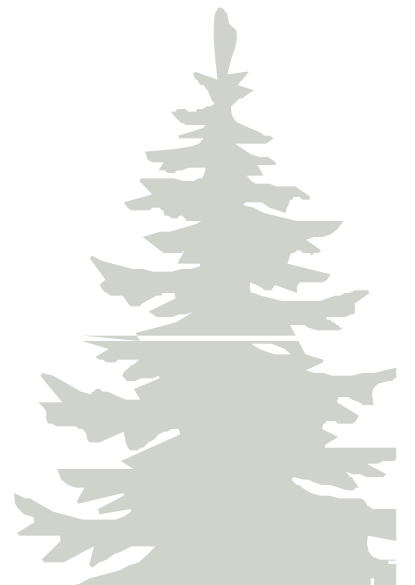




Fraser Valley Regional District Mosquito Control Program 2025 Year-End Report



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Executive Summary

Morrow BioScience Ltd. (MBL) has now completed the second year of a renewed five-year contract term as mosquito control contractor for the Fraser Valley Regional District (FVRD). The mosquito control program reduces floodwater mosquito abundance throughout the region where floodwater mosquito breeding sites are located. Most control activities take place along the Lower Fraser River foreshore and the Nicomen slough, at associated floodwater and seepage sites, and at Stave Lake, north of Hatzic Valley.

Prior to the 2025 mosquito monitoring season, the snowpack in basins contributing to the Lower Fraser River was lower than normal and, by early June, the snowpack was depleted. Seasonably warm weather and above average precipitation within contributing basins in 2025 led to the official seasonal peak of the Lower Fraser River on 6 June at 4.003 meters. River levels (Mission gauge) were higher than those of 2024. Environmental conditions were not optimal for a high rate of mosquito development and did not trigger high densities of floodwater mosquito eggs to hatch, although small permanent water mosquito hatching events in 2025 continued into July and August.

Larval mosquitoes were treated between 8 May and 18 July. The total floodwater mosquito habitat treated by ground was 72.84 ha. The total habitat treated by air was 286 ha. The total Fraser River-associated floodwater mosquito habitat treated by air was 150.8 ha on June 10 and 11. Aerial treatments took place at Stave Lake, totaling 135.2 ha, on May 26, June 4, 12, July 4 and 15. At all known sites, efficacy was assessed as high. A real-time monitoring and treatment data dashboard was provided to the FVRD program manager. The dashboard enabled managers to view up-to-date treatment information and ensure quality control.

Public engagement remained strong, with few complaints (three reports total). The introduction of the Mosquito Reporter tool enhanced data quality and streamlined reporting. Remotely Piloted Aircraft Systems (RPAS) technology remains on hold pending provincial certification, limiting operational flexibility despite clear environmental and financial benefits.

Looking ahead, La Niña conditions are expected to persist into early 2026, suggesting a potential high-water year. Budgeting and early-season notifications under the Pest Management Plan should anticipate increased larval densities if higher river levels activate dormant eggs.

Key Operational Innovations:

Introduction of Mosquito Reporter for enhanced public engagement and predictive monitoring at Stave Lake improved efficiency; RPAS technology remains pending provincial certification.

Season Highlights

- Hydrology & Environment:
 - Fraser River peak: 4.003 m (June 6).
 - Snowpack: 42% of normal by June; precipitation below average; temperatures above average.
 - Local precipitation accumulation for April, May, and June was below average, while July and August were above average.
- Operations:
 - Ground treatments: 72.84 ha.
 - Aerial treatments: 286 ha (Fraser River + Stave Lake).
 - Predictive monitoring improved efficiency: real-time dashboard supported QA/QC.
- Public Engagement:
 - Minimal complaints (3 total).
 - Mosquito Reporter tool introduced for streamlined reporting, allowing for easier reporting and more robust data for analysis.
- Technology and Future Outlook:
 - RPAS certification delayed; operational flexibility limited.
 - La Niña forecast suggests possible high-water year in 2026—plan for increased larval densities.
- Public Health Summary:
 - Zero human cases of West Nile Virus (WNV) reported in British Columbia as of September 29, 2025; four Canadian travel-related cases confirmed.
 - BCCDC launched a pilot project in July 2025 to monitor mosquito-borne viruses in B.C.'s Sea to Sky region following four encephalitis cases in late 2024.
 - CDC reported zero WNV cases in Washington and seven cases in Idaho as of October 7, 2025.

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Cover Image: Sq’ewlets FN mosquito development site, mapping exercise (2024)

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Introduction

Morrow BioScience Ltd. (MBL) is the longest-operating mosquito control firm in British Columbia, having conducted mosquito control in this province for nearly four decades. MBL has been the mosquito control contractor for the Fraser Valley Regional District (FVRD) since 2004. The 2025 mosquito season marked MBL's second year in a renewed five-year contract term with the FVRD.

The FVRD mosquito control program involves a range of floodwater mosquito habitat, extensive program coverage area, and a high population density, coupled with the influence of the Fraser River, the largest river system in British Columbia. These variables make the FVRD mosquito control program complex. Historical experience with this program and other comparable regional programs has created a strong knowledge base from which to build. That understanding has helped improve floodwater mosquito development site management within this district. In addition to MBL's knowledge base, MBL's commitment to public engagement, program data transparency through the use of MBL's in-house real-time data collection portal and client dashboard, combined with improved environmental accountability via annual carbon offset purchases, further strengthens the FVRD mosquito control program.

Carbon Offsets

The spatial reach of the FVRD mosquito program is such that driving is an inevitable requirement. The accumulated mileage over the course of 2025 was approximately 20,000 km (ground transportation only). MBL continues to reduce this impact with the acquisition of two electric vehicles this year. All mileage associated with adult trapping (our most intensive mileage category) was conducted with an electric vehicle.

As an estimation, the driving requirements for this program result in the production of approximately 5.5 tonnes of CO₂ emissions. To offset this addition of CO₂ to the environment, MBL has committed to supporting a local environmental charity (TBD).

Methodology

As large areas of the FVRD are within the Lower Fraser River's flood plain, the primary targets of the FVRD mosquito control program are floodwater mosquito larvae. Female floodwater mosquitoes (e.g., *Aedes vexans*, *Ae. sticticus*) deposit their eggs on damp substrate that experiences flooding. Within the FVRD, floodwater mosquito development sites primarily exist along the flooding corridor of the Fraser River, including associated seepage sites and the islands within the Fraser River. When water floods these sites, due to the freshet and/or significant localized precipitation, the result is large-scale floodwater mosquito egg hatching. If more than one season has passed between high-water years, then high river levels may trigger a compounded number of mosquito eggs to hatch, resulting in a compounded number of mosquito larvae. While study results vary, Breeland and Pickard (1967) estimate that *Aedes vexans* eggs can remain viable for up to four (4) years while they await environmental hatching cues.

MBL field technicians began monitoring floodwater mosquito development sites within the FVRD prior to the Fraser River levels rising in the spring. Mosquito development sites are adaptively managed; regional river levels and local temperatures largely dictate how frequently

sites are visited, as opposed to a prescribed monitoring schedule. At the height of the mosquito season, MBL staff may monitor highly productive sites multiple times a week. Adaptive management techniques allow MBL staff to most accurately time treatments, if necessary. Prescribed monitoring methods increase the risk of missing optimal treatment windows due to potential accelerated mosquito development rates with rising temperatures (Read and Moon 1996). Hence, as regional river levels and ambient temperatures begin to rise consistently, monitoring efforts increase accordingly.



Image 1. Standard dip (350 ml) with 3rd and 4th instar floodwater mosquito larvae (Abbotsford site; June 14, 2022).

applications, although typically with a higher application rate to penetrate canopy cover. All sites are checked within 1 or 2 days of the initial treatment to ensure treatment efficacy. If necessary, touch-up treatments are conducted.

Treatments are timed to target the 3rd and 4th larval instars. If treatments are applied too early, the larvae will not have reached their highest feeding rate yet and may not ingest the Bti spore. If applied too late, the larvae molt into pupae (i.e., non-feeding stage). Both circumstances may result in the development of adult mosquitoes. Additionally, by waiting until mosquito larvae are in the 3rd and early 4th instar stages, early instar larvae are available as food sources in the ecosystem. Sites are treated when a standard dip (350ml) collects >4 late instar (3rd or 4th instar) larvae per dip. When flooding commences and ambient temperatures rise, many dips easily exceed this threshold. Larval densities within the range of 200-500 per dip are commonly detected (Image 1).

Larval mosquitoes in sufficient number (i.e., >4/dip; Image 1) are treated by applications of a microbial larvicide product, Vectobac[®]. This product has the active ingredient *Bacillus thuringiensis* var. *israelensis* (Bti). In 2025, only the granular formulations of Vectobac[®] were used, which is carried on a corncob mixture. The mode of action is relatively simple and with a high degree of target species specificity. Receptors within the mid-gut region of the mosquito larvae are compatible with the toxin proteins that are produced alongside each bacterial spore. After the mosquito larvae ingest the toxin protein, disruption of the larval mid-gut cells occurs. This event causes damage to the wall of the gut and quickly leads to larval death (Boisvert and Boisvert 2000).

As the season progresses and more mosquito development sites become flooded, it is increasingly difficult to treat sites by ground due to access challenges and concurrent site activation. At this point, a helicopter can be used to conduct aerial treatments. The aerial treatments use the same pesticide as ground

Environmental Conditions

Lower Fraser River levels are the primary environmental factor influencing floodwater mosquito sites, as most development areas within the FVRD program are directly tied to these levels. The conditions that affect the Lower Fraser river levels throughout the mosquito season (i.e., April – August) are: 1) snowpack in basins contributing to the Lower Fraser River, 2), local precipitation, and 3) ambient temperature in snow basins contributing to the Lower Fraser River. Local ambient temperature is also of interest, due to the effect that local ambient temperature can have on mosquito egg hatching and larval development rates. Each condition provides insights into the onset of floodwater mosquito egg hatching, development rate, and success. As such, all noted conditions are tracked throughout the season.

Snowpack

The water levels of the Lower Fraser River are largely dictated by the freshet moving through the Fraser, Thompson, and Nechako Plateaus between April and July. The Fraser River is also influenced by tidal variations and high, spatially concentrated precipitation accumulation, although to a lesser degree. When snowpack exceeds 100 percent of normal and when regional precipitation accumulation is above average, higher-than-average Lower Fraser River levels are expected during the mosquito season. Similarly, high ambient temperatures within contributing basins can compress the melt timeline, resulting in high Lower Fraser River levels even if the snowpack in the contributing basins do not exceed 100 percent.

