

Regional Mosquito Control Program

Proposed for the City of West Kelowna

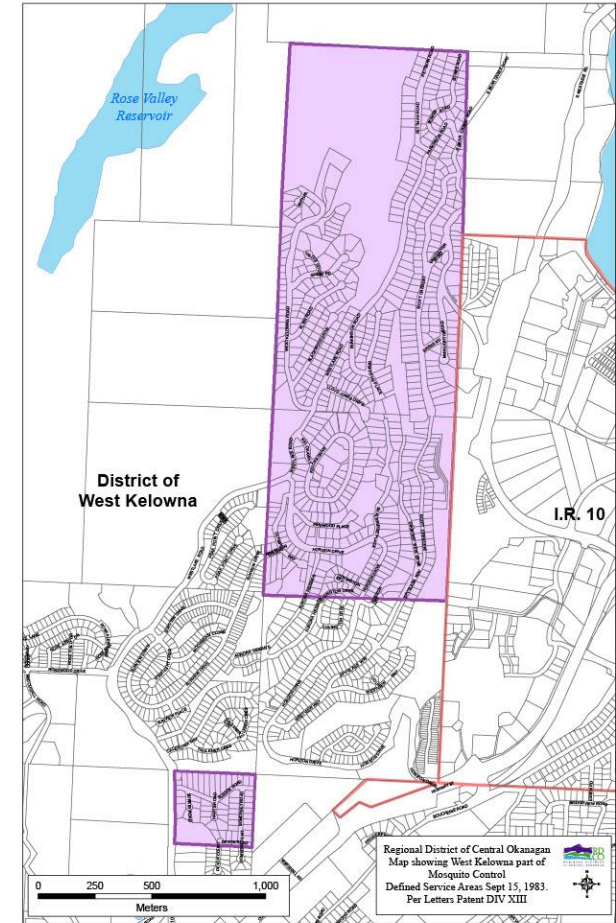
March 16, 2021

1450 K.L.O. Road
Kelowna, BC, V1W 3Z4
rdco.com



Regional Mosquito Control Program

- Program operating for over 45 years
 - Previously supported through BC grants, discontinued in 2012
 - Now funded by Local Governments and First Nations
 - Similar programs in place in CSRD, RDOS, and TNRD
- Current Program serves all Central Okanagan municipalities and electoral areas
 - Only a small portion of West Kelowna is currently in the program



Regional Mosquito Control Program

- **Regional Mosquito Control Program includes:**
 - Administration, Program Management, and Regulatory reporting
 - Monitoring, Sampling and Analysis
 - Mosquito Control Treatments (Larvicide)
 - 3651 Catch Basins
 - 38 potentially significant locations (surface water bodies, wetlands, etc.)
 - Habitat Modification and Public Outreach

Estimated Program Expense (City of West Kelowna): \$57,000 / year

- **Service delivered through Duka Environmental Services Ltd.**
 - Held previous contract from 2016 through to 2021
 - New 5 year contract starting in 2021

Why Mosquito Control?

- An effective mosquito control program won't necessarily be obvious or acknowledged by the great majority of residents or businesses, but adult mosquito nuisance seldom goes unnoticed and is usually reported.
- Mosquito control programs are typically created and provided because there is noticeable, and reportable adult mosquito nuisance and annoyance which affects quality of life and business operations.
- Enjoyment or participation in organized or recreational sports is diminished, use of passive parks for picnics and fairs, patio use at restaurants, pubs and vineyards is similarly reduced. Field workers efficiency is affected, they are uncomfortable, or unable to harvest crops. Outdoor workers (construction, equipment operators) may be distracted enough by mosquito nuisance to create a potential workplace hazard. Some individuals are also highly sensitive to mosquito bites and secondary infections for others are possible.
- Most mosquito control programs are initiated by Mayor and Council, along with administration staff, in response to resident and business reports of adult nuisance affecting their quality of life, operations or livelihood

Mosquito Facts



- Over 60 species found in B.C.
- 25 species found in RDCO / Kelowna area.
- Over 40% of mosquitos collected in Kelowna are capable WNV vectors.
- 1 larvae/350ml dip sample in a pond the size of a backyard pool would contain 21,429 larvae.
- A 1 Hectare site (~2 Football Fields in size) would produce 4,285,174 larvae.
- If birds or bats eat 300 mosquitos/day, it would take a total of 14,283 birds/bats to consume them all. Over three weeks, it would require 680 birds/bats.
- Average # of larvae per dip in RDCO/Kelowna, where the control program has suppressed populations are 10–15 larvae/dip.
- 1 hectare with 15 larvae/dip would result in 64,277,610 mosquitos. Birds or bats eating 300 mosquitos per day for 21 days, would need 10,202 birds/bats.
- West Kelowna has ~24.3 hectares of potential larval habitat identified.

Three Phases of Mosquito Control

- Phase I: Development Site Survey
- Phase II: Pest Management Plan (PMP) acquisition
- Phase III: Operational Mosquito Control Program

