



THOMPSON-NICOLA
REGIONAL DISTRICT

MOSQUITO CONTROL PEST MANAGEMENT PLAN

CONFIRMATION NO: 116-0030-15/20
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EXECUTIVE SUMMARY

This Pest Management Plan (PMP) will serve as a strategic management tool that will allow for the effective prevention and control of larval mosquitoes within specified mosquito control areas of the Thompson-Nicola Regional District (TNRD) including all public, private and First Nations Reserve lands by permission of the applicable owner, agent or authority.

TNRD carries out mosquito control activities only within Electoral Areas ‘J’, ‘L’, ‘M’, ‘N’ (except area around Coquihalla Summit Recreation Area), ‘O’, ‘P’ and a portion of Area ‘A’. The municipalities included within the treatment boundaries are the City of Kamloops, the District of Clearwater, the District of Barriere, the Village of Chase, the Resort Municipality of Sun Peaks, and the District of Logan Lake. The City of Merritt is not covered under this PMP.

Larval mosquito control will be the primary emphasis of this PMP. The use of adulticides is included in this PMP only as a last resort to control mosquitoes that have been inadequately controlled by larviciding. Adulticiding has not been conducted in the TNRD since 2002.

Adult mosquitoes are a source of annoyance and are capable of transmitting arboviruses such as West Nile Virus to both humans and domestic animals. Adult biting counts of more than three bites per minute on one forearm are intolerable for most people, and can negatively affect outdoor worker performance and human activities. The TNRD’s primary objective is to minimize the annoyance caused by large populations of adult mosquitoes.

This PMP is the legal authority for the TNRD to utilize pesticides for the purposes indicated above.

All mosquito control activities will be undertaken in a manner that minimizes risk to the environment and human health. This PMP addresses all required elements of a PMP as outlined in Section 58 of the BC *Integrated Pest Management Regulation*.

1.0 INTRODUCTION

The goal of the Thompson-Nicola Regional District (TNRD) mosquito control program is to reduce mosquito populations to a tolerable level. In areas adjacent to extensive larval development habitat, mosquito populations can become extremely high. When this happens, quality of life for residents in the area can decrease because of severely limited outdoor activity. Further, high numbers of mosquitoes can cause allergic reactions in some individuals, and can also impact tourism.

In some instances, human and animal health can also be impacted as some mosquito species are capable of transmitting illnesses such as Western Equine Encephalitis, Canine Heartworm and West Nile virus and therefore, the TNRD may also undertake vector mosquito control aimed at the reduction of mosquito species known to transmit disease.

The TNRD has conducted a mosquito control program since 1972. The program is based on the principles of Integrated Pest Management (IPM) in that the most environmentally sensitive methods of control are considered first. Prevention and reduction of mosquito larval development sites is the first objective of the TNRD program, as preventing a problem is always better than trying to control the problem once it occurs.

Next, the majority of the TNRD mosquito control campaign is focused on controlling mosquitoes while they are in their larval stages, (as opposed to their adult stage) for two primary reasons. Firstly, larval control is much more efficient than adulticiding – it is possible to treat larval mosquitoes in very high concentrations in rearing ponds, while adult mosquitoes tend to disperse soon after emerging over a much wider area. Secondly, larvicides such as Aquabac, Vectobac, Altosid and VectoLex are species-specific, affecting only aquatic members of the Order Diptera, which includes mosquitoes, black flies and midges. Adulticides can have the undesired effect of impacting non-pest and beneficial insects such as pollinators and predators.

In cases of extreme numbers of adult mosquitoes, the TNRD will consider the use of chemical pesticides for the control of adult mosquitoes. These pesticides would only be considered when all of the following criteria are met: 1) mosquito population numbers have reached threshold levels (See Section 2.4.2) and landowners are finding them to be intolerable; 2) a specific request for adulticiding has been made; 3) all landowners are in agreement with the application of the pesticide and give their permission; and 4) strict adherence to environmental legislation can be maintained. **Since 2002, adulticiding of nuisance mosquitoes has not been**

conducted by the TNRD. The TNRD considers the application of adulticides for nuisance mosquitoes as “a last resort control method”, to be utilized only when all other methods of control have been exhausted. In addition, such adulticiding applications shall only be made with the written permission of affected local residents by way of a signed petition (See Appendix A).

In the case of adult vector mosquito control (control of mosquito species capable of disease transmission), adulticiding would be undertaken only under the Order of a Medical Health Officer and in this instance, the pesticide application would be done under the rules of the West Nile Virus Regulation and any parameters set by the Medical Health Officer.

The BC *Integrated Pest Management Act* and the *Integrated Pest Management Regulation* require pesticides to be applied pursuant to the principles of IPM. This in turn requires the development of a Pest Management Plan (PMP) (this document) and the use of pesticides in accordance with the terms and conditions of the *Integrated Pest Management Regulation* and the commitments made in this PMP. The content of PMP's prepared in the province of British Columbia is also legislated under the *Integrated Pest Management Regulation* (Section 58) and a checklist of required components is included in Appendix B.

1.1. IDENTIFYING INFORMATION [IPMR SECTION 58(1)]

1.1.1. Responsibility for the TNRD Integrated Mosquito Control Program [IPMR Section 58(1)(b)(c)]

The TNRD mosquito control program is conducted by mosquito control contractor(s). Within the TNRD, the primary contact for information relating to this Pest Management Plan is:

Martin Dickson
Environmental Services Technologist
300-465 Victoria Street
Kamloops, B.C. V2C 2A9.
Phone: (250) 377-7199 or at 1-877-377-8673.

1.1.2. Geographic Boundaries of the Area to Which This Plan Applies [IPMR Section 58(1)(a)]

The TNRD mosquito control program is conducted within Electoral Areas ‘J’, ‘L’, ‘M’, ‘N’ (except area around Coquihalla Summit Recreation Area), ‘O’, ‘P’ and a portion of Area ‘A’ including all public, First Nation and private land by permission of the applicable owner, agency or authority. The program area includes the municipalities of Kamloops, Clearwater, Barriere, Sun Peaks, Chase and Logan Lake. The City of Merritt is not covered under this PMP. A map

of the geographic boundaries to which this PMP applies can be found in Appendix C. Maps displaying the locations of larval development sites can be provided upon request. Please contact Martin Dickson, Environmental Services Technologist (Section 1.1.1) at the TNRD for specific larval development site information.

1.1.3. Term of this PMP

This PMP shall be in force for a five-year period from November 10th, 2015 to November 9th, 2020.

2.0 INTEGRATED PEST MANAGEMENT

A requirement of all PMP's in British Columbia is an explanation of how the applicant (in this case, the TNRD) will utilize the elements of Integrated Pest Management (IPM). The six elements of an IPM strategy that will be discussed in detail in the following sections are:

- 1) a strategy to *prevent* organisms from becoming pests (planning);
- 2) a method to *identify* pests;
- 3) a *monitoring* (surveillance) program;
- 4) a description of the *injury thresholds* used to make treatment decisions;
- 5) a description of *treatment options* and selection criteria; and
- 6) a method for *evaluating effectiveness* of pesticide use.

2.1. PREVENTION (PLANNING) [IPMR SECTION 58 (2) (A)]

Prevention is one of the most important options for successful mosquito control. The TNRD actively pursues the following preventative measures in its mosquito control program:

- Reduction and/or modification of mosquito larval development sites; and,
- Public education

2.1.1. Source Reduction & Habitat Modification

The TNRD encourages the reduction of mosquito larval development sites and water management as effective methods of mosquito control. The fact that mosquitoes require water to develop is the key to their effective control. Mosquitoes are unable to complete their life cycle without water.

Source reduction is simply the use of physical methods to eliminate standing water by draining or filling in mosquito larval development sites, or allowing water to flow through the site. If draining or filling is not an option, many mosquito larval development sites such as storm water retention ponds, sewage treatment ponds, farm dugouts, and ornamental ponds, can be made unsuitable for mosquito larval development through a combination of good design (*e.g.*, steeply sloped and gravelled shore lines), water level manipulation, and control of emergent

vegetation. Bodies of water with sloped, gravelled, rocky or sandy shorelines generally will support few mosquitoes, as larvae will be exposed to wave action and will have difficulty obtaining food.

Scraping of sediment from the bottom of roadside ditches every few years can make the ditches unattractive for mosquito larvae. Ditches that are slow to drain may form a series of pocket pools and support lush grasses and weeds, thereby becoming prime larval development sites. Land owners and local governments will be encouraged to use the above described methods within their lands.

In some agricultural areas, over-irrigation or flood-irrigation can produce significant larval development habitat. Proper watering of fields at ranching and hay farming operations will be encouraged by the TNRD through education. Efforts will be made to contact farmers when over-irrigation, flood-irrigation or broken irrigation pipes are noticed. Farmers will be encouraged to alter their practice and/or repair broken irrigation pipes.

Homeowners/residents will be encouraged to participate in habitat management. Since some species of mosquitoes (e.g. *Culex* and *Culiseta*) can readily breed in containers, the TNRD encourages residents to reduce standing water around their homes. Some examples of measures that can be undertaken by residents to help eliminate mosquito larval habitat on their property include:

- Eliminating standing water outdoors from empty artificial containers (e.g., flower pots, wheel barrows, old tires, barrels, storage drums, abandoned equipment and tins cans) at least once a week by emptying them of water, storing them in an inverted position, drilling holes in them, disposing or covering them;
- Covering the top of water collecting containers (e.g. rain barrels) with a screen to prevent mosquitoes from laying floating eggs;
- Draining water from swimming and wading pools when not in use, or covering them so that mosquitoes cannot lay eggs;
- Keeping water off swimming pool covers and ensuring that the pump is circulating water;
- Changing water in bird baths weekly;
- Installing fountains or aerators in artificial water bodies;
- Clearing leaves and twigs from tarps, awnings, eaves troughs, storm gutters and roof gutters throughout the summer and early fall so water does not pool or collect;
- Avoiding over-irrigating lawns and fields, and drain standing water;
- Ensuring proper drainage of septic tank fields so mosquitoes cannot lay eggs;
- Draining or filling in low areas to eliminate standing water;

- Filling-in or levelling any depressions in the landscape caused by tire ruts or excavation;
- Educating/encouraging ranchers/agricultural producers to change water weekly in livestock watering troughs; and,
- Installing pumps to circulate water in ornamental ponds to discourage mosquitoes from laying their eggs.

2.1.2. Public Outreach

The TNRD has, for a number of years, included public outreach as a vital component of their mosquito control program. Public outreach includes advising the public on personal protective measures that they can take to reduce the incidence of mosquito bites.

Some examples of public outreach initiatives conducted by the TNRD include:

- Maintenance of a 24-hour Mosquito Advisory Line whereby residents can leave a message and have the mosquito control contractor(s) return their call within 24 hours to answer any questions residents may have concerning mosquito control, mosquito biology, or current mosquito control activities. Residents can also report new potential habitats.
- Attendance (as funding allows) at events such as trade shows, club meetings, outdoor festivals and fairs, workshops, farmer's markets, presentations to age groups from pre-schoolers to seniors, information booths at public events, public meetings, parades and rodeos, community garage sales, home and garden shows, family fun days, arts festivals, events in conjunction with statutory holidays, and presentations/workshops held for individual First Nations;
- Advertising on radio and television (as funding allows) on topics related to mosquitoes and WNV, including promoting the use of mosquito repellents; and.
- A website for information related to the mosquito control program. This website can be accessed at: <http://tnrd.ca/content/mosquito-control-overview>

As part of its public education initiatives, the TNRD promotes the following:

- Avoiding, where possible, being out between dusk and dawn, as mosquitoes tend to be more active between these times;
- Wearing protective clothing, especially outside in the early evening and at dawn. This includes long-sleeve shirts or jackets and long pants that mosquitoes cannot bite through. Pants should be tucked into socks for extra protection;
- Avoiding dark coloured clothing as it can attract mosquitoes;
- Using mosquito netting for babies and toddlers in cribs and strollers;
- Using Health Canada approved mosquito repellents according to their labels. Applying personal insect repellents, such as those containing DEET (N,N-dithyl-m-toluamide), Icaridin or Lemon Eucalyptus Oil (30%) is an effective protection from mosquito bites; and

- Discouraging the use of bug zappers, devices that give off sound waves and Citrosa plants for protection against mosquito bites as these are not shown to be affective.

2.2. A DESCRIPTION OF THE PROGRAM THAT WILL BE EMPLOYED TO IDENTIFY THE PEST [IPMR SECTIONS 58(2)(B)]

One of the most important steps in mosquito control is to correctly identify the pest species and its habitat. This is particularly important because only certain mosquito species are known to be a significant nuisance, while other species are known to be competent vectors of WNV (and related arboviruses). Species identification allows control staff to tailor their program to meet specific objectives (i.e., nuisance control or dvector control).

Mosquito surveillance allows controllers to identify when and where mosquito pests occur. The TNRD has engaged in both ongoing larval surveillance and adult surveillance. At least 38 different species of mosquitoes representing all of BC's six genera of mosquitoes have been captured in adult light traps and as larvae in the Regional District (Table 1). All of the following species present in the TNRD except *Culex territans* (which feeds on amphibians) and *Culex pipiens* (which feeds on birds) can be a nuisance species to some degree. *Culex pipiens* is an excellent vector of mosquito-borne illness among birds and therefore is an important species targeted when undertaking vector control:

Table 1. List of the Mosquito Species Present within the TNRD

<i>Aedes cinereus</i>	<i>Culiseta morsitans</i>	<i>Ochlerotatus increpitus</i>
<i>Aedes vexans</i>	<i>Ochlerotatus campestris</i>	<i>Ochlerotatus intrudens</i>
<i>Anopheles earlei</i>	<i>Ochlerotatus canadensis</i>	<i>Ochlerotatus melanimon</i>
<i>Anopheles freeborni</i>	<i>Ochlerotatus communis</i>	<i>Ochlerotatus mercurator</i>
<i>Anopheles punctipennis</i>	<i>Ochlerotatus cataphylla</i>	<i>Ochlerotatus pionips</i>
<i>Coquillettidia perturbans</i>	<i>Ochlerotatus dorsalis</i>	<i>Ochlerotatus provocans</i>
<i>Culex pipiens</i>	<i>Ochlerotatus euedes</i>	<i>Ochlerotatus pullatus</i>
<i>Culex tarsalis</i>	<i>Ochlerotatus excrucians</i>	<i>Ochlerotatus punctor</i>
<i>Culex territans</i>	<i>Ochlerotatus fitchii</i>	<i>Ochlerotatus sierrensis</i>
<i>Culiseta alaskaensis</i>	<i>Ochlerotatus flavescens</i>	<i>Ochlerotatus spencerii</i> var <i>idahoensis</i>
<i>Culiseta incidens</i>	<i>Ochlerotatus hendersoni</i>	<i>Ochlerotatus spencerii</i> var <i>spencerii</i>
<i>Culiseta inornata</i>	<i>Ochlerotatus hexodontus</i>	<i>Ochlerotatus sticticus</i>
<i>Culiseta impatiens</i>	<i>Ochlerotatus implicatus</i>	

In the field, mosquito larvae and adults are difficult to identify to the species level. For positive identification, most mosquitoes need to be examined under a microscope. In the TNRD, the determination as to whether a larva is likely to be a pest species or not will be based on the habitat where the larvae are found and the time of year. Mosquitoes are selective with their habitats. Different species of mosquitoes tend to choose different types of habitats. The time of year can also give clues to the identity of the mosquito species.