Basin	2024 April Snowpack	2025 April Snowpack
Upper Fraser East	75%	79%
Upper Fraser West	87%	94%
Lower Fraser	69%	85%
Middle Fraser	66%	75%
North Thompson	78%	85%
South Thompson	78%	86%
Nechako	64%	67%

Table 1. Snow basin indices (1 April % of normal - 2024, 2025) for basins that directly affect the Lower Fraser River flood plain, determined by the River Forecast Centre.

On April 1, immediately preceding the 2025 FVRD mosquito monitoring season, the snowpack within basins influencing the Lower Fraser River ranged from 0-85 percent of normal (**Table 1**). The June 2025 Snow Survey and Water Supply Bulletin identified the average of all snow measurements for the entire Fraser River basin (e.g., upstream of the Lower Mainland and inclusive of Upper Fraser West, Upper Fraser East, Nechako, Middle Fraser, Lower Fraser, North Thompson, and South Thompson) was 42%, decreasing from 63% on May 15th¹. Lower elevation snowpack melted from warm weather in late March and April. Higher elevation snowmelt was initially trending later than normal with generally seasonal temperatures, until heat in late May resulted in a rapid melt.

The Revolution Creek snow survey station (ID: 1A17P) reflects weather trends in the Upper Fraser snow basin and as a representative site for the regional snowmelt trajectory for high-elevation snowpack. On the Fraser River at Hope, the snow basin index for May 1st was 70% of

¹ [2025_jun1.pdf](#)

normal.² Notably, snowpack slightly increased through April and then rapidly decreased through May, with the depletion of high elevation snowpack by mid-June. (**Figure 1, next page**).

This trend is consistent with other high elevation snow survey station data throughout the influential basins. Lower elevation snowpack showed signs of considerable melting in April and May. Snow Basin Indices (SBI) for June 15th throughout the province were all below 30% of normal³.

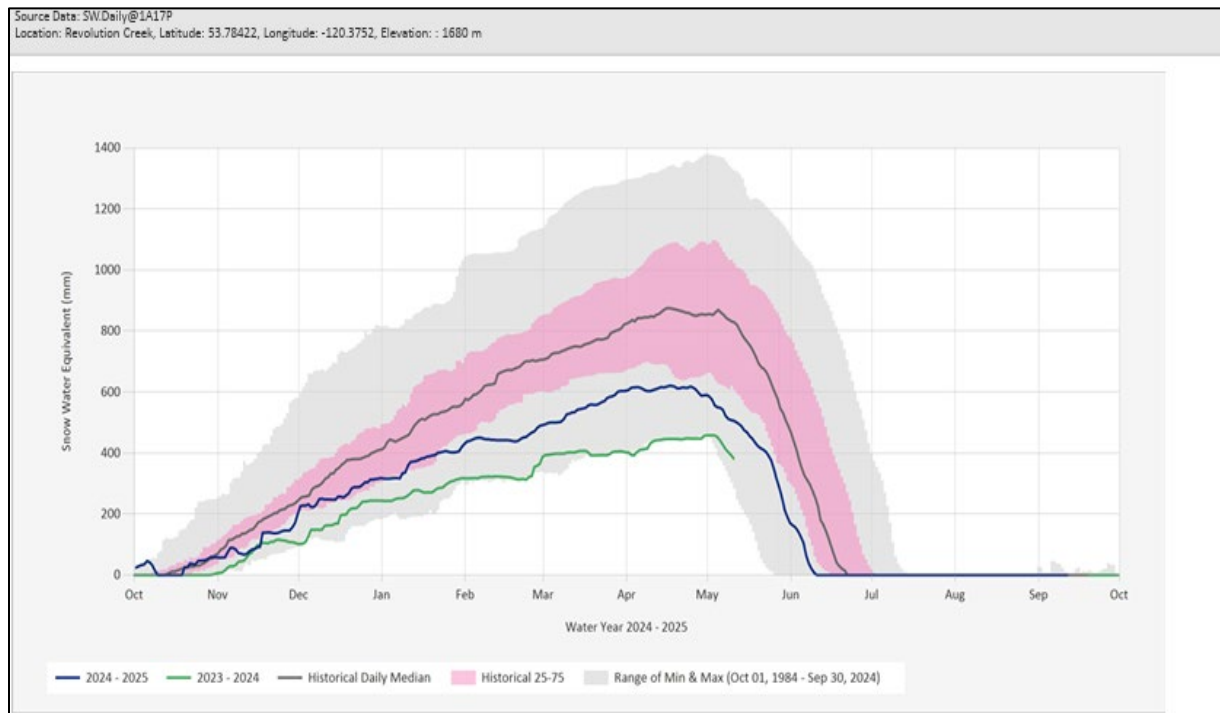


Figure 1. Snow Water Equivalent (SWE; mm) at the Revolution Creek snow survey station (ID: 1A17P) within the Upper Fraser East basin. The upper blue line indicates SWE data for 2024-2025.

Local Precipitation

Substantial temporally and spatially concentrated precipitation accumulation may elevate Lower Fraser River levels and increase seepage site levels. Tracking local precipitation accumulation can aid MBL field staff in determining how long mosquito development sites may require management. The Mission West Abbey weather station (ID: 1105192) provides both historical precipitation accumulation averages (i.e., 1981 – 2010) and current-year totals, allowing for the comparison between the two. This comparison facilitates some level of prediction regarding larval mosquito hatching and treatment timing requirements. When greater-than-average precipitation is received within peak hatching months additional floodwater mosquito eggs may be triggered to hatch.

Precipitation received to the Mission West Abbey weather station in April (127.6 mm) was lower than average (**Figure 2**). Due to low Fraser River levels, it is unlikely that local precipitation impacted target mosquito development in April. Local precipitation in May and

²[2025_may1.pdf](#)

³[2025_jun15.pdf](#)

June was also below average (127.0 mm, 157.0 mm, respectively.) Precipitation received in July (35.6 mm) and August (122 mm) registered above the 5-year average.

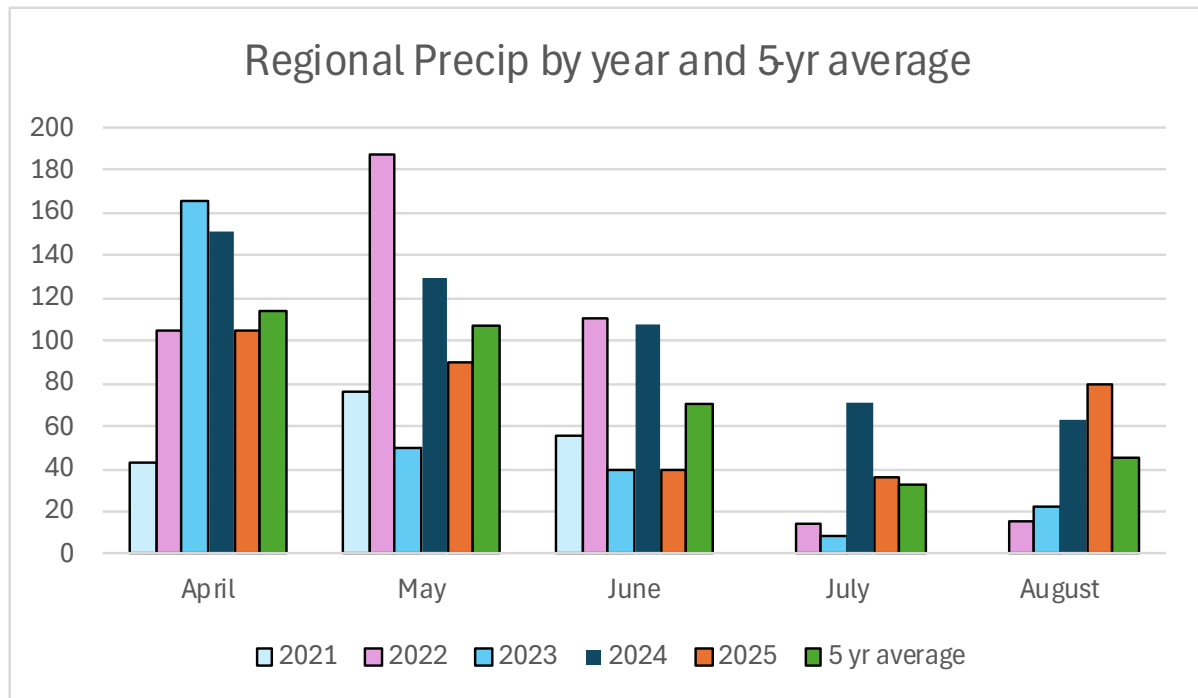


Figure 2. Precipitation values (rainfall and snow accumulation; mm) recorded at the Mission West Abbey Station (ID: 1105192) for 01 April – 31 August; 2025 (orange), and 5-year average 2021-2025 (green).

Precipitation accumulated in July at the Mission West Abbey station (36.4 mm), was slightly above the station's 5-year average for July by 4.1 mm. August precipitation was nearly double the average (79.8 mm; **Figure 2**), though it was of little consequence to the regional Fraser River levels and associated mosquito development sites; the uni-voltine⁴ floodwater mosquito species had already hatched and/or seepage sites had returned to dry states. It is possible, however, that precipitation received in August created habitat for container mosquito species to reproduce. Thus, adult mosquito presence toward the end of the season was likely due to multi-voltine mosquitoes from these sites, not floodwater mosquito species in certain areas.

Ambient Temperature

Tracking ambient temperatures at all basins associated with the Lower Fraser River is important. Local ambient temperature fluctuations from April through August can affect mosquito egg hatching, larval development rates, adult dispersal, and adult survival within FVRD mosquito development habitat. Within contributing snow basins, ambient temperature dictates the commencement and often the intensity of the freshet, which directly impacts floodwater mosquito development habitat.

⁴ **Uni-voltine** refers to species that have **one generation per year**. **Multi-voltine** refers to species that have **multiple generations per year**, often more than two.

Fraser River Watershed Temperatures

The 2025 mosquito monitoring season began in April accompanied by slightly above normal to above normal temperatures (+0.5°C to +2.5°C) throughout British Columbia in April due to generally stable weather conditions⁵. Warm and drier weather occurred at the start of May before switching to primarily seasonal temperatures and unstable conditions through to the middle of May. The first week of June brought dry and seasonally warm temperatures before returning to a variable weather pattern⁶. La Niña conditions remained throughout this period and were expected to transition to ENSO-Neutral for the summer months (June to August)⁷.

Low-elevation snowmelt during May and June within the Fraser River watershed provided gradual freshet to the Fraser River. Continued warm temperatures throughout June depleted remaining high elevation snowpack in contributing snow basins. Ambient temperature data are consistent with 2025 automated snow station data depicting snowmelt points correlating with regional ambient temperature spikes⁸.

July and August were above average in temperature, with slightly above average precipitation, providing very little input to the Lower Fraser River and helping to dry the majority of floodwater mosquito development sites within the program purview.

