles. After taking a blood meal, the female may be inactive for several days while the eggs develop, then oviposit in the appropriate habitat. Usually, a second blood meal must be taken for disease transmission to occur.

The lifespan of an adult mosquito depends on which type of mosquito it is. Winter conditions will help determine if the next summer has large numbers of permanent water species or not. Although flood pool adults only live about a month, the over-wintering females of the standing water species, such as Culex tarsalis, may live for more than six months.

## 3. MOSQUITO SAMPLING AND SURVEILLANCE

Surveys are essential for the planning, operation and evaluation of an effective mosquito-control program, whether for the prevention of mosquito-borne diseases or to reduce mosquito populations to levels permitting normal activities. Initial surveys identify the species of mosquitoes present and provide general information on locations, densities and disease potential. Subsequent surveys provide additional information for prioritization and treatment timing.

A basic surveillance program addresses adult and larval population density and species composition, rainfall monitoring, and breeding site locations. Such inspections do not determine the absolute population of mosquitoes, but they can show fluctuations in relative mosquito abundance and diversity over time in the various habitats visited. Larval surveys are very effective and efficient in monitoring populations and species content. Before routine breeding site inspection and larviciding operations can begin, all sites within the proposed jurisdiction should be identified and mapped.

Several methods are available for sampling adult mosquitoes. CDC light traps are most common. Traps are used to capture nocturnal mosquitoes that are $CO_2$ and light attractive. A CDC trap consists of a canister, which emits $CO_2$, a small incandescent bulb to attract the mosquitoes, and a fan to force them down into a mesh net. Season-long trapping results can be used to identify population trends, component species and to effectively time spray applications.

Another technique includes taking landing/biting counts. Collecting mosquitoes as they bite or land on the surveyor's body is a convenient method of sampling populations. The subject sits quietly for a designated period of time, collects the mosquitoes with an aspirator and places them in the collection jar for later identification.

Monitoring efforts by BMCD personnel and contractors has identified mosquito production areas on CFWMA. Specifically, the area is located in the Missouri River delta north of Townsend and immediately north of the State 287 Highway Bridge over the Missouri River to the shoreline of Canyon Ferry Reservoir. At full elevation of the reservoir approximately 300 acres could be involved in treatment. The specific areas involved include the following: T7N R1E: SE ¼ Section 13, NE ¼ Section 24; T7N R2E Section 19, W ½ Section 20, S ½ Section 18, W ½ Section 17. These sections as well as tentative breeding sites as shown in Exhibit A include approximately 1920 land acres and approximately 300 acres of wetlands at the south end of Canyon Ferry.

## 4. CONTROL OF MOSQUITOES

### Prevention.

The only viable means of minimizing the production of mosquitoes through managing their habitat on the CFWMA would be to control water levels in the reservoir. This is outside the responsibility of MFWP and is beyond the scope of this plan and therefore will not be discussed further.

### Control Options

Control measures include source reduction, larvicides, adulticides, biological control and personal protection.

An important consideration in the practice of mosquito control is the advisability, whenever possible, to target control operations against immature (larval stage) populations. These stages are usually concentrated, relatively immobile and therefore occupy minimum acreage compared with adults, which may rapidly disperse over large areas. By targeting the immature stage, it is possible to minimize the area treated and often avoid treating populated areas. Conversely, targeting adult mosquitoes may require highly visible and extensive applications of adulticides within residential and urban areas. Achieving good larval control while at the same time minimizing the use of adulticides is environmentally and client friendly, and appreciated by the public.

## 5. INTEGRATED PEST (MOSQUITO) MANAGEMENT

Integrated Pest Management (IPM) is a system that utilizes multiple approaches to a pest problem. In the case of mosquitoes, this includes public education, record keeping and mapping, monitoring, habitat modifications, chemical control efforts, and other actions. Overall, mosquito IPM takes a pro-active approach to the problems, rather than a re-active one, while retaining the ability to modify actions in response to public health concerns.

An IPM is based on sound scientific knowledge and makes use of the latest technology, equipment and materials. When brought together these methods furnish cost-effective level of mosquito suppression needed to protect man and domestic animals from harassment and disease.

In an IPM program, there are pre-determined points at which actions are taken. These are called *action thresholds*. They are the point at which, if no action is taken, negative events will begin to occur. The Broadwater Mosquito Control District utilizes a set of informal, but time-proven, action thresholds.