Generally, the mosquito larvae that appear in early spring (sometimes even before ice-off) are of the genera *Aedes* and/or *Ochlerotatus*. Also floodwater mosquitoes are generally of the *Aedes* and/or *Ochlerotatus* genus and these larvae appear in any kind of flooded habitat including: flooded fields from over-irrigation; stream and river flooding; ditches; snowmelt pools in woodlands and fields; and flooding from rising lake and marsh waters.

Aedes is the Greek word for disagreeable, and is an accurate reflection of these species in terms of both numbers and ferocity. *Aedes* and *Ochlerotatus* species lay their eggs in moist soil near recently flooded area. Snowmelt species rely on warm temperatures and/or low oxygen levels in water to induce their eggs to hatch. Larvae of the floodwater species usually appear as soon as their eggs are wetted. Large areas of habitat often become active at once with rising floodwaters along creeks, rivers, and lakes and in permanent marshes as the snow melts and raises the water level in the marshes. Eggs laid by most species remain viable for a number of years, and therefore egg concentrations in the soil can become very dense. *Whenever habitat along flooding creeks, rivers, lakes, ditches, fields and in permanent marshes in the spring contains mosquito larvae, it is assumed that these are pest species and treatment of the larvae will be considered.*

As the summer progresses, the occurrence of floodwater larvae tends to decrease (unless a large storm event causes flooding, or in the case of agriculture, a farmer over-irrigates, flood-irrigates or fails to repair broken pipes). Water left standing after the spring floods will begin to colonize with species of mosquitoes from the *Anopheles*, *Culiseta* and *Culex* genera. *Anopheles* mosquitoes are easily recognized as the larvae are much different in appearance from all other larvae in British Columbia. They lay flat on the surface of the water and lack a siphon. *All Anopheles species in British Columbia can be considered pests and therefore whenever these species are seen, treatment will be considered.*

Culiseta and *Culex* mosquitoes lay their eggs on the surface of standing water and will produce multiple generations over the summer. Most species from each of these genera can be nuisance mosquitoes and/or vectors of mosquito-borne illness so if they are present in high enough numbers, they may be considered for treatment.

In order to determine if adult mosquitoes are a pest, bite counts will be employed and when counts reach threshold levels (Section 2.4.2) the mosquitoes will be considered a nuisance, regardless of the species.

The determination as to whether a vector mosquito species is posing a health risk and therefore warranting adulticiding control is a duty of the local Medical Health Officer and the TNRD will only conduct adulticiding for vector control under an Order from a Medical Health Officer.

2.3. MONITORING (SURVEILLANCE) PROGRAM [IPMR SECTIONS 58(2)(C)(I)(II)(III)]

The TNRD conducts three kinds of surveillance as part of the mosquito control program including: 1) environmental conditions; 2) larval development sites and larval populations, and 3) adult mosquito populations.

2.3.1. Environmental Monitoring

As the first stage of environmental monitoring, the TNRD mosquito control contractors monitor river levels, snow pack levels, temperature forecasts, dam release plans (for Nicola River) and precipitation forecasts. Water Survey Canada maintains real-time continuous flow data for many rivers in the province including the North and South Thompson Rivers. This data is monitored by our contractors daily during peak flows at

http://wateroffice.ec.gc.ca/index_e.html . Snow pack levels are viewed on the Ministry of Forest, Lands and Natural Resource Operation website:

<http://bcRFC.env.gov.bc.ca/data/asp/realtime/index.htm>. Monitoring of each of these variables before and during the control season, allows mosquito control staff to estimate the size and number of larval development sites that will appear throughout the season. These factors are also of critical importance when attempting to predict river levels and peaks. It is a goal of the program to postpone aerial larviciding in the North Thompson valley until after a major river peak to reduce the amount of larvicide needed to conduct the aerial campaign; however, this is balanced with larval development as the larvae cannot be allowed to pupate while waiting for the river to peak.

Also, current weather conditions are monitored through Environment Canada weather forecasts as these can affect whether or not treatments are carried out on any given day. Ground based treatments of granular larvicides are occasionally deferred during high precipitation events or during wind storms. When helicopter applications are planned, wind and precipitation monitoring is especially important as helicopter treatments are halted when wind conditions make it difficult for the pilot to aim granular larvicides at the larval development sites (*i.e.* the pilot is unable to compensate for drift of the granular product due to wind). Also, helicopter campaigns are not possible during precipitation events as the granular larvicides become wet and clog the application equipment. This can result in improper application rates and possible damage to the application equipment.

Current weather conditions are exceptionally relevant during adulticiding campaigns. Wind speed, ambient temperature and precipitation all influence the application of adulticides and suitable parameters are included on most of the adulticide labels. Winds must be negligible to prevent excessive drift of Ultra Low Volume (ULV) droplets, however some labels state that a slight breeze is desirable. Adulticides such as malathion can only be applied when the ground and vegetation is dry and is expected to remain dry for at least 8 hours. Also, ambient temperature can be important with some chemical pesticides, and their effectiveness is impeded if they are not applied when the ambient temperature is optimal (*e.g.* malathion should be applied when ambient temperatures are between 15°C and 30°C).

2.3.2. Surveillance of Larval Mosquitoes

The TNRD will conduct larval surveillance in areas previously identified as known or potential larval development sites. Sampling will be undertaken as required, based on meteorological factors such as rainfall, temperature, river levels or flooding events. The results of sampling will be used to make treatment decisions.

Monitoring Methods, Frequency of Monitoring and Data Collected

Regular surveillance of larval mosquito populations will be undertaken by TNRD contractors throughout the mosquito season to determine when and if treatment is required (based on threshold levels- See Section 2.4.1). Larvicides have been shown to be most effective when the mosquito larvae are actively feeding and when the larvae are at the right stage (instar) of development. The results of larval surveillance will be used to:

- Define the nature and extent of the mosquito problem within the control area based on larval surveys;
- Give direction to daily mosquito control operations (priorities will be set based on the instar of the larvae);
- Determine which larval development sites can be eliminated from future surveillance;
- Generate the data needed to determine if larviciding should be done (i.e. the treatment threshold has been reached or surpassed); and,
- Identify the genus of mosquito present at a larval site (if possible), to evaluate whether the species are significant human pests.

The most common tool that is used to determine the density (numbers) of mosquito larvae is a dipper. With this device, a 300 ml sample of water from a suspected larval development site is checked for the presence of mosquito larvae. The number of larvae present and their development stage (instar) is recorded, and the process repeated at several locations to determine the average density. The results of this sampling are used to make a treatment decision, and later, they will also be used to document treatment effectiveness, as the numbers of mosquito larvae present after treatment can be compared with pre-treatment levels.

The TNRD or its contractors will maintain an electronic database that enables staff and contractors to access larval development site data quickly and accurately.

The database currently includes the following information:

- The location and size of the larval development habitat (size estimate as this fluctuates with flood level);
- Description of the habitat (floodwater, snowmelt, manmade, etc);
- Maps and/or photographs associated with each development site;
- The status of the land (public or private);
- Status regarding “no treatment areas” if any;
- Landowners contact information;
- Larval development site data (mosquito species present, if known, and surveillance history) and;
- Monitoring and treatment data including the following:
 - Date and Time of monitoring or treatment event
 - Number of larvae present per dip or adult bite count
 - Name of pesticide
 - Active ingredient
 - PCP No.
 - Kilograms or litres of pesticide applied
 - Number of hectares treated
 - Technicians also keep a record of precipitation (if any), wind speed and temperature in a notebook

2.3.3. Surveillance of Adult Mosquitoes

Adult surveillance will be conducted in the TNRD for a number of reasons. First, it will be used to assess the effectiveness of the larval control program. When adult mosquitoes are trapped on an annual basis, comparisons can be made year to year to determine the ongoing effectiveness of the program. Next, adult trapping may be conducted in response to specific concerns from landowners. When adult mosquito populations increase unexpectedly, mosquito collections can give a clue as to the proximity and type of larval development site that the adults came from. Different species of mosquitoes rear in different types of development sites, and once the species of mosquito causing the nuisance is determined, crews can search for possible development sites in the area. Finally, adult trapping can be used (along with other methods) to assess mosquito numbers when adulticiding has been requested and is being considered.

In the TNRD, adult surveillance may be conducted with the use of CDC black light traps, and/or New Jersey light traps and/or by the use of bite- counts. CDC black light traps and New Jersey traps use black light to attract adult mosquitoes which are sucked into a collection jar. To increase these traps effectiveness, dry ice can be placed near the trap as it releases carbon dioxide, a powerful mosquito attractant. Light traps attract mosquitoes that are in the blood-seeking phase of their cycle.

Another method of adult surveillance is the use of bite-counts. To perform a bite-count a crew member exposes one bare forearm at a time of day when mosquitoes are causing their greatest nuisance. The crew member counts the number of bites on his or her forearm over a one minute period. Adulticiding decisions are often made based on bite counts that meet a predetermined threshold. Bite-counts can also be used post-treatment to determine the effectiveness of an adulticiding campaign.

2.3.4. Assessing Environmental Conditions and Damage Caused by Mosquitoes Before Insecticide Use

Damage Caused by Mosquito Larvae

Unlike other types of pests, mosquito larvae do not cause direct environmental damage or affect environmental conditions. Potential damage caused by mosquito larvae is related to the potential of some species (as adults) to cause a nuisance and/or to transmit WNV and other arbovirus to humans and some animals.

Damage Caused by Mosquito Adults

Adult mosquito outbreaks can have negative economic effects. Adult mosquitoes can, and do, interfere with a variety of recreational activities by limiting the use of outdoor areas, especially when they are present in high numbers. This can have economic consequences where tourism is a significant industry. Next, studies have also shown that numerous outdoor work activities (e.g., agriculture, forestry, construction) are negatively impacted by the presence of large numbers of biting mosquitoes. In the farming industry, dairy and beef cattle have been shown to have smaller weight gains when exposed to both constant annoyance and being bitten while grazing or feeding.

There can also be health concerns related to mosquito bites. There are several species of mosquitoes that are known or potential vectors of WNV with the geographic boundaries of this PMP. Also, mosquito bites can cause severe reactions in some individuals and skin infections can occur when individuals scratch their bites.

2.4. INJURY THRESHOLDS [IPMR SECTIONS 58(2)(D)(I)&(II)]

With respect to mosquitoes, injury thresholds are generally referred to as treatment thresholds. The TNRD has established treatment thresholds for both larval mosquito populations and adult mosquito populations.

2.4.1. Treatment Thresholds for Mosquito Larvae

The treatment threshold for mosquito larvae is determined by the certified applicator and takes into account a number of variables. The applicator makes a decision as to whether the numbers of larvae present are likely to cause a nuisance or health risk if allowed to develop to adults.

As a general guideline, the treatment threshold for mosquito larvae is an average of **three larvae per 300ml dip**. This threshold was selected as it is the standard that has been used in British Columbia and other areas of Canada and the United States. However, the TNRD will consider exceptions to this rule. In some cases, an applicator may decide that an average of three larvae per dip may not be sufficient numbers for treatment. For example, if the larval development site is very small and a good distance from the public, the applicator may decide that allowing the larvae to develop will not pose a nuisance problem and therefore no treatment would be necessary. In some instances, the technician will determine that the site is likely to dry-up prior to the larva emerging. Conversely, a technician may encounter a site that is very

large and deep with larvae distributed throughout the water column. In this case, it may be difficult to capture three larvae in a dip, however the cumulative number of larvae in the site can be significant and treatment could be warranted. Certified Mosquito and Biting Fly Pesticide Applicators working for the TNRD contractor(s) will make the final decision as to whether or not to carry out larval treatment. No larviciding will be conducted on private property without the consent of the landowner.

2.4.2. Treatment Thresholds for Mosquito Adults

Adulticiding is considered the absolute last resort in the TNRD mosquito integrated pest management program. It is believed that with proper source reduction and larviciding activities, adulticiding will rarely be required. However, in some instances, adulticiding will be considered.

When a nuisance mosquito concern from the public has been received, the TNRD will undergo a number of steps. First, the caller will be informed of the criteria that need to be met before adulticiding can be considered. The caller will be informed of the three-bites-per-minute minimum threshold and no pesticide zones around water bodies. If the caller believes that this threshold is being met and that the no-pesticide zones do not apply to them (*i.e.* they live away from water), then the caller will be sent (via fax, email or hand delivery) a copy of the TNRD Mosquito Adulticiding Petition and the caller will be asked to go door to door in his or her neighbourhood to determine if the neighbours are in favour of a spray campaign. The petition describes the adulticide that will be used and the precautions that the landowner must take during a spray event (see a copy of the petition in Appendix A). In urban areas, many households may need to provide signatures in order for a spray campaign to be reasonable. For example, if only two or three houses in a row of houses are in favour of treatment, it would be ineffective to spray such a small area. If an individual is unavailable to sign the petition, or refuses to sign the petition, their property WILL NOT BE SPRAYED and a 10 m pesticide-free zone will be maintained around the perimeter of their property. This may mean that no properties on the street will be sprayed if it is felt that it would be impossible to spray without having drift onto a property that refuses or is unable to provide permission.

In rural areas, there may be times that no petition is required if the landowner that is requesting spray has a large enough property that a campaign can be completed within their

property boundaries while maintaining a 10 m pesticide-free zone around neighbouring properties.

