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EXECUTIVE SUMMARY

In 2003, The Ontario Ministry of Health and Long-Term Care mandated that all public health units in the Province develop and implement a West Nile Virus program. The objective of this program was to “prepare for, prevent or mitigate the risk, if possible, of contracting WNV illness” (Ontario Ministry of Health and Long-Term Care).

While the program was originally focused on the threat posed by an outbreak of West Nile Virus (WNV) in Ontario in 2000, the program has now expanded to address the threats to human health posed by mosquitoes that may be carrying Eastern Equine Encephalitis virus (EEE) and by black-legged ticks that may be carrying Lyme disease (LD). The program will continue to expand as necessary in response to potential threats from other vector-borne diseases of concern, including malaria, plague, tularemia and yellow fever.

Accordingly, this report will focus on Durham Region’s surveillance, vector control and health promotion activities related to WNV, EEE and LD, but will also provide information and highlight ongoing surveillance activities related to the other vector-borne diseases of concern.

The Durham Region West Nile Virus Response Committee (DRWNVRC) is a local committee that was created under the authority of Regional Council to coordinate WNV response activities in Durham Region. The DRWNVRC is comprised of regional, municipal, conservation authority and provincial ministry representatives. The committee receives technical advice from the Ontario Ministry of the Environment (MOE), Ontario Ministry of Health & Long-Term Care (MOHLTC), the Ontario Ministry of Agriculture, Food & Rural Affairs (OMAFRA) and the Ontario Ministry of Natural Resources (MNR).

In 2001, the DRWNVRC developed the Durham Region West Nile Virus Response Plan, in compliance with the requirements of the provincial West Nile Virus Preparedness and Prevention Plan, to effectively respond to the occurrence of WNV in Durham Region. The Response Plan was first implemented in the spring of 2002 in response to WNV epidemiology during 2001.

The goal of the Response Plan is to provide an effective response to the presence of WNV in the Region. Its objectives are as follows:

- to limit the impact of WNV on human health
- to reduce the availability of larval mosquito development sites
- to educate the public about personal protective measures against mosquitoes
- to provide accurate and timely information on WNV to health professionals, the public and the media
- to employ the principles of Integrated Mosquito Management (IMM) to reduce the risk that vector mosquitoes may pose to humans.

The Response Plan outlines the coordinated actions that are to be taken to protect the life and health of the citizens of Durham Region in response to the threat of WNV. The plan applies to Durham Region Health and Works Departments as well as all 8 Durham Region municipalities. The plan is a working document and, as such, is subject to updates and revisions as required.

Durham Region’s response to WNV activity is organized into four levels with the roles of the various stakeholder agencies being delineated for each response level. Durham Region is currently operating the Vector-borne Disease Program at a Level 4 response level which corresponds to one or more confirmed human cases of WNV being identified in the Region.
In 2003, in accordance with the requirements of the provincial West Nile Virus Preparedness and Prevention Plan, the DRWNVRC created a Durham Region West Nile Virus Vector Control Plan that lays out the specific measures to be implemented to reduce the number of WNV vector mosquitoes in Durham Region and thereby reduce the risk of exposure for Durham Region residents. The four major components of the Vector Control Plan now include: Adult Mosquito Surveillance; Larval Mosquito Surveillance and Control; Monitoring of Human Health Effects / Complaints and Communication & Public Education.

Between 2001 and 2008, the Durham Region Health Department (DRHD) also conducted wildlife (dead bird) surveillance. During this period, a total of 52 WNV-positive birds were identified in Durham Region, with positive birds being found in each of the 8 Regional municipalities. However, since WNV has been demonstrated in the bird population throughout Ontario annually since 2001, the MOHLTC discontinued the funding for dead bird surveillance in 2009. While DRHD no longer conducts active dead bird surveillance (as of 2009), it will continue to refer public requests for testing to the Canadian Cooperative Wildlife Health Centre (CCWHC) subject to a risk assessment.

The majority of the surveillance activities prescribed by the Vector Control Plan are conducted by DRHD staff while any control activities are performed by a licensed pest control operator under contract to the Region.

Larval mosquito surveillance generally begins each year in early May. The larval mosquito component of the Vector Control Plan consists of weekly monitoring of surface water on public property in relation to the potential for these sites to become larval mosquito development sites.

A roadside catch basin monitoring and larviciding program has also been undertaken since 2003. Historically, 3 rounds of catch basin larviciding have been conducted in Durham Region by a licensed pest control operator, with the first treatment beginning in mid-June and the other treatments following in mid-July and mid-August. Catch basins on Regional properties (long-term care homes, day cares and Regional housing) are larvicided using a methoprene briquette formulation.

Adult mosquito surveillance (trapping and testing) was implemented in late 2002 and has been undertaken every year since, beginning mid-June and continuing generally until mid-September. Traps for adult mosquitoes are set up annually at predetermined locations throughout the Region. Trap site locations are determined using the following criteria: site security, historical data (e.g., previous positive surveillance results), ease of access and geographical distribution.

Trapped mosquitoes are sent to an accredited laboratory on a weekly basis where they are enumerated, identified by species and tested for WNV. In addition to testing for WNV, Culex melanura pools have been subject to testing for EEE. In 2011, in response to increased EEE activity in the Unites States, the MOHLTC asked public health units to increase monitoring of adult mosquitoes to include other species that may act as bridge vectors for transmission of EEE to humans. Durham Region implemented this enhanced surveillance but found no EEE-positive mosquito pools during the 2011 season.

Human case surveillance for WNV, EEE, LD and the other vector-borne diseases of concern consists of DRHD staff collecting information regarding human cases of disease reported by physicians to the MOHLTC.

Surveillance data is used to assist the DRHD to determine areas where vector control activities (i.e., mosquito larviciding) may have to be implemented.
DRHD investigates complaints regarding stagnant water, on regional and municipal land, in accordance with divisional policies and procedures. In consultation and cooperation with local municipalities, private standing water sites are individually assessed to determine the need for treatment and or remediation. This assessment includes dipping for the presence of mosquito larvae. If WNV vector larvae are present, a Section 13 Order pursuant to the Health Protection and Promotion Act, R.S.O. 1990, c.H.7 (HPPA), is issued to owner(s) of private property, requiring remediation of the mosquito development site. Where remediation is not possible, other vector control activities such as the application of larvicide may be considered.

The DRHD will also investigate complaints related to human black-legged tick exposures. Any ticks involved in human contact that are submitted to DRHD are sent to the public health laboratory for identification and potential testing for LD (i.e., if ticks are identified as black-legged ticks). When specific geographic areas are identified as potential tick habitats, DRHD staff will work with property owners to provide LD information, to conduct active tick surveillance and/or to determine if properties can be remediated to reduce the risk of human contact with ticks.

Each year a communication plan is developed with an aim to increasing community awareness of WNV and personal precautions that can be taken to prevent transmission. This communication plan has been evaluated, using the Rapid Risk Factor Surveillance System (RRFSS) WNV modules, on a regular basis since 2002. Durham Region’s WNV communication plan involves providing WNV standing water prevention and personal protection information through a variety of media including our Durham Region website, local media (i.e., TV, radio and newspaper), shopping mall and arena advertising and community events.

In 2010 a communication plan was developed for Lyme disease. The Durham Region website was updated to include information about endemic areas for LD in Ontario, disease transmission, and personal protective measures to avoid tick bites. In addition, an LD information pamphlet, a “Banner-Bug” display and various health promotion items were produced and utilized at community events and health fairs. In 2011, various community groups were targeted for distribution of the LD information, including all Durham Region elementary school boards, a provincial park and various horticultural societies and riding stables. WNV and LD presentations were provided to community groups upon request. An interactive game has also been developed for use at community events. Our regional website can be accessed at www.durham.ca.