IPM means more than simply combining several technological approaches. To successfully control mosquitoes, we must know:

1.) Which mosquito species are locally important as the primary source of intolerable annoyance or as vectors of disease? The efforts of the BMCD have resulted in a partial list of the mosquitoes in the area, and the knowledge that *Culex tarsalis* is the most prevalent of the permanent water species.
2.) Where the breeding sites of these mosquito species are located. The BMCD has developed maps over the years that record the majority of the larval habitats and document which areas are the most productive. In some areas, long-term management has eliminated production sites, or resulted in changes in the management strategies.
3.) When the mosquitoes are developing in these breeding sites and when the emergence of adult mosquitoes will take place. The history of mosquito development in the various areas in the BMCD is known, and is used to determine when to start sampling for mosquito larvae in the district. Once sampling is initiated, action thresholds and environmental conditions drive treatment regimes.

4.) What mosquito control measures are needed and can be applied effectively, economically, and safely with minimal disruption to the local environment.
5.) How much funding will be required to coordinate and execute the plan devised.

## 6. PESTICIDE REVIEW

All information on pesticides is from U.S. Environmental Protection Agency web site http://www.epa.gov/pesticides/health/mosquitoes/. Pesticides are divided into 2 main groups depending the life stage targeted and are commonly referred to as larvicides and adulticides.

### Larvicides

Larvicides kill mosquito larvae. Larvicides include biological insecticides, such as the microbial larvicides *Bacillus sphaericus* and *Bacillus thuringiensis israelensis.* Larvicides include other pesticides, such as temephos, methoprene, oils, and monomolecular films. Larvicide treatments of breeding habitats help reduce the adult mosquito population in nearby areas.

State and local agencies in charge of mosquito control typically employ a variety of techniques in an Integrated Pest Management (IPM) program. An IPM approach includes *surveillance*, *source reduction*, *larviciding* and *adulticiding* to control mosquito populations. Since mosquitoes must have water to breed, source reduction can be as simple as turning over trapped water in a container to undertaking large-scale engineering and management of marsh water levels. Larviciding involves applying pesticides to breeding habitats to kill mosquito larvae. Larviciding can reduce overall pesticide usage in a control program. Killing mosquito larvae before they emerge as adults can reduce or eliminate the need for ground or aerial application of pesticides to kill adult mosquitoes.

Microbial larvicides are bacteria that are registered as pesticides for control of mosquito larvae in outdoor areas such as irrigation ditches, flood water, standing ponds, woodland pools, pastures, tidal water, fresh or saltwater marshes, and storm water retention areas. Duration of effectiveness depends primarily on the mosquito species, the environmental conditions, the formulation of the product, and water quality. Microbial larvicides may be used along with other mosquito control measures in an IPM program. The microbial larvicides used for mosquito control are *Bacillus thuringiensis israelensis (Bti)* and *Bacillus sphaericus (B. sphaericus).*

***Bacillus thuringiensis israelensis*** is a naturally occurring soil bacterium registered for control of mosquito larvae. *Bti* was first registered by EPA as an insecticide in 1983. Mosquito larvae eat the *Bti* product that is made up of the dormant spore form of the bacterium and an associated pure toxin. The toxin disrupts the gut in the mosquito by binding to receptor cells present in insects, but not in mammals. There are 26 *Bti* products registered for use in the United States. Aquabac, Teknar, Vectobac, and LarvX are examples of common trade names for the mosquito control products.

***Bacillus sphaericus*** is a naturally occurring bacterium that is found throughout the world. *B. sphaericus* was initially registered by EPA in 1991 for use against various kinds of mosquito larvae. Mosquito larvae ingest the bacteria, and as with *Bti*, the toxin disrupts the gut in the mosquito by binding to receptor cells present in insects but not in mammals. VectoLex CG and WDG are registered *B. sphaericus* products and are effective for approximately one to four weeks after application.

The microbial pesticides have undergone extensive testing prior to registration. They are essentially nontoxic to humans, so there are no concerns for human health effects with *Bti* or *B. sphaericus* when they are used according to label directions.

Extensive testing shows that microbial larvicides do not pose risks to wildlife, nontarget species, or the environment, when used according to label directions.

Another larval control agent is **Methoprene** which is a compound first registered by EPA in 1975 that mimics the action of an insect growth-regulating hormone and prevents the normal maturation of insect larvae. It is applied to water to kill mosquito larvae, and it may be used along with other mosquito control measures in an IPM program. Altosid is the name of the methoprene product used in mosquito control and is applied as briquets (similar in form to charcoal briquets), pellets, sand granules, and liquids. The liquid and pelletized formulations can be applied by helicopter and fixed-wing aircraft.