Regardless of the number of individuals requesting spray, no adulticiding will ever be considered unless meteorological conditions are appropriate as outlined on the product label and adequate buffer zones can be maintained around the following:

- **Bodies of water** including dry streams and wetlands (10m, pesticide-free zones are required around these habitats and thus, in the case of ULV sprayers, a 100m no-treatment zone will be employed);
- **Water supply intakes or wells used for domestic or agricultural purposes** (including water used for livestock or irrigation of crops) (a 30m no-treatment zone must be maintained around a water supply intake or well unless the confirmation holder is “reasonably satisfied” that a smaller no-treatment zone is sufficient to ensure that pesticide from the use will not enter the intake or well- a record must be kept of the information on which the decision was based for a smaller no-treatment zone); and
- **Apiaries.**

If all of the above criteria are satisfied, then an applicator must conduct a bite count and this must reveal an **average bite count of three-bites-per-minute or more on one exposed forearm (which will be the threshold for treatment)**. This threshold is commonly used in abatement programs throughout North America. When mosquito populations rise above these thresholds, outdoor activity and work can be affected as well as tourism and agricultural returns.

It should also be noted that adulticiding will not be performed unless an attempt has been made to control the mosquito population with larvicides. For example, if a landowner refuses larval treatment on his or her property, the landowner will be ineligible for adulticiding treatments later in the season once the adults emerge.

All adulticiding will be carried out between sunrise and sunset to minimize the impact on human, livestock and beneficial insects.

The criteria outlined above apply to adult nuisance mosquitoes. The TNRD will not be adulticiding to control insect vector species unless directed to do so under Order by a Medical Health Officer and the TNRD would then follow the direction of the Officer and the threshold levels and criteria set above may not apply.

2.5. TREATMENT OPTIONS FOR CONTROLLING MOSQUITO LARVAE [IPMR SECTIONS 58(2)(E)(I)(II)(III) (IV)]

IPM involves the use of different techniques to control mosquitoes. The treatment options that the TNRD will employ include:

- Source reduction and habitat modification (prevention);
- Biological control of larvae;
- Chemical control of larvae;
- Chemical control of adult mosquitoes.

2.5.1. Source Reduction and Habitat Modification

The physical and mechanical control options that the TNRD both promotes and utilizes to control the larvae of mosquitoes have been described in Section 2.1.1(Source Reduction).

Rationale/Selection Criteria for Source Reduction and Habitat Modification

Mosquitoes require water to develop. Removal of standing water sources or modification of habitats, as described in Section 2.1.1, will effectively control mosquito larvae. This is always the preferred treatment option since elimination of the larval habitat is the most effective immediate and long-term control strategy.

Benefits of Source Reduction and Habitat Modification

The use of source reduction and habitat modification provides an effective, long-term solution to controlling mosquito larvae, and may preclude the need for using pesticide control measures.

Limitations of Source Reduction and Habitat Modification

Typically, source reduction or habitat modification is conducted on small man-made habitats. Activities such as draining water collecting containers around a property and ditching can only go so far to reduce overall mosquito numbers. The most important habitats (natural ponds and floodwaters) cannot be modified as these are protected under provincial legislation.

2.5.2. Biological Control of Mosquito Larvae

Biological control involves the release or introduction of bacterial agents to reduce larval mosquito populations. The biological control agents proposed for use under this PMP are bacterial agents belonging to the genus *Bacillus*, and include *Bacillus thuringiensis* var *israelensis* (*Bti*) and *Bacillus sphaericus* (Table 2). The biological control products, and their

formulations, manner of application and the type of equipment required for each manner of application is detailed in Section 5.0 .

Rationale/Selection Criteria for Using Biological Agents

Mosquitoes are most efficiently and economically controlled when they are concentrated as larvae in a larval development site.

The primary selection criteria for using biological bacterial agents from the genus *Bacillus* is that they are well suited for use in an integrated pest (mosquito) management program. They have been shown to have minimal impact on most other organisms that may be present in mosquito larval development sites.

Benefits of Using Biological Agents

During the spore-forming stage of their life cycle, biological bacterial agents from the genus *Bacillus* produce a protein crystal protoxin that is activated by the alkaline conditions in the host digestive system and is then toxic to the larvae. The benefits of using these products are that they pose little risk to the applicator when they are being applied or through exposure after application and that they have little or no acute toxic impact on non-target species.

Limitations of Using Biological Agents

The primary limitation in using biological bacterial agents from the genus *Bacillus* to control mosquito larvae is the limited treatment window that is available. Treatments must be completed before the larvae stop feeding in the late 4th instar phase of development. Also, it is most beneficial from an operational and environmental standpoint to wait until the larvae are in their 3rd or early 4th instar. Waiting for later instars allows the greatest amount of time for the highest number of mosquito eggs to hatch and be available to the larvicide. Also, it keeps the larvae in the environment longer and available to predators that benefit from the larvae as a food source. Consequently, an increased frequency of monitoring is required to ensure that applications are made within the treatment-time window. In the case of *Bti* as formulated in Vectobac and Aquabac, the secondary limitation is that because of the rapid breakdown of these products in water through exposure to sunlight and aquatic microorganisms (generally 48 to 72 hours), treatments have to be repeated if monitoring confirms the presence of newly hatched mosquito larvae. *Bacillus sphaericus* formulated as VectoLex does not have this limitation as it has a prolonged action of up to 30 or more days.

According to the *Integrated Pest Management Regulation* Section 78(2), a pesticide-free zone is not required around standing water when applying the mosquito larvicides included in this PMP. However, in accordance with Section 78 (1) of the *Integrated Pest Management Regulation*, mosquito larvicides are limited in that they may not be applied in permanent, fish-bearing bodies of water or waters that have permanent, direct, surface-water connections with fish-bearing bodies of water. An exception to this rule is if a Medical Health Officer declares that an arbovirus is in the area, (e.g. WNV). In that case, fish bearing waters may also be considered for treatment of larvae.

2.5.3. Chemical Control of Larvae

In the context of this PMP, the only chemical larvicide proposed to control mosquito larvae contains the active ingredient methoprene. Table 2 includes the formulations of methoprene that may be used under this PMP. The larval chemical control products, and their formulations, manner of application and the type of equipment required for each manner of application is detailed in Section 5.0 .

Rationale/Selection Criteria for Using Chemical Larvicides Containing Methoprene

As was noted earlier, mosquitoes are most effectively and economically controlled when they are in the larval stage and are concentrated in a larval development site (such as a storm water catch basin or a human-made, self-contained, water body).

Methoprene is selected as the preferred larvicide in man-made, self-contained habitats (such as flood-irrigated fields and ditches, and disturbed seepage sites) because of its low toxicity to non-target organisms and its extended action of up to 60 days depending on the formulation.

Benefits of Using Chemical Larvicides Containing Methoprene

Methoprene products have a benefit over the biological products in that they are active for up to 30 days in water AND the pellets can be applied to sites that may periodically dry-up and then become wetted again. Methoprene is considered safe for applicators to use without significant protective gear and is environmentally friendly, meaning that it has very low toxicity to non-target organisms when applied at the labelled rates. Because the larvae are allowed to develop to their pupal stage, they are present in the water for a longer time than with the bacteria controls and therefore are available to feed natural predators in the habitat. Also, similar to bacterial agents from the genus *Bacillus*, preventing the larvae from becoming adult mosquitoes minimizes the area that needs to be treated, and can reduce overall chemical use by reducing or eliminating the need for applying chemicals to kill adult mosquitoes.

Limitations of Using Chemical Larvicides Containing Methoprene

There are some disadvantages associated with the application of chemical larvicides containing methoprene. At present, methoprene is much more expensive than *Bti*. In the laboratory, high doses of methoprene have been shown to be slightly toxic to non-target organisms such as some crustaceans and fish. In the field, when applied according to the label, toxic concentrations are not reached and the product is undetectable in the environment within a few days. However, following current legislation, **methoprene will only be considered for use in man-made water bodies that would never become contiguous with running water or for treatment of storm water catch basins.** Ideal locations include sewage lagoons, disturbed seepages and agricultural fields that are repeatedly flooded by over-irrigation and thus produce repeated generations of mosquitoes. The greatest disadvantage is that applicators are unable to

assess the efficacy of a treatment until after the larvae pupate and therefore if the treatment failed, adult mosquitoes are inevitable.

Table 2. List of larvicides that are included in this PMP, (Confirmation No 116-0030-15/20), for use within the Thompson-Nicola Regional District. Selection of the larvicide will be made by the applicator following assessment of the larva development habitat and consideration of available resources.

Trade Name	Formulation	Active Ingredient	PCP No.	Application Rate	Manner of Application	Application Methods*
Mosquito Dunks	13g dunk	<i>Bacillus thuringiensis</i> var <i>israelensis</i> Strain H-14 (BMP-144)	28888	1 dunk per 6 m ² of water surface	Ground	Manual placement
Vectobac 200G	Granules	<i>Bacillus thuringiensis</i> var <i>israelensis</i> Strain H-14 (AM65-52)	18158	3-10kg/ha	Ground & Aerial	Manual placement, backpack applicator, granular spreader, helicopter or fixed-wing aircraft
Vectobac 1200L	Liquid	<i>Bacillus thuringiensis</i> var <i>israelensis</i> Strain H-14 (AM65-52)	21062	0.25-1.0L/ha	Ground & Aerial	Backpack sprayer, truck/ATV-mounted sprayer, helicopter or fixed-wing aircraft
Aquabac 200G	Granules	<i>Bacillus thuringiensis</i> var <i>israelensis</i> Strain H-14 (BMP-144)	26863	2.5-20kg/ha	Ground & Aerial	Manual placement, backpack applicator, granular spreader, helicopter or fixed-wing aircraft
Aquabac XT	Liquid	<i>Bacillus thuringiensis</i> var <i>israelensis</i> Strain H-14 (BMP-144)	26860	300-2400mL/ha	Ground & Aerial	Backpack sprayer, truck/ATV-mounted sprayer, helicopter or fixed-wing aircraft
Altosid Pellets	pellets	methoprene	21809	2.8-11.2kg/ha	Ground	Manual placement or Backpack Applicator
Altosid XR Briquets*	36.4g Briquet	methoprene	27694	1 briquette per basin	Ground	Manual placement
VectoLex WSP*	10g water soluble pouch	<i>Bacillus sphaericus</i>	28009	1 pouch per catch basin	Ground	Manual placement
VectoLex CG	Granules	<i>Bacillus sphaericus</i>	28008	5.6-16.8 kg/ha in water bodies & 0.56-1.68 g/m ² of water surface area in tires	Ground & Aerial	Manual placement, backpack applicator, granular spreader, helicopter or fixed-wing aircraft
VectoLex WDG	powder to be mixed with water	<i>Bacillus sphaericus</i>	28007	0.56-1.68kg/ha	Ground & Aerial	Backpack sprayer, truck/ATV-mounted sprayer, helicopter or fixed-wing aircraft

*for use in storm water catch basins only

2.5.4. Chemical Control of Adult Mosquitoes

As mentioned before, adult control will only be considered as a last resort in the TNRD mosquito control program and will not be conducted in Electoral Area ‘A’. Adulticiding will only be considered if:

- 1) the provincial health officer or a medical health officer has issued a Pesticide Application Order under section 3(1) of the *Public Health Act*, West Nile Virus Control Regulation (the TNRD would apply pesticides following the parameters of the Order); **OR**
- 2) the threshold level for adult treatment is met, appropriate buffer zones can be maintained, meteorological conditions are appropriate, and there is written consent of all landowners where the spray would be applied (Section 2.4.2).

Also, it is a policy of the TNRD that no adulticiding for nuisance mosquitoes will be considered unless larviciding actions have been attempted and failed (*i.e.* a landowner who refuses permission to larvicide will not later be eligible for adulticide treatments on his or her lands). **Aerial application of adulticides will not be undertaken under this PMP.** The TNRD will consider the use of any of the registered mosquito adulticides listed in Table 3. The adult chemical control products, and their formulations, manner of application and the type of equipment required for each manner of application is detailed in Section 5.0 .

Rationale/Selection Criteria for Using Adulticides to Control Adult Mosquitoes

The rationale for using adulticides to control adult mosquitoes is generally a combination of:

- the failure of larviciding programs to control mosquito larvae and adult mosquitoes have reached the threshold levels for adulticiding; and/or,
- Provincial surveillance results have provided evidence that the risk of outbreak of WNV is significant and the Medical Health Officer has issued an Order to Adulticide.

Benefits of Using Adulticides to Control Adult Mosquitoes

The benefits of using adulticides to control adult mosquitoes include:

- Breaking the zoonotic cycle that is amplifying WNV and reducing the chances of being bitten; or
- Providing short-term localized relief from nuisance mosquitoes.

Limitations of Using Adulticides to Control Adult Mosquitoes

The primary limitations to the use of the adulticides proposed for use are:

- Their rapid rate of degradation (especially at high air temperatures) may necessitate additional treatments if surveillance results still show high levels of adult mosquitoes (that have moved from un-treated areas into treated areas, or from subsequent hatches);
- They are highly toxic to most insects, including beneficial species;
- They are highly toxic to honeybees. Registered beekeepers must be notified prior to nuisance adulticide treatments to determine the location of colonies, and to ensure that mitigation measures are in place to protect foraging bees;
- Adulticiding can only be conducted between dusk and dawn to protect honey bees which is difficult for applicators and requires extensive preparation and understanding of spray routes which are then driven in the dark;
- If using the Gardex Commercial Industrial micro spray concentrate, mixing is required which puts the applicator at increased risk;
- Prior to ground based applications, signs advising of the treatment must be posted at least 24 hours prior to treatment at the main access points to the treatment areas **or** individual landowners must be notified; and,
- Adulticide applications cannot be made to control adult mosquitoes located in areas within 10 metres of water bodies due to the high toxicity of the active ingredients proposed for use to both fish and aquatic insects. An additional buffer zone is also recommended based on spray width of equipment (100m in the case of the truck mounted sprayers currently owned by the TNRD).

Table 3. List of adulticides that are included in this PMP (TNRD-MOS-2015/2020) for use within the TNRD (except Electoral Area ‘A’) Selection of the adulticide will be made by the applicator following assessment of the area to be treated and the products available.