Program Successes:

- Durham Region has experienced only seven confirmed human WNV cases between 2002 and 2011.
- Establishment of the DRWNVRC which has served to streamline the communication and coordination of public education and vector control measures within the Region.
- Establishment of a partnership between municipal by-law departments and DRHD for the investigation of stagnant water complaints on private property. As set out in the agreement between DRHD and local municipalities/municipal by-law enforcement officers by the Notice of Required Action (distributed annually to municipalities), municipal staff respond first to investigate stagnant water complaints on private property. Where compliance, is not achieved within 48 hours, the complaint is sent to DRHD for follow-up action.
- Since 2003, DRHD staff have investigated over 430 complaints regarding stagnant water on private property. In most instances, property owners have complied promptly with DRHD requests to remediate the source of standing water (i.e. pool, pond, bird bath, land depression, etc.). In instances where compliance was not immediately achieved, a Section 13 Order, under the HPPA, was issued. Seven standing water Orders were issued during 2011 and since 2003, 61 such Orders have been issued.
resulting in 21 charges to property owners. In many instances the properties were remediated once an Order was issued and in all instances where charges were laid compliance with the Section 13 Order resulted. The preceding numbers do not include complaints of stagnant water on private property that were investigated by municipal by-law enforcement staff and where compliance was achieved without further action by DRHD.

- In general, WNV activity in mosquitoes, equines and humans has been very low since the inception of WNV surveillance and control activities in Durham Region.
- Few equine cases of EEE have been reported in Durham and, to date, no human cases of EEE have ever been reported in Ontario.
- Active and passive surveillance for black-legged ticks in Durham Region has yet to yield any LD-positive specimens
- Only a small number of human cases of LD are reported within Durham Region each year.
- Four (4) human cases of malaria were reported in 2011. Two of the cases were confirmed to be travel-related while no details were available regarding exposures for the other two cases.
- There were no cases of plague, tularemia and/or yellow fever reported in Durham in 2011.

**Program Challenges:**

- DRHD budget uncertainties in relation to maintaining vector surveillance and vector control activities.
- Lack of consistency at the municipal level in relation to the maintenance and remediation of municipally and privately owned storm water management ponds (SWMPs). Although there are guidelines and best practices for the maintenance and design of SWMPs, it is not clear who enforces or oversees adherence to the relevant guidelines.
- Municipal budgets in relation to the remediation of municipally owned larval mosquito development sites such as ditches. While the remediation of surface water sites that are larval mosquito development sites is always the preferred option, the financial reality is that these sites may take many years to be remediated. Furthermore, it is not feasible to remediate all surface water sites that are larval mosquito development sites.
- Remediation of derelict pools, ornamental ponds and/or other water features on private properties where the property has been abandoned by the property owner(s). In these instances, tracking the responsible property owners (i.e., individuals, financial institutions, property management firms, etc.) to enforce remediation of the standing water can often involve a considerable amount of time and staff resources.
- Inconsistent and, in some cases, inadequate municipal property standards by-laws related to standing water on private property (i.e., derelict pools, ponds, etc.). Since not all local municipalities have such by-laws, it was necessary to establish a partnership with all 8 of our local municipal by-law enforcement departments whereby they conduct the initial investigation of stagnant water complaints on private property, but refer outstanding issues to DRHD staff when the issue can not be resolved within 48 hours. With as many as 75 complaints regarding stagnant water occurring on private property each year, this can involve a considerable utilization of DRHD staff resources.
2011 ANNUAL VECTOR-BORNE DISEASE PROGRAM RESULTS

AND SUMMARY RESULTS FOR YEARS 2007 - 2011
WEST NILE VIRUS (WNV)

Overview:

WNV is maintained in nature in a transmission cycle that occurs between mosquitoes and birds. Mosquitoes become infected when they feed on the blood of a bird infected with the virus and they can then pass the virus on to other birds. The virus can be transmitted to humans and other mammals by mosquitoes that choose to feed on both birds and mammals. These mosquitoes are known as “bridge vectors”. Humans and other mammals (i.e., horses) are only incidental or “dead end” hosts and are generally incapable of transmitting the virus further. In rare instances WNV has been transmitted within the human population through blood transfusions, organ/tissue transplants or via breast milk.

WNV is endemic in many areas of the world including Africa, Europe, the Middle East, West Asia, South America and throughout North America.

Most people infected with WNV will not develop any symptoms. When symptoms do develop they appear within 3-15 days following the bite of an infected mosquito and they can range from mild fever, headache and flu-like illness to the rapid onset of severe neuro-invasive disease (meningitis, encephalitis or poliomyelitis) symptoms including headache, high fever, stiff neck, muscle weakness, convulsions, paralysis or coma. Severe WNV symptoms are more likely to occur in the elderly, the very young and those with suppressed immune systems. There is no specific treatment for WNV once symptoms develop and victims can only be provided with supportive care. In rare cases, WNV can result in death. However, most people do recover fully over time.

There is no human vaccine for WNV so preventative measures are based on vector control and the use of personal precautions against mosquitoes.

Surveillance Results:

Wildlife Surveillance

Summary:

- DRHD has not actively collected / submitted dead birds for testing since 2009.
- Between 2005 and 2008 the percentage of birds testing positive for WNV in Durham Region ranged from a low of 8% (2007) to a high of 18% (2008).
- The percentage of birds testing positive was similar in 2005 and 2006 at 12% and 13% respectively. There was a notable decrease in the percentage of positive birds identified in 2007 (8%) and a sizeable increase in 2008 (18%).

2011
- There were no wildlife submissions by DRHD in 2011

2010
- There were no wildlife submissions by DRHD in 2010
- A single WNV-positive bird was reported to the DHRD by the Canadian Cooperative Wildlife Health Centre (CCWHC) in September 2010. That bird was collected and submitted for testing in August 2010 by an Ajax resident.

2009

June 13, 2013
There were no wildlife submissions by DRHD during 2009

2008

- 9 WNV-positive results (51 Submissions)
  - CDC Week 31 - 1 positive result
  - CDC Week 32 - 1 positive result
  - CDC Week 33 - 3* positive results
  - CDC Week 34 - 2 positive results
  - CDC Week 35 - 1 positive result
  - CDC Week 36 - 1 positive result
  *One additional positive result report received by Health Unit 2008/10/07 (submission date 2008/08/12 - Necropsy date 2008/08/14)
- Positive results occurred between weeks 31 and 36 (inclusive)
- Total # of birds reported (incl. non-sentinel) = 104

2007

- 3 positive results (36 Submissions)
  - CDC Week 32 - 1 positive result
  - CDC Week 33 - 1 positive result
  - CDC Week 36 - 1 positive result
- Positive results occurred between weeks 32 and 36 (inclusive)
- Total # of birds collected (incl. non-sentinel) = 108

Vector Surveillance

Adult Mosquito Surveillance

Summary:
- In 2011, the MOHLTC provided public health units with new criteria for viral testing of adult mosquito captures so as to include vectors for EEE. The new order of preference for viral testing of adult mosquitoes instituted in 2011 was as follows:
  1. *Culex pipiens/restuans* – WNV
  2. *Culiseta melanura* – EEEV
  3. *Ochlerotatus canadensis* – EEEV
  4. *Coquillettidia perturbans* – EEEV
  5. *Aedes vexans* – EEEV
  6. Remaining order of WNV vectors

Note: Durham Region’s EEE surveillance results are included under a separate section entitled Eastern Equine Encephalitis (EEE) later in this report.