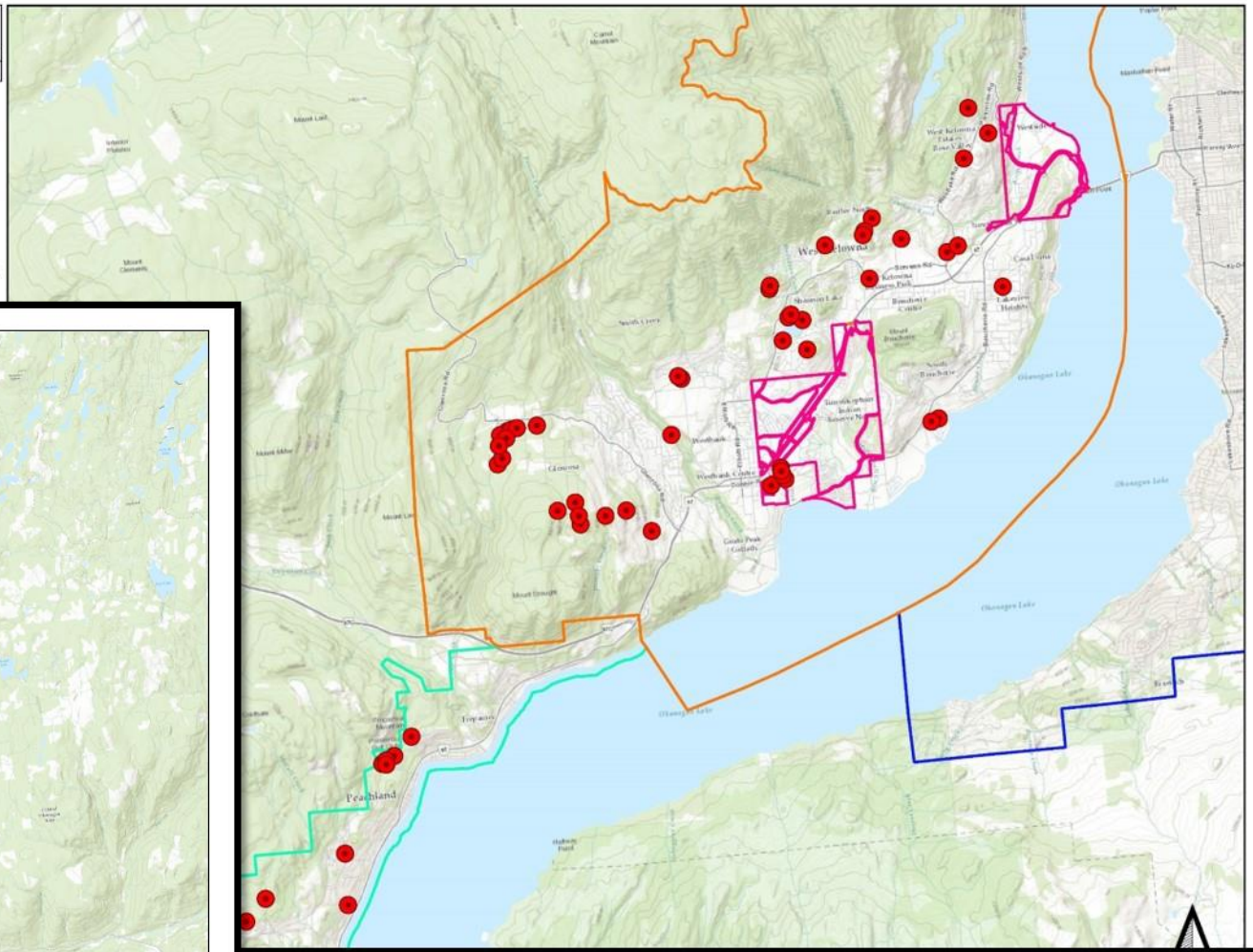
Phase 1 - Development Site Survey

- Public and administration staff input is used to help identify and confirm areas where adult mosquito nuisance is extreme or protracted.
- Larval surveys to identify open water habitats are focused on the areas of reportable adult nuisance and through aerial, ground-based and map (ie. Google Earth™) surveys.
- Potential sites are mapped. Larval and adult specimens are collected for species identification.
- Mosquito species composition, distribution and the onset of development is correlated with temporal factors (ie. river levels, snowpack, precipitation etc) and is used to identify predictive thresholds for larval development.
- A report is generated summarizing study findings. A potential scope for operations and estimated costs are provided.

Mosquito Control Program 2021

Figure 2

Potential Development Site Map
West Kelowna & Peachland



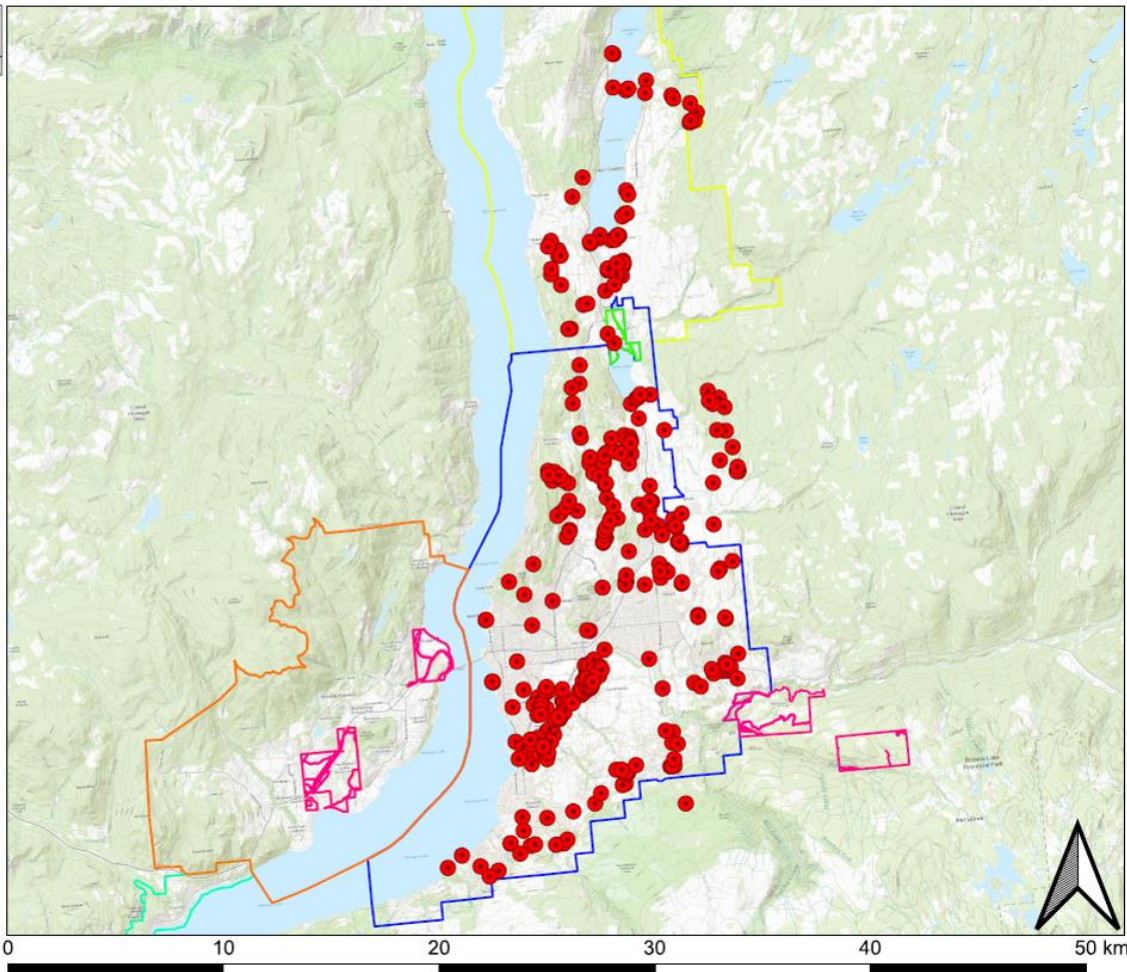
Mosquito Control Program 2021

Figure 1

Potential Development Site Map
City of Kelowna and
District of Lake Country

Legend

- Potential Development Sites ●
- Okanagan Indian Band
- Westbank First Nation
- City of Kelowna
- City of West Kelowna
- Lake Country
- Peachland



Phase 2 - Plan Preparation and Development

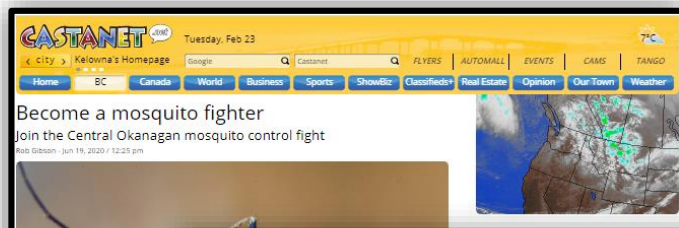
- A Pest Management Plan (PMP) is developed and prepared using information from the Phase I report. Program to be based on an Integrated Pest Management (IPM) approach.
- BCMOE requisite advertising for public and First Nation consultations, input, comments etc. are collected and incorporated into the PMP, and the proposed program, where appropriate. This can take a minimum of 45 days.
- The PMP is finalized with any such input and forwarded to BCMOE for review and acceptance /confirmation to proceed. This requires 30-51 days.
- 2021 – 2026 PMP for the RDCO has been completed and submitted. West Kelowna and Peachland were included.

Phase 3 – Mosquito Control

Once a PMP is approved. An operational mosquito control program can proceed. Five components to an Integrated Pest Management approach to control include:

- Public Education
- Surveillance and identification of mosquito species and their distribution
- Timely implementation of mosquito controls and preventative measures
- Ongoing assessment of efforts/success and adaptive management during a season
- End of season program reporting and evaluation to ensure sustainable and effective controls have been achieved

Public Education and Outreach



request-form



DUKA
ENVIRONMENTAL SERVICES LTD.