FVRD Temperatures

Local ambient temperature is a predictive tool when gauging floodwater egg hatch commencement. If the ground proximate to the Fraser River contains floodwater mosquito eggs and if hatching conditions are present (i.e., low dissolved oxygen, higher ambient temperatures), then floodwater mosquito egg hatching will commence (Mohammad and Chadee 2011). Local ambient temperature data are acquired from the Mission West Abbey weather station (ID: 1105192).

To illustrate the effect of ambient temperature on floodwater mosquito egg hatching events, Trpis and Horsfall (1969) exposed submerged eggs of a common uni-voltine floodwater mosquito species, *Aedes sticticus*, to various constant air temperatures and recorded hatching success. Results revealed that eggs began to hatch at 8°C, although larval development was slow and survivorship was low. Eggs held at 21°C provided the optimal temperature, of the five temperatures tested, for hatching and larval development. These temperature boundaries are depicted in black on **Figure 3**, below.

While *Ae. sticticus* is not the sole floodwater species present in the FVRD, it serves as a representative species for our purposes and provides general developmental benchmarks.

⁵ [2025_may1.pdf](#)

⁶ [2025_jun15.pdf](#)

⁷ [2025_jun15.pdf](#)

⁸ <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-science-data/water-data-tools/snow-survey-data/automated-snow-weather-station-data>

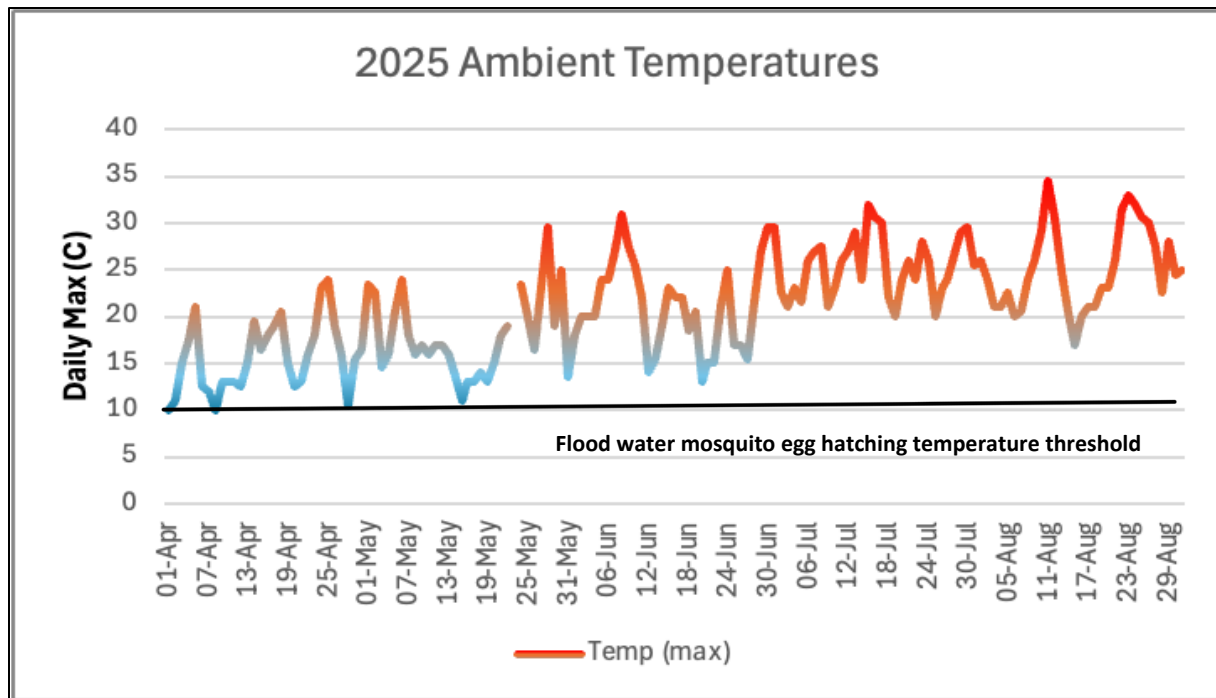


Figure 3. Maximum daily ambient temperatures (C) as recorded at the Mission West Abbey Station (ID: 1105192) 01 April – 31 August 2025.

The FVRD 2025 season began with above average ambient temperatures for April. The monthly average for April (15.6°C) was 2.29° C warmer than the 1990-2024 historical station average⁹. Given that April temperatures frequently were above the lower temperature threshold for successful floodwater mosquito egg hatching, floodwater mosquito eggs within the FVRD were likely activated within April if exposed to flooding conditions (**Figure 3**). If mosquito eggs were exposed to water during this month, the larval development at cooler temperatures would have been slow (Trpis and Horsfall 1969).

Local ambient temperatures in May were warm and within the temperature range for favourable larval development conditions for target mosquito species. The average maximum daily temperature of 17.8° C for May 2025, was 0.6°C warmer than the 1990-2024 historical station average. Thus, mosquito egg hatching and larval development was likely faster than normal for that point in the season. Appropriately, larval mosquito treatments increased in mid-May as local ambient temperatures approached the upper thresholds of temperatures associated with higher floodwater mosquito hatching success rates. (**Figure 3**).

Ambient temperatures during June were also warm, providing sufficient hatching cues for all target mosquito eggs exposed to water. Warm weather in June corresponded with levels consistently above 3 metres for the Lower Fraser River at Mission. When river levels remain high during periods of warm ambient temperature, the result is large-scale mosquito egg hatching events and increased larval development rates. Therefore, because considerable

⁹ [Climate data extraction tool - Daily climate data](#)

floodwater development sites were at peak levels during periods of warm ambient temperatures, there was a need to treat mosquito larvae in June.

High ambient temperatures, such as those noted in late July and August, are likely to decrease the lifecycle of adult mosquitoes (Ciota et al. 2014). Thus, any mosquitoes that successfully emerged would have had a reduced lifespan with the heightened ambient temperatures through August. (**Figure 3**).

While not a target of the FVRD mosquito control program, container mosquito abundance typically increases in July and August. Container mosquito habitats near residential homes can be created throughout warmer summer months whenever the presence of water is coupled with high ambient temperatures. MBL technicians regularly inform residents that container-bred mosquitoes can be reduced around homes by ensuring conducive environments (i.e., bird baths, kiddie pools, flowerpot holders, etc.) are either free of water or refreshed frequently.

River Levels

Floodwater mosquito development sites within the FVRD are found along the foreshore of the Fraser River and within associated tributaries and seepage sites. As the presence of water is the main hatching cue for floodwater mosquito eggs, springtime Fraser River levels provide predictions about the timing and extent of floodwater mosquito egg hatching. The 2025 Lower Fraser River freshet began in early May as the result of warm high elevation temperatures within contributing basins causing snowmelt and the gradual rise of the Lower Fraser River (Mission gauge; 08MH024). The official peak was recorded at 4.003 meters on 5 June. (**Figure 4, next page**).

By mid-June 2025, nearly all snow basins contributing to the Fraser River were depleted of snow, with the exception of eastern contributing basins which showed 30% - 0% percent of average snowpack¹⁰.

In light of seasonal temperatures and below-average precipitation, low peak levels for the Lower Fraser River were recorded at Mission gauge in 2025¹¹. The Lower Fraser River levels dropped and remained below 3 m by June 25, associated seepage sites reduced quickly and, by July, many of the mosquito development sites were dry.

The level at which mosquito development sites within the FVRD have been observed to become active is approximately 3 metres. In 2025, the Fraser River reached 3.13 meters on 29 May. (**Figure 4**). River levels were sustained over the critical 3-metre Lower Fraser River level long enough to provide suitable conditions for floodwater mosquito development at associated floodwater and seepage sites.

The length of time that the Fraser River at Mission remains higher than 5 metres (during more typical years) helps predict the extent of mosquito larval abundance within a given year. The

¹⁰ [2025_jun15.pdf](#)

¹¹ [Historical Hydrometric Data Search Results - Water Level and Flow - Environment Canada](#)

Fraser River never rose above the 5-metre threshold in 2025. In average years, such as 2021, Lower Fraser River levels may remain above 5m for closer to 20 days.

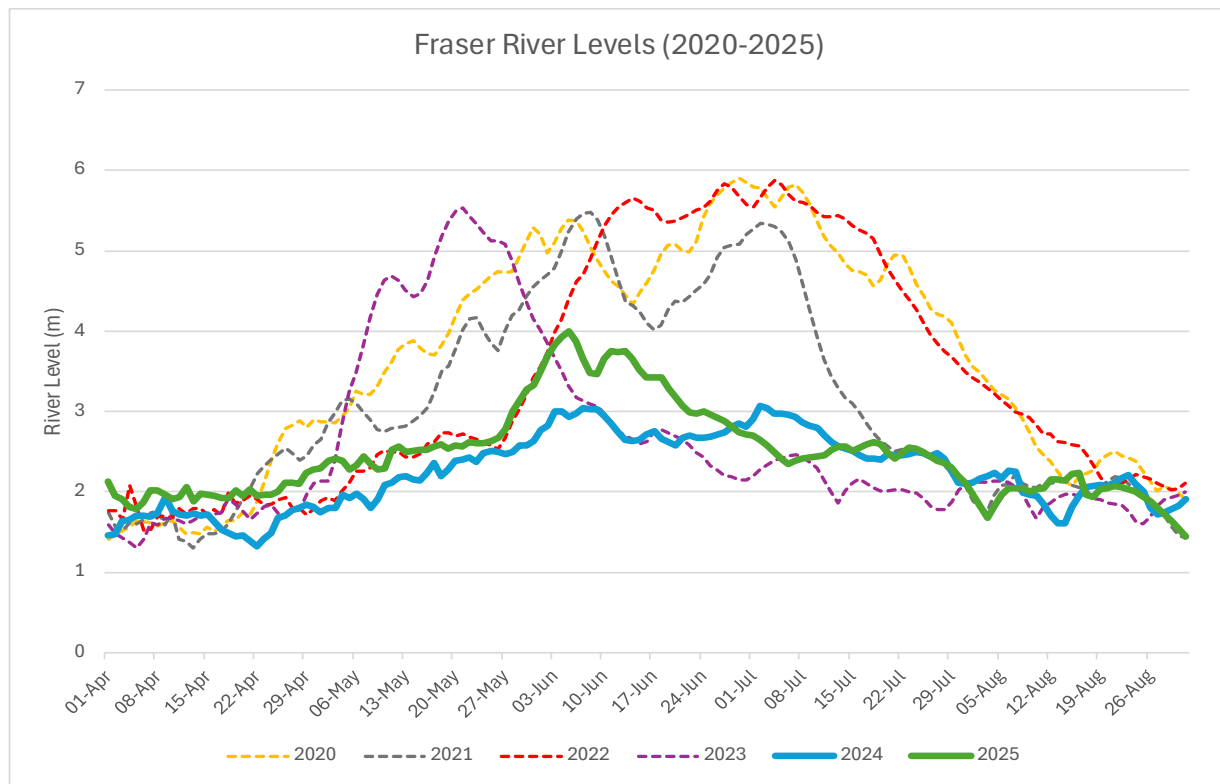


Figure 4. 2025 river levels (m) as recorded for the Lower Fraser River (Mission gauge, 08MH024) from 01 April – 31 August. Compared to previous 5 seasons (2020-2025).