- Total mosquito captures have increased steadily and significantly between 2007 (16,590 captures) and 2011 (48,462 captures). Since the number of trapping weeks, trap locations and total number of traps set have remained relatively constant over the past several years, it is presumed that favourable climate conditions (heavy rainfall followed by hot temperatures) contributed to the high numbers of captures seen.
- The 2011 trapping season ran from the week of June 12th (CDC week 24) to the week of September 25th (CDC week 39) due to the unusually high temperatures and rainfall experienced during September 2011.
- *Coquillettidia perturbans* was by far the most dominant mosquito species captured in Durham Region in 2011, representing 87% of total captures. *Cq. perturbans* is a bridge vector for WNV. It has not been shown to be a particularly efficient vector in laboratory
The second most prevalent species of mosquito captured in Durham Region was *Aedes vexans* at 6% species abundance. *Aedes vexans* are bridge vectors for WNV since they are known to seek out both bird (avian) and human hosts.

The third most prevalent species captured was the *Culex pipiens/restuans* group at 2% species abundance. This species group is of concern since they are known vectors for WNV.

Although overall captures for *Culex pipiens/restuans* mosquitoes were low (less than 10 specimens per trap 15 capture weeks out of 16) they were found in all trap sites throughout the season.

Between 2007 and 2011 the percentage of total captures that were *Culex pipiens/restuans* has decreased from a high of 15% (in 2007) to a low of 2% (in 2011).

8 WNV-positive mosquito pools were identified from 3 different municipalities (Pickering, Ajax and Oshawa) in 2011. The number of WNV-positive pools identified in 2011 was a significant increase compared to past years with only one positive pool identified in 2010 and no positive pools identified in any of the 2007, 2008 and 2009 seasons.

2011

- Trapping season: weekly basis weeks 24 – 39
- # traps: 192
- # mosquitoes captured: 48,462
- # viral pools tested for WNV: 198
- # WNV-positive pools: 8 (from 3 different municipalities)
- % *Culex pipiens/restuans* in the capture population: 2%
- % bridge vectors in the capture population: 93% (*Cq. perturbans*: 87%, *Aedes vexans*: 6%)

2010

- Trapping season: weekly basis weeks 24 - 37
- # traps: 154
- # mosquitoes captured: 34,896
- # viral pools tested: 436
- # WNV-positive pools: 1 (week 33)
- % *Culex pipiens/restuans* in the capture population: 5%
- % bridge vectors: 88% (*Cq. perturbans* 76%, *Aedes vexans* 12%)

2009

- Trapping season: weekly basis from week 24 - 37
- # traps: 163
- # mosquitoes trapped: 26,417
- # viral pools tested: 473
- # WNV-positive pools: 0
- % *Culex pipiens/restuans* in the population: 5%
- % bridge vectors: 77% (*Cq. perturbans* 64%, *Aedes vexans* 13%)

2008

- Trapping season: weekly basis from week 25 - 39
- # traps: 241
- # mosquitoes trapped: 25,125
- # viral pools tested: 652
- # WNV-positive pools: 0
% Culex pipiens/restuans in the population: 13%
% bridge vectors: 67%

2007
- Trapping season: weekly basis from week 25 - 39
- # of traps: 178
- # mosquitoes trapped: 16,590
- # viral pools tested: 485
- # WNV-positive pools: 0
- % Culex pipiens/restuans in the population: 15%
- % bridge vectors: 67%

Larval Mosquito Surveillance

Summary:
- During the 2011 surveillance season a total of 960 samples of mosquito larvae were analyzed by our licensed pest control operator resulting in 8,909 mosquito larvae being identified.
- In both 2011 and 2010 the most abundant species sampled overall has been *Culex territans*. This is not surprising since larval sampling tends to focus on its breeding habitats. *C. territans* is not a species of concern for WNV as its primary host is frogs.
- In 2011, the second most abundant species sampled was *Culex pipiens* followed by *Culex restuans* and then *Aedes vexans*. These species are all of concern since *Culex pipiens* and *Culex restuans* are both known WNV vectors and *Aedes vexans* has been identified as a “bridge vector”, known to seek out both avian (bird) and human hosts.

2011
- The most abundant larval mosquito species identified in 2011 was *Culex territans* (44% species abundance).
- The second most abundant species identified was *Culex pipiens* (23% species abundance), followed by *Culex restuans* (14% species abundance).
- In catch basins, *Culex restuans* was the most abundant species identified (37%), followed closely by *Culex pipiens* (31%) and then *Oc. japonicus* (18%). All three species are vectors of WNV in Ontario.
- In SWMPs, the predominant species identified was *Culex territans* (64% species abundance).
- In natural sites, *Culex territans* was the most abundant species identified (64% species abundance).
- In ditches, the dominant species identified were *Culex pipiens* (25%), *Aedes vexans* (25%) and *Culex territans* (24%).
- In “other” sites, *Culex territans* was again the most predominant species identified (41% species abundance) followed by *Culex pipiens* (31%).

2010
- The most abundant larval mosquito species identified in 2010 was *Culex territans* (48% species abundance) as larval sampling was focused on its breeding habitats.
- The second most abundant species identified was *Culex pipiens* (23% species abundance), followed by *Aedes vexans* (13% species abundance).
- In catch basins, *Culex pipiens* was the most abundant species identified (35%), followed by *Oc. japonicus* (27%) and *Culex restuans* (24%).
- In SWMPs, the dominant species identified was *Culex territans* (56% species abundance).

June 13, 2013
• In natural sites, *Culex territans* was the most abundant species identified (66% species abundance.
• In ditches, the dominant species identified was *Aedes vexans* (43%) followed by *Culex pipiens* (27%) and *Ochlerotatus sp.* (11%).

**Human Case Surveillance**

**Summary:**
• One* confirmed and 1* probable case of human WNV were reported in Durham Region in 2011.
• In Ontario, in 2011, 71* human cases of WNV were reported and 102* human cases were reported in Canada.
• A single confirmed case of human WNV was reported in Durham in 2010 and another single suspect case of WNV was reported in 2009.
• Only 5 confirmed human cases were identified in Durham between 2002 and 2008 with three of those cases occurring in 2002.

Note:  * as of December 31, 2011

**2011**
• 1 confirmed case and one probable case of human WNV, from two different Durham Region municipalities

**2010**
• 1 confirmed case

**2009**
• 1 suspect case was identified via a laboratory report notation: “evidence of past WNV infection”

**2008**
• 1 confirmed case (non-neurological)

**2007**
• 1 confirmed case (non-neurological), travel-related

**2003 – 2006**
• 0 cases

**2002**
• 3 confirmed cases

**Vector Control Measures**

**2011**

**Roadside Catch Basins:**
• Catch basin monitoring commenced at CDC week 20 (May 17, 2011). Forty-four catch basin stations (each with 10 catch basins sampled) were monitored from 7 to 10 times.
• High numbers of *Culex* larvae were first observed during monitoring at CDC week 24 (June 12 – 18) resulting in catch basin treatments being launched.
• Product used: Altosid (Methoprene) pellets.
• Three rounds of larviciding treatment were conducted in 2011, with the first round of treatment commencing mid-June (running from June 17 – June 27), the second commencing mid-July (running from July 15 – July 24) and the third commencing mid-August (running from August 15 – August 25).
• # of roadside catch basins treated per round: 53,270 round 1, 52,141 round 2 and 52,285 round 3.
• Larvicide treatments occurred in all 8 Durham Region municipalities: Pickering, Ajax, Whitby, Oshawa, Clarington, Scugog, Uxbridge and Brock

**Backyard Catch Basins and Catch Basins located on Regional Property:**
• Selected catch basins, located on Regional properties (including long-term care facilities, daycares and regional housing) were treated with larvicide concurrently with the first round of general catch-basin treatments (between June 17 – 27).
• Back-yard catch basins (i.e. municipally-owned catch-basins located on private properties) were treated upon request by the property owner and based on a risk assessment.
• A total of 357 Regionally-owned and backyard catch basins were treated in 2011.
• Treatments were scheduled to occur concurrently with the first round of roadside catch basin larviciding (where possible). Some delays in treatment of back-yard catch basins occurred due to communication issues arising from the 2011 Canada Post mail strike. All treatments were concluded as of round 2 (July 15 – 24).
• Product used: Altosid (Methoprene) briquettes.