HOME | MOSQUITO CONTROL | OTHER SERVICES | CONTACT | LINKS

Mosquito Service Request Form:

Please fill in the form below to submit your request

*First	*Last
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Address

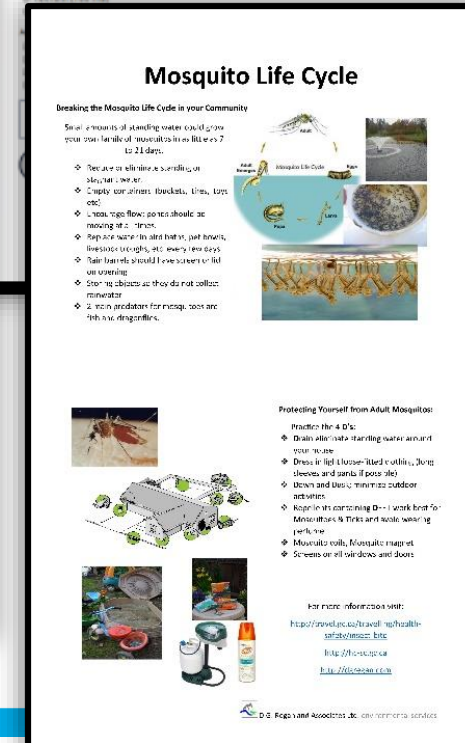
Street Address
City
Postal / Zip Code
*Daytime Contact Number
*Email

Land Development Site Type

- ☐ Pond/Marsh
- ☐ Drivk
- ☐ Flood Water (River, Stream)

Approximate Size

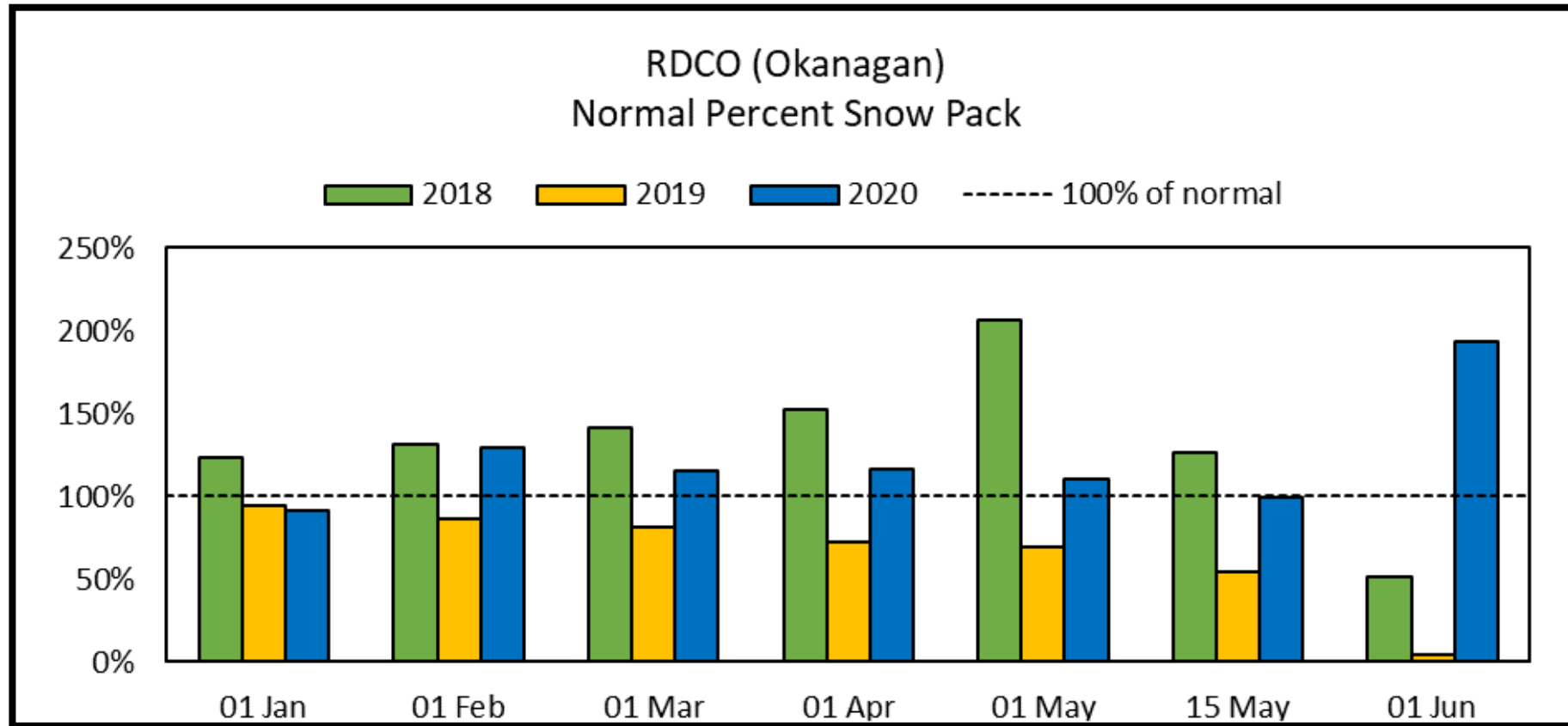
- ☐ <10 m²
- ☐ 10-100 m²



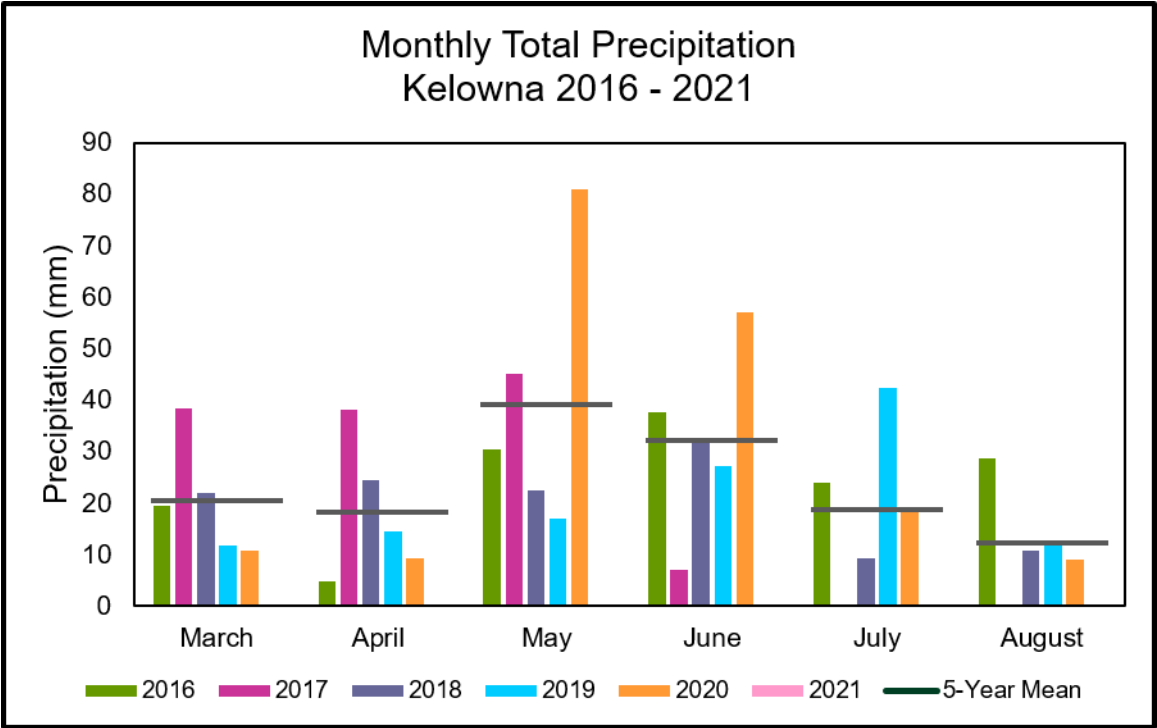
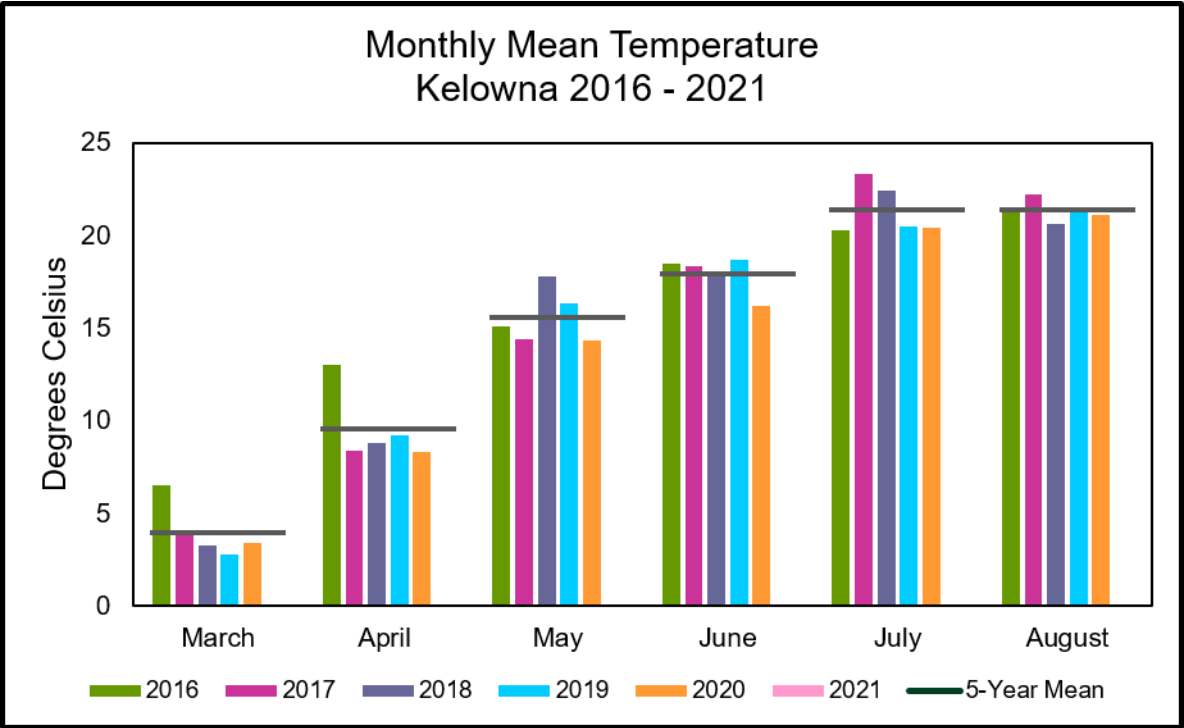
Surveillance / Data Collection