The Fraser River's peak relative to recent seasons is another predictive variable that may help explain an associated year's larval mosquito abundance. If the current year's peak regional river levels far exceed those of preceding season, mosquito eggs laid between the high-water mark of both years could have remained dormant until current-year freshet trigger their hatching. Because the 2025 peak of the Fraser River was only approximately 0.93 meters higher than the 2024 peak, the 2025 high water likely did not trigger significant additional dormant floodwater mosquito eggs to hatch. (**Figure 4**). Note that the majority of mosquito habitat along the Fraser River does not typically activate until the river hits 4m at the mission gauge. Nevertheless, sustained high water levels occurred during a period of seasonably warm weather in 2025, providing hatching cues for floodwater mosquito eggs at a greater number of sites than in 2024.

Larval Control

Monitoring within the FVRD began on 1 May at floodwater mosquito development sites. Although most of the floodwater mosquito development sites are not active until the Fraser River (Mission gauge) exceeds 3 metres, sites were monitored beginning in May due to the potential for early arrival of freshet, to evaluate site conditions and catch the leading edge of any potential hatching events. The warm ambient temperatures coincide with increased monitoring and larval mosquito treatments throughout May.

Appendix I shows a map of average larval densities found throughout the 2025 season. Larval abundance is assessed in the field using a system of ranges (0, 1-4, 5-49, 50+) for early and late instar mosquito larvae. In order to transfer these data to a map (**Appendix I A-D**), data are summarized and assigned to a hexbin (i.e., hexagonal polygons) representing an area of 21.65 ha. Only wet sites were included in the analysis. An intensity value representing the relative number and life stage of the mosquito larvae are assigned to each single sample. For each sample, late instar larvae ranges are weighted more heavily than early instar larvae ranges to indicate targeted life stage and treatment urgency. In this way, each sample is assigned an intensity value from 0 to 1. All sample intensity values are then averaged by hexbin. Thus, each hexbin is also assigned an average intensity value from 0-1. The intensity value thresholds within **Appendix I** denoting ‘low’, ‘moderate’, ‘high’, and ‘very high’ were assigned based on biological significance and operational urgency¹². Of note, the areas with highest recorded larval abundance amongst known sites are the northeast portion of Stave Lake, Crescent Island, Matsqui Trail Regional Park area, Island 22, sites near the Chehalis River Campground, Laidlaw, and near Hope (**Appendix I A-C**). Further reconnaissance efforts took place around the Chilliwack Creek and the Chilliwack Wastewater Facility. No new mosquito development sites were identified throughout the FVRD program purview in 2025.

Appendix II is a collection of maps by municipality depicting where and how frequently treatments took place in 2025. In certain cases, hexbins denoted as ‘Non-Detected’ or ‘Low’ do have treatments associated with them (**Appendix II A-C**). In these cases, treatments may have been triggered by the larval activity of a representative site. Historically, when representative sites become active the other sites in the area have proven to also be active. Thus, sites with a previous designation of ‘Non-Detected’ or ‘Low’ may require later treatment due to representative site’s activity level without the need to sample. However, maps provide a high-level understanding of where treatments were concentrated.

Ground Application Summary

Floodwater mosquito development sites within the FVRD are typically visited on a weekly basis during larval development phases unless conditions require more frequent monitoring (i.e., Fraser River levels > 5m, ambient temperatures > 20°C, large precipitation event). Sites are treated when a standard dip (350ml) collects 5 or more late instar (3rd or 4th instar) larvae per dip. All sites are checked within two days of the initial treatment to ensure high treatment efficacy. If necessary, touch-up treatments are conducted.

The first floodwater mosquito development site was treated by ground on 8 May (**Figure 5**). Ground treatments were clustered between 08 May and 04 July, as many mosquito development sites became dry with the drop in regional Fraser River levels in early July. (**Figures 5, 6**).

¹² Note that treatments occur after the detection of larvae. Sites that produce higher levels of larvae are prioritized for more frequent monitoring/treatments.

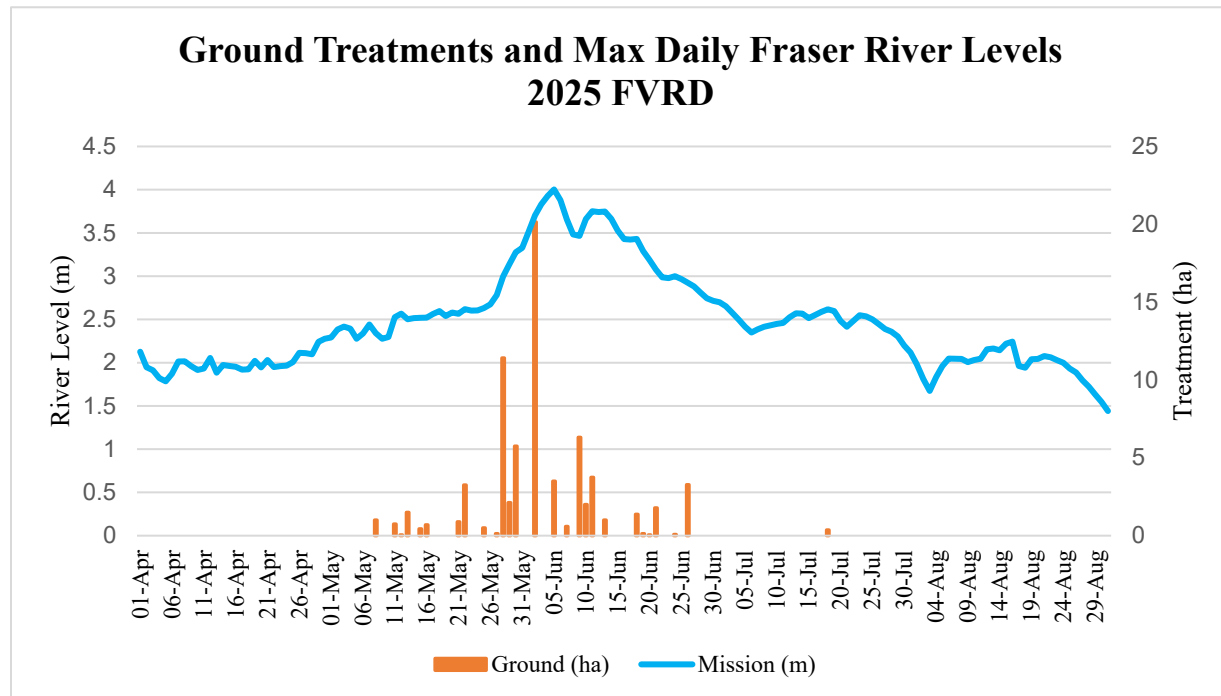


Figure 5. Fraser River levels (m; Mission gauge) with total floodwater mosquito development area treated by ground (ha) from 1 April – 31 August 2025. Note that ground treatments (ha) are recorded on the alternate y-axis.

Vectobac® (a.i., *Bacillus thuringiensis* var. *israelensis* (BTI)) is the product used for all larval mosquito treatments conducted by MBL. Bti has high target specificity and achieves high efficacy in typical field conditions (Vectobac® Mosquito Biolarvicide - Technical Bulletin). Within the FVRD’s highly organic water conditions, MBL staff note an average field efficacy rate of approximately 85%-90%. The granular formulation was used in 2025. Certain sites in the FVRD require a ground application rate of 6 kg/ha, although the majority require 4 kg/ha.

The total area treated by ground at floodwater mosquito development sites in 2025 was approximately 72.84 ha (291.35 kg Vectobac®; 4 kg/ha). (Figure 5). The total area treated by ground in 2025 was 16.04 hectares more than the total area treated by ground in 2024. This slight increase in ground-based treatment area in 2025 is due to the higher and longer sustained Lower Fraser River levels, increasing the duration of floodwater larval activity at development sites. If sites are inaccessible by ground, they are included in aerial treatment campaigns. Real-time data associated with each treatment are available through MBL’s client-registered, real-time program portal.

Relative to the low water year of 2024, floodwater mosquito development habitat increased in 2025. The 2025 snowpack within contributing snow basins was lower than the historical average. Records were slightly augmented through April before rapidly melting during mid-May through early June. Similar conditions across much of contributing snow basins resulted in relatively low Lower Fraser River levels through August. A compounded number of floodwater mosquito eggs hatched in 2025 as environmental triggers (i.e., gradual freshet, sustained water levels, high ambient temperatures) were in place for continued hatching events through July.

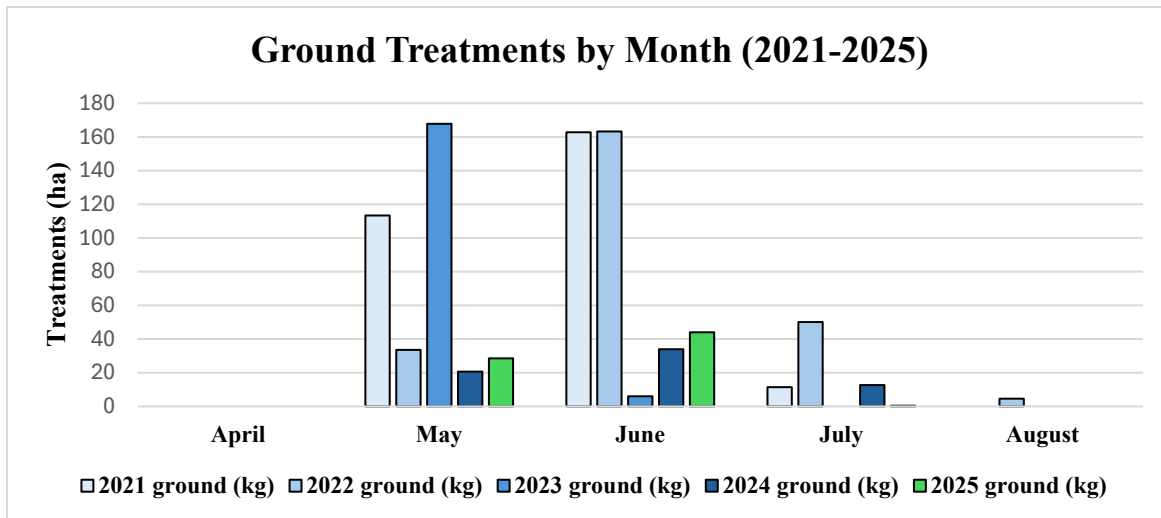


Figure 6. 2021-2025 ground treatment area (ha) by month from April – August; 2025 (green).