**Number of Catch Basin Treatments**

<table>
<thead>
<tr>
<th>Year</th>
<th>Roadside Catch Basins</th>
<th>Backyard and Regional Facility Catch Basins</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>157,696</td>
<td>357</td>
</tr>
<tr>
<td>2010</td>
<td>153,953</td>
<td>264</td>
</tr>
<tr>
<td>2009</td>
<td>152,414</td>
<td>306</td>
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<td>2008</td>
<td>164,716</td>
<td>312</td>
</tr>
<tr>
<td>2007</td>
<td>151,990</td>
<td>286</td>
</tr>
</tbody>
</table>

**Standing Water Sites:**
• Monitoring of storm water management ponds (municipally-owned).
• Complaint investigations regarding storm water management ponds (privately owned), derelict swimming pools, ditches, field pools etc.
• Treatment with Bti is dependent upon a risk assessment that takes into account the number and type (species) of larvae found, the time of year, the potential for timely site remediation, and WNV surveillance data obtained from Durham Region and from other health unit jurisdictions:

  Risk thresholds are as follows:
  • for storm water management ponds, ≥30 larvae in ≤10 dips to prompt an initial larviciding treatment. Thereafter, larviciding is initiated if any mosquito larvae are present;
• for derelict pools and ornamental ponds, > 0 larvae based on close proximity to human population and relative ease of remediation; and
• for ditches, field pools, etc. the potential for timely site remediation and risk assessment criteria are assessed.

### Standing Water Site Treatments

<table>
<thead>
<tr>
<th>Year</th>
<th># of Standing Water Sites Routinely Monitored</th>
<th># of Site Visits</th>
<th># of Standing Water Sites Requiring Treatment</th>
<th># of Treatment Events</th>
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<tbody>
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<td>371</td>
<td>3,009</td>
<td>190</td>
<td>731</td>
</tr>
<tr>
<td>2010</td>
<td>270</td>
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<td>266</td>
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<td>2008</td>
<td>210</td>
<td>1,419</td>
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<td>2007</td>
<td>175</td>
<td>1,032</td>
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### Standing Water Complaint Investigations / PHI Responses

<table>
<thead>
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<th>Year</th>
<th># Complaint Investigations</th>
<th>Requests for Service</th>
<th>PHI Responses</th>
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</thead>
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<td>2011</td>
<td>32 Complaints</td>
<td>34 requests for service</td>
<td>117 PHI responses</td>
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<td>2010</td>
<td>33 Complaints</td>
<td>24 Requests for Service / PHI Responses</td>
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<td>2009</td>
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<td>2008</td>
<td>79</td>
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<td># of Items</td>
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<tr>
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<td>---------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Pesticide Notification</td>
<td>“Metroland” Newspapers</td>
<td>8 Ads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oshawa/Whitby/Clarington This Week</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pickering/Ajax News Advertiser</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Port Perry Star</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Uxbridge Times Journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Brock Citizen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Fight the Bite” Advertisement</td>
<td>WNV TV Commercial</td>
<td>100 spots</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• CHEX TV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WNV Radio Commercial</td>
<td>Ran on KX96, The Rock and CKDO for three weeks. 60 x 30 second commercials on each station</td>
<td>180 commercials</td>
<td></td>
</tr>
<tr>
<td>“Fight the Bite”</td>
<td>Mall Media - backlit posters (4’x6’)</td>
<td>14 sites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pickering Town Centre - 1 month duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oshawa Centre - 1 month duration (one backlit plus 12 digital units)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Fight the Bite” Web Advertisement</td>
<td>Web Banner - Metroland Newspapers (three size variations)</td>
<td>80,000 impressions over two months</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oshawa/Whitby/Clarington This Week</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pickering/Ajax News Advertiser</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Port Perry Star</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Uxbridge Times Journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Brock Citizen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 2 months duration (July &amp; August)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Fight the Bite” Display</td>
<td>Community Events - Poster Display</td>
<td>17 display days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Regional Headquarters (5 days in each of 3 months - June, July, August)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Whitby Community Safety Day (1 day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Durham District School Board Wellness Fair (1 day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Fight the Bite” Health Promotion</td>
<td>Community Information</td>
<td>Distribution of &gt;3,000 WNV promotional items over 12 display days</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>• Regional Headquarters, Environmental Health Week (5 days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Durham District School Board Safety Day (1 day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Port Perry Fall Fair (2 days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Orono Fair (2 days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Whitby Community Safety Day (1 day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oshawa Community Children’s Festival (1 day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Media Inquiries / Interviews</td>
<td>Durham Radio - phone interviews</td>
<td>8 interviews</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• May 18 – West Nile Virus update</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• May 24 – West Nile Virus update</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• August 12- West Nile Virus update</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• August 18- Provided info on 2nd positive pool</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• CHEX Television - interviews</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• May 25 - West Nile Virus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Aug 12 - First positive mosquitoes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• October – WNV Season Summary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Response to Public Inquiries - Environmental Help Line

Summary:
- In 2011 the number of public inquiries regarding WNV was similar to that seen in 2010.
- In 2009, 2010 and 2011, the number of public inquiries regarding West Nile virus remained low as compared to 2007 and 2008. This is likely due to the fact that the public was aware that the DRHD was no longer recording dead bird sightings or collecting dead bird carcasses for testing.
- In 2009, DRHD announced the cessation of dead bird surveillance activities.
- From 2002 to 2008, public interest in WNV, including complaints, remained relatively constant.

### 2011

<table>
<thead>
<tr>
<th>Topic</th>
<th># Telephone Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information*</td>
<td>92</td>
</tr>
<tr>
<td>Stagnant Water</td>
<td>91</td>
</tr>
<tr>
<td>Promotional Material Provided*</td>
<td>4</td>
</tr>
<tr>
<td>Referrals*</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
</tr>
</tbody>
</table>

### 2010

<table>
<thead>
<tr>
<th>Topic</th>
<th># Telephone Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information*</td>
<td>44</td>
</tr>
<tr>
<td>Stagnant Water</td>
<td>59</td>
</tr>
<tr>
<td>Dead Bird Information**</td>
<td>N/A</td>
</tr>
<tr>
<td>Dead Bird Sightings**</td>
<td>N/A</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
</tr>
</tbody>
</table>

### 2009

<table>
<thead>
<tr>
<th>Topic</th>
<th># Telephone Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information</td>
<td>25</td>
</tr>
<tr>
<td>Stagnant Water</td>
<td>76</td>
</tr>
<tr>
<td>Dead Bird Information^</td>
<td>18</td>
</tr>
<tr>
<td>Dead Bird Sightings^</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
</tr>
</tbody>
</table>