Trade Name	Formulation	Active Ingredient	PCP No.	Application Rate	Manner of Application	Application Method
Pro Malathion ULV Concentrate Liquid (previously Wilson Malathion ULV Concentrate)	Liquid for ULV spray	malathion	14597	Residential areas: <223ml/ha Other areas: 425-550 ml/ha	Ground	Non-thermal, ULV aerosol generator
Fyfanon ULV Concentrate	Liquid for ULV spray	malathion	9337	Residential areas: <260ml/ha Other Areas: 425-550ml/ha	Ground	Non-thermal, ULV aerosol generator
Malathion 95 ULV Insecticide	Liquid for ULV spray	malathion	25638	Residential areas: <274 ml/ha Other areas: 425-500ml/ha	Ground	Non-thermal, ULV aerosol generator
Gardex Commercial Industrial micro spray concentrate	Liquid for ULV spray (requires mixing prior to application)	pyrethrins 3.0%; Piperonyl butoxide 6.0%; N-Octyl bicycloheptene dicarboximide 10.0%	11855	2.5-3g pyrethrin/ha	Ground	Non-thermal, ULV aerosol generator
Pyrenone 25-5 M.A.G. Liquid Insecticide	Liquid for ULV spray	pyrethrin 5%; piperonyl butoxide 25%	14632	2.25ml-2.75ml pyrethrin/ha; 11-15ml piperonyl butoxide/ha	Ground	Non-thermal, ULV aerosol generator
Pyrocid Fogging formula 7067 for ULV Mosquito Adulticiding	Liquid for ULV spray	pyrethrin 5%; piperonyl butoxide 25%	13378	2.8g-3.4g pyrethrin/ha; 25-30g piperonyl butoxide/ha	Ground	Non-thermal, ULV aerosol generator

*Ultra Low Volume (ULV) adulticiding applications may be done truck or ATV-mounted sprayers or backpack sprayers. NO AERIAL adult mosquito control will be conducted under this PMP in the TNRD.

2.5.5. Selection of a Treatment Method

Once a decision has been made to conduct a treatment, the applicator must decide which product they will use. The decision will be based on a combination of the following considerations:

FOR LARVAL TREATMENTS

- 1) the advantages and disadvantages of each pesticide as discussed in Sections 2.5.2 to 2.5.3 and the properties of the pesticide and its method of application as will be discussed in Section 5.0 ;
- 2) the life stage (instar) and species of the larvae (single generation mosquito, or multi-generational mosquito);
- 3) the characteristics of the larval habitat (high organics, intermittently dry, type of habitat, and size and location of site);
- 4) the availability of the larvicide;

- 5) the cost of the larvicide; and
- 6) the proximity to fish bearing water and the likelihood of intermittent connection to fish bearing water.

FOR ADULT TREATMENTS

- 1) the advantages and disadvantages of each pesticides as discussed in Section 5.3. ;
- 2) the method of application and properties of the pesticide as will be discussed in Section 5.3. ;
- 3) the ambient temperature (optimal application temperature are different for different adulticides and are displayed on the label);
- 4) the proximity to fish bearing water, riparian habitat and no-spray zones;
- 5) the availability of the adulticide;
- 6) the cost of the adulticide;
- 7) the size of the area to be treated and the number of property owners granting permission to treat; and
- 8) whether the application is in an urban or rural area (there may be greater safety concerns with applications in urban areas).

2.6. DESCRIPTION OF THE MONITORING PROGRAM FOR EVALUATING THE EFFECTIVENESS OF THE PESTICIDE [IPMR SECTIONS 58(2)(F)(I)(II)(III)]

The final component of an Integrated Pest Management approach is that of post-treatment evaluation. Post-treatment evaluation can help to improve a program over time as applicators learn which pesticides, application rates, methods and timing worked best at each application site. Constant evaluation of a program and its results will allow TNRD staff to improve and refine their mosquito control program.

2.6.1. Evaluating the Effectiveness of Pesticide Use on Pest Populations

The *Integrated Pest Management Regulation* Section 78(4b) specifies that the efficacy of a mosquito larvicide be assessed by conducting pre-treatment and post-treatment larval samples of the water being treated. Within 10 days following treatment, certified applicators will return to a number of the larval development sites to conduct post-treatment monitoring using the same methods of assessing and recording larvae counts as described in Section 2.3.2 for pre-treatment monitoring. This information will be used to determine if the rate and type of pesticide application chosen for the location was suitable, and if the application failed, it will allow the applicator to plan for alternate methods of control.

Adult mosquito populations will be monitored post-treatment using bite counts and possibly mosquito light traps (see Section 2.3.3). As each of the adulticides proposed in this

PMP have short-term action, post-treatment evaluation will be conducted within three days of treatment. After this time, adult populations may again begin to increase as adult mosquitoes fly into the treated area from outside the treatment area. Post-treatment assessment information will be used by the applicators to determine if application rates were adequate, and if the area treated was of sufficient size to impact the adult mosquito population. Post-treatment bite-count data will be entered into the electronic database.

2.6.2. Post-Treatment Monitoring of the Environment and Non-Target Organisms

Following Larval Control

As was discussed earlier, larvicides containing methoprene or biological bacterial agents belonging to the genus *Bacillus* have been shown to have no adverse environmental impacts when applied according to label directions, and no lasting adverse effects on populations of invertebrates or other non-target aquatic organisms. Consequently, post-treatment monitoring of non-target organisms and environmental effects will not be undertaken.

2.6.3. Post-Treatment Evaluation of Environmental Impacts and Non-Target

Effects Following Adult Treatments

When applicators return to the treatment area to conduct post-treatment monitoring of the pest (see Section 2.6.1), they will also take time to look for any evidence of non-target effects.

Technicians will review:

- Whether environmentally sensitive areas were adequately protected;
- Whether the application rate or droplet size needs to be adjusted based on the results of mosquito control or any signs of non-target control;
- Whether there was any observable off-site insecticide movement or impact on surrounding areas; and
- Whether the established PFZs and NTZs were appropriate for the treatment method that was employed.

If a technician believes that possible unintended environmental impacts have resulted from an adulticiding campaign, the technician must inform the Manager of the mosquito control company immediately and a review of the program must be undertaken with the TNRD and the MOE.

3.0 DESCRIPTION OF OPERATIONAL INFORMATION THAT WILL BE FOLLOWED UNDER THE PMP [IPMR SECTION 58(3)(A)]

The transportation, storage, handling, mixing, loading, application and disposal of pesticides are governed by federal and provincial legislation. All persons working with pesticides will follow safe handling practices including workplace requirements for Workplace Hazardous Materials Information System (WHMIS) labelling and worker education. The required practices for pesticide applicators are detailed in:

- Workers' Compensation Board of British Columbia *Occupational Health and Safety Regulation* (BC Reg. 296/97) as amended – Sections 6.70 to 6.102;
- B.C Ministry of Environment (2005 or current edition) *Handbook for Pesticide Applicators and Dispensers*; and,
- Worker's Compensation Board of British Columbia (2009) *Standard Practices for Pesticide Applicators*.

3.1. DESCRIPTION OF PROCEDURES FOR SAFELY TRANSPORTING INSECTICIDES [IPMR SECTION 58(3)(A)(I)]

The following procedures for safely transporting pesticides will be practiced by all TNRD staff or contractors working under this PMP. The *Integrated Pest Management Regulation* (section 65(1)) legislates that pesticides must be kept, handled, stored and transported in the container in which it was originally packaged and with the label originally affixed by the manufacturer, or in a container designed for containing the pesticide and labeled accordingly. Also section 33 (2) of the *Regulation* states that a “person who transports or causes or allows the transport of a pesticide must ensure that the pesticide is secured and transported ... in a manner that prevents the escape, discharge or unauthorized removal of the pesticide from the transport vehicle, and prevents the contamination of food or drink intended for animal or human consumption, household furnishings, toiletries, clothing, bedding or similar items that are transported with the pesticide.”

Further, the Handbook for Pesticide Applicators and Dispensers, 5th Ed. (Ministry of Environment, 2005) outlines a number of general precautions to be taken during transport of pesticides, and the TNRD and their contractors will adhere to the following practices:

- 1) all pesticide containers will be inspected for defects prior to transporting and pesticides will be in original containers with original label;
- 2) chemical pesticides will not be transported in the passenger compartment of any vehicle, nor will anyone ride in the back of a truck together with these pesticides
- 3) pesticides will never be transported along with food, feed or consumer goods;

- 4) chemical pesticides will not be transported on wooden truck beds as it is difficult to clean wood in the case of a spill, and future items carried in the truck could become contaminated;
- 5) all pesticide containers will be secured to prevent spillage;
- 6) the driver of any vehicle transporting pesticides will be trained in spill clean-up and will carry, along with the pesticides, necessary equipment to contain and/or neutralize a spill;
- 7) the drivers of vehicles containing pesticides will ensure that all documents and placards are carried in, or placed on, transport vehicles if required under the *Transport of Dangerous Goods Act*, R.S.B.C 1996, c. 458, and regulations, the IPMA or the IPMR;
- 8) limited amounts of pesticides shall be carried in any one vehicle (the quantity shall be no more than what is necessary for each project, except where transportation occurs between storage facilities);
- 9) pesticides shall be carried in a secure lockable compartment such as a locked storage box or a canopy; and
- 10) pesticides shall be transported separately from food and drinking water, safety gear and people.

3.2. DESCRIPTION OF PROCEDURES FOR SAFELY STORING INSECTICIDES [IPMR SECTION 58(3)(A)(II)]

The majority of the insecticides proposed for use in this PMP will be stored at the TNRD Shop site, located at 660 Mission Flats Road, Kamloops, B.C. All other insecticide storage shall be on premises owned or controlled by TNRD contractors. The TNRD and/or their contractors will adhere to the following standards of the *Integrated Pest Management Regulation* with respect to the safe storing of pesticides:

- 1) a person who stores a pesticide will store it in a manner that minimizes hazards to human health and the environment (IPMR Section 33 (1));
- 2) all pesticides will be stored in the container in which it was originally packaged and with the label originally affixed by the manufacturer, or in a container designed for containing the pesticide and labelled with the trade name, chemical name, concentration of active ingredient and Pest Control Product number (IPMR Section 65 (1));
- 3) all pesticides will be stored separately from food intended for human or animal consumption (IPMR Section 66 (1a));
- 4) according to IPMR Section 66 (1b) all pesticides will be stored in a facility that is:
 - (i) ventilated so that pesticide vapors are vented to the outside (not applicable to granular larvicides),
 - (ii) not used for the storage of food intended for human or animal consumption,
 - (iii) locked when unattended, and
 - (iv) accessible only to persons authorized by the person storing the pesticide.

- 5) according to IPMR Section 66 (3) of the IPMR, fumigants and other pesticides that release vapours, and bear a "poison" symbol on the label (e.g. malathion) must be stored in a storage facility that is not attached to or within a building used for living accommodation;
- 6) according to IPMR Section 66 (2), each door providing access to a storage facility will clearly bear the words "WARNING: CHEMICAL STORAGE — AUTHORIZED PERSONS ONLY" written in block letters";
- 7) vehicle canopies are considered mobile storage units and must adhere to the rules in item numbers 4 and 5 above; and
- 8) according to IPMR Section 31, the TNRD and/or its contractors will inform the local fire department of the pesticide storage location within 60 days after starting to store pesticides.

3.3. DESCRIPTION OF PROCEDURES FOR SAFELY MIXING, LOADING AND APPLYING INSECTICIDES [IPMR SECTION 58(3)(A)(III)]

Only one adulticide included in this PMP will require mixing prior to use (Gardex Commercial Industrial micro spray concentrate). As this is the most dangerous activity with respect to pesticide application, special care will be taken at all times and mixing will only be done by certified applicators over the age of 16 years old. At the time of mixing, a spill kit and all first aid supplies will be nearby, including eye wash facilities and a copy of this PMP. Emergency phone numbers and a telephone will be present. The person mixing the pesticide will wear protective clothing, gloves, boots, face shield, hat and respirator. When mixing the product, the applicator will take care to keep the pesticide container well below eye level to reduce the chances of pesticide splash on face and eyes. Before pesticides are applied, applicators will inspect all application equipment to ensure there are no leaks or needed repairs. No mixing or loading of adulticides will occur within 15 meters of fish or wildlife habitat or riparian areas.

Prior to adulticiding, applicators will ensure that appropriate warning signs are posted at normal points of entry to the treatment site, to reduce the chances of injury to bystanders and residents of the area. Prior to spray, each landowner that owns property that will be sprayed should be notified so they can bring in or cover children's toys, and ornamental ponds. It will also be recommended that all people and pets are kept indoors with the windows closed and the air conditioner off during the spray applications.

During adulticiding applications, spare clothing for the applicators, spill kits, emergency first aid kits and phone numbers will be readily available in the vehicle and stored separately

from the pesticide. The applicators will wear all necessary protective gear during the entire spray campaign including coveralls, rubber boots, rubber gloves, respirators and eye protection. The applicators will always work in pairs.

Vectobac 1200L and Aquabac XT are the only larvicides listed in this PMP that require mixing. These pesticides are mixed with water to obtain a better distribution on the surface of the larval development habitat. The labels specify that the level of dilution is up to the applicator and is based on weather, the size of the larval development habitat and the method of application. The person mixing the pesticide will wear protective clothing as listed on the product labels, which may include gloves, boots, face shield, and hat.

3.4. .DESCRIPTION OF PROCEDURES FOR SAFE DISPOSAL OF EMPTY INSECTICIDE CONTAINERS AND UNUSED INSECTICIDES [IPMR SECTION 58(3)(A)(IV)]

The safe disposal of empty insecticide containers and unused insecticides shall comply with all current federal and provincial legislation governing their disposal. In addition, personnel shall follow these procedures for safely disposing of empty insecticide containers and unused insecticides proposed for use under this PMP:

- Ensure that all insecticide waste is disposed of in a manner consistent with the requirements of the *Environmental Management Act*, S.B.C. 2003, Chapter. 53 and the *Hazardous Waste Regulation* B.C. Reg. 63/88, as appropriate;
- Ensure that empty insecticide containers are returned to the insecticide distributor as part of their recycling program (if applicable); or triple rinsed or pressure rinsed, altered so that they cannot be reused, and disposed of in a permitted sanitary landfill or other approved disposal site; and
- Ensure that all leftover insecticide mix is stored for future use in a manner consistent with the requirements specified in Section 3.3.

3.5. DESCRIPTION OF PROCEDURES FOR RESPONDING TO PESTICIDE SPILLS [IPMR SECTION 58(3)(A)(V)]

Appropriate spill treatment equipment will be ready and available at the storage site (including mobile storage), mixing and loading sites, and during all pesticide applications. All persons authorized and trained to work with the pesticides will be familiar with the protocol for containing and responding to spills. The spill equipment will include:

- 1) personal protective equipment;
- 2) absorbent material such as sawdust, sand, activated charcoal, vermiculite, dry coarse clay, kitty litter or commercial absorbent (not applicable to larvicides);
- 3) neutralizing material such as lime, chlorine bleach or washing soda (not applicable to larvicides);

- 4) a long handled broom;
- 5) a shovel; and
- 6) water-proof waste-receiving container with lid and a pen to label the contents.