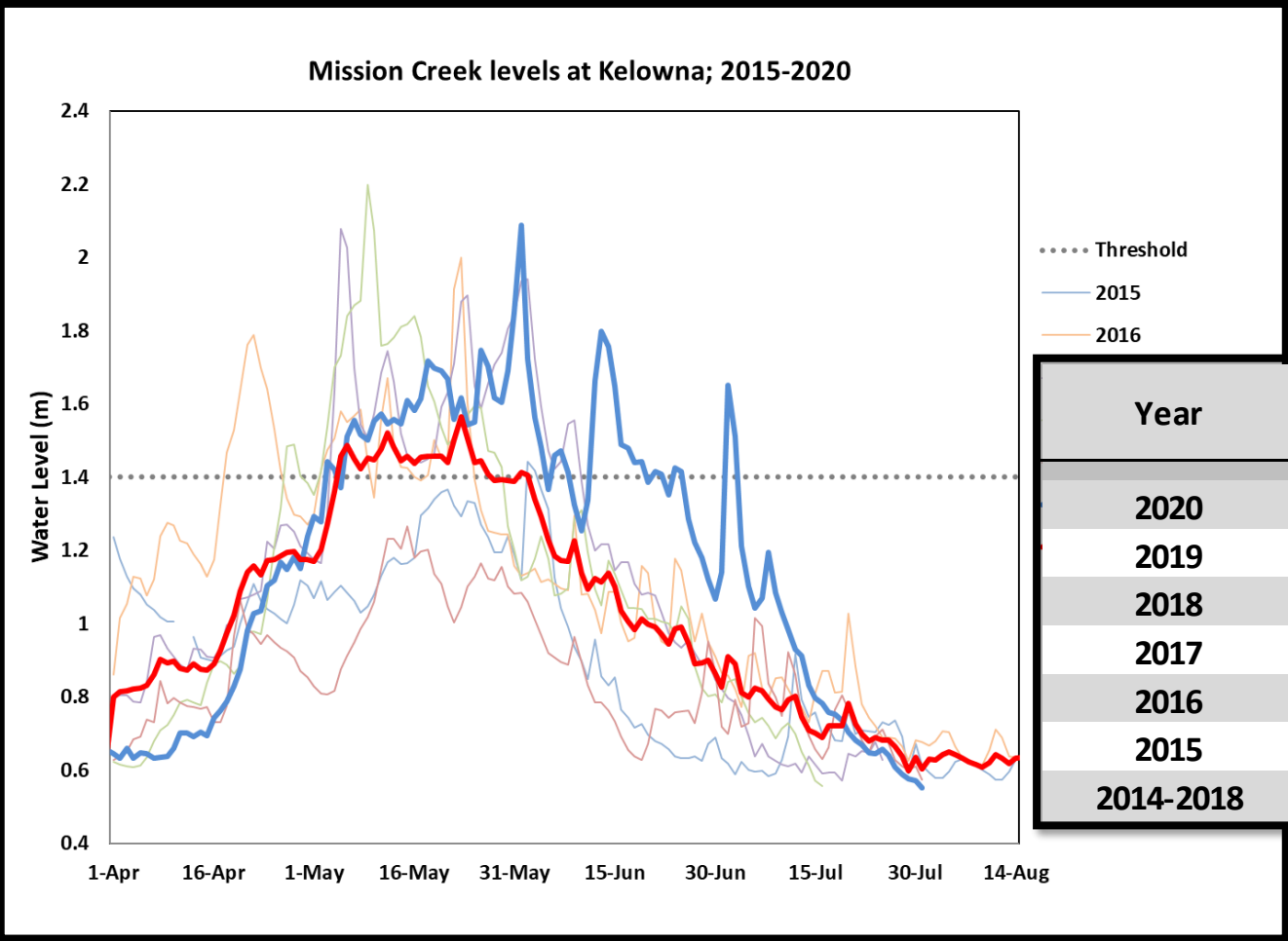
Predictive Modeling - Snowpack



Predictive Modeling – Temperature and Precipitation



Predictive Modeling – Lake Levels



Year	Freshet Duration	1.4m Days+	1.8m Days+	Peak River Level (m)	Date
2020	03 May - 25 June	45	1	2.09	01-Jun
2019	N/A	0	0	1.26	15-May
2018	27 April - 29 May	30	8	2.2	09-May
2017	04 May - 10 June	38	8	2.1	05-May
2016	18 April - 24 May	30	2	2	23-Jun
2015	02 June - 03 June	2	0	1.4	02-Jun
2014-2018	N/A	25	4	1.8	N/A