Methoprene, used for mosquito control according to its label directions, does not pose unreasonable risks to human health. In addition to posing low toxicity to mammals, there is little opportunity for human exposure, since the material is applied directly to ditches, ponds, marshes, or flooded areas that are not drinking water sources.

Methoprene used in mosquito control programs does not pose unreasonable risks to wildlife or the environment. Toxicity of methoprene to birds and fish is low, and it is nontoxic to bees. Methoprene breaks down quickly in water and soil and will not leach into ground water. Methoprene mosquito control products present minimal acute and chronic risk to freshwater fish, freshwater invertebrates, and estuarine species.

**Monomolecular films** are low-toxicity pesticides that spread a thin film on the surface of the water that makes it difficult for mosquito larvae, pupae, and emerging adults to attach to the water's surface, causing them to drown. Films may remain active typically for 10-14 days on standing water, and have been used in the United States in floodwaters, brackish waters, and ponds. They may be used along with other mosquito control measures in an IPM program. They are also known under the trade names Arosurf MSF and Agnique MMF.

Monomolecular films, used according to label directions for larva and pupa control, do not pose a risk to human health. In addition to low toxicity, there is little opportunity for human exposure, since the material is applied directly to ditches, ponds, marshes, or flooded areas that are not drinking water sources.

Monomolecular films, used according to label directions for larva and pupa control, pose minimal risks to the environment. They do not last very long in the environment, and are usually applied only to standing water, such as roadside ditches, woodland pools, or containers, which contain few nontarget organisms.

There are other larval control agents however available information suggests that they are more toxic to aquatic invertebrates and fresh water fish than alternative larvicides and will not be considered in this plan.

## Adulticides

**Malathion** is an organophosphate (OP) insecticide that has been registered for use in the United States since 1956. It is used in agriculture, residential gardens, public recreation areas, and in public health pest control programs. When applied in accordance with the rate of application and safety precautions specified on the label, malathion can be used to kill mosquitoes without posing unreasonable risks to human health or the environment.

The mosquito goes through four distinct stages during its life cycle: egg, larva, pupa, and adult. Malathion is an *adulticide*, used to kill adult mosquitoes. In mosquito control programs conducted by state or local authorities, malathion is applied by truck-mounted or aircraft-mounted sprayers. Malathion is applied as an ultra-low volume (ULV) spray. ULV sprayers dispense very fine aerosol droplets that stay aloft and kill mosquitoes on contact. ULV applications involve small quantities of pesticide active ingredient in relation to the size of the area treated. For mosquito control, malathion is applied at a maximum rate of 0.23 pounds (or about 2.5 fluid ounces) of active ingredient per acre, which minimizes exposure and risks to people and the environment.

Malathion can be used for public health mosquito control programs without posing unreasonable risks to the general population when applied according to the label. EPA has estimated the exposure and risks to both adults and children posed by ULV aerial and ground applications of malathion. Because of the very small amount of active ingredient released per acre of ground, the estimates found that for all scenarios considered, exposures were several times below an amount that might pose a health concern. These estimates assumed that a toddler would ingest some soil and grass in addition to skin and inhalation exposure. However, at high doses, malathion, like other organophosphates, can overstimulate the nervous system causing nausea, dizziness, or confusion. Severe high-dose poisoning with any organophosphate can cause convulsions, respiratory paralysis, and death.

Malathion used in mosquito control programs does not pose unreasonable risks to wildlife or the environment. Malathion degrades rapidly in the environment, especially in moist soil, and it displays low toxicity to birds and mammals. Malathion is highly toxic to insects, including beneficial insects such as honeybees. For that reason, EPA has established specific precautions on the label to reduce such risks.

As part of its responsibility to reassess all older pesticides registered before 1984, EPA is currently reviewing malathion as part of its reregistration process. The review of malathion is scheduled for completion in 2006. A risk assessment covering all uses of malathion is currently available to the public for review at http://www.epa.gov/oppsrrd1/op/malathion.htm. Visit the EPA Web site (see address above) for the most current information on malathion.