If a spill occurs, TNRD staff and/or their contractors will follow the recommendations as described in the Handbook for Pesticide Applicators and Dispensers, 6th Ed. (Ministry of Environment, 2005):

- 1) the source of the spill will be contained;
- 2) people and animals will be kept away from the spill site and people will be prevented from walking through, driving through, or breathing in fumes from the spill;
- 3) the product label or knowledgeable agencies will be consulted to determine the best course of action for clean-up of the spill;
- 4) if the spill is small enough to be handled without assistance, clean-up will begin immediately;
- 5) personal protective gear will be worn during clean up and if the spill is indoors, adequate ventilation will be ensured;
- 6) the spilled material should be stopped from spreading by creating a barrier with soil, sawdust, newspaper or spill kit dam(not applicable to granular larvicides);
- 7) absorbent material shall be spread over the spill, if applicable, to absorb any liquid;
- 8) the absorbent material shall be collected in water proof containers with the contents clearly labelled with the pesticide name, P.C.P. number and quantity of pesticide;
- 9) the area should be decontaminated with a neutralizing solution (*e.g.* for malathion, a mixture of washing soda (sodium bicarbonate) and caustic soda (sodium hydroxide) will decontaminate the site (not applicable to larvicides);
- 10) when more than five (5) litres or five (5) kg of insecticide are spilled, the person responsible for the project shall immediately report to the BC Provincial Emergency Program by telephoning 1-800-663-3456 or, where that is not practical, to the local police or nearest detachment of the RCMP, and to the appropriate regional office of the BC Ministry of Environment, Integrated Pest Management Program; and
- 11) An approved representative of the TNRD shall be notified of the details related to the spill as soon as practical by the contractor project supervisor.

4.0 DESCRIPTION OF ENVIRONMENTAL PROTECTION STRATEGIES AND PROCEDURES THAT WILL BE FOLLOWED UNDER THE PMP [IPMR SECTIONS 58(3)(B)]

The following sections describe the TNRD's strategies for protection of the environment. Much of the information included in the following sections is drawn directly from the *Integrated Pest Management Regulation* and the Handbook for Pesticide Applicators and Dispensers, 6th Ed. (Ministry of Environment, 2005).

4.1. STRATEGIES TO PROTECT COMMUNITY WATERSHEDS [IPMR SECTION 58(3)(B)(I)]

The TNRD staff and/or their contractors will follow the guidelines contained in the *Forest Practices Code of British Columbia Act* and the *IPMR* to protect community watersheds, and will ensure that each of the steps listed below are conducted:

- 1) the location of community watersheds will be determined by accessing the Ministry of Environment Community Watershed website:
http://www.env.gov.bc.ca/wsd/data_searches/comm_watersheds/index.html
- 2) when adulticiding, a 10m pesticide-free zone (PFZ) will be maintained around all streams, lakes and other water bodies (see Section 73(1) of *IPMR*) and the 10m must be measured in horizontal distance from the high water mark of the waterbody;
- 3) when larviciding no PFZ is required (see Section 78(2) of the *IPMR*);
- 4) a 100 meter no-treatment zone shall be maintained upslope of a community water supply water intake (except in the case of larvicides);
- 5) an adequate buffer zone will be maintained around the PFZ and the buffer zone will be clearly marked prior to adulticiding;
- 6) no mixing of pesticides will occur within a community watershed; and
- 7) insecticides will not be stored within a community watershed for more than 24 hours prior to their use, and removed from the community watershed within seven days of their use, unless they are stored in a permanent structure; and
- 8) insecticide applications will be stopped if insecticide residues or insecticide breakdown products are detected at a community watershed water intake, and there will be no further insecticide applications until the local Medical Health Officer has been satisfied that all required measures have been implemented to preserve water quality.

In order to protect domestic drinking water and water for agricultural use, the TNRD staff and/or their contractors will strictly adhere to all standards for pesticide-free zones (PFZs) and no-treatment zones (NTZs) as specified in the *Integrated Pest Management Act and Regulations*. Table 4 lists the PFZ's and NTZ's for mosquito control applications.

Table 4. Standards as described in the *Integrated Pest Management Regulation (IPMR)* for Pesticide Free Zones (PFZ) and No Treatment Zones (NTZ) to protect water during mosquito control activities.

Insecticide	Water Source	Regulation	Applicable Section from IPMR
Adulticides	Water supply intake or well used for domestic or agricultural purposes, including water for livestock or for irrigation of crops.	30m NTZ	71(3)
	Bodies of water* and streams	10m PFZ	73(1)
Bacterial Larvicides	Water supply intake or well used for domestic or agricultural purposes, including water for livestock or for irrigation of crops.	Exempted from PFZ	71(12)
	Bodies of water and streams	Exempted from PFZ however no treatment allowed in permanent, fish bearing bodies of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water	78(2); 78(1)
Non-Bacterial Larvicides (methoprene)	Water supply intake or well used for domestic or agricultural purposes, including water for livestock or for irrigation of crops.	30m NTZ unless applicator is reasonably satisfied that the smaller zone will ensure that pesticide from the use will not enter the water supply intake or well.	71(3); 71(4)
	Bodies of water and streams	Exempted from PFZ however no treatment allowed in permanent, fish bearing bodies of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water	78(2); 78(1)

*Body of water does not include a human-made, self-contained body or structure for water

4.2. STRATEGIES TO PROTECT FISH AND WILDLIFE, RIPARIAN AREAS AND WILDLIFE HABITAT [IPMR SECTION 58(3)(B)(II)]

Riparian areas are defined as the areas around bodies of water. These areas usually contain lush vegetation, including trees and shrubs, and high biodiversity (birds, insects, reptiles, amphibians, plants and mammals). They are often critical habitats, home ranges and travel corridors for wildlife. Riparian areas are essential for stream, lake and marsh health as they support vegetation that maintains bank stability and provides cover for water bodies to help maintain cooler water temperatures.

Endangered wildlife species are protected under the federal *Species at Risk Act (SARA)*. All pesticide use under this PMP shall be undertaken in a manner to ensure that endangered wildlife species are not impacted.

Due to the low toxicity of the bacterial larvicides, applications may be conducted within riparian areas, and sensitive wildlife habitat, however the following will be undertaken to keep impacts to riparian, wildlife habitat and fish bearing waters to a minimum:

- (1) Care will be taken to keep impacts on vegetation and soil at a minimum (*e.g.* attempt will be made to stay on paths and avoid trampling vegetation).
- (2) There will be no fuelling of machinery/application equipment or mosquito larvicide mixing within 15 meters of riparian areas, or sensitive wildlife habitat.
- (3) There will be no cleaning up or disposal of larvicides or their containers within 15 meters of riparian areas, sensitive wildlife habitat, or permanent, fish bearing bodies of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water.

Also, as per the *Integrated Pest Management Regulation*, fish habitat will be further protected as no larviciding will take place in fish-bearing waters or waters with continuous surface water connections with fish-bearing waters unless the BCCDC, under Section 78(1.1) of IPMR, has advised that WNV has been identified in mosquitoes in the region and the mosquito species targeted for treatment are vectors of WNV.

During adulticiding treatments, the standard PFZs and NTZs will be maintained (Table 4), and crews will ensure that no disposal, rinsing, mixing or storing of pesticides, or fuelling or maintenance of equipment will occur within 40 m of riparian areas, fish-bearing waters, waters with a permanent, direct, surface water connection to fish-bearing waters or in sensitive wildlife management areas. Prior to adulticiding treatments, riparian areas, fish bearing waters and waters with a permanent, direct surface water connection to fish bearing waters, and sensitive wildlife areas will be identified and clearly understood by all applicators.

4.3. STRATEGIES TO PREVENT CONTAMINATION OF FOOD INTENDED FOR HUMAN CONSUMPTION [IPMR SECTION 58(3)(B)(III)]

The larvicides proposed for use in this PMP will not cause contamination of food intended for human consumption. This is due to their physical properties and their use only in aquatic areas. However, general guidelines for safety will be followed by applicators (*e.g.* applicator will wash hands before eating and food will be stored separately from pesticides and equipment used for larviciding).

Greater care will be taken when using adulticides. Applicators will exercise caution and ensure that no food comes in contact with adulticides, safe gear for adulticiding (gloves, coveralls, etc. that may be contaminated) or adulticiding equipment. No applicator will be allowed to eat while conducting an adulticiding campaign (all sprayers must be turned off and the applicator must wash before eating).

Mosquito adulticides also have the potential to cause a temporary contamination of food if adulticiding is conducted near gardens or orchards. Prior to any treatment, farmers and home owners will be advised of the potential risk of pesticide residues and will be instructed to wash all fruits and vegetables before eating them. Adulticides are degraded quickly by sunlight and with increased air temperatures; however, landowners will be cautioned to avoid eating fruits and vegetables for at least 24 hours after an application. A NTZ and PFZ amounting to 110 m will be employed around honey bee hives to protect the bees and honey from adulticide being applied by truck-mounted sprayer. In the case of a backpack ULV sprayer, a minimum of a 40m no-treatment zone will be employed depending on the expected swath width of the sprayer.

4.4. PRE-TREATMENT INSPECTION PROCEDURES FOR IDENTIFYING TREATMENT AREA BOUNDARIES [IPMR SECTIONS 58(3)(B)(IV)]

Section 58(3)(b)(iv) of the IPMR requires that a PMP include a description of the pre-treatment inspection procedures for identifying treatment area boundaries. Section 71(1)(a)(c) of the IPMR requires that a confirmation holder to do all of the following before the pesticide use:

- ensure that each individual who will be using the pesticide is informed of the boundaries of the proposed treatment area, the requirements for personal protection, and the pesticide use procedures required to protect human health and the environment;
- carry out an inspection of the treatment area to ensure that the applicable regulatory requirements and standards can be met in carrying out the use, and
- if the pesticide is to be applied aerially, ensure that the pilot conducts an inspection of the proposed treatment area to ensure that he or she is familiar with the boundaries and other critical features of the treatment area.

To ensure that the above regulatory requirements are met, the TNRD will establish and implement the following strategies and procedures prior to the application of mosquito larvicides and adulticides, as applicable.

Prior to any *adulticiding* work, TNRD staff and/or contractors will visit the treatment area and complete an assessment of the area. This will be conducted during the day, not on the night of treatment so that all areas of the treatment site can be seen. The staff, in consultation

with the residents who requested the spray, will plan a driving route, and clearly mark the route so that it can be easily followed in the dark. When sensitive areas like organic gardens, bee hives, riparian areas, fish-bearing waters, waters with permanent surface water connections to fish-bearing waters, sensitive wildlife habitat, standing or running water, domestic and agricultural water sources, and community watersheds are found, they will be clearly marked so that buffer zones and pesticide-free zones are maintained. The staff will also confirm permission of the landowners of all lands to be sprayed, and if permission is not granted, a buffer zone surrounding the non-treatment property will be clearly laid out. If the applicators feel that they cannot safely conduct the application without affecting any of the sensitive areas described above, the spray plan will be aborted.

Prior to *ground* based *larviciding*, the applicator will ensure that he or she has permission to treat the site, and the applicator will ensure that he or she is not treating in a permanent, fish bearing body of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water unless the BCCDC has advised that WNV has been identified in mosquitoes in the region and the mosquito species targeted for treatment are vectors of WNV (*IMPR* Section 78(1.1)).

When the *larviciding* application is to be done by *air*, the pilot will be guided on a reconnaissance flight prior to the treatment and will be shown the habitats to be treated. Ground crews will have completed pre-treatment monitoring, and will have determined the boundaries of the habitat to be treated. During the application, the pilot will remain in direct radio contact with the ground crew in case of any questions or concerns related to the location of, or permission for, treatment.

4.5. PROCEDURES FOR MAINTAINING AND CALIBRATION PESTICIDE APPLICATION EQUIPMENT [IPMR SECTION 58(3)(B)(V)]

All pesticide application equipment used by the TNRD and its contractors shall be safe, clean, in good repair, compatible and calibrated appropriately for the larvicide or adulticide being applied (See Section 7(1)(b) of the *IPMR*).

Equipment used for adulticiding will be calibrated prior to use each season, and periodically throughout the season if many hours of spray time are required. Re-calibration will be conducted if the type of pesticide to be applied changes and a new application rate is required. For each piece of application equipment that requires calibration, records of the date of

calibration and the data collected during the calibration will be maintained for three years from the date of calibration.

In order to calibrate the ULV sprayers, they will be filled with pesticide and then tested for flow rate by measuring the volume of liquid pumped through the system during a one minute interval. Next, the droplet sizes and Mass Median Diameter in the spray output will be determined either manually by collection of droplets on a Teflon microscope slide and measurement of the droplets under a microscope, or with the use of a droplet analyser. The appropriate flow rate, droplet size and application procedure (*e.g.* swath width, truck speed, etc.) will be determined by reading the label on the product to be sprayed. No applications will be done before the equipment can be shown to be appropriately calibrated.

Calibration of backpack applicators and aerial application equipment used to apply granular formulations of larvicides will be conducted daily prior to larviciding treatments being undertaken. As these products broadcast spread the larviciding granules, the applicators must be aware of the spread pattern and its correlation to application rate. Spread-pattern “posters” will be displayed at the spray contractor’s office and at the TNRD storage shed. Applicators will be trained on the appropriate use of backpack granular applicators prior to use so that they are able to adjust their calibration as they walk through and around standing water (*i.e.* to walk slower or faster with a higher or lower throttle and flow rate).

4.6. PROCEDURES FOR MONITORING WEATHER CONDITIONS AND STRATEGIES FOR MODIFYING PESTICIDE APPLICATION METHODS FOR DIFFERENT WEATHER CONDITIONS [IPMR SECTION 58(3)(B)(VI)]

As currently required by Section 35(1)(i) of the *IPMR*, prior to, and periodically during larviciding and adulticiding applications, measurements will be made to record weather conditions.

Specifically, measurements will be made and recorded of:

- Wind speed and direction (with anemometer)
- Precipitation; and,
- Air temperature.

It should be noted that amendments are currently being considered to Section 35(1)(i) of the *IPMR* that would eliminate the requirement for recording wind speed, temperature and precipitation during the granular application of larvicides for mosquito control. If this

amendment shall come into force during the term of this PMP, the TNRD shall comply with all amended regulations.

Environment Canada shall be consulted for up-to-date local forecasts and predictions as to future rainfall events. Every effort shall be made to ensure that weather conditions are suitable for insecticide application, and are consistent with pesticide label requirements.

Adulticiding applications will be terminated/suspended if any of the following apply:

- The maximum/minimum temperature stated on the insecticide label is exceeded; or,
- Unprotected people enter the treatment area; or,
- The wind speed exceeds or is less than the optimum wind speeds as described on the product label; or,
- The wind speed and direction causes the insecticide to drift outside the treatment area and/or miss the intended target.