Population Sampling

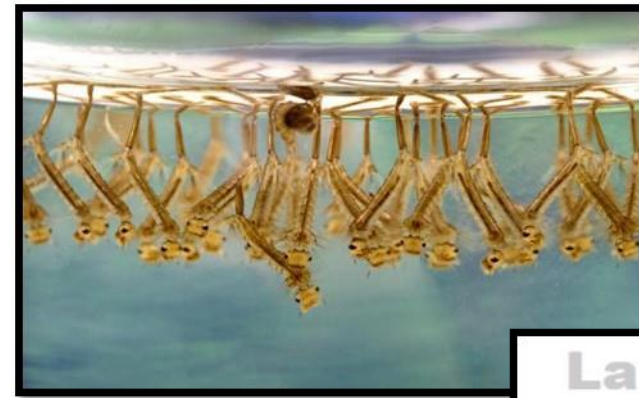
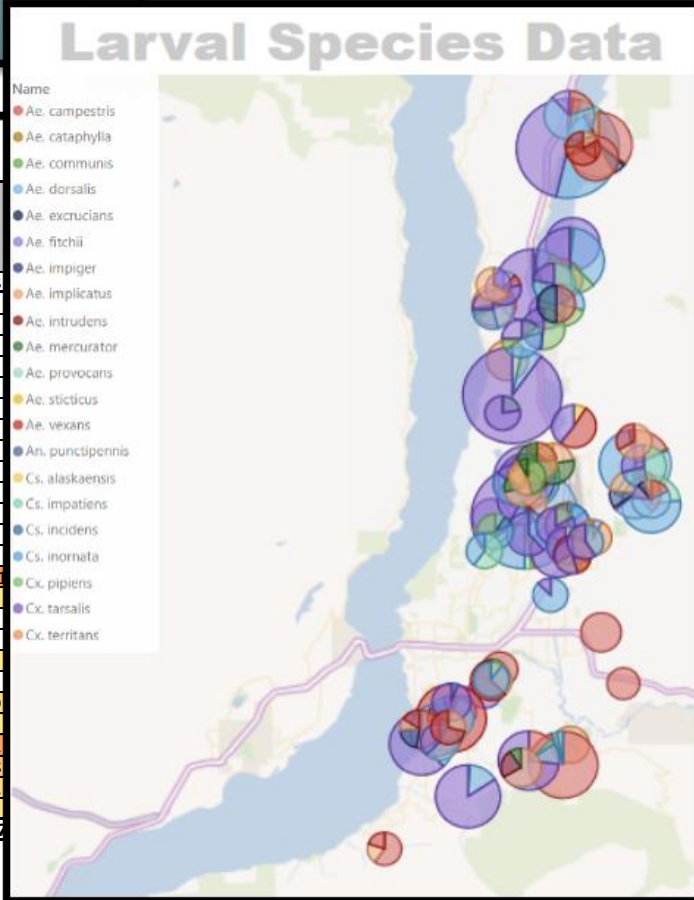


Table 1: Regional District of Central Okanagan; Larval Mosquito Temporal Distribution and Occurrence by Species - 2020

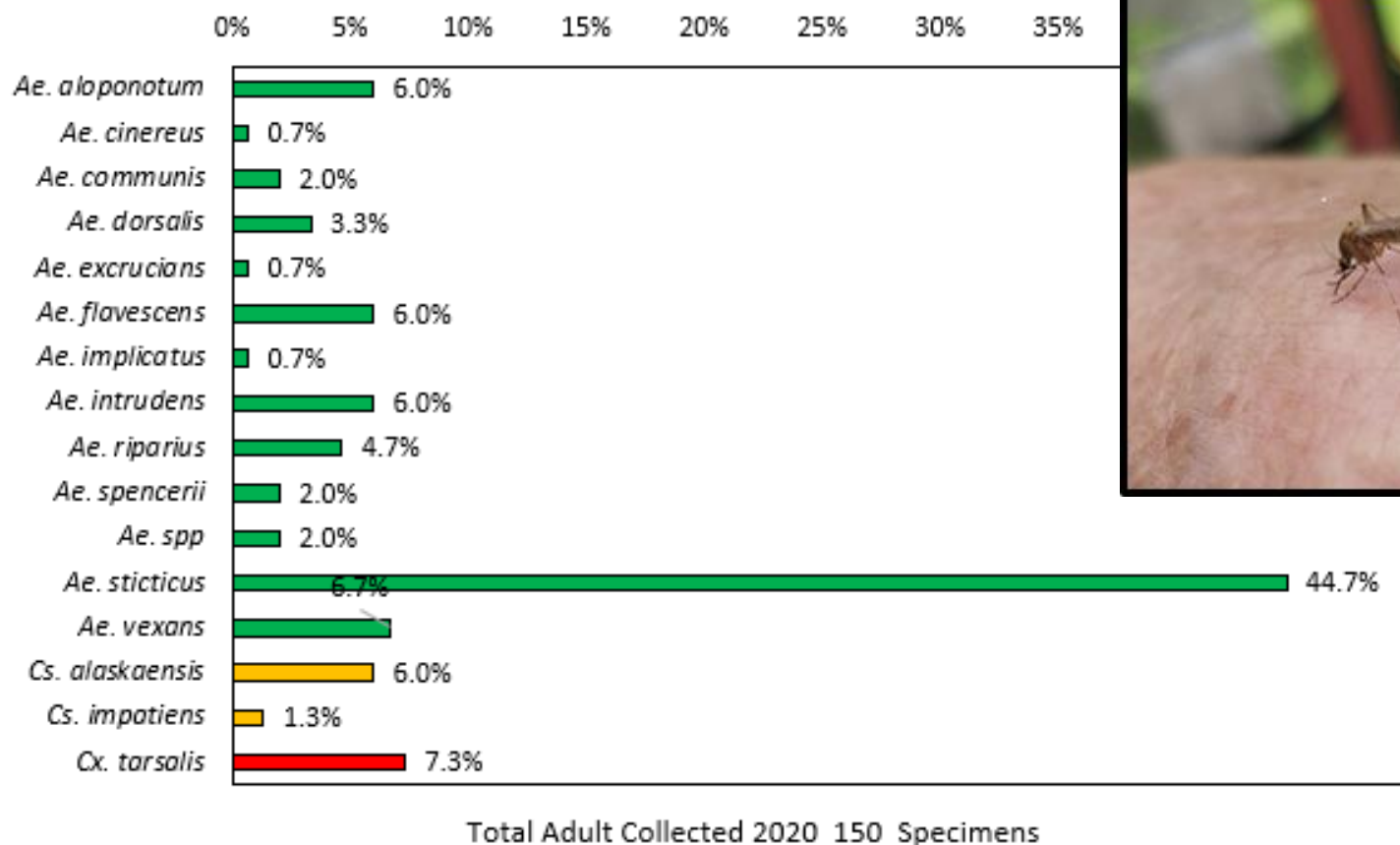
Species	WNv competence	Species Occurrence # of Samples	Total # of Individuals	% occurrence	April				May				June				July				August			
Week # →					14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
<i>Ae. campestris</i>	0	28	388	10.7%	0	0	0	6	295	65	22	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. cataphylla</i>	0	2	2	0.1%	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. communis</i>	0	3	10	0.3%	0	0	0	0	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. dorsalis</i>	+++	16	237	6.5%	0	0	0	0	17	109	19	0	0	0	10	27	22	1	13	19	0	0	0	
<i>Ae. excrucians</i>	0	1	6	0.2%	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. fitchii</i>	0?	11	29	0.8%	0	1	0	0	8	18	2	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. impiger</i>	0	9	36	1.0%	0	0	0	8	1	1	20	0	0	6	0	0	0	0	0	0	0	0	0	
<i>Ae. implicatus</i>	0	34	166	4.6%	0	13	0	10	46	43	44	5	0	5	0	0	0	0	0	0	0	0	0	
<i>Ae. intrudens</i>	0	5	14	0.4%	0	0	0	0	13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. mercurator</i>	0	14	59	1.6%	0	2	0	7	34	11	5	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. provocans</i>	0?	1	1	0.0%	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. spp</i>	N/A	13	161	4.4%	0	0	0	0	21	91	5	3	0	0	0	0	1	0	39	0	0	0	1	
<i>Ae. sticticus</i>	+	8	22	0.6%	0	0	0	0	8	0	7	2	0	0	3	0	0	0	0	0	2	0	0	
<i>Ae. vexans</i>	++	19	198	5.5%	0	2	0	0	6	10	52	5	0	0	17	0	4	1	0	0	0	0	10	
<i>An. punctipennis</i>	+	7	16	0.4%	0	0	0	0	0	0	6	1	0	0	0	0	0	0	2	0	0	3	4	
<i>An. spp</i>	N/A	2	9	0.2%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0		
<i>Cs. alaskaensis</i>	0	1	1	0.0%	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Cs. impatiens</i>	0?	31	125	3.4%	0	0	0	0	0	0	1	11	6	9	5	0	3	0	33	35	0	18	2	
<i>Cs. incidens</i>	++?	1	1	0.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
<i>Cs. inornata</i>	+++	57	549	15.1%	0	0	0	0	0	0	11	16	30	43	61	17	20	0	106	127	35	55	9	
<i>Cs. spp</i>	N/A	6	95	2.6%	0	0	0	0	1	41	0	0	0	0	0	0	5	0	39	7	0	0	2	
<i>Cx. pipiens</i>	+++	9	106	2.9%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14		
<i>Cx. spp</i>	N/A	9	90	2.5%	0	0	0	0	0	0	0	0	9	0	0	0	13	0	0	0	0	6		
<i>Cx. tarsalis</i>	++++	83	1236	34.1%	0	0	0	0	0	0	11	33	25	13	88	66	98	20	250	211	108	125	167	
<i>Cx. territans</i>	0?	8	67	1.8%	0	0	0	0	0	0	13	3	0	0	0	0	25	0	12	0	1	5		
Larval Total		378	3624	100%	0	18	0	37	459	392	220	80	70	76	184	110	191	22	494	399	147	220	208	