EPA's most recent analysis of toxicity data for malathion received since 2000 shows that its risk characterization remains generally unchanged. However, EPA has also refined its characterization of the potential risk from ***malaoxon***, a more toxic compound that is formed from malathion under certain conditions. For example, malathion runoff and spray drift may reach drinking water sources downstream from where the malathion was used. Malathion present in untreated water will form malaoxon during the chlorination process in water treatment facilities. Malaoxon can also form more slowly when malathion is deposited on hard, dry surfaces and exposed to air over time. The Agency's assessment shows that, even when considering the presence of malaoxon on surfaces following applications of malathion for mosquito control, the relatively low application rates and small droplet sizes used in these types of applications result in minimal exposure to people in the treated area.

**Pyrethroids** are synthetic chemical insecticides that act in a similar manner to pyrethrins, which are derived from chrysanthemum flowers. Pyrethroids are widely used for controlling various insects. **Permethrin, resmethrin,** and **sumithrin** are synthetic pyrethroids commonly used in mosquito control programs to kill **adult mosquitoes** and brand names are Anvil and Permanone.

Permethrin has been registered by EPA since 1977. It is currently registered and sold in a number of products such as household insect foggers and sprays, tick and flea sprays for yards, flea dips and sprays for cats and dogs, termite treatments, agricultural and livestock products, and mosquito abatement products.

Resmethrin has been registered by EPA since 1971 and is used to control flying and crawling insects in the home, lawn, garden, and industrial sites. It can also be used to control insects on ornamental plants (outdoor and greenhouse use), on pets and horses, and as a mosquitocide. Because of its toxicity to fish, resmethrin is a Restricted Use Pesticide (RUP) that is available for use only by certified pesticide applicators or persons under their direct supervision.

Sumithrin has been registered by EPA since 1975 and is used to control adult mosquitoes and as an insecticide in transport vehicles such as aircraft, ships, railroad cars, and truck trailers. It is also used as an insecticide and miticide in commercial, industrial, and institutional nonfood areas, in homes and gardens, in greenhouses, and in pet quarters and on pets.

Most pyrethroid mosquito control products can be applied only by public health officials and trained personnel of mosquito control districts. Mosquito control professionals apply

pyrethroids as an ultra low volume (ULV) spray. ULV sprayers dispense very fine aerosol droplets that stay aloft and kill adult mosquitoes on contact. Pyrethroids used in mosquito control are typically mixed with a synergist compound, such as piperonyl butoxide, which enhances the effectiveness of the active ingredient. The product is often diluted in water or oil and applied at rates less than 1/100th of a pound of active ingredient or less than 4 fluid ounces of mixed formulation per acre.

Pyrethroids can be used for public health mosquito control programs without posing unreasonable risks to human health when applied according to the label. Pyrethroids are considered to pose slight risks of acute toxicity to humans, but at high doses, pyrethroids can affect the nervous system.

Pyrethroids used in mosquito control programs do not pose unreasonable risks to wildlife or the environment. Pyrethroids, when applied at mosquito control rates, are low in toxicity to mammals, and are practically nontoxic to birds. Mosquito control formulations of permethrin break down in the environment, and high temperatures and sunlight accelerate this process. However, pyrethroids are toxic to fish and to bees. For that reason, EPA has established specific precautions on the label to reduce such risks, including restrictions that prohibit the direct application of products to open water or within 100 feet of lakes, streams, rivers or bays.

## 7. SELECTED CONTROL STRATEGY (PROPOSED ACTION)

Achieving good larval control is environmentally friendly and the Center for Disease Control (CDC) has stated that larvicidal applications in catch basins and standing water is an essential component to a mosquito management program and is the most successful method to eliminate mosquitoes over time. In addition, the CDC recommends larvicidal applications rather than spraying for both efficacy in reducing mosquito populations, environmental factors and cost effectiveness. Adulticiding only kills mosquitoes that are flying and remains effective for only a few hours. The efficacy of adulticiding is open for debate and is not considered an effective tool for mosquito management or control through only one application, or, over time, as shown through scientific research. Reapplications of adulticide may compound negative human health effects of pesticide usage. In addition, adulticide chemicals are not selective for mosquitoes but affect non-target insects, many which are beneficial and essential components of wildlife diets. Some adulticides are also toxic to fish.

For the above stated reasons, it is recommended that mosquito control efforts on the CFWMA consist of timely application of larvicidal agents. Application will be done by licensed applicator ideally from fixed-winged aircraft due to the inaccessible nature of the area where mosquito habitat occurs. Some ground or water (backpack or boat) application of larvicide agents may occur at the discretion of FWP. Application will also be based on agreed upon systematic and scheduled monitoring and only when agreed upon thresholds of larval presence are reached.