During **larviciding applications** (hand application, backpack blower application or helicopter application), the following weather conditions will be considered:

- Weather forecasts will be consulted, and conditions at the treatment site will be observed. In significant rain events, aerial application may be postponed as granules tend to clump in the application equipment and therefore application rates can be affected (precipitation rarely impacts ground application of granular larvicide);
- When wind speeds reach a level that causes the granular larvicides to drift outside of the treatment area (i.e. the applicator is no longer able to control the placement of the granules accurately), the application will be postponed; and,
- Air temperature will be recorded as per the *IPMR* and larviciding may be postponed when extreme high temperatures are expected (over 35C).

5.0 INSECTICIDES PROPOSED FOR USE, THEIR PROPERTIES, MANNER OF APPLICATION AND EQUIPMENT REQUIRED FOR APPLICATION [IPMR SECTION 58(3)(C)]

The following sections will provide an overview of the mosquito control products, their modes of action, manners of application (ground and/or air), and the equipment required for their application.

5.1. BACTERIAL LARVICIDES

Biological pesticides for mosquitoes are the least toxic control option for non-target organisms. Therefore, control of larvae using a biological larvicide will be the preferred and most common approach for controlling mosquitoes with pesticides in the TNRD. The TNRD will consider the use of any of the registered biological mosquito larvicides listed in Table 2, and this PMP may be updated with any new larvicides that become registered in Canada during the course of this PMP.

5.1.1. *Bacillus thuringiensis* var *israelensis* Strain H-14(AM65-52) or H-14(BMP-144)

The majority of the larval treatment within the TNRD will be with granular larvicides containing strains of the active ingredient *Bacillus thuringiensis* var *israelensis* (*Bti*) (trade names Vectobac and Aquabac). During its spore-forming stage, *Bti* produces an endotoxin that contains five different proteins that can be digested in the alkaline gut of mosquito larvae. The toxin is attached to crushed corncob that serves as a carrier. Once digested, the proteins become toxic to the larvae and work to destroy the larvae's gut. The *Bti* products are effective against mosquitoes in the larval stage. The granular formulations are applied by manual placement, backpack applicator, granular spreader, or helicopter or fixed-wing aircraft. Application rates for the granular formulations vary from 2.5 to 20 kilograms per hectare (with the higher rates applied to polluted or highly organic water), although most sites are treated at about 5 to 10 kilograms per hectare. Liquid formulations of these products may also be used and these can be applied with applied with a backpack sprayer, truck or ATV-mounted sprayer, helicopter or fixed-wing aircraft at applications rates between 250 ml and 2400 ml per hectare depending on the product. *Bti* Mosquito Dunks, another formulation, are always applied by manual placement.

Bti can be applied to virtually any standing water except finished, treated drinking water, or permanent, fish-bearing bodies of water or waters that have a permanent, direct, surface-water connections with fish bearing bodies of water. The exception to this is if the BCCDC has advised the public that it has identified WNV in mosquitoes in the region of the Province where the pesticide is to be applied, and the mosquitoes to be treated are vectors of WNV, then *Bti* products may also be applied to permanent, fish bearing bodies of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water (*IMPR* Section 78(1.1)).

The vast majority of the larviciding program will be conducted with *Bti* larvicides as they are fast acting, moderately priced and are virtually non-toxic to non-target organisms.

Benefits of Bacillus thuringiensis var israelensis

The benefits of the *Bti* larvicides are many. When applied at label rates, *Bti* larvicides are considered to be very specific to mosquito larvae and non-toxic to fish, amphibians, reptiles, mammals and most other insects. They are easy to apply and have no residual effect. They are the most economical of the larval controls. *Bti* larvicides work best when applied to larvae in their 2nd and 3rd instars, however control can be achieved when applied to 1st and early 4th instar larvae as well. Death of the larvae usually occurs within 24 hours. This allows for technicians to be able to assess effectiveness soon after application.

Limitations of Bacillus thuringiensis var israelensis

There are very few disadvantages associated with the use of *Bti*. When applied according to the labelled rates, it is virtually non-toxic to all organisms aside from mosquito larvae. However, studies have shown that at application rates 10 to 1,000 times greater than the labelled rates, some effects have been documented on non-target larvae such as chironomids, biting midges and dixid midges. Since the *Bti* products have no residual effect, only the larvae present at the time of application are affected. In habitats where multiple generations of larvae appear, more than one application of larvicide may be necessary. Another possible disadvantage is the short window for treatment with optimum control of the larvae in the 2nd and 3rd instars.

5.1.2. Bacillus sphaericus

Bacillus sphaericus is a naturally occurring bacterium that acts as an endotoxin to mosquito larvae. *Bacillus sphaericus* formations contain living sporulated bacteria and a crystal protoxin that is released by alkaline conditions in the gut. The toxin destroys the lining of the intestine of the mosquito larvae that then releases lethal chemicals into the blood's haemocoel. The bacteria recycle, and spores from dead larvae can remain suspended for extended periods of time. The duration of activity depends on many biotic and abiotic factors. Three products containing *Bacillus sphaericus* are registered for larval mosquito control under the trade name VectoLex and the manner of application and the application methods are detailed in Table 2

When VectoLex products are used at label rates, these will control several species of mosquito larvae in freshwater marshes, salt marshes, flood plains, flooded fields and pastures, wetlands, ponds, storm water detention/retention and seepage ponds, wastewater sewage effluent, sewage lagoons, oxidation ponds, log ponds, impounded waste water, septic ditches,

drainage ditches including open storm sewers and irrigation ditches, although applicators must read each label carefully as the different formulations are registered for use in different habitats. If the BCCDC has advised the public that it has identified WNV in mosquitoes in the region of the Province where the pesticide is to be applied, and the mosquitoes to be treated are vectors of WNV, *Bacillus sphaericus* products may also be applied to permanent, fish bearing bodies of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water (IMPR Section 78(1.1)). *Bacillus sphaericus* will not be applied to any water sites that serve as a source of treated finished drinking water.

Benefits of Bacillus sphaericus

The benefits of *Bacillus sphaericus* are similar to those of *Bti* in that it is virtually non-toxic to non-target organisms while being very effective and specific to mosquito larvae. This product works better than *Bti* when applied to highly organic larval habitats and it has the added benefit of maintaining its effectiveness for up to 28 days and thus can control multiple generations of larvae with a single application. The *Bacillus sphaericus* formulated as VectoLex WSP is the larvicide of choice in catch basins due to its low toxicity, easy manual application and extended action of up to 28 days.

Limitations of Bacillus sphaericus

The greatest disadvantage of *Bacillus sphaericus* is its cost. At present it is the most costly of the biological larvicides and therefore will only be considered in larval development sites where multiple generations of larvae are known to occur. In these cases, the increased cost of the larvicide may be warranted as fewer applications would be required over the course of the summer.

5.2. CHEMICAL LARVICIDES

The only chemical larvicide included in this PMP is methoprene.

5.2.1. Methoprene

Methoprene is a synthetic mimic of a naturally occurring growth hormone (called juvenile hormone) that keeps insects in the juvenile or immature stage. When applied to habitat with larvae, methoprene interferes with the mosquito life cycle and prevents the mosquito from reaching maturity. The mosquito dies during the pupal stage or as the adult mosquito attempts to emerge from the pupal case.

Methoprene is available in two formulations under the trade name Altosid (Table 2). The pellets and briquettes can both be applied by hand (manual application) and the pellets can also be applied using a backpack applicator. Methoprene is only applied by ground (no aerial application).

Methoprene is of very low to moderate toxicity to terrestrial non-target organisms when used at label rates. In aquatic habitats, this product can have a wide range of toxicity to invertebrates and fish. Under this PMP methoprene will only be used in storm water catch basins or to man-made bodies of water that would never become contiguous with natural bodies of water. A recent amendment to the *IPMR* [See Section 71(5) & 71(13)] has exempted methoprene from the requirement to maintain a no-treatment zone when used in storm water runoff catch basins for the management of mosquitoes. This amendment was made followed a determination that the use of methoprene would have no likely environmental impact when used in this aquatic habitat. Studies have shown that methoprene breaks down quickly in water and soil and will not leach into groundwater.

Methoprene generally remains active for up to 30 days under typical environmental conditions, but some formulations remain active for up to 150 days. Because methoprene is an insect growth regulator, proper timing of applications is critical.

If the BCCDC has advised the public that it has identified WNV in mosquitoes in the region of the Province where the pesticide is to be applied, and the mosquitoes to be treated are vectors of WNV, products containing methoprene may also be applied to permanent, fish bearing bodies of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water (IMPR Section 78(1.1)).

Products containing methoprene will not be applied to any water sites that serve as a source of treated, finished drinking water.

5.3. CHEMICAL ADULTICIDES

The TNRD will consider the use of any of the registered mosquito adulticides listed in Table 3. In accordance with Section 78(4)(C) of the *Integrated Pest Management Regulation*, all adulticiding for mosquitoes will be conducted between sunset and sunrise. Adulticiding for mosquitoes will be done with strict adherence to the Operational and Environmental Guidelines outlined in sections 3.0 & 4.0 . All applications will be done by individuals that hold valid

British Columbia Pesticide Applicator Certificates in the Mosquito and Biting Fly Category. The pesticide labels will be carefully followed to confirm acceptable rates, meteorological parameters, and appropriate application equipment. Electoral Area 'A' has opted out of the adulticiding component of the program and will not be considered for adulticiding activities.

5.3.1. Malathion

Malathion is an organophosphate, contact insecticide that works by inhibiting cholinesterase and thereby causes paralysis of the insect. This insecticide is the most commonly used chemical control for adult mosquitoes in North America. It will be applied by ground non-thermal ULV sprayers. Ecologically, malathion is moderately toxic to birds, has a wide range of toxicity to fish, and is highly toxic to aquatic invertebrates, amphibians and honeybees. Malathion will break down rapidly in sunlight, with a reported half-life in air of about 1.5 days. The half-life of a pesticide is the time that it takes for the active ingredient to break down to one half of the originally applied concentration.

The **benefits** of this adulticide are its low cost (compared to other adulticides), and ease of use (no mixing required) and rapid knock down of mosquitoes in the treatment area. The **limitations** include strong odour, a propensity to cause paint damage (if applied incorrectly) and, in some areas of North America, resistance among mosquito populations has developed. Also, there is a limited duration of effect and mosquitoes from around the treatment area can quickly re-infest the treatment area.

5.3.2. Pyrethrins

Pyrethrins are natural chemicals that are produced in the flowers of chrysanthemums. Pyrethrin pesticides affect sodium channel function in the neurological system of the insect. Natural pyrethrins are formulated with additives such as piperonyl butoxide and N-octyl bicycloheptene dicarboximide to enhance the effectiveness and stability of the pyrethrins. All are applied by non-thermal ULV generators.

There are many **benefits** of the pyrethrins. First, they have rapid knockdown properties. They are unstable when exposed to light and break down quickly. Unlike malathion, pyrethrins are non-corrosive and have a less offensive smell. They are considered to have a very low mammalian toxicity. Finally, they can be applied at lower temperatures than malathion.

There are **limitations** to the use of pyrethrins as well. Pyrethrins are very expensive insecticides. Also, they pose a slightly higher safety risk as some formulations need to be diluted

prior to use (thus there is increased handling and increased chance of spill). They are toxic to non-target organism, and especially toxic to fish.

6.0 RECORDS AND REPORTING

Under the *Integrated Pest Management Regulation* the TNRD and/or their contractors are required to maintain records of all pesticide applications and submit an Annual Record of Pesticide Use for Confirmation Holders and an annual Notice of Intent to Treat.

6.1. TREATMENT RECORDS [IPMR SECTION 37(1)]

The TNRD will maintain, for at least three years from the date of treatment, operation records of all pesticide applications including:

- 1) treatment location;
- 2) pre-treatment monitoring results (larval dips, landing counts);
- 3) treatment date and time;
- 4) type of pest targeted (mosquito larvae or adult);
- 5) trade name of pesticide used and its PCP number;
- 6) method of application;
- 7) rate of application;
- 8) total quantity of pesticide used;
- 9) relevant meteorological conditions (*i.e.* wind, precipitation, temperature);
- 10) result of post-treatment monitoring and evaluation;
- 11) for adulticiding, how the public was notified (*e.g.* door to door); and
- 12) if the applicator decides that the 30 m non-treatment zone around a water supply intake or well used for domestic or agricultural purposes may be reduced, the information upon which the decision was based.

6.2. RECORDS OF LARVAL DEVELOPMENT SITES

The TNRD will maintain updated records of all larval development sites, including:

- 1) GPS location or description of the location of the site;
- 2) name, address and phone number of owner or manager of the treatment site; and
- 3) information concerning no-treatment areas or areas where permission has not been granted by the landowner.

6.3. ANNUAL REPORT OF PESTICIDE USE [IPMR SECTION 39 (1)(2)]

The TNRD will submit an Annual Report of Pesticide Use for Confirmation Holders to the Administrator of the *Integrated Pest Management Regulation* by January 31 of every year, which will include a summary of the previous calendar year's use including:

- 1) the name and address of the TNRD and its confirmation number;
- 2) for each pesticide use in the year, the trade name, PCP registration number, active ingredient name(s) and amount of pesticide product used in kilograms; and
- 3) the total area treated with each product.

6.4. ANNUAL NOTICE OF INTENT TO TREAT

The TNRD or its contractor(s) will provide a Notice of Intent to Treat to the Administrator *Integrated Pest Management Regulation* 21 days prior to the commencement of the project in each calendar year of the PMP confirmation. The Notice of Intent to Treat will contain the following information:

- 1) the name and business location of the confirmation holder;
- 2) a description of the proposed treatment locations for the calendar year and a map or diagram that clearly identifies those locations;
- 3) a description of the proposed treatment for each area, including the pesticide to be used and its method of application; and
- 4) the total area of the treatment areas in the proposed treatment locations for the calendar year.

6.5. NOTIFICATION OF ADULTICIDING

Prior to adulticiding being conducted in a local area (as a result of a signed petition), the TNRD shall notify **all** residents in the proposed treatment area. This notification includes the date, time and location of the proposed adulticiding, the name of the pesticide proposed for use, and information on recommended precautions to take prior to spraying and immediately after spraying. No residents will have their properties treated or sprayed without permission of the landowner and/or occupying resident.

7.0 CONSULTATIONS [IPMR SECTION 61(1)]

The *Integrated Pest Management Regulation* specifies that persons preparing a PMP must conduct public consultations. The *Integrated Pest Management Regulation* specifies that the consultation must include newspaper notices and “reasonable” efforts to contact and consult with individuals who have the potential to be impacted by a proposed pesticide use under the PMP. The Regional District will complete all necessary consultations as described in the following sections.