Below-average to average precipitation from April through June, however, likely did not increase mosquito development activity at seepage sites.

Aerial Application Summary (Fraser River)

Floodwater mosquito development sites are treated by air when multiple large-scale sites become active at once and/or when site-access by ground is unsafe. In contrast to record low water levels in 2024 requiring no aerial treatments along the Fraser River corridor, one aerial campaign was conducted in 2025 (June 10-12). Total hectares treated by air equaled 150.8 ha.

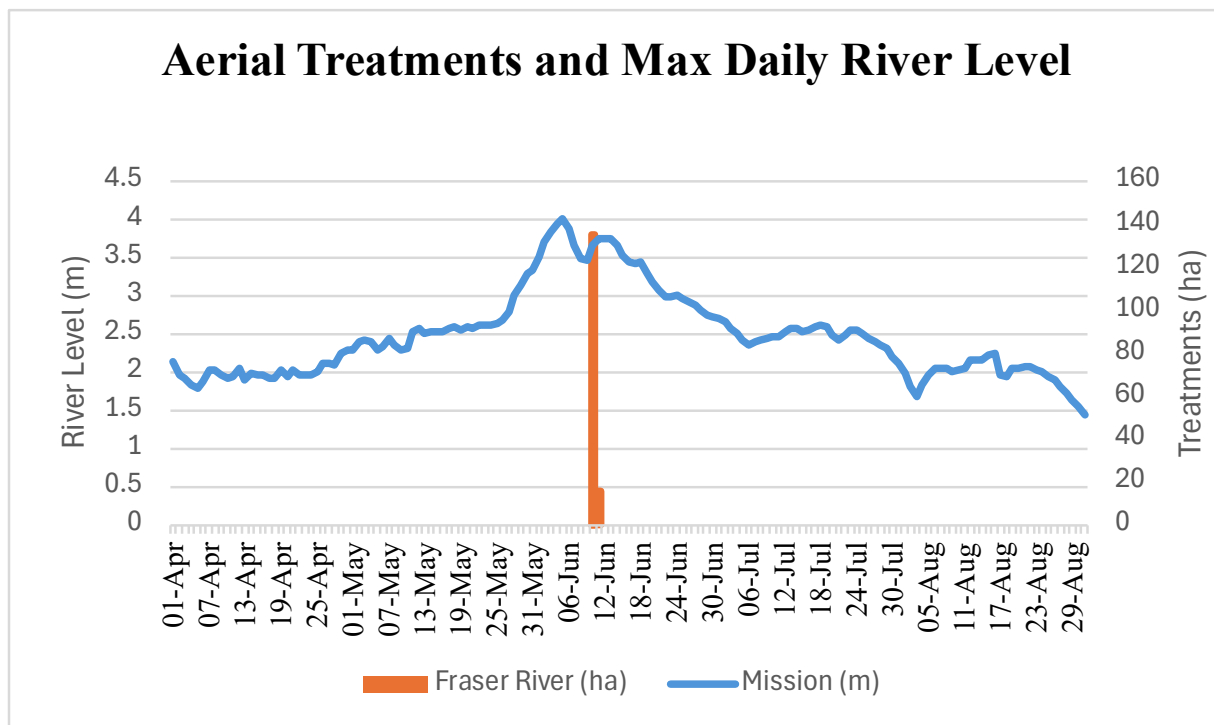


Figure 7. Aerial treatment in response to the peak in the Fraser River. Note that treatments took place over 2 days

Stave Lake

Stave Lake is a reservoir located in Electoral Area ‘F’ and at the northern end of the District of Mission. BCHydro manages the hydroelectric project connected to the Stave Lake reservoir, which is contained by Stave Lake Dam. Stave Lake levels are measured at Stave Falls, at the south end of Stave Lake. When Stave Lake levels increase sufficiently in the spring months, suitable mosquito development habitat adjacent to the lake north of Hatzic Valley is flooded. MBL has monitored Stave Lake for larval mosquito habitat since 2015 and treated that habitat since 2016.

Mosquito larval monitoring at Stave Lake takes place throughout the late spring and summer months. Monitoring efforts typically increase as Stave Lake levels increase, targeting floodwater mosquito hatching events that are triggered when floodwater mosquito eggs are wetted. Based on accumulated data, MBL has developed predictive models that correlate water level fluctuations with larval emergence, thereby minimizing the necessity for continuous on-site monitoring.

MBL staff make daily assessments of the Stave Falls levels and begin monitoring Stave Lake-associated sites when those levels begin to consistently increase. The area of Stave Lake that requires monitoring and treatment is in the southeast arm of the Lake. It is accessible only by boat or by air. Stave Lake received five aerial treatments throughout the 2025 mosquito season. (Figure 8.) Currently, the only effective treatment method is by helicopter due to the large mosquito development habitat at higher water levels. However, this site presents a perfect opportunity for RPAS treatments.

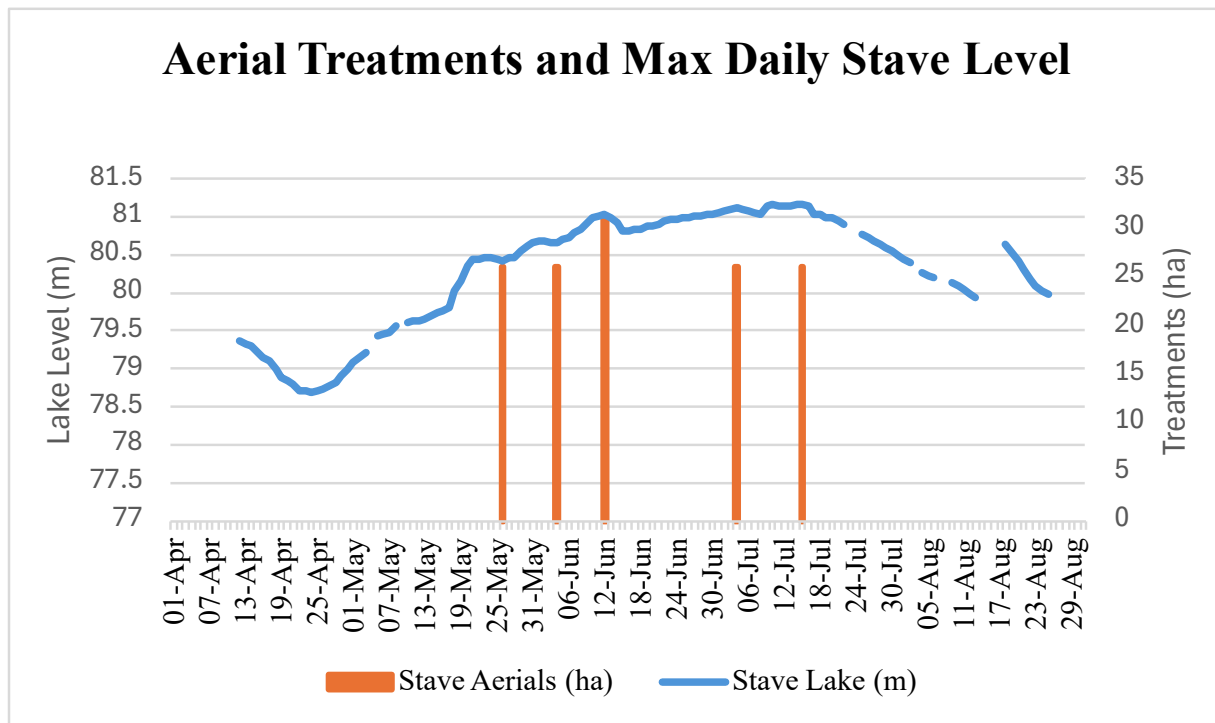


Figure 8. 2025 Stave Lake water levels with treatments (ha). Note that ‘Treatment’ is on the alternate y-axis. In 2025, monitoring took place on May 23 and June 6. Water levels at the May 23 sampling event had just risen to 80.42m. Past monitoring has shown that larvae begin developing at just

over 80m. Rising water levels coupled with warming weather triggered the first aerial treatment on May 26. Subsequent aerials took place on June 5, 12, and July 4, 15. Total treatments amounted to 109.2 ha.

A total of five (5) aerial treatments were conducted at Stave Lake in 2025 (and two (2) at associated floodwater mosquito habitat sites on the Fraser River. (**Figures 7 and 8**). In total, approximately 286 ha (855 kg granular Vectobac®) were dispersed.

Adult Mosquito Trapping

The primary objective of the adult mosquito trapping program is to assess adult mosquito abundance, which operates as a quality assurance/quality control measure for larval mosquito control activities conducted by MBL technicians. The trap data allows MBL to compare intra and inter-annual nuisance levels. Additionally, species composition data elucidates species present in the region, their primary habitat, and contributes to the general knowledge bank of mosquito science in the region.

Adult mosquito trap locations include the Hope Wastewater Plant, Abbotsford Wastewater Plant, Kent Wastewater Plant, Mission Raceway, the Chilliwack Wastewater Plant, and the Jubilee Hall in Silverdale. Adult mosquito trap monitoring has occurred at all locations, except the Jubilee Hall site, since 2011. The Jubilee Hall location was added in 2021.

All adult mosquitoes were collected using battery operated Center for Disease Control (CDC) traps with dry ice as bait. A black light (night-operating only) and dry ice (CO₂) act to attract adult mosquitoes. A continuously working fan ensures that attracted mosquitoes are pulled into an attached basket. Basket contents were collected the following morning. As per MBL collection and shipping protocol, adult mosquito specimens were collected from traps, stored in a freezer with desiccant, before being sent to the MBL head offices for counts and later identification. A real-time data collection application was developed to track trap set-up, take-down, and content shipments. Additionally, one consistent MBL staff member was responsible for all mosquito trap efforts, improving field efficiency and reducing operator error.

RPAS (Drone Update)

Despite a promising start in early 2024, the Province reprioritized its efforts in 2025 and paused further development of a certification category for pesticide applications using drones for the foreseeable future. The latest mandate letters from the Ministers did not include advancing RPAS (Remotely Piloted Aircraft Systems) certifications to support larvicide applications with this technology. While some other provinces have established categories for drone-based pesticide applications, others have simply adapted their existing “aerial application” classifications to include drones.

Currently, the only barrier preventing MBL from using drones to treat larval mosquitoes as part of its mosquito control program is the absence of a drone-specific pesticide applicator certification from the Province. In response to inquiries from several local governments, Minister Tamara Davidson (Minister of Environment and Parks, Nov. 3, 2025) indicated that, while this is on their radar, it is not happening imminently. Further, in response to a question at the IVMA (Integrated Vegetation Management Association) forum in Prince George, Ministry staff suggested that this is a priority for their work beginning March 2026 (Nov. 5, 2025).