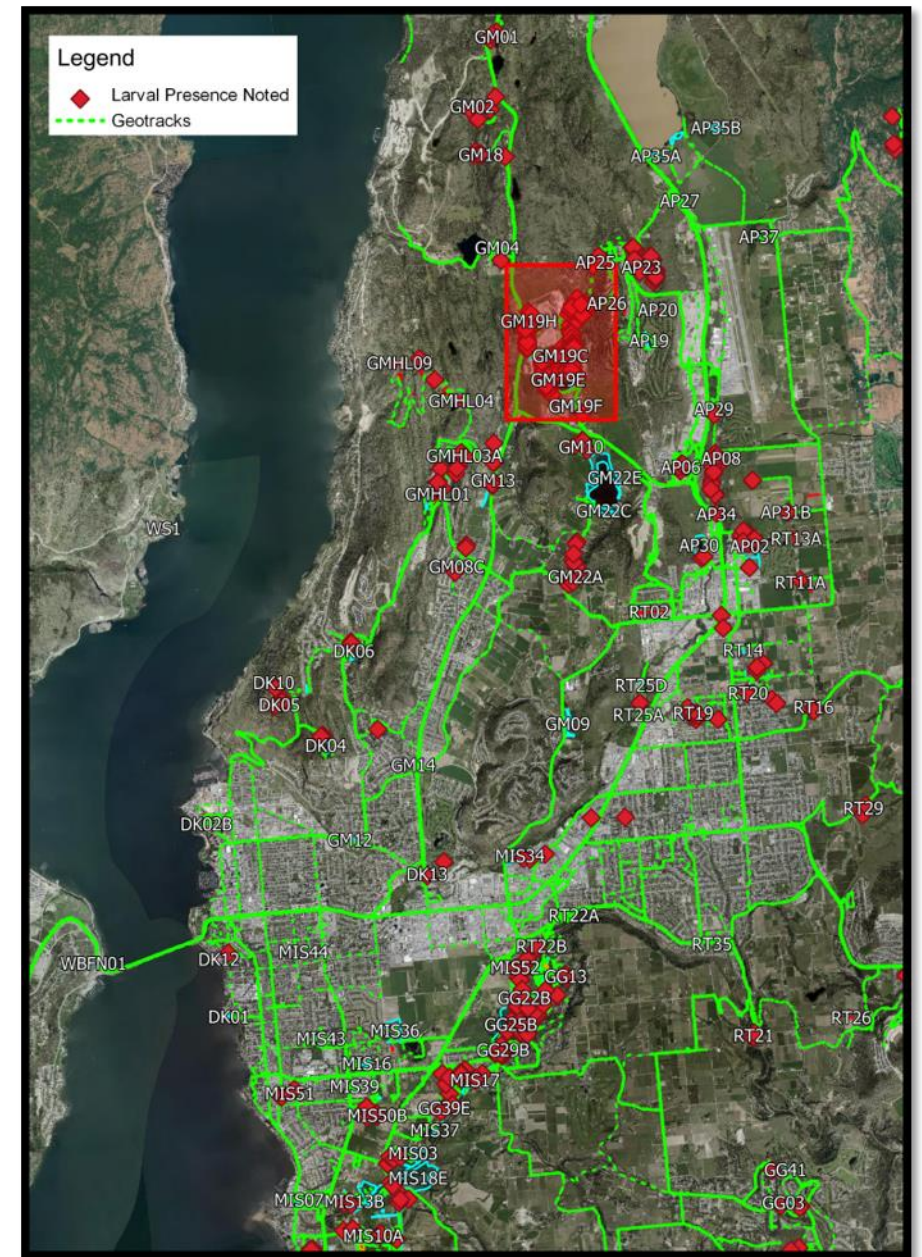
Notes:

- **Species Occurrence:** Lowest Value Highest Value
- West Nile Virus (WNV) competency was ranked by the BC Centres for Disease Control (2005) and Belton (2015). Mosquito species were ranked from (0), or no potential to transmit the disease, to (++++), or the ability to readily, and effectively transmit the disease.