Specific larvicides that will be used for controlling mosquito production include Methoprene (Altocid), *Bacillus sphaericus, Bacillus thurigensis israelensis* (Bti). Larvicides are more effective and less toxic than adult mosquito sprays, and the applications are unlikely to result in human exposure.

Unlike conventional pesticides, each Altocid formulation contains methoprene, an insect growth regulator (IGR) that stops mosquitos from becoming breeding, biting adults. Methoprene is target-specific, and will not affect fish, waterfowl, mammals or beneficial predatory insects.

Bti or *Bacillus sphaericus* products are recommended due to their low toxicity to non-target organisms, (Washington Department of Ecology 2002). Federal laws prohibit the application of Bti to reservoirs that contain drinking water, (EPA 1998). *B. sphaericus* has very few environmental risks associated with its use. *B. sphaericus* is both non-toxic and non-pathogenic for a variety of species tested, (Washington Department of Ecology 2002). When used according to label rates, *B. sphaericus* does not appear to harm mammals, birds, fish, or most non-target invertebrates (insects and worms). Since *B. sphaericus* is primarily used in contained waters, the potential for contact among certain terrestrial and aquatic species is further limited. Bti is very specific for mosquitoes and black flies, and has some toxicity toward certain other dipterans (including midges). Bti is the primary material used for mosquito control because of its low toxicity to non-target species.

Details as to the monitoring efforts, timing of application, larvicide's to applied, record keeping, public outreach efforts, and other aspects of the mosquito control program on CFWMA will be documented in a Memorandum of Understanding (MOU) between Montana Fish, Wildlife and Parks and Broadwater County. The county will be responsible for all aspects of the control program as outlined below. Surveillance, mapping and monitoring of potential mosquito sites will be done by the Broadwater County mosquito contractor and/or qualified county personnel and will occur at the following periodic intervals and application of any larvicide will be by properly licensed personnel.

- April 15 to May 16
    - Initial survey of entire area (this will be coordinated with the adjoining mosquito district land)
    - Follow up survey two weeks later
    - Submit survey reports for the period to Montana Fish, Wildlife and Parks office in Townsend.
- May 15 to May 30
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Pre aerial survey of the area
    - Monitor adult populations and set up light traps placed at appropriate locations

    - Apply larvicide products if action thresholds exceed 5 larvae (1st to 4th instars) per dip, notify FWP prior to application
    - Post aerial survey of the area
    - Submit reports of all activities for the period to Montana Fish, Wildlife and Parks office in Townsend.
- June 1 to June 15
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Monitor adult populations via CDC light traps placed at appropriate locations
    - Apply larvicide products if action thresholds exceed 5 larvae (1st to 4th instars) per dip, notify FWP prior to application
- June 15 to July 15
    - Pre aerial survey
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Monitor adult populations via CDC light traps and landing/bite counts
    - Apply larvicide products to sites if action thresholds exceed 5 larvae (1st to 4th instars) per dip, notify FWP prior to application
    - Post aerial survey of the area
    - Submit reports of all activities for the period to Montana Fish, Wildlife and Parks office in Townsend.
- July 15 to August 30
    - Perform larval and pupal surveys weekly or as weather conditions dictate
    - Monitor adult populations via CDC light traps and landing/bite counts (action threshold is 5 bites per 10 minutes)
    - Apply larvicide products to sites if action thresholds exceed 5 larvae (1st to 4th instars) per dip, notify FWP prior to application
    - Submit reports of all activities for the month of July and August to Canyon Ferry BOR office and Tom Carlsen, FWP.
    - Submit reports of all activities for the period to Montana Fish, Wildlife and Parks office in Townsend.

Year-end reports summarizing the season's results and activities with recommendations for the following year's program will be submitted to Montana Fish, Wildlife and Parks office in Townsend. Additionally, copies of all maps, records, logs, complaints and correspondence will be available to FWP upon request. Year-end reports will include a description of the activities, methods and materials to be used including but not limited to:

- Pesticides with EPA Establishment Number and Registration Numbers
- Requirements to use pesticides consistent with FIFRA
- Application rate

- GPS technology may be used to track application of larviciding
- Acreage covered with application of larvicide on Canyon Ferry WMA
- Times of larvicide application
- Monitoring data
- Methods used for surveillance
- Control methods
- Evaluation plan

## 8. REFERENCES


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