Given the potential significant financial and environmental benefits this technology offers, MBL remains committed to working with the Province to help establish the necessary certification framework. See Appendix XX for a list of sites that MBL feels RPAS applications will enhance the program and reduce costs.

Public Relations

Maintaining positive public relations continues to be a high priority for MBL. Public relations occur on several levels: the “Mosquito Reporter”, in-person communication with members of the public, the mosquito hotline, presentations to stake holders, and email correspondence. MBL continues to look for new areas to expand this aspect of our program.

Mosquito Reporter

To strengthen public engagement and improve operational efficiency, MBL introduced the Mosquito Reporter tool in 2025 (<https://www.mbl-gis.com/reporter/>). This platform provides residents and visitors with a simple, user-friendly way to submit georeferenced mosquito observations online. By streamlining the reporting process, Mosquito Reporter reduces reliance on phone calls and emails while generating structured, location-specific data. These reports enhance the program’s ability to identify active mosquito development sites, support adaptive management decisions, and contribute to more robust seasonal analysis.

A link has been provided that allows residents and visitors to easily create a comprehensive, georeferenced mosquito report that staff are able to easily follow up on. We also continue to offer a toll-free Mosquito Hotline (877-986-3363).

This year saw three (3) reports come in to the Mosquito Reporter. One report in April suggested the mosquitoes were bad in Mission, one in May commented on the mosquitoes up near Cultus, and the third was highlighting holes left by a developer in Chilliwack. The latter report requested a follow-up; crews visited the site and have added it to our monitoring efforts going forward.

Phone Calls and Emails

FVRD residents have multiple traditional venues to communicate with MBL. MBL’s Mosquito Hotline (877-986-3363) and email form are outlined prominently on the contact tab of the MBL website (www.morrowbioscience.com). The FVRD also established an in-house hotline (1-888-733-2333). Emails received from the FVRD via their mosquito-specific email address (mosquitoes@FVRD.ca) and calls received to their in-house hotline are forwarded to MBL staff for follow-up.

The volume of concern calls and emails from residents was low with one complaint (1 May) and two concern reports received (31 March, 2 April). The low call and email volume is the result of a reduced area of active floodwater mosquito development sites. All calls and emails are designated as either concern or inquiry based. MBL’s goal is to respond to all calls and emails within 24 hours; this goal was achieved for the 2025 season.

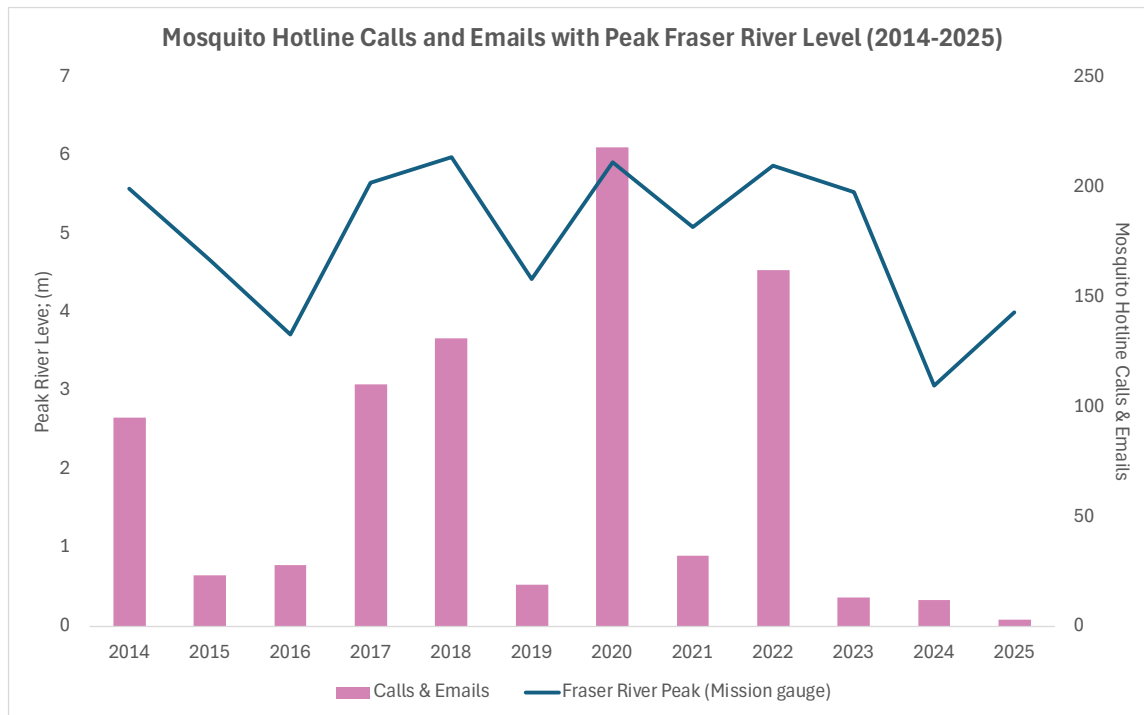


Figure 9. Peak Fraser River levels (m; blue, Mission gauge) with total Mosquito Hotline calls and emails received to the FVRD Program Manager and/or MBL Mosquito Hotline. (2014-2025, pink).

MBL remains committed to continuing reconnaissance efforts to identify floodwater mosquito development sites, adaptive site management, and expanding in-house knowledge of sites. Expanding public engagement reach may also result in the identification of new sites and reduction of mosquito larvae in the region. Through these efforts, MBL aims to further reduce adult mosquito nuisance within the FVRD purview.

Direct Communications

Direct communication between MBL staff and the public can occur in many situations. The most common direct interfacing with the public occurs when technicians are in the field. While conducting site visits, MBL technicians are often asked questions by residents. These encounters provide an excellent opportunity for public relations and the dissemination of MBL contact information including its website address, an email, phone number, and, most importantly, the “Mosquito Reporter”. Crews now carry business cards with two QR codes on them, one taking residents directly to the “Mosquito Reporter” and another taking them to our website, allowing for a deeper dive into available information.

Social Media

In 2023, MBL made the decision to move away from posting on social media. We have found that the negative aspects of social media far outweigh the positive aspects. MBL has, upon request, provided material for the FVRD to post updates for program activities. This was not requested in 2025.

MBL Website

The MBL website (www.morrowbioscience.com) was launched in 2015 and redesigned in 2025. This site was developed to allow clients and the public to have access to information about MBL's background, activities, outreach, and company.

MBL website (www.morrowbioscience.com) has highlighted two sets of FAQ documents focused on (1) mosquito biology and disease transmission and (2) the active ingredient used in control efforts (*Bacillus thuringiensis var. israelensis*).

To further support residents in contract areas, the homepage includes visible tabs for resources and contact information. The 'Contact' tab allows users to directly send a message to MBL.

Education / Outreach

Communication with program residents remains a priority for MBL. All interview requests are approved by the FVRD program manager. Every effort will be made to accommodate interviews which assist in raising awareness about mosquito control efforts and personal protective measures.

Public Health Summary

West Nile Virus Summary

Although floodwater mosquito species in Canada are not the main West Nile virus (WNV) vectors, it is important to remain current in regional mosquito-related diseases. Monitoring West Nile virus nationally is a joint effort between the Government and its partners, including provincial and territorial ministries of health, First Nations authorities, and blood supply agencies¹³. Along with its partners, Health Canada compiles on-going provincially reported surveillance data of WNV cases in humans, animals, and mosquito pools.

As of the 29 September 2025 update, zero human cases of WNV have been reported originating from British Columbia and four cases have been reported among residents of Canada who became infected while travelling outside of the country.¹⁴

Washington State and Idaho State share a border with British Columbia, so it is important to follow WNV activity in those areas, as well. According to the Center for Disease Control, as of 7 October, zero human cases of WNV have been reported in Washington and seven in Idaho¹⁵.

BCCDC Mosquito Surveillance Study

In late 2024, four cases of encephalitis, originating from the Sea to Sky corridor of BC, were reported to Vancouver Coastal Health (VCH) and the BC Centre for Disease Control (BCCDC).

In July 2025, VCH and the BCCDC, together with partners from Lilwat Nation, Squamish Nation, and the University of BC, commenced a mosquito surveillance pilot project in the Sea to Sky

¹³ [Surveillance of West Nile virus - Canada.ca](http://Surveillance.of.West.Nile.virus-.Canada.ca)

¹⁴ [Seasonal update: Mosquito-borne disease surveillance in Canada — Canada.ca](http://Seasonal.update.Mosquito-borne.disease.surveillance.in.Canada---Canada.ca)

¹⁵ [Current Year Data \(2025\) | West Nile Virus | CDC](http://Current.Year.Data.(2025)|West.Nile.Virus|CDC)

region to better understand the local mosquito population and the viruses they carry¹⁶. The study implements the use of Encephalitis Virus Surveillance (EVS) mosquito traps.

Zika Virus Summary

According to the CDC, Canada is not known to have mosquitos that transmit Zika¹⁷. HealthLinkBC reports that no Zika cases have originated in Canada due to presumed lack of vector mosquito species¹⁸.

According to Peach (2018), the primary Zika mosquito vectors (i.e., *Aedes aegypti*, *Ae. albopictus*) are not found in British Columbia. *Ae. albopictus* has been found on east coast but tested negative for Zika. There is currently a low risk for Zika virus to circulate within British Columbia.

Discussion

The 2025 mosquito season was characterized by continued atypical hydrological conditions, marking the second consecutive year of below-average Fraser River levels. Although the peak river level (4.003 m on June 5) was approximately 0.93 m higher than in 2024, it remained well below the 5 m threshold typically associated with widespread foreshore inundation and large-scale larval development. Consequently, mosquito habitat activation was limited to isolated pockets influenced by groundwater, precipitation, and tidal fluctuations rather than extensive floodplain flooding. This pattern constrained larval abundance and reduced nuisance levels, as reflected in minimal public concern reports.

Operationally, adaptive management strategies were critical. Ground treatments were concentrated between May 8 and July 4, totaling 72.84 ha, an increase of 16.04 ha over 2024, due to slightly higher and sustained river levels. Aerial treatments were reintroduced along the Fraser River corridor for the first time since 2023, covering 150.8 ha during the June peak (Figure 7). Stave Lake continued to require intensive aerial intervention, with five campaigns totaling 135.2 ha (Figure 8). Predictive monitoring at Stave Lake, based on water level trends, improved efficiency and reduced unnecessary site visits.

Environmental conditions—low snowpack (42% of normal by June), below-average precipitation through June, and above-average temperatures—played a decisive role in shaping larval dynamics. Warm temperatures accelerated larval development, necessitating timely treatments, while rapid snowmelt compressed the freshet period, limiting prolonged habitat inundation. These factors collectively explain the modest treatment footprint compared to high-water years.