### 2008

<table>
<thead>
<tr>
<th>Topic</th>
<th># Telephone Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information</td>
<td>23</td>
</tr>
<tr>
<td>Stagnant Water</td>
<td>69</td>
</tr>
<tr>
<td>Dead Bird Information</td>
<td>241</td>
</tr>
<tr>
<td>Dead Bird Sightings</td>
<td>113</td>
</tr>
<tr>
<td>Total</td>
<td>446</td>
</tr>
</tbody>
</table>

June 13, 2013
2007

<table>
<thead>
<tr>
<th>Topic</th>
<th># Telephone Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information</td>
<td>19</td>
</tr>
<tr>
<td>Stagnant Water</td>
<td>67</td>
</tr>
<tr>
<td>Dead Bird Information</td>
<td>349</td>
</tr>
<tr>
<td>Dead Bird Sightings</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>463</strong></td>
</tr>
</tbody>
</table>

* Note: As of 2011, two new categories, “Promotional Materials Provided” and “Referrals” were created to track these services

* Note: As of 2010, public inquiries related to “Dead Bird Information” and “Dead Bird Sightings” are counted under the heading “General Information”

^ Note: In 2009 the public were advised, via voicemail, media and our website, that DRHD had discontinued its dead bird surveillance and collection program. As a result, inquiries relating to “Dead Bird Information” and “Dead Bird Sightings” decreased substantially for 2009, 2010 and 2011 as compared to previous years.
EASTERN EQUINE ENCEPHALITIS (EEE)

Overview:

Like WNV, EEE is spread by the bite of infected mosquitoes. EEE is maintained in nature in a cycle between *Culiseta melanura* mosquitoes and avian (bird) hosts in freshwater, hardwood swamps. Horses and other mammals, including humans, serve only as dead-end hosts.

*Cs. melanura* is not an important vector of EEE to humans because it feeds almost exclusively on birds. Transmission to humans requires mosquito species capable of creating a "bridge" between infected birds and uninfected mammals such as some *Aedes*, *Coquillettidia*, and *Culex* species.

EEE can cause serious disease in horses with case fatality rates ranging from 50 - 90% in symptomatic animals. Equine cases of EEE have been reported throughout North America, particularly in Eastern Canada, in a number of US states and in Mexico. Emus and ostriches are also highly susceptible to EEE infection. Fortunately an EEE vaccine is available for horses.

EEE can also cause severe infection in humans with a case fatality rate between 30 - 70%. The United States Department of Agriculture (USDA) reports that EEE has been isolated from 27 different mosquito species in the USA. However, the primary vector is *Culiseta melanura* and the key bridge vectors are thought to be *Aedes vexans* and *Aedes canadensis*.

In 2008, the province of Quebec reported 19 confirmed equine cases of EEE. In addition there were three reported confirmed EEE emu deaths and a further 13 suspected EEE emu deaths on a single Quebec farm. That same year in Ontario there were four confirmed equine cases of EEE reported as well as a confirmed EEE emu death.

In the spring of 2011, the MOHLTC asked that Ontario health units conduct increased surveillance for EEEV in response to the increase in EEE activity in mosquitoes, birds, horses and humans in several US states and the province of Quebec during 2010. As a result, the new order of preference for viral testing of adult mosquitoes instituted in 2011 is as follows:

1. *Culex pipiens/restuans* – WNV
2. *Culiseta melanura* – EEE
3. *Ochlerotatus canadensis* – EEE
4. *Coquillettidia perturbans* – EEE
5. *Aedes vexans* – EEE
6. Remaining order of WNV vectors

Surveillance Results – Annual Results for 2011 and Summary Results 2008-2011

Summary:

- For the first time, in the Spring of 2011, the MOHLTC asked that public health units conduct increased surveillance for the EEE in response to an increase in EEE activity in mosquitoes, birds, horses and humans in several US states and the province of Quebec during 2010.
- A new order of preference for viral testing of adult mosquitoes was instituted in 2011 (see above).
- No EEE-positive mosquitoes were identified in Durham in 2011.
- No cases of equine EEE were reported in Durham Region in 2011, 2010 or 2009
- No human cases of EEE were reported in Durham Region in 2011. Note: to date, there has never been a human case of EEE reported within the province of Ontario.
One case of equine EEE was reported in Durham Region in 2008.
In Ontario, 4 equine cases of EEE were reported in 2011, 3 in 2010, 2 in 2009 and 4 in 2008.
In the United States, in 2011, the USDA reported 50 equine cases of EEE occurring in seven US states and in 2010 there were 247 equine cases of EEE reported in 18 US states. This is of some concern in Ontario because many of the equine cases reported in recent years occurred in border states, including Michigan and New York.

Adult Mosquito Surveillance:

2011
- # mosquito pools tested for EEE: 337
- # EEE-positive mosquito pools detected: 0

Equine Surveillance:

2011
- # equine EEE cases reported in Durham: 0
- # equine EEE cases reported in Ontario: 4

2010
- # equine EEE cases reported in Durham: 0
- # equine EEE cases reported in Ontario: 3

2009
- # equine EEE cases reported in Durham: 0
- # equine EEE cases reported in Ontario: 2

2008
- # equine EEE cases reported in Durham: 1
- # equine EEE cases reported in Ontario: 4

Human Surveillance

2011
- No human cases of EEE were reported in Durham Region.

Note: To date, there has never been a human case of EEE reported in Ontario.
LYME DISEASE (LD)

Overview:

LD is an infection caused by the spirochete *Borrelia burgdorferi*. The infection is transmitted to humans via the bite of an infected tick. In Ontario, *Ixodes scapularis*, the black-legged tick (or “deer tick”) is the primary vector of LD.

LD is the most common vector-borne disease in North America and in 2010 it became a nationally reportable disease in Canada. The Public Health Agency of Canada (PHAC) has stated that there is a low risk of encountering ticks infected with the LD agent in most of Canada although the number of risk areas is increasing in eastern Canada. The risk for exposure to the disease is highest in regions where the ticks that transmit LD are known to be established. However, surveillance data indicates that small numbers of black-legged ticks can be introduced into widely separated areas of Canada by migratory birds, posing some risk that individuals in other areas may also be exposed to infected ticks.

Historically, within Durham Region, neither passive nor active tick surveillance data has demonstrated the presence of any endemic, LD-positive, tick populations. In 2011, 12 ticks, removed from human hosts, were submitted for species identification and potential testing by either a member of the public or their physician (passive surveillance). Although identification and/or test results are still pending for some of these specimens, no LD-positive test results were received as of the end of December 2011.

Active tick surveillance (tick dragging), in likely tick habitats, was conducted in Durham Region, during the month of October in both 2010 and 2011. No ticks have yet been found as a result of active surveillance.

Between 2006 and 2011, a total of 11 confirmed human cases of LD were reported in Durham Region.

While the risk of contracting LD within Durham Region is currently low, the potential for infection is likely to increase subject to deer and bird migration patterns across the north shore of Lake Ontario and changing climatic conditions that may contribute to an expansion of the distribution of ticks that carry LD.

In 2010, in an effort to increase public awareness about the risk of LD, DRHD developed a communication plan that includes provision of LD information on the Durham Region website, development of an LD brochure and a “Banner Bug” display.