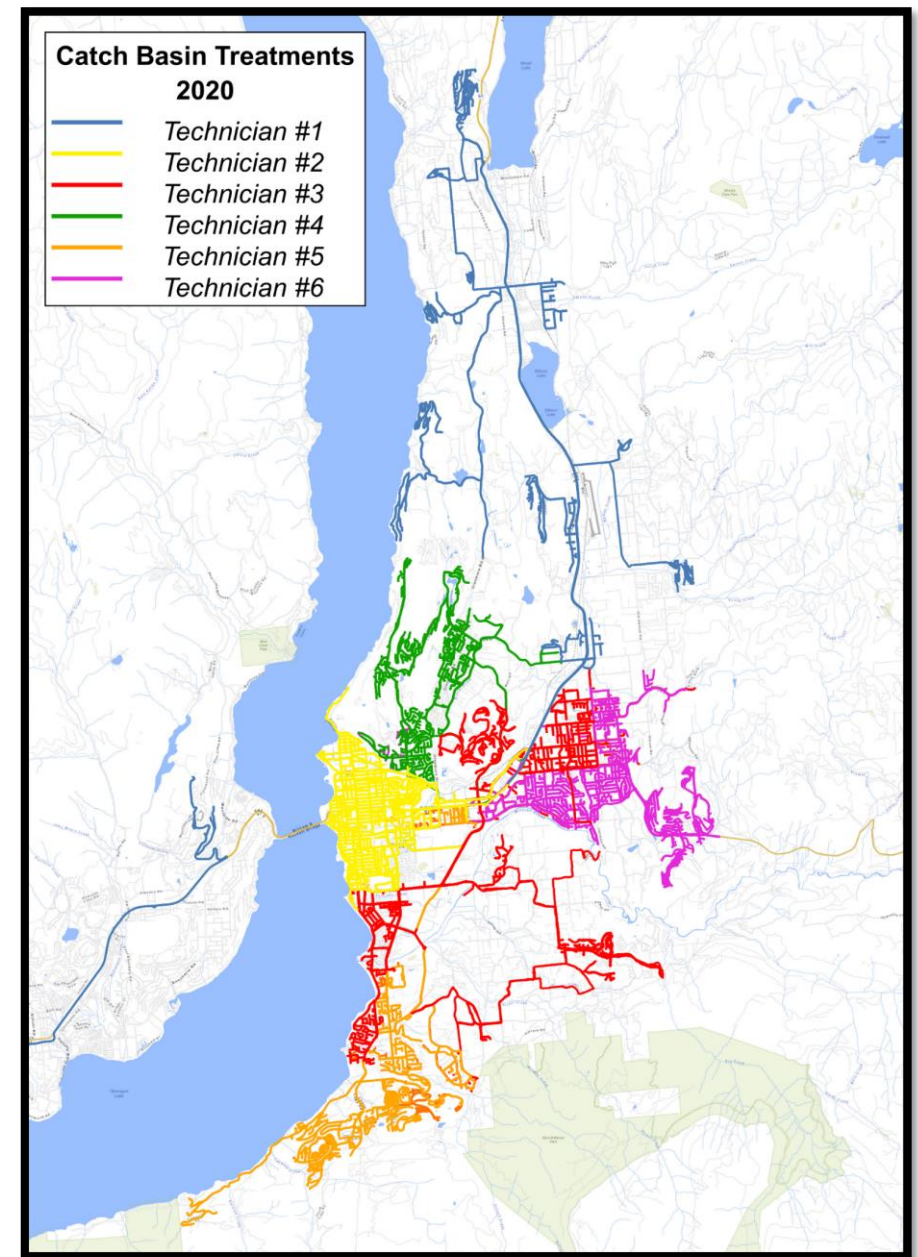
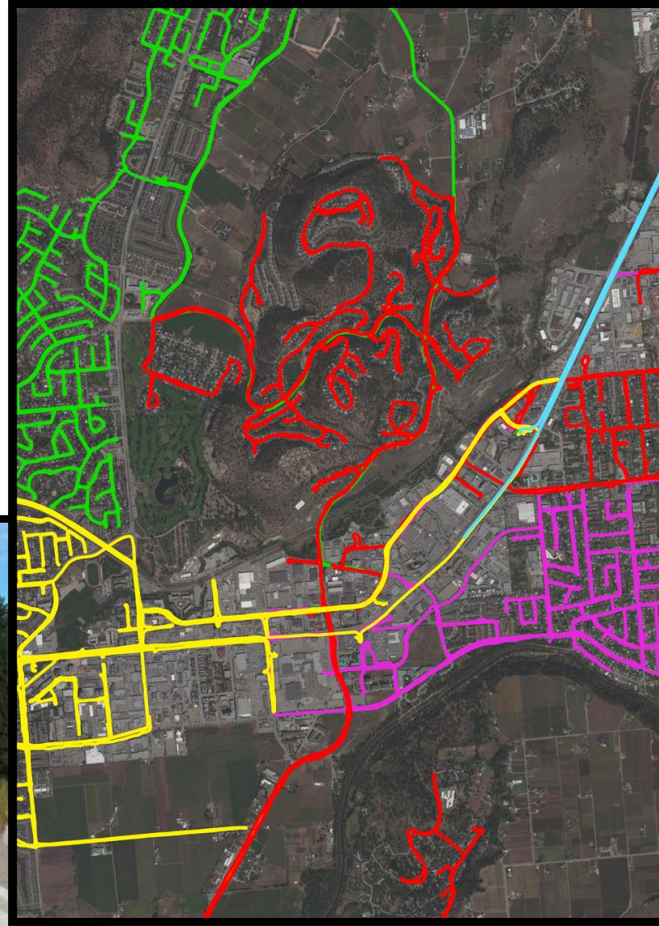
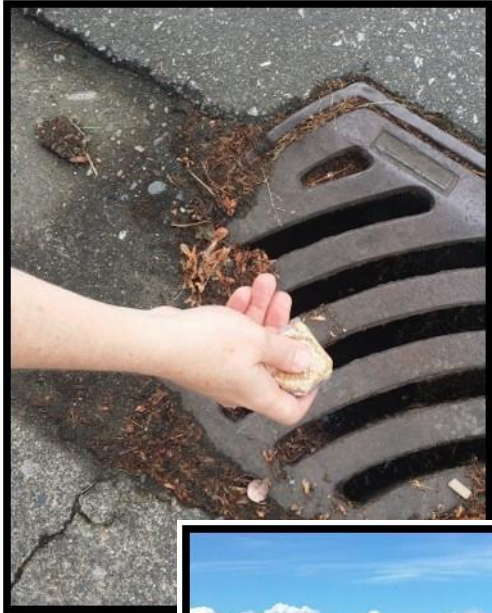


Sampling





Mapping - Catchbasins



Data Management

Site #	Date Last Visited	Days Since Last Visited	
MIS3	August 12, 2020		<div>Site Number: MIS1</div> <div>Site Type: Flood</div> <div>Site Description: Flood</div> <div>Site Address: 3885</div> <div>Site Owner: Miss</div> <div>Contacts:</div> <div></div> <div>Name</div> <div>Name</div> <div>Name</div> <div>Name</div>
MIS7	August 7, 2020		
MIS11	August 7, 2020		
MIS12	July 29, 2020		
MIS13A	August 6, 2020		
MIS13B	August 6, 2020		
MIS13C	August 6, 2020		
MIS15A	August 12, 2020		
MIS15B	August 12, 2020		
MIS18A	August 13, 2020		
MIS18B	August 13, 2020		
MIS18C	August 13, 2020		
MIS18D	August 13, 2020		
MIS18E	August 13, 2020		
MIS21A	August 13, 2020		
MIS21B	August 13, 2020		
MIS23	August 12, 2020		
MIS25	August 7, 2020		
MIS26	August 7, 2020		
MIS32	August 7, 2020		
MIS35	August 12, 2020		
MIS36	August 12, 2020		
MIS38	August 7, 2020		
MIS43	August 13, 2020		
MIS49A	August 7, 2020		
MIS49B	August 7, 2020		
MIS50A	August 12, 2020		
MIS50B	August 12, 2020		
MIS51	August 13, 2020		
MIS53	August 13, 2020		

MISSION RDCO DEVELOPMENT SITE DATABASE						
Site Number:	MIS13A		Latitude: 119 24.268	Longitude: 49 55.164		
Site Type:	<u>Floodwater</u>	<u>Level</u>	<u>Class</u>	<u>Ground</u>	<u>Hectares</u>	<u>Active</u>
Site Description:	Flooding In Fields					
Site Address:	3885 Gordon Drive					Site Details: **Always Get Permission Each Year** Flooding Fields Behind Kelowna Riding Club On Mission Creek Ranch. A: Pond Near Middle Of Property; In Heavy Rainfall Years Can Overflow To Flood Fields North Of Pond.
Site Owner:	Mission Creek Ranch					
Contacts:			E-mail		Year	
	Name		E-mail		Year	
	Name	Phone	E-mail		Year	
	Name	Phone	E-mail		Year	
	Name	Phone	E-mail		Year	
<u>Index</u>	Site Map: MIS13A					
Larval Monitoring/Treatment Results						
Date (D/M/Y)	Larvae/Dip	Instar	Area (ha)	Rate (kg/ha)	VectoBac (kg)	Notes/Comments/Species:
08-Jul-2019	0-2	3-4	0.227	7.5	1.70	Found larvae in a few sections in A, duckweed is still on surface, patchy. Light trap collected <i>1 Ae aloponotum</i>
11-Jul-2019	0	0	0.067	7.5	0.50	Adults present, still lots of duckweed. Set up trap collected <i>1 Ae aloponotum</i>
18-Jul-2019	0	0	0.093	7.5	0.70	Adults present, still lots of duckweed. Light trap collected <i>1 cx territans, 1 cx tarsalis, 1 ae aloponotum</i>
30-Jul-2019	0	0	0.067	7.5	0.50	Adults present, still lots of duckweed.
14-Aug-2019	0	0	0.053	7.5	0.40	Adults present, still lots of duckweed. Vegetation very overgrown along pond. Light trap did not collect any samples.
29-Apr-2020	0	0	0.000	7.5	0.00	no larvae in dippable spots
07-May-2020	0-2	2-3	0.027	7.5	0.20	Pond is relatively clear of larvae. Recent rainfall has created puddles lining the outside of the pond - many larvae present in puddles
15-May-2020	0	0	0.000	7.5	0.00	Pond remains clear of larvae. Wood ducks and Northern Shovelers present
26-May-2020	0-2	2-3	0.093	7.5	0.70	Heavy rainfall has caused new flooded areas around manure piles
10-Jun-2020	5-10	1-3	0.200	7.5	1.50	Many adult mosquitos present in the shaded areas underneath deadfall. Adults collected <i>8 Ae sticticus</i>