From a programmatic perspective, the introduction of the Mosquito Reporter tool enhanced public engagement and data quality. While we didn't experience high volume in this program, other programs run by MBL did receive a high volume of reports, and information from this tool has been helpful in guiding program efforts.

¹⁶ <https://www.vch.ca/en/news/new-pilot-project-study-mosquito-population-sea-sky-region>

¹⁷ [Countries & Territories at Risk for Zika | Zika Virus | CDC](#)

¹⁸ [Zika Virus | HealthLink BC](#)

RPAS (drone) technology remains on hold pending provincial certification. This regulatory delay continues to limit operational flexibility and cost savings, despite strong evidence of environmental and financial benefits.

Looking ahead, the persistence of La Niña conditions into early 2026 suggests a potential return to higher water levels. If realized, this could activate previously dormant eggs above the 4 m mark, resulting in significantly higher larval densities. Budgeting and resource allocation should anticipate a high-water scenario, and early-season notifications under the Pest Management Plan will be essential.

2026 Program Recommendations

- Budgeting should consider a high-water year for 2026.
- Notify the Ministry of Environment of the FVRD intent to treat mosquitoes in 2026 under the FVRD Pest Management Plan. Notification should take place 2 months before the start of the season (the end of February at the latest).
- It is important to attach copies of all the mosquito development site maps with the Notice of Intent to Treat (NIT).
- Develop a protocol and information for distribution regarding the introduction of Drones (likely for 2026/7).
- Submit a letter to the Provincial Ministry seeking a higher priority for RPAS certification for pesticide applications.

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Mosquito Larval Frequency at Sample Locations (1/3)

Morrow BioScience Ltd

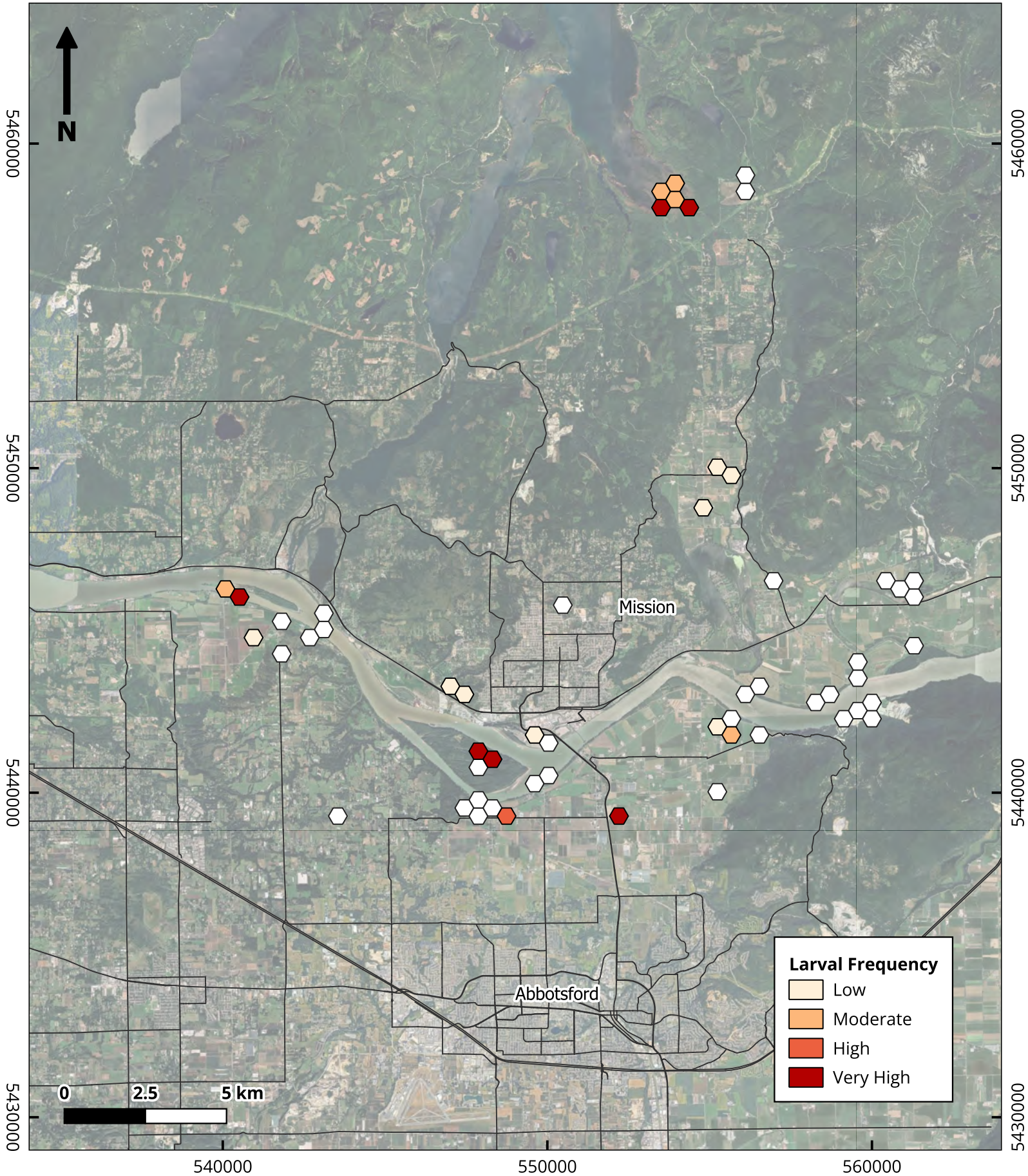
PO Box 1013 Rossland, BC V0G 1Y0
gis@morrowbioscience.com 1(877)986-3363



Appendix I-A

2025

Scale = 1 : 150,000 CRS = NAD83 UTM Zone 11N
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Mosquito Larval Frequency at Sample Locations (2/3)

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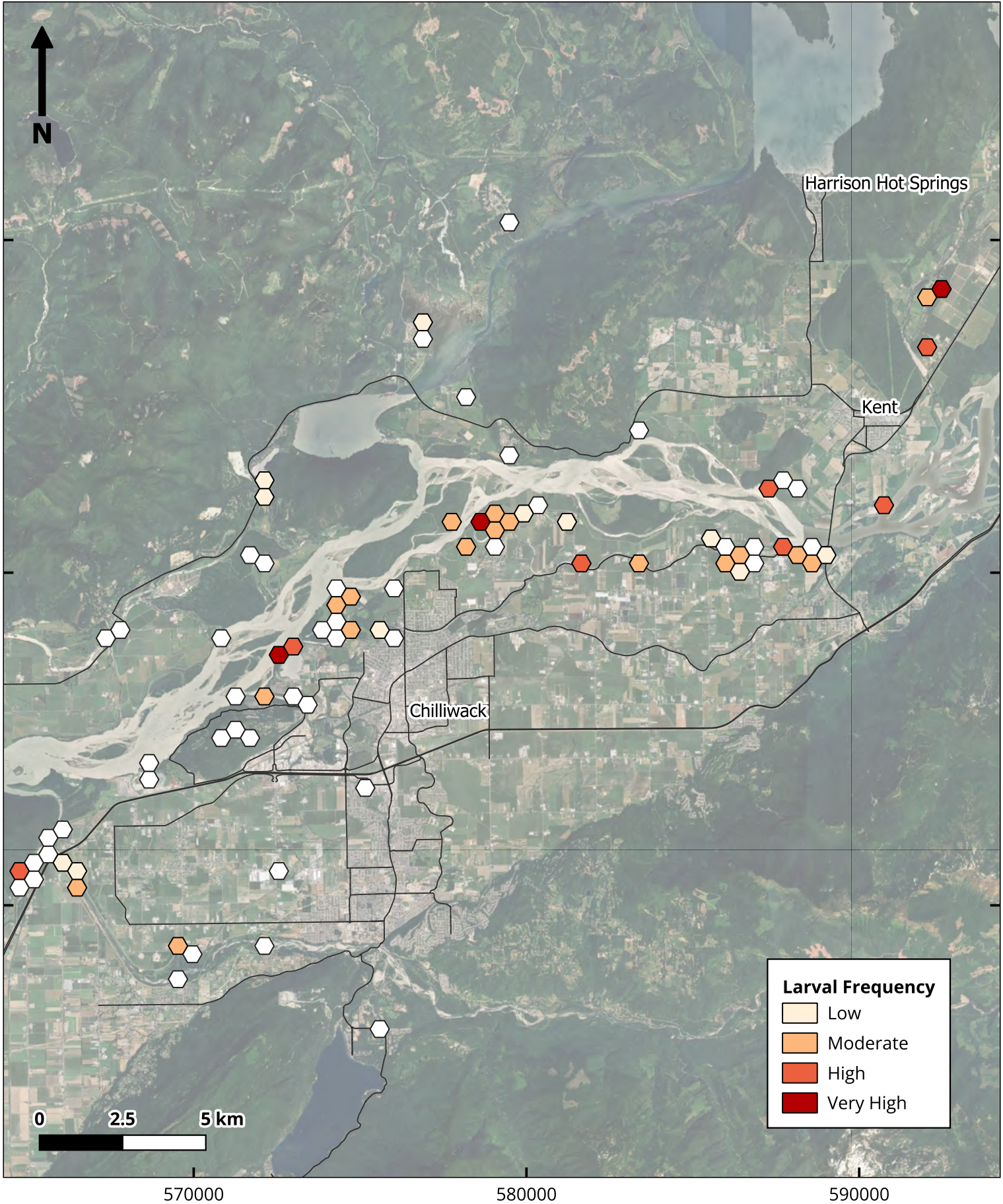
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Appendix I-B

2025

Scale = 1 : 150,000 CRS = NAD83 UTM Zone 11N
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Mosquito Larval Frequency at Sample Locations (3/3)