7.1. PUBLIC CONSULTATIONS

Prior to submitting a Pesticide Use Notice to the Ministry of Environment (MoE) for PMP confirmation, the plan holder will carry out a consultation process with the public throughout the proposed PMP area.

The objectives of conducting consultations when this PMP is at the draft stage are:

- To increase public awareness of the PMP process and of the principles of Integrated Pest Management which are embodied in the PMP;

- To ensure that the public have an opportunity to identify concerns, and for the plan holder(s) to address those concerns before the PMP is finalized and a Pesticide Use Notice submitted for confirmation;
- To ensure a transparent and accountable review process for the PMP;
- To educate the public on the need to manage the larval stage; and,
- To explain how the planning process that is described in the PMP recognizes the need to protect human health and the environment.

The public will be consulted of the PMP development via notices in local community newspapers within the geographic boundaries of the mosquito control area. As per Section 61(1) of the *IPMR*, at least 45 days before submitting a Pesticide Use Notice, the first of two notices, at least 40 cm² in size, will be published within a two-week period in newspapers circulated in the various communities (or nearest communities). The published advertisements will be placed in the main or legal sections of the newspapers with the heading “DEVELOPMENT OF A PEST MANAGEMENT PLAN”. A copy of the advertisement that will be placed in newspapers within the mosquito treatment areas can be found in Appendix D.

During the public consultation process, the draft PMP will be accessible on the TNRD website.

Table 5. Names and location of newspapers and date of publishing of Plan Development advertisement.

Newspaper	Community	Date of 1st Publishing	Date of 2nd Publishing
Kamloops This Week	Kamloops	Feb 12, 2015	Feb 17, 2015
The Valley Brew	Logan Lake	Feb 10, 2015	Feb 24, 2015
The Sunflower	Chase	Feb 13, 2015	Feb 20, 2015
Clearwater Times	Clearwater	Feb 12, 2015	Feb 19, 2015
Star Journal	Barriere/ North Thompson	Feb 12, 2015	Feb 19, 2015
SPIN News Magazine	Sun Peaks	Feb 20, 2015	Only publish monthly
Merritt Herald	Electoral Areas M & N	Nov 26, 2015	Dec 3, 2015

7.1.1. Summary of Public Consultation

There were no responses or comments submitted from the public regarding the Pest Management Plan during the February Consultation Period.

7.2. FIRST NATIONS CONSULTATIONS

First Nations consultations will be conducted in compliance with Section 61(2) of the IPMR.

This legislation requires that:

*“If a proposed pesticide use under a pest management plan has the potential to **significantly impact** an individual or a member of an organization or community, the confirmation holder must make reasonable efforts, starting at least 45 days before submitting a pesticide use notice to the administrator, to contact and consult these individuals”*

Apart from meeting this legislative requirement, the objectives of conducting First Nations consultations were:

- To increase First Nation awareness of the PMP process and of the principles of Integrated Pest Management which are embodied in the PMP;
- To ensure that First Nations have an opportunity to identify concerns, and for the plan holder(s) to address those concerns before the PMP is finalized and a Pesticide Use Notice submitted for confirmation;
- To ensure a transparent and accountable review process for the PMP;
- To explain how the planning process that is described in the PMP recognizes the need to protect human health and the environment.

7.2.1. Draft Guidelines for First Nations Consultation

When the *Integrated Pest Management Act (IPMA)* and Regulation (IPMR) was introduced in December 2004, the provincial government made a commitment to develop and implement procedures for First Nations consultation. Appropriate consultation is necessary when industry or government agencies develop plans for pest management activities that may potentially adversely impact First Nations' rights or title interests.

The Ministry of Environment has prepared guidelines that are to be used by pest managers as guidance when First Nations consultation is required. These guidelines are largely based on previous requirements for First Nations consultation under the former *Pesticide Control Act*. The Ministry asks that proponents (persons who prepare Pest Management Plans, and gives the Ministry Pesticide Use Notices) to use the interim guidelines when pest management activities are in areas where a First Nation asserts aboriginal interests or has treaty rights. The Ministry will monitor industry use of the guidelines. In instances where aboriginal interests or treaty rights might be adversely impacted by pest management activities under the *IPMA*, the Ministry will assess the proponent's conduct and fulfillment of the consultation steps in the guidelines.

There are thirty-four First Nations communities who have asserted aboriginal interest within the proposed treatment area. Each of these will be consulted to determine whether there are any concerns of adverse effects on their land and resource use. Because the precise locations of areas that may require larviciding or adulticiding cannot be determined at the development stage of the PMP, First Nations will be asked, as part of the continuing consultation process, if they wish to be advised of proposed treatments once precise locations where larviciding or adulticiding may occur have been determined. Appendix E contains a sample of the letter that will be sent along with a complete copy of the Draft PMP to each of the following First Nations governments.

The First Nations within the geographic area covered by the PMP include:

- Adams Lake Indian Band
- Ashcroft Indian Band
- Bonaparte Indian Band
- Boston Bar Indian Band
- Boothroyd Indian Band
- Canim Lake Indian Band
- Coldwater Indian Band (Esh-kn-am Cultural Resource Management Services)
- Cook's Ferry Indian Band (Esh-kn-am Cultural Resource Management Services)
- High Bar First Nation
- Little Shuswap Indian Band
- Lower Similkameen Indian Band
- Lower Nicola Indian Band
- Lytton First Nation
- Neskonlith Indian Band
- Nicola Tribal Association
- Nicomen Indian Band
- Nlaka'pamux Nation Tribal Council
- Nooaitch Indian Band
- Okanagan Indian Band
- Okanagan Nation Alliance
- Oregon Jack Creek Indian Band
- Penticton Indian Band
- Shackan Indian Band
- Siska Indian Band (Esh-kn-am Cultural Resource Management Services)
- Simpcw First Nation (North Thompson Indian Band)
- Skeetchestn Indian Band
- Splats'in First Nation
- Spuzzum First Nation
- Stk'emlupsemc te Secwepemc Nation

- Tk'emlups (Kamloops) Indian Band
- Upper Nicola Indian Band
- Upper Similkameen Indian Band
- Westbank First Nation
- Whispering Pines/Clinton Indian Band

7.2.2. First Nations Consultation Report (Summary)

In order to facilitate Ministry consideration of the adequacy of First Nations consultations and of the plan holder response to any issues raised, the plan holder prepared a report that described the consultation process and outcomes. This report was submitted to the Administrator, *IPMA*, in conjunction with the submission of the Pesticide Use Notice application.

When the PMP was initially written Electoral Areas 'M' & 'N' were not included. Therefore, when the plan was amended to include this area, twenty-eight First Nations required consultation as they had asserted territory in the new mosquito service area.

The following bands had special requests associated with the PMP and these requests will be met by the TNRD and/or its contractors in each year of the PMP:

1. Adam's Lake Indian Band has requested that any individuals planning mosquito control activities on the Adam's Lake Indian Band reservations first contact Albert Quinn at the band office prior to conducting work. There are specific access protocols that would be discussed prior to access.
2. The members of the Esh-kn-am Cultural Resources Management Services (Siska Indian Band, Coldwater Indian Band & Cook's Ferry Indian Band) have requested that "...should any previously unrecorded archaeological sites or heritage sites such as camps, human remains or lithics be encountered during the tenure and development of this project, the following measures should be undertaken:
 - a) Modify or stop any land-altering activities in the immediate vicinity of the previously unidentified site so that it will not be adversely impacted; and
 - b) Promptly inform Esh-kn-am CRMX of the existence and location of the newly discovered site(s) so that an acceptable mitigation strategy or further archaeological investigation may be agreed upon."
3. The Nicola Tribal Association has requested that the TNRD forward a copy of its Annual Notice of Intent to Treat to the Nicola Tribal Association each season. In addition, the Council has requested that should any previously unrecorded archaeological sites or heritage sites such as camps, human remains or lithics be encountered during the tenure and development of this project, the following measures should be undertaken:
 - a) Modify or stop any land-altering activities in the immediate vicinity of the previously unidentified site so that it will not be adversely impacted; and

- b) Promptly inform Nicola Tribal Association of the existence and location of the newly discovered site(s) so that an acceptable mitigation strategy or further archaeological investigation may be agreed upon.
- 4. The Simpcw First Nation has requested that the TNRD forward a copy of the Annual Notice of Intent to Treat to the Simpcw FN.
- 5. The Whispering Pine/Canton Indian Band has requested that the TNRD forward a copy of the Annual Notice of Intent to Treat to the Whispering Pine/Canton Indian Band along with a letter outlining any habitats that may be treated during the season and the approximate timeline for treatment.
- 6. The Nooaitch Indian Band has requested that a copy of the Annual Notice of Intent to Treat be forwarded to them along with associated maps each season. In addition, the Band has requested that should any previously unrecorded archaeological sites or heritage sites such as camps, human remains or lithics be encountered during the tenure and development of this project, the following measures should be undertaken:
 - c) Modify or stop any land-altering activities in the immediate vicinity of the previously unidentified site so that it will not be adversely impacted; and
 - d) Promptly inform Nooaitch Indian Band of the existence and location of the newly discovered site(s) so that an acceptable mitigation strategy or further archaeological investigation may be agreed upon.

The following bands responded that they had no questions or concerns regarding the PMP:

- 1. Ashcroft Indian Band
- 2. Bonaparte Indian Band
- 3. Boothroyd Indian Band
- 4. Boston Bar Indian Band
- 5. Canim Lake Indian Band
- 6. High Bar First Nation
- 7. Little Shuswap Indian Band
- 8. Lower Nicola Indian Band
- 9. Lytton First Nation
- 10. Neskonlith Indian Band
- 11. Oregon Jack Creek Indian Band
- 12. Shackan Indian Band (responded during initial consultation for the plan but did not provide information when consulted on the amendment to include Areas 'M' & 'N')
- 13. Skeetchestn Indian Band (did not respond to initial consultation for the plan but did indicate that there were no concerns with the plan when consulted on the amendment to the plan)
- 14. Splat's in First Nation (responded that there were no concerns during initial consultation but did not respond to consultation on the amended areas)
- 15. Upper Nicola Indian Band (responded to the initial consultation but did not provide information when consulted on the amendment to include Areas 'M' & 'N'.)
- 16. Westbank First Nation (indicated that the plan was not in their asserted territory)

The following bands did not respond to the invitations for consultation, but are welcome to provide input at any time during that term of the PMP.

1. Lower Similkameen Indian Band (did not respond during initial consultation of the plan but did request additional information when consulted again for the amendment- did not provide any information after much dialogue)
2. Nicomen Indian Band
3. Nlaka'pamux Nation Tribal Council
4. Nooaitch Indian Band
5. Okanagan Indian Band
6. Okanagan Nation Alliance
7. Penticton Indian Band
8. Spuzzum First Nation
9. Stk'emlupsemc te Secwepemc Nation
10. Tk'emlups (Kamloops) Indian Band
11. Upper Similkameen Indian Band

APPENDIX A THOMPSON NICOLA REGIONAL DISTRICT ADULTICIDING PETITION

Request for Adult Mosquito Control

Community and/or Street _____ Date: _____

WE, the undersigned, having been advised of the requirements for adulticiding and the properties of the pesticides involved, request that the TNRD mosquito control contractor attend at our area and carry out adult mosquito control as required according to the terms and conditions of the BC *Integrated Pest Management Act and Regulations* and the applicable sections of the TNRD Pest Management Plan.

NAME (print)	STREET ADDRESS	PHONE #	SIGNATURE

Terms and Conditions for Adulticiding

As the main emphasis of the TNRD mosquito control program is mosquito larval control, residents are advised that adulticiding will not completely and forever eliminate mosquitoes from any given neighbourhood. Adulticiding will provide temporary relief for perhaps two to three days and the final determination whether or not to spray will be made by the contractor at the time of the site inspection. Spraying will also be restricted to the period between dusk and dawn when bee activity is low and only if weather conditions permit. No aerial adulticiding will be carried out.

The pesticides used for adulticiding (resmethrin and malathion) are toxic to mosquitoes as well as most other airborne household and garden insects. When used as intended these pesticides are safe to humans, however, precautions must be taken to provide maximum possible protection. Area residents are advised to take the following precautions during spraying activities:

- All residents, especially children and pets, should be brought indoors when applications are being made;
- Close all windows and doors, and turn off air conditioners;
- Advise the applicator immediately if you are aware of any beehives in the area;
- Children and pets should be kept from playing in any areas that may still be wet from spraying;

Mosquito Control Pest Management Plan

- Home-grown fruits and vegetables should not be eaten for 24 hours after spraying has occurred, and should then be washed or peeled before being eaten;
- Bring in any laundry or children's toys that may be in your yard; and,
- Cover ornamental ponds that contain fish.

For current information on TNRD mosquito control activities or to leave a message regarding problem areas, call the Mosquito Advisory Line at (250) 372-5700.

To speak to a TNRD representative about mosquito control, call the Environmental Health Services Department at (250) 377-7199 or toll-free at 1-877-377-8673. The fax number for the TNRD is (250) 372-5048.