During 2011, DRHD staff distributed LD brochures to a number of target groups (i.e. school boards, horticultural societies, campers and hikers, etc.) as well as providing information and displays at a number of community events. The LD “Banner Bug” display was used at a number of community events and for LD presentations. An interactive LD trivia game was developed for future use during presentations or at displays aimed at increasing awareness amongst school-aged groups.
Surveillance Results – Annual Results for 2011 and Summary Results 2006-2011

Summary:

- From 2006 to 2011 there have been only 11 confirmed human cases of LD reported in Durham. Six of these cases were reported in 2007.
- In 2011, 1 confirmed case of LD was reported and 2 further cases remain under investigation.
- A total of 28 ticks were submitted for identification and potential testing between 2006 and 2011. So far, all of the black-legged ticks submitted have tested negative for Borrelia burgdorferi the agent that causes LD.
- Active tick surveillance (“tick dragging”) was conducted in Durham in the fall of 2010 and in the fall of 2011. No ticks have been found during active surveillance to date.

2011

- # human cases of LD reported: 1 confirmed, 2 under investigation
- # ticks submitted for identification and potential testing: 12
- # ticks found through active tick surveillance (dragging) in the fall (October): 0

2010

- # human cases of LD reported: 2 confirmed, 2 probable, 2 suspect.
- # ticks submitted for identification and potential testing: 5
  One tick was identified as Ixodes cookei, a potential vector of Powassan virus. None of the ticks submitted were reported positive for B. burgdorferi (the bacteria that transmits LD)
- # ticks found through active tick surveillance (dragging) in the fall (October): 0

2009

- # human cases of LD reported: 1 confirmed
- # ticks submitted for identification and potential testing: 2 captured in Durham
  One of the two ticks was identified as Ixodes scapularis (a black-legged tick). It tested negative for Borrelia burgdorferi

2008

- # human cases of LD reported: 0
- # ticks submitted for identification and potential testing: 6
  None of the submitted ticks were found positive for B. burgdorferi

2007

- # human cases of LD reported: 6 confirmed
- # ticks submitted for identification and potential testing: 2 with neither found positive for B. burgdorferi

2006

- # human cases of LD reported: 1 confirmed
- # ticks submitted for identification and potential testing: 1
  The tick was found negative for B. burgdorferi
OTHER VECTOR-BORNE DISEASES OF CONCERN

MALARIA

Overview:

Malaria is an acute flu-like illness caused by one of four species of parasite of the genus Plasmodium: Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, and Plasmodium malariae.

Malaria is most commonly transmitted to humans through a bite of an infected female Anopheles mosquito. When an Anopheles mosquito ingests blood from a malaria-infected person, malaria parasites develop in the mosquito and migrate into the mosquito's salivary glands. When the infected mosquito bites another human, malaria can be transmitted to that individual. In rare instances the malaria parasite can also be transmitted by transfusion with infected blood, by shared needle use, or from a mother to her unborn child.

Symptoms of malaria include fever and flu-like symptoms such as headache, nausea, vomiting, muscle pain or spasms, chills and malaise. Acute infection can cause enlargement of the spleen and make the liver tender.

The severity of the illness varies depending on which species of the malaria parasite is responsible for the infection. Of the 4 species causing malaria, P. falciparum leads to the most serious illness and can cause seizures, coma, kidney failure and respiratory failure, which can lead to death.

If identified early and treated appropriately, almost all malaria cases can be completely cured. However, even short delays in the diagnosis can make treatment more difficult and less successful.

Malaria is endemic (i.e., constantly occurring) in most of sub-Saharan Africa and New Guinea; in large areas of South Asia, Southeast Asia, Oceania, Haiti, Central and South America; and in parts of Mexico, the Dominican Republic, North Africa and the Middle East.

According to PHAC, there are roughly 400 reported travel-related cases of malaria in Canada each year and it is estimated that up to 50% of cases are never reported.

Measures to prevent malaria infection include personal precautions to avoid mosquito bites and the use of effective anti-malaria medications. No vaccine is available.

Surveillance Results:

2011

- Four human cases of Malaria were reported as follows: two cases of Plasmodium falciparum and one case each of Plasmodium ovale and Plasmodium vivax. Details regarding exposure were not available for the two (2) Plasmodium falciparum cases. The other two were reported to be related to travel outside of Canada.
PLAGUE

Overview:

Plague is an infectious disease, caused by the bacteria *Yersinia pestis*. It can affect both animals and humans. The plague is transmitted between animals and humans by the bite of infected fleas, direct contact with infected rodents, inhalation and rarely, ingestion of infective materials. While there have been many outbreaks of plague in human history outbreaks are rare today.

There are three different types of illness that the plague infection can cause. They are bubonic, pneumonic and septicemic plague. All forms of plague begin with flu-like symptoms including fever, chills, muscle pain, weakness and headache. Symptoms can also include nausea, vomiting, diarrhea and abdominal pain.

Bubonic plague is the most common form of the plague. Infection results from the bite of an infected flea that has fed on an infected rodent, such as a rat. Bubonic plague infection affects the lymph nodes, causing swelling and pain.

Pneumonic plague is the least common but most deadly form of plague. It can be spread through airborne droplets released through coughs or sneezes or contact with infected body fluids. It can also be spread through contact with clothing or bed linens that have been contaminated with infected body fluids.

Septicemic plague can result from either bubonic or pneumonic plague.

Rapid diagnosis and treatment of plague is essential to reduce complications and fatality. Effective treatment methods enable almost all patients to be cured if diagnosed in time. Several antibiotics can effectively treat plague along with supportive therapy.

While there is a vaccine to protect people who are at high risk of exposure to the disease, the vaccine is not available for general public use.

Because plague is usually transmitted from animals to humans via wildlife rodents or their fleas, in areas where the Plague is established in wildlife populations people should avoid contact with the habitats where infected rodents or fleas might reside.

Surveillance Results:

2011

- No cases of plague were reported
- Human cases of plague are very rare in Canada with the last case being reported in 1939
TULAREMIA

Overview:

Tularemia is an infection that is caused by the bacteria *Francisella tularensis*. It is endemic throughout North America and many parts of Europe as well as the Soviet Union, China and Japan.

The reservoirs for tularemia in North America include rodents, rabbits, muskrats and beavers. The organism can also be carried by various hard ticks. Tularemia can be spread from animals to humans, although this is not common. Human infection usually results from direct contact with infected live animals, animal hides or uncooked meat, but may also occur as a result of the bite of a tick or from inhalation of contaminated dust from animal environments (i.e., cages, barns, etc.).

The clinical signs of tularemia infection in animals are not always obvious and will vary depending on how susceptible the species is to the bacteria, the virulence of the bacteria, and the source of the infection.

There are two types of tularemia: Type A and Type B. Type A tularemia usually causes more serious illness in people.

The onset of disease in humans is usually sudden with cases experiencing flu-like symptoms including: high fever, chills, general body aches, headache and nausea. An ulcer often develops on the skin or mouth at the site of introduction of the organism and there may be swelling and pain in the lymph glands.

Ingestion of the organism can produce pharyngitis, abdominal pain, diarrhea and vomiting, inhalation can result in pneumonia and introduction into the eyes can result in painful and productive conjunctivitis. Symptoms usually appear three to five days after exposure to the bacteria but can take as long as 14 days to appear.

While both types of tularemia can be usually be successfully treated with antibiotics, in rare cases tularemia can be fatal.

Surveillance Results:

2011

- No human cases of tularemia were reported
YELLOW FEVER

Overview:

Yellow fever is caused by a virus that is transmitted to humans by the bite of an infected mosquito. Yellow fever derives its name from the yellowing of the skin and eyes (jaundice) that occurs when the virus attacks the liver.