Kilograms Applied							
Site #	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	DB Total
Monthly Totals	0.00	1.75	30.40	91.05	112.90	21.35	257.45
AP1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AP2	0.00	0.00	8.80	9.80	4.80	4.90	28.30
AP3	0.00	0.00	0.00	0.00	3.20	1.40	4.60
AP4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AP5	0.00	0.00	0.80	1.10	0.70	0.50	3.10
AP6	0.00	0.00	0.40	0.00	0.80	1.45	2.65
AP7A	0.00	0.40	0.55	1.30	3.70	0.30	6.25
AP7B	0.00	0.00	0.60	1.30	1.10	0.40	3.40
AP7C	0.00	0.00	2.70	6.20	6.20	1.60	16.70
			0.10	0.20	1.30	0.00	1.60
			0.00	0.00	0.00	0.00	0.00
Active			3.50	2.50	1.00	0.00	7.00
			0.00	1.00	4.80	0.00	5.80
			1.80	0.50	1.00	0.00	3.30
Mission Each Year**			0.00	0.00	0.00	0.00	0.00
Behind Kelowna Riding Club On Mission			0.00	0.00	0.80	0.00	0.80
			0.25	1.00	1.40	0.00	2.65
Edge Of Property; In Heavy Rainfall Years			0.30	0.90	1.00	0.00	2.20
Flooded Fields North Of Pond.			1.70	6.10	7.60	0.00	15.40
			0.00	0.90	1.40	0.00	2.30
			0.35	0.40	0.80	0.30	1.85
			0.00	0.00	0.00	0.00	0.00
			0.50	2.40	0.90	0.00	3.80
Notes/Comments/Species:			0.70	1.80	1.20	0.00	3.70
New sections in A, duckweed is still on			0.50	2.60	3.00	0.00	6.10
Light trap collected 1 <i>Ae aloponotum</i>			0.35	3.90	6.20	1.40	11.85
lots of duckweed. Set up trap collected 1			0.10	3.90	6.80	2.00	12.80
			1.70	9.80	8.00	2.30	22.55
lots of duckweed. Light trap collected 1			0.50	3.70	3.90	1.90	10.00
<i>A. triseriatus</i> , 1 <i>Ae aloponotum</i>			0.00	0.00	0.00	0.00	0.00
lots of duckweed.			0.80	3.50	1.60	0.00	6.20
lots of duckweed. Vegetation very			0.00	0.00	0.40	0.40	1.10
pond. Light trap did not collect any			0.40	0.30	0.80	1.20	2.70
			0.00	0.10	0.90	0.70	1.70
le spots			0.00	0.00	0.00	0.00	0.00
near of larvae. Recent rainfall has created			3.00	4.10	5.20	0.00	12.30
outside of the pond - many larvae present			0.00	0.25	0.20	0.00	0.45
			0.00	10.50	13.70	0.00	24.20
of larvae. Wood ducks and Northern			0.00	8.20	5.10	0.00	13.30
caused new flooded areas around manure			0.00	0.00	0.00	0.00	0.00
			0.00	2.80	13.40	0.60	16.80

Data Management

Month	# of Sites Treated	# of Treatments	ha Treated	Kg Applied
March	0	0	0.000	0.00
April	21	21	1.413	10.60
May	61	101	5.893	44.20
June	70	109	16.320	122.90
July	36	53		
August	12	12		
Total	95	296		

Area	# of Sites Treated	# of Treatments
GG	36	103
MIS	35	133
RT	24	60
WS	0	0
NSN	0	0
Total	95	296

Kilograms applied (GOTR page)						
	March Total	April Total	May Total	June Total	July Total	August Total
	0.00	2.30	13.20	28.40	30.00	
Site #	March	April	May	June	July	August
GG01	0.00	0.00	0.30	1.00	4.00	
GG02	0.00	0.00	0.00	0.00	0.00	
GG03	0.00	0.00	0.00	0.00	0.00	
GG04	0.00	0.10	0.00	0.00	0.00	
GG05	0.00	0.00	1.10	1.50	0.00	
GG06	0.00	0.00	0.20	0.50	3.00	
GG07	0.00	0.00	1.90	0.50	4.50	
GG08	0.00	0.00	0.00	0.00	0.00	
GG09	0.00	0.00	0.00	0.00	0.00	
GG10A	0.00	0.00	0.00	0.70	0.00	
GG10B	0.00	0.00	0.00	0.50	0.00	
GG10C	0.00	0.00	0.20	0.00	0.00	
GG11	0.00	0.00	0.00	0.00	0.00	
GG12	0.00	0.00	0.00	0.00	0.00	
GG13	0.00	0.00	0.20	0.00	0.00	
GG14	0.00	0.00	0.00	0.00	0.00	
GG15	0.00	0.00	0.00	0.00	0.00	
GG16	0.00	0.00	0.00	0.00	0.00	
GG17	0.00	0.60	1.00	0.50	1.50	
GG18	0.00	0.00	0.00	0.00	0.00	

Number of Treatments (GOTR page)						
	March Total	April Total	May Total	June Total	July Total	August Total
	0	21	101	109	53	12
Total	0	21	101	109	53	12
Site #	March	April	May	June	July	August
GG01	0	0	2	2	1	0
GG02	0	0	0	0	0	0
GG03	0	0	0	0	0	0
GG04	0	1	0	0	0	0
GG05	0	0	3	2	0	0
GG06	0	0	1	1	1	0
GG07	0	0	2	1	2	0
GG08	0	0	0	0	0	0
GG09	0	0	0	0	0	0
GG10A	0	0	0	1	0	0
GG10B	0	0	0	1	0	0
GG10C	0	0	1	0	0	0
GG11	0	0	0	0	0	0
GG12	0	0	0	0	0	0
GG13	0	0	1	0	0	0
GG14	0	0	0	0	0	0
GG15	0	0	0	0	0	0
GG16	0	0	0	0	0	0
GG17	0	1	3	1	1	0
GG18	0	0	0	0	0	0

Ground Applications

2020

10 130.32 Hectares
10 209 Sites
10 919 Applications

2019

10 166.37 Hectares
10 190 Sites
10 816 Applications

2018

10 157.34 Hectares
10 231 Sites
10 877 Applications

Catch Basin Treatments (2) - Totals

2020

• 19,799

2019

• 19,806

2018

• 19,395

Tire Round-Up

Years	Total	RDCO	West Kelowna	%
2019	1458	1280	178	12.2
2018	1189	1069	120	10.1
2017	1081	1081	132	12.2
2016	1171	997	174	14.9



Assessment

West Kelowna has 38 potential sites identified:

- 38 sites totalling ~24.3 hectares
- Routine surveillance every 6-8 days
- Anticipate 160 -180 treatments
- Estimated 3651 catch basins with two treatments each
- Tire round-up x1
- Public Education Booths x2