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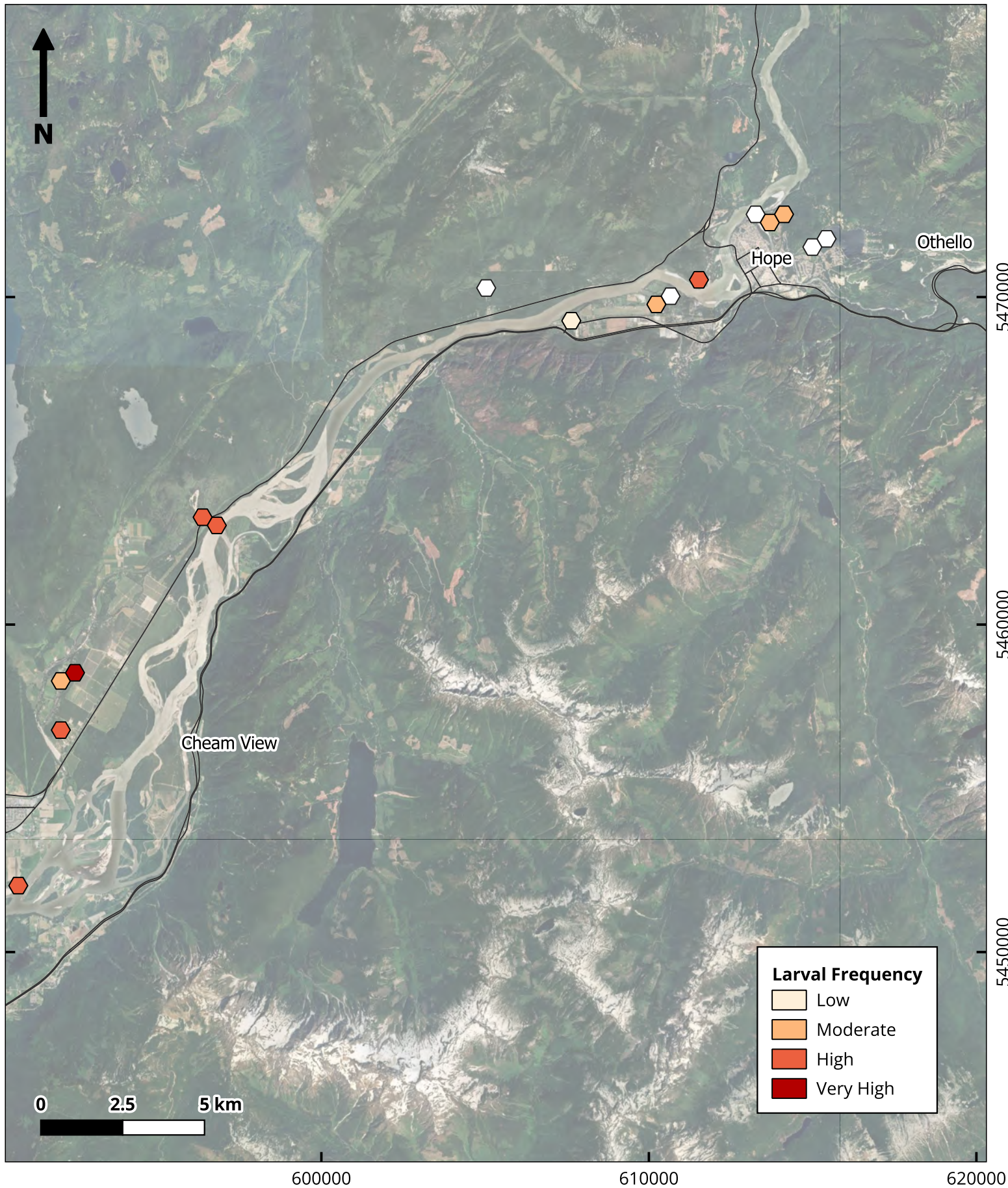
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Appendix I-C

2025

Scale = 1 : 150,000 CRS = NAD83 UTM Zone 11N
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Mosquito Larvicide Treatment Locations (1/3)

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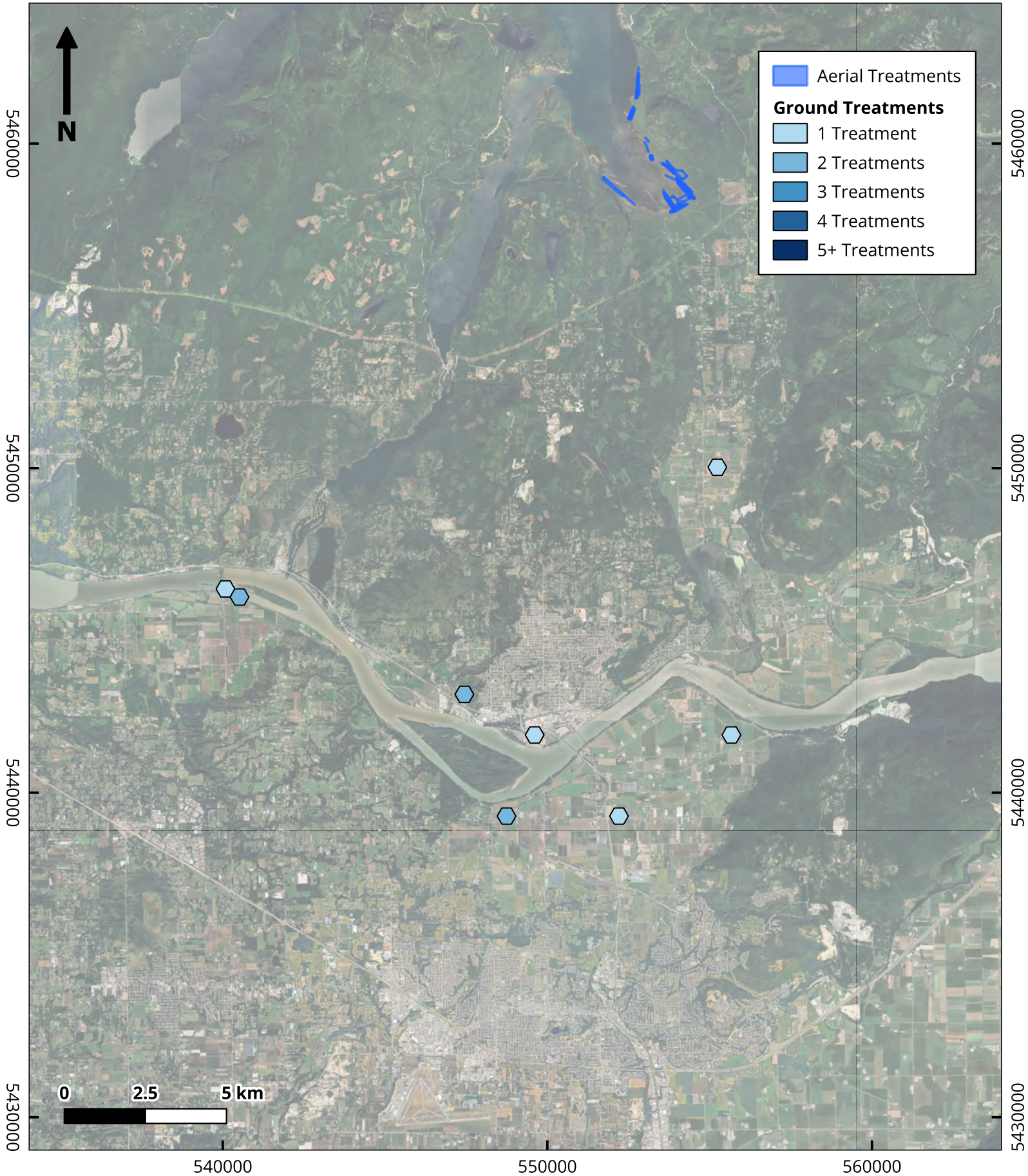
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Appendix II-A

2025

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Mosquito Larvicide Treatment Locations (2/3)

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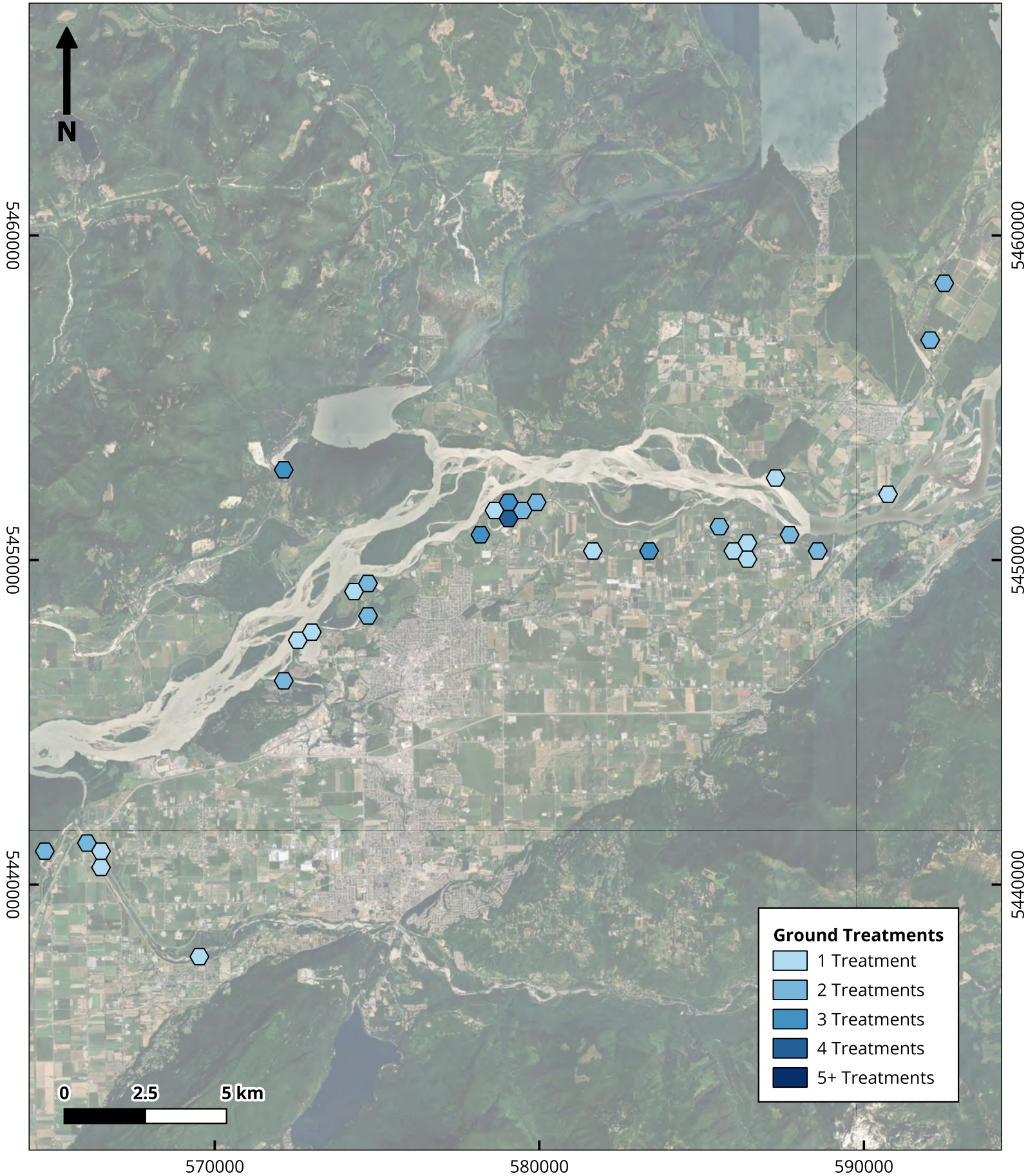
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Appendix II-B

2025

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Mosquito Larvicide Treatment Locations (3/3)

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Appendix II-C

2025

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