The primary vector of yellow fever virus is *Aedes aegypti* but other *Aedes* species in Africa and the *Haemagogus* species in South America also play a role in transmission. Non-human primates (e.g., monkeys) can also be infected with the yellow fever virus and these animals serve as a reservoir for the virus in rural and jungle areas.

Yellow fever is endemic (always present) in many tropical areas of South America and Africa. Canadians travelling to endemic areas may be at risk of contracting the virus.

Symptoms of yellow fever usually take 3-6 days to appear in infected individuals and may include sudden onset of fever, headache, joint pain, loss of appetite, abdominal pain, vomiting and dehydration. Most patients recover after this stage. However, in severe cases, the disease can lead to shock, internal bleeding, jaundice (yellowing of the skin and eyes) and organ failure. This occurs in about 15% of patients.

The case-fatality rate for those who develop severe yellow fever disease is 20-50%. Once symptoms develop there is no specific treatment and the only option is supportive care.

A yellow fever vaccine is available to prevent infection. First time recipients of the vaccine must be vaccinated at least 10 days before travelling to endemic areas for the vaccine to be effective. In addition to vaccination, personal protective measures against mosquitoes are recommended for persons travelling to endemic regions.

PHAC indicates that mosquito control has played a major role in preventing transmission of Yellow fever in North America and Europe.

Surveillance Results:

2011
- No human cases of Yellow fever were reported
### Summary of 2011 Human Case Surveillance Results for Malaria, Plague, Tularemia and Yellow fever in Durham Region

<table>
<thead>
<tr>
<th>Disease</th>
<th>Organism</th>
<th>Number of Human Cases</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malaria</strong></td>
<td><em>Plasmodium falciparum</em></td>
<td>2</td>
<td>no details available with respect to risk factors or exposure</td>
</tr>
<tr>
<td></td>
<td><em>Plasmodium ovale</em></td>
<td>1</td>
<td>exposure related to travel outside of Canada</td>
</tr>
<tr>
<td></td>
<td><em>Plasmodium vivax</em></td>
<td>1</td>
<td>exposure related to travel outside of Canada</td>
</tr>
<tr>
<td></td>
<td><em>Plasmodium malariae</em></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Plague</strong></td>
<td><em>Yersinia pestis</em></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Tularemia</strong></td>
<td><em>Francisella tularensis</em></td>
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</tr>
<tr>
<td><strong>Yellow fever</strong></td>
<td><em>Yellow fever virus</em></td>
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</table>
PROGRAM EVALUATION

Durham Region Rapid Risk Factor Surveillance System (RRFSS)

The purpose of RRFSS is to provide timely data relevant to local public health needs through ongoing monitoring of key public health issues and collection of information on emerging issues. The results from RRFSS are used to support program planning and evaluation, to advocate for public policy development, and to improve community awareness regarding the risks for chronic diseases, infectious diseases and injuries.

RRFSS involves an ongoing telephone survey of adults aged 18 years and older, conducted by the Institute for Social Research at York University, on behalf of DRHD and other participating Ontario health units. Since 2001, a sample of at least 100 Durham Region residents has been surveyed on a monthly basis regarding knowledge, attitudes and risk behaviours of importance to public health.

RRFSS Data Notes:
- Percentages are expressed in the form of the point estimate ± the 95% confidence interval around the estimate. The true or actual percentage falls within this range 95 out of 100 times.
- Significant difference refers to a difference between two estimated percentages that is not likely due to chance. If the 95% Confidence intervals of two estimates do not overlap there is considered to be a significant difference between the estimates.

RRFSS West Nile Virus Trends, Durham Region, 2002 to 2010

Personal Protective Behaviours
- The percent of adults who cover-up with long sleeves, pants and socks all or most of the time to protect themselves from being bitten by mosquitoes increased significantly from 24% (± 4%) in 2002 to a high of 36% (± 5%) in 2004, fell back to 26% (± 4%) in 2005, and rebounded to 34% (± 5%) in 2008 and 2010.
- The percent of adults reporting use of a DEET-based insect repellent all or most of the time increased significantly from 11% (± 3%) in 2002 to a peak of 25% (±4%) in 2004 and decreased significantly to 15% (±3%) in 2010.

Household Protective Behaviours
- The percent of households with no containers outside where water is allowed to collect and stand for more than 7 days increased significantly from 2002 to 2003 and has since remained relatively steady ranging from about 92% to 95% of households.
- The percent of households with screens in good repair or where doors and windows are not left open has remained relatively steady since 2002 ranging from about 85% to 90% of households.

The RRFSS West Nile Virus survey questions will be asked again during the summer months of 2012 to continue monitoring these protective behaviours among Durham Region residents.

RRFSS Lyme Disease Awareness and Behaviour Monitoring, Durham Region, 2011

In 2011 DRHD led the development of two new RRFSS modules to measure awareness and perceived risk of LD among Durham Region adults and the use of personal protective measures when outdoors in grassy fields or wooded areas. The survey results will provide baseline data for evaluation of DRHD initiatives to increase public awareness and encourage behaviours that reduce the risk of contracting LD. Data collection will be repeated in 2012.
Other Evaluation Tools:

Durham Region Epidemiology & Evaluation Division - “Snapshot On... West Nile Virus” (June 2007)

OVERALL SUMMARY / CONCLUSIONS

WEST NILE VIRUS

Surveillance activities have revealed that WNV has been present in one or more of the adult mosquito, wildlife or human populations within Durham Region since 2002.

Each year since 2002, in order to control the spread of WNV, the DRHD has instituted a Vector Control Plan which includes control measures such as adult mosquito surveillance, larval mosquito surveillance, the monitoring of human health effects / complaints as well as a public awareness campaign focusing on source reduction and personal protective measures.

For several years the Vector Control Plan included an active avian (dead bird) surveillance component. However, this surveillance was discontinued in Durham Region in 2009 resulting in no birds being collected and submitted for testing by the DRHD since that time. However, general public inquiries and atypical avian fatalities are still referred to the Canadian Cooperative Wildlife Health Centre (CCWHC) for their follow-up, which may include bird pick-up and testing.

Beginning in 2003 and in each subsequent year, the DRHD has contracted a licensed pest control operator for the delivery of our Vector Control Program.

No equine cases of WNV were reported in Durham Region in 2011 but OMAFRA reported 8 cases of equine WNV in Ontario.

With regard to larval mosquito surveillance, a total of 960 larval mosquito samples were analyzed in Durham Region during 2011, with 8,909 mosquito larvae being identified. *Culex territans* was the most abundant species identified during larval sampling (44% species abundance) due to sampling being focused on its breeding habitats. The second most abundant species sampled overall was *Culex pipiens* at 23% species abundance followed by *Culex restuans* (14% species abundance).

Adult mosquito surveillance / trapping was conducted in Durham Region between CDC weeks 24 (w/o June 12, 2011) and 39 (w/o September 25, 2011). The surveillance system consisted of a network of 12 established trapping stations and 4 “hot spot” sites (associated with findings of WNV-positive pools of mosquitoes) distributed over 7 Durham Region municipalities. Over the 16 week capture period a total of 192 traps were set and 14 different mosquito species or species groups were identified. The highest number of adult mosquito captures occurred during week 28 (w/o July 10, 2011) when the average number of mosquitoes per trap reached 1,303.

Between trapping weeks 24 and 31 the predominant mosquito species captured was *Coquillettidia perturbans*. *Aedes vexans* was present in traps throughout the season and became dominant in the latter part of the season, with capture numbers peaking in weeks 35 and 36. Although *Culex pipiens-restuans* mosquitoes were found across the entire Region throughout the trapping season, their numbers were low with season averages below 10 specimens per trap per week.