**APPENDIX B: CHECKLIST OF REQUIRED INFORMATION FOR THE DEVELOPMENT
OF A PEST MANAGEMENT PLAN (FROM SECTION 58 OF THE
INTEGRATED PEST MANAGEMENT REGULATION)**

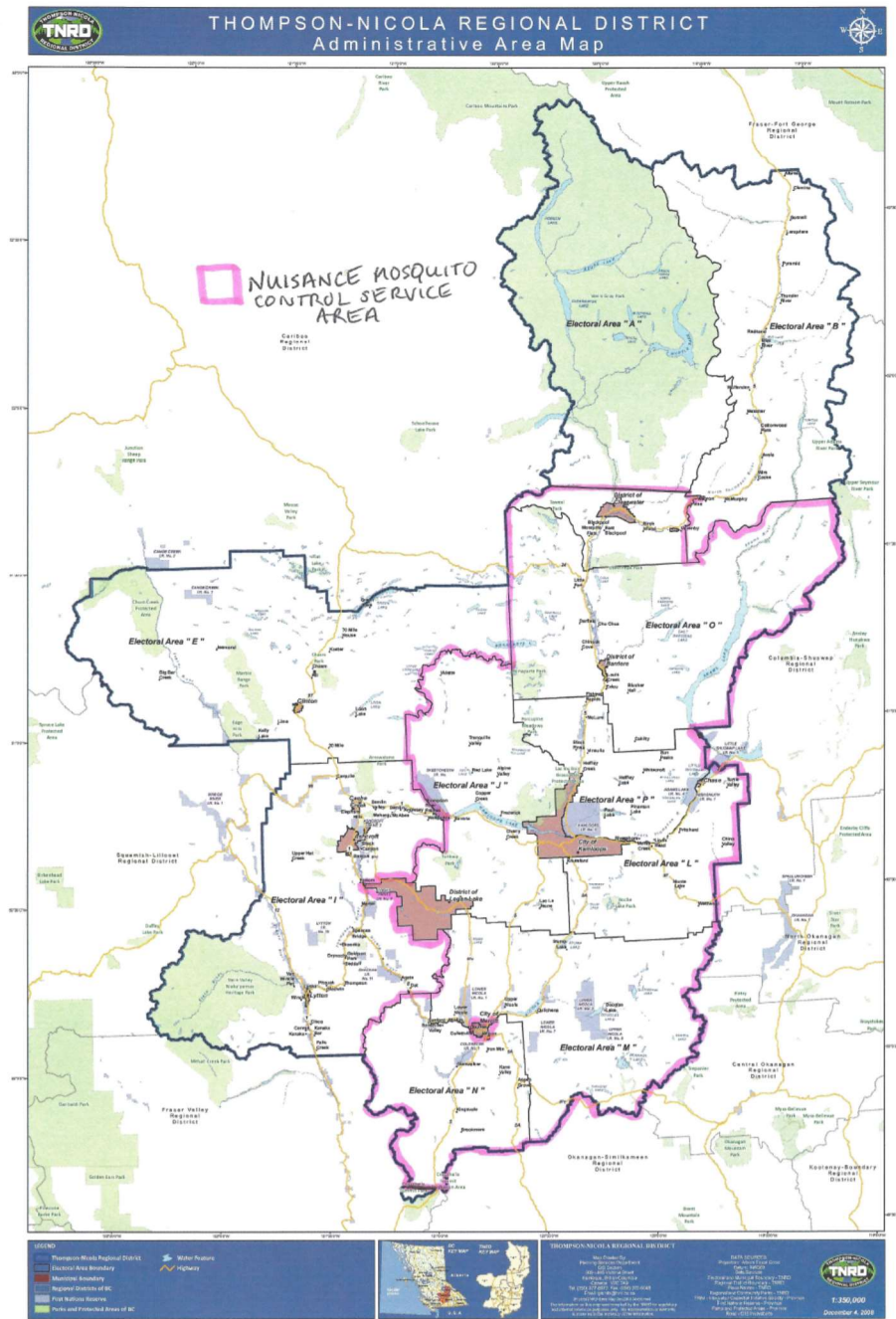
Checklist for required contents of a Pest Management Plan (from Section 58 of the Integrated Pest Management Regulation).

	Section of IPMR	Task	Associated Section Within this PMP
<input checked="" type="checkbox"/>	58 1(a)	Description of geographic boundaries with maps etc	Section 1.1.2, Appendix C
<input checked="" type="checkbox"/>	58 1(b)	Person responsible for managing pests in relation to land described above	Section 1.1.1
<input checked="" type="checkbox"/>	58 1(c)	Name & phone number of individual who is the principal contact for information relating to the PMP	Section 1.1.1
<input checked="" type="checkbox"/>	58 2(a)	Description of the program to prevent organisms from becoming pests	Section 2.1.
<input checked="" type="checkbox"/>	58 2(b)	(i) a description of the program that will be employed to identify pests targeted by the plan, or (ii) identification of the pests targeted by the plan	Section 2.2.
<input checked="" type="checkbox"/>	58 2(c)i	Description of the monitoring methods that will be used to assess pest populations, environmental conditions and damage caused by pests	Section 2.3.
<input checked="" type="checkbox"/>	58 2(c)ii	Description of monitoring frequency of above before and during pesticide use	Section 2.3.
<input checked="" type="checkbox"/>	58 2(c)iii	Description of the data that will collected before and during pesticide use	Section 2.3.
<input checked="" type="checkbox"/>	58 2(d)i	Description of the treatment threshold and how it was chosen	Section 2.4.
<input checked="" type="checkbox"/>	58 2(d)ii	Description of how treatment threshold will be applied	Section 2.4.
<input checked="" type="checkbox"/>	58 2(e)i	Description of the pesticide & non-pesticide treatment methods	Section 2.5.
<input checked="" type="checkbox"/>	58 2(e)ii	Rational for selecting a specific treatment method	Sections 2.5.1 to 2.5.4
<input checked="" type="checkbox"/>	58 2(e)iii	Benefits and limitations for each possible method under sec 2(e)i	Sections 2.5.1 to 2.5.4
<input checked="" type="checkbox"/>	58 2(e)iv	Description of how treatment method will be chosen	Section 2.5.5
<input checked="" type="checkbox"/>	58 2(f)i	Description of post-treatment monitoring methods used to determine pesticide efficacy and any environmental effects	Section 2.6.1
<input checked="" type="checkbox"/>	58 2(f)ii	Description of frequency of post-treatment monitoring	Section 2.6.1
<input checked="" type="checkbox"/>	58 2(f)iii	Description of data collected during post-treatment monitoring	Section 2.6.
<input checked="" type="checkbox"/>	58 3(a)i	Procedures for safely transporting pesticides	Section 3.1.
<input checked="" type="checkbox"/>	58 3(a)ii	Procedures for safely storing pesticides	Section 3.2.
<input checked="" type="checkbox"/>	58 3(a)iii	Procedures for safely mixing, loading, and applying pesticides	Section 3.3.
<input checked="" type="checkbox"/>	58 3(a)iv	Procedures for the safe disposal of empty pesticide containers and unused pesticides	Section 0
<input checked="" type="checkbox"/>	58 3(a)v	Procedures for responding to pesticide spills	Section 3.5.

Mosquito Control Pest Management Plan

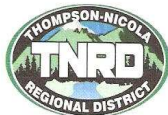
<input checked="" type="checkbox"/>	58 3(b)i	Strategies to protect community watersheds & other domestic & agricultural water sources	Section 4.1.
<input checked="" type="checkbox"/>	58 3(b)ii	Strategies to protect fish, wildlife, riparian areas & wildlife habitat	Section 4.2.
<input checked="" type="checkbox"/>	58 3(b)iii	Strategies to prevent human food contamination	Section 4.3.
<input checked="" type="checkbox"/>	58 3(b)iv	Pre-treatment procedures for identifying treatment area boundaries	Section 4.4.
<input checked="" type="checkbox"/>	58 3(b)v	Procedures for calibrating & maintaining application equipment	Section 4.5.
<input checked="" type="checkbox"/>	58 3(b)vi	Procedures for monitoring weather conditions and strategies for modifying pesticide application methods for different weather conditions	Section 4.6.
<input checked="" type="checkbox"/>	58 3 (c)	Identification of each pesticide that will be used under the plan, the manner of its application and the type of equipment required for each manner of application	Section 5.0

APPENDIX C. MAP OF THE GEOGRAPHIC BOUNDARIES OF THE PMP AREA



The pink border indicates the geographic boundaries of the mosquito control program described within this PMP.

**APPENDIX D: COPY OF THE ADVERTISEMENT PUBLISHED IN LOCAL NEWSPAPERS
THROUGHOUT THE MOSQUITO CONTROL AREAS.**



**DEVELOPMENT OF A PEST
MANAGEMENT PLAN
Pest Management Plan Number:
116-0030-15/20**

Applicant: The Thompson-Nicola Regional District, 300- 465 Victoria St, Kamloops, BC V2C 2A9 Tel: (250) 377-7199 Fax: 250-374-6489 Attention: Martin Dickson, Environmental Services Technologist

Location: The TNRD intends to apply pesticides for mosquito control within the designated mosquito controls areas in Electoral Area 'A', 'J', 'L', 'M', 'N', 'O', & 'P'. This includes the municipalities of Kamloops, Sun Peaks, Logan Lake, Chase, Barriere, & Clearwater but excludes the City of Merritt.

Pesticides: The active ingredients and trade names of the Pesticides proposed for use under this plan are as follows:

Larval Control: *Bacillus thuringiensis* var *israelensis* Strain H-14 (AM65-52) (Vectobac 200G & Vectobac 1200L); *Bacillus thuringiensis* var *israelensis* Strain H-14 (BMP-144) (Mosquito Dunks, Aquabac XT & Aquabac 200G); *Bacillus sphaericus* (VectoLex WSP, VectoLex CG & VectoLex WDG); Methoprene (Altosid XR briquets & Altosid Pellets).

Adult Control :malathion (Pro Malathion ULV Concentrate Liquid, Fyfanon ULV Concentrate, & Malathion 95 ULV insecticide), pyrethrin +piperonyl butoxide (Pyrenone 25-5 MAG Liquid Insecticide & Pyrocid Fogging Formula 7067), pyrethrin + piperonyl butoxide+ N-Octyl bicycloheptene dicarboximide (Gardex Commercial Industrial micro spray concentrate).

Application Methods: **Larval Control:** Backpack applicator, granular spreader, & manual placement for Vectobac 200G, Aquabac 200G & Altosid Pellets. Manual placement only for Mosquito Dunks, Altosid XR Briquettes & VectoLex WSP. Backpack sprayer & truck/ATV mounted sprayer for Vectobac 1200L, VectoLex WDG & Aquabac XT. Helicopter or fixed wing aircraft for Vectobac 200G, Vectobac 1200L, Aquabac 200G, Aquabac XT, VectoLex CG & VectoLex WDG. **Adult Control:** Truck/ATV mounted or backpack, non-thermal ULV generators for all adulticides as listed above.

The selection of insecticides has been chosen to target mosquito populations in the most environmentally responsible manner. The pesticide applications will only occur within the boundary areas outlined in the Pest Management Plan.

The proposed duration of the Pest Management Plan is from Nov 9, 2015 to Nov 8, 2020.

A draft copy of the Pest Management Plan may be viewed online at www.tnrd.ca or a hardcopy can be viewed at the Thompson-Nicola Regional District, 4th Floor, 465 Victoria Street, Kamloops, V2C 2A9

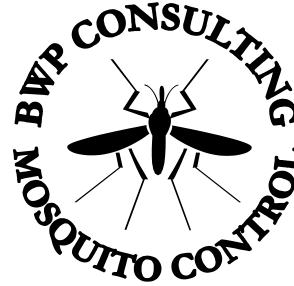
A person wishing to contribute information about a proposed treatment site, relevant to the development of the Pest Management Plan, may send copies of the information to the consultant at the address below within 30 days of the publication of this notice.

BWP Consulting Inc
Attention: Cheryl Phippen
6211 Meadowland Cres S
Kamloops, BC V2C 6X3
Email: BWP@shaw.ca
Phone: 250-573-1750

**APPENDIX E: LETTER SENT TO THE FIRST NATION BANDS REQUESTING INPUT
CONCERNING THIS PMP.**

BWP Consulting Inc.

6211 Meadowland Cres S
Kamloops, BC V2C 6X3



February 4, 2015

Address

Attention Chief:

This letter is to advise you that of a proposed application of pesticide for the control of mosquitoes by the Thompson-Nicola Regional District (TNRD) in accordance with the requirements of the British Columbia *Integrated Pest Management Act* and regulations. This application of pesticide is being proposed as part of a Pest Management Plan (PMP) process. A draft of the proposed PMP (No. TNRD-MOSQ-2015) is now complete and in the Public and First Nations Consultation phase of development.

Pursuant to British Columbia Ministry of Environment guidelines, BWP Consulting Inc. is seeking comment from the XXXX First Nation on the proposed pesticide application. Please be advised that this letter forms part of the Crown's consultation process for the following proposed pesticide use:

The active ingredients and trade names of the mosquito larvicides proposed for use under this plan include:

- *Bacillus thuringiensis* var *israelensis* Strain H-14 (AM65-52) (Vectobac 200G, and Vectobac 1200L);
- *Bacillus thuringiensis* var *israelensis* Strain H-14 (BMP-144) (Mosquito Dunks, Aquabac XT, & Aquabac 200G);
- *Bacillus sphaericus* (VectoLex WSP, VectoLex CG and VectoLex WDG); and
- Methoprene (Altosid XR briquets and Altosid Pellets).

In the event that adult mosquito control is required (as a last resort) the following adulticides are included in our plan:

- malathion (Pro Malathion ULV Concentrate, Fyfanon ULV Concentrate, & Malathion 95 ULV insecticide);
- pyrethrin +piperonyl butoxide (Pyrenone 25-5 MAG Liquid Insecticide, & Pyrocid Fogging Formula 7067);
- pyrethrin + piperonyl butoxide+ N-Octyl bicycloheptene dicarboximide (Gardex Commercial Industrial micro spray concentrate).

Mosquito control activities will begin in April and may extend as late as September each year. The proposed term of the PMP May 2015 to May 2020.

Treatments under this PMP may occur within the mosquito control designated service areas in Electoral Areas 'A', 'J', 'L', 'O' & 'P' including all private, public and First Nations Reserve lands by permission of the applicable landowners, local government or agency. This includes the municipalities of Kamloops, Logan Lake, Chase, Sun Peaks, Barriere, Clearwater. A map

of the geographic boundaries to which this PMP applies can be found in Appendix C of the enclosed PMP.

In accordance with the requirements of the British Columbia *Integrated Pest Management Act* and Regulations, we are required to ask you following questions;

- a. What traditional activities have been or are being practiced within the proposed area and where have they taken place?
- b. Do you have any technical or traditional knowledge of the area under application which would assist us in assessing the impact of this application on First Nations asserted aboriginal interests or treaty rights?
- c. Do you have any concerns regarding potential impacts of our proposed activities on your asserted aboriginal interests or treaty rights, and if so, can you provide proposals on how we may address those concerns?

We would welcome an opportunity to meet with a representative of your First Nation with the intent being to carry on further meaningful consultation as needed. Alternately, we welcome you to submit information pertaining to the enclosed plan in writing or by calling Cheryl Phippen of BWP Consulting Inc (250) 573-1750. Please contact Cheryl by February 18, 2015 if you would like to discuss the plan or to arrange a meeting. If you prefer to respond in writing, please do so within 30 days. Written responses can be sent by mail to Cheryl Phippen at 6211 Meadowland Cres. S., Kamloops, BC V2C 6X3 or by email to bwp@shaw.ca

If you would like to speak to a Ministry representative directly about the proposed pesticide use outlined in this letter, please contact the Ministry of Environment Regional Office at 102 Industrial Place, Penticton, BC V2A 7C8, phone 250-490-8200.

Sincerely,

Cheryl Phippen, BSc, RN
President, BWP Consulting Inc.

c.c. Integrated Pest Management Program, Ministry of Environment, Penticton, BC.