A total of 198 pools of captured mosquitoes were tested for the presence of WNV using the RT-PCR method. Eight pools of *Culex pipiens-restuans* mosquitoes tested positive for the presence of WNV between weeks 32 and 37.

There was 1 confirmed human case and 1 probable human case of WNV reported in Durham Region during 2011. As of December 31, 2011 there have been 71 confirmed human cases of
WNV reported in Ontario, 102 cases reported in Canada and 690 cases reported in 44 different states within the United States of America.

A “degree-day” analysis was conducted for the 2011 season, by Durham Region’s licensed pesticide contractor, from weather data collected at the Environment Canada, Oshawa WCPC station. The analysis demonstrated that the mean temperatures for 2011 were above normal throughout the season except for April. Overall, temperatures during 2011 were slightly cooler than in 2010 except for July and September. Warmer mean temperatures in July and August caused the cumulative degree-days to exceed the 109 EIP theoretical threshold that indicates a viral amplification of WNV. The amount of rain received in Durham in 2011 (509.6mm) was higher than normal (466.3mm) with 40% of the rain falling during April and May and another 40% falling in August and September (an average of 106mm per month). Overall, Durham received slightly more rainfall in 2011 than in 2010. The regionally contracted pest control operator has advised that the results of their degree day analysis demonstrate that “2011 conditions were favourable for the replication of WNV in mosquitoes” and that conditions were “more favourable to amplification than what has been observed in the last 4 years”.

EASTERN EQUINE ENCEPHALITIS

Increased EEE activity in bordering US states and in Quebec in recent years prompted the MOHLTC to request public health units to enhance adult mosquito surveillance for EEE vector mosquitoes in 2011. While Durham Region’s surveillance results demonstrated the presence of varying numbers of four EEE vector species including: Culiseta melanura (2 mosquitoes), Aedes vexans (3,000 mosquitoes), Coquillettidia perturbans (41,899 mosquitoes) and Ochlerotatus Canadensis (capture numbers unavailable), none of the captured specimens tested positive for EEEV.

No cases of equine EEE were reported in Durham Region in 2011. However, 4 cases of equine EEE were reported in Ontario.

No human cases of EEE were reported in Durham Region in 2011 and, to date, no human cases have ever been reported in Ontario.

LYME DISEASE

In 2010, the MOHLTC and public health units initiated a campaign to increase public awareness of LD in response to an increase in the number of established populations of black-legged ticks in the southern part of the province.

At this time, the risk of acquiring LD within Durham Region appears to be low. Historically, neither passive nor active tick surveillance data has demonstrated the presence of any endemic, LD-positive, tick populations. In 2011, 12 ticks, removed from human hosts, were submitted for species identification and potential testing by either a member of the public or their physician (passive surveillance). Although identification and/or test results are still pending for some of these specimens, no LD-positive tick test results were received as of the end of December 2011.

Active tick surveillance (tick dragging), in likely tick habitats, was conducted in Durham Region, during the month of October in 2010 and 2011. No ticks have yet been found as a result of active surveillance.
The results for human case surveillance in Durham Region demonstrate that of 11 confirmed human cases of LD reported in Durham Region, between 2006 and 2011, only 1 case has indicated they may have acquired the tick within the Region. All other cases reported travel-related exposures to ticks.

OTHER VECTOR-BORNE DISEASES OF CONCERN

Historically, human cases of malaria, plague, tularemia and yellow fever have been rare in Durham Region.

Four cases of malaria were reported in Durham Region in 2011. Two of the 4 cases were confirmed to be related to travel outside of Canada. For the other 2 cases, no exposure details were available.

There have been no cases of plague reported in Canada since 1939.

No cases of tularemia or yellow fever were reported in Durham Region in 2011.
OUTLOOK / PLANS FOR 2012

- Maintenance of an effective vector surveillance (adult and larval mosquito) program for WNV and EEE.
- Maintenance of passive and, when applicable, active surveillance programs for black-legged ticks (*Ixodes scapularis*).
- Maintenance of effective human surveillance programs for WNV, EEEV, LD, malaria, plague, tularemia and yellow fever.
- Where possible, reports of equine cases of WNV and EEE will be investigated.
- Maintenance of an effective control program for WNV vector populations (i.e., *Culex pipiens* and *Culex restuans*) in municipal and private catch basins and in open water sites such as storm water management ponds (SWMPs), sewage lagoons and ditches beginning May/June and continuing through to the end of September.
- Maintenance of an effective control program for *Aedes vexans* and other secondary vector species via monitoring of and, where necessary, larviciding of ditches, temporary pools, etc. from early May through to the end of September.
- Maintenance of effective and timely communications with municipal representatives regarding upkeep and remediation of municipal properties.
- Maintenance of an effective and comprehensive public communication campaign designed to educate the community regarding WNV and the need for source reduction, vector control and personal protective measures against mosquitoes. In the absence of a vaccine or cure for infections caused by WNV, the cycle of transmission must be interrupted to prevent outbreaks. The promotion of personal protective measures through public education is an important step in combatting both WNV and EEE.
- Continued development of an effective and comprehensive public communication campaign designed to educate the community regarding LD and the need for personal protective measures against ticks.
- Maintenance of a 48 hour response to public complaints regarding potential mosquito breeding sites on public and private property (i.e., derelict swimming pools, ornamental ponds, backyard catch basins and other areas of standing water).
- Maintenance and enhancement of partnerships with local, municipal by-law departments in respect to the investigation of stagnant water complaints.
- Maintain surveillance of WNV personal and household protective behaviours using the RRFSS.
- Continued use of a RRFSS survey module to measure public a LD.
Appendix A

Graphs of 2011 WNV Data
Number of Mosquitoes Captured Per Year (2007-2011)

<table>
<thead>
<tr>
<th>Year</th>
<th># of Mosquitoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>16590</td>
</tr>
<tr>
<td>2008</td>
<td>25125</td>
</tr>
<tr>
<td>2009</td>
<td>26417</td>
</tr>
<tr>
<td>2010</td>
<td>34896</td>
</tr>
<tr>
<td>2011</td>
<td>48462</td>
</tr>
</tbody>
</table>

June 13, 2013
Results of Adult Mosquito Trapping (2007-2011)

<table>
<thead>
<tr>
<th>Year</th>
<th># of Mosquitoes</th>
<th># of Traps</th>
<th># of Viral Pools Tested</th>
<th># of WNV-positive Viral Pools</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>485</td>
<td>172</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>652</td>
<td>241</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>473</td>
<td>163</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>436</td>
<td>154</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>198</td>
<td>193</td>
<td>8</td>
<td>0</td>
</tr>
</tbody>
</table>
Results for Standing Water Site Surveillance (2007-2011)

Year

2007 2008 2009 2010 2011

Number

# Sites Monitored # Sites Treated # Larvicide Applications

June 13, 2013
Number and Type of Public Inquiries Received (2007-2011)

Note 1: In 2009 & 2010 the public were advised, via voicemail, media and our website, that the Durham Region Health Department had discontinued its dead bird surveillance and collection program. As a result, inquiries relating to “Dead Bird Information” and “Dead Bird Sightings” dropped substantially as compared to previous years.

Note 2: In 2010, Vector-borne Disease Program data relating to “Dead Bird Information” and/or “Dead Bird Sightings” was incorporated into the “General Information” category, resulting in an increase in number of calls in this category as compared to previous years.

Note 3: In 2011 two new categories, “Promotional Materials Provided” and “Referrals”, were created to differentiate the type of public inquiries received.