50 YEARS 1958-2008
METROPOLITAN MOSQUITO CONTROL DISTRICT

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Dear Reader:

The Technical Advisory Board (TAB) has reviewed the following report and provided comments and recommendations for improvement in District operations. At their April 2008 meeting the Metropolitan Mosquito Control Commission (MMCC) approved the Metropolitan Mosquito Control District's (MMCD) 2007 Operational Review and Plans for 2008 and thanked the TAB for their work.

In 2008 MMCD celebrates 50 years of serving metro citizens. MMCD has always been an innovational leader in the mosquito abatement industry. The organization has been instrumental in the development and implementation of environmentally compatible and cost effective control materials and methods. We continue this innovative approach today as current employees develop and use sophisticated data bases and implement new technologies. In addition, the District has adopted a Continuous Quality Improvement philosophy which encourages staff to improve processes and continually research more efficient ways to deliver services.

MMCD has established a strategic growth plan based on specific objectives. This long range plan provides for expanded services, improved outreach and notification and the reduction of mosquito and tick-borne disease. The organization stands ready to serve an ever expanding metropolitan area and is committed to meeting the needs and expectations of metro citizens.

The following report describes our 2007 activities and plans for 2008. I hope you find the information in this report useful and please do not hesitate to contact me if you would like additional information regarding our program.

Sincerely,

James R. Stark

James R. Stark, Executive Director
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MINNESOTA DEPARTMENT OF
AGRICULTURE
FROM THE FARM TO YOUR FAMILY

March 31, 2008

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Commissioner Penny Steele, Chair
Metropolitan Mosquito Control Commission
2099 University Avenue West
St. Paul, MN 55104

Dear Commissioner Steele:

The Technical Advisory Board (TAB) met on February 20, 2008 to review and discuss MMCD operations in 2007 and plans for 2008. As you know, the TAB was originally formed to provide annual independent review of field control programs and to enhance inter-agency cooperation.

After an excellent interchange of questions and information between the TAB and MMCD staff, the TAB approved the following resolutions.

> The Technical Advisory Board expresses satisfaction with the manner of data management and control the Metropolitan Mosquito Control District has presented, and commends the District on a very good report.
>
> The District should continue using adulticide materials currently proven and continue to do rigorous testing on only those materials.

Thank you for the opportunity to review MMCD operations.

Sincerely,

Robert L. Koch

Robert Koch, PhD
Chair, Technical Advisory Board

RK:jen

cc: Stephen Manweiler, PhD
Teresa McDill, MDA

Table of Contents

Executive Summary ..... *i*

Chapter 1 - Mosquito Surveillance *1*
2007 Mosquito Surveillance Results 1
Rainfall 1
Larval Collections 2
Adult Collections 5
Vector Mosquito Surveillance 13
Plans for 2008 19

Chapter 2 - Vector-borne Disease *20*
Background 20
2007 Mosquito-borne Disease Services 21
Breeding Source Reduction 21
La Crosse Encephalitis 22
Eastern Equine Encephalitis 22
Western Equine Encephalitis 23
West Nile Virus 23
West Nile Virus Research 25
Larval *Culex* Surveillance 25
Mapping *Culex* Larval Habitats in Stormwater Management Structures 26
Community Cooperation Treating Underground Stormwater Structures 26
Larval *Culex* Control in Catch Basins 28
Adult *Culex* Research 29
Plans for 2008 – Mosquito-borne Disease 31
2007 Tick-borne Disease Services 31
Ixodes scapularis Distribution 31
Tick Identification Services/Outreach 33
2008 Plans for Tick-borne Services 33
Metro Surveillance 33
Tick Identification Services/Outreach 33

Chapter 3 - Mosquito Control *35*
Background Information 35
2007 Mosquito Control 36
Larval Mosquito Control 36
Adult Mosquito Control 38
2008 Plans for Mosquito Control Services 38
Larval Control 38
Cattail Mosquitoes 38
Floodwater Mosquitoes and *Culex* Species 38
Adult Mosquito Control 39
Vector Mosquito Control 39

Chapter 4 - Black Fly Control *40*
Background 40
2007 Program 40
Small Stream Program - *Simulium venustum* Control 40
Large River Program 41
Adult Population Sampling 41
Non-target Monitoring 46
2008 Plans 46

Chapter 5 - Product & Equipment Tests *47*
Background 47
2007 Projects 47
Acceptance Testing of Altosid® (Methoprene) Briquets and Pellets 47
Evaluation of Active Ingredient Levels in Adult Mosquito Control Products 48
Improvement of Warehouse Operations 49

Recycling of Pesticide Containers 49
Efficacy of Control Materials 50
Vectobac® G Applications 50
New Control Material Evaluations 50
Cattail Mosquito Control Program 50
Altosid® XR-G Sand Treatments 50
Control of *Culex* in Catch Basins 51
FourStar® *Bti/B. sphaericus* Briquets in Catch Basins 51
Valent VBC60092 *Bti* "Donut" in Catch Basins 53
Altosid® XR Briquets in Catch Basins 55
Control of *Culex* in Pond Regulators 55
Altosid® XR Briquets in Pond Regulators 56
VectoMax® CG Granules in Pond Regulators 56
Control of *Culex* in Culverts 57
Adulticide Tests 58
Permethrin Barrier 58
Natural Pyrethrum (ULV) in Agricultural Areas 59
Scourge 4+12 59
Equipment Evaluation 60
Helicopter Swath Analysis and Calibration Procedures for Larvicides 60
Evaluation of Fixed Wing Aircraft 60
Droplet Analysis of Ground-based Spray Equipment 60
Evaluation of a Utility Vehicle-mounted Cold Fog Generator 61
Plans for 2008 61
References 61

Chapter 6 - Supporting Work *62*
2007 Projects 62
Aerial Treatment Tracking and Guidance 62
Field & Lab Data Entry and Reporting 64
Wetland and Stormwater Mapping 65
Web Map and Geocoder 65
Stormwater Management, Wetland Design, and Mosquitoes 68
Nontarget Studies 69
Notification 70
Calls Requesting Service 70
Curriculum in Schools 71
Presentations, Posters, and Publications 71

Appendices
APPENDIX A Mosquito Biology 74
APPENDIX B Ave. No. of Specimens of Common Mosquitoes/Night in NJ Light Traps, 1965-2007 76
APPENDIX C Description of Control Materials 78
APPENDIX D 2007 Control Materials: AI Identity, % AI, Dosage/Acre, AI Applied/Acre, & Field Life. 81
APPENDIX E Acres Treated by Control Material used for Mosquito and Black Fly Control, 1999-2007. 82
APPENDIX F Control Material Labels 83
APPENDIX G Technical Advisory Board Meeting Notes 113

Executive Summary

The Metropolitan Mosquito Control District (referred to as MMCD or the District in this document) has been working to provide service to citizens for 50 years, and several activities are planned to honor that anniversary in 2008. The original focus, reducing the impact of mosquitoes and mosquito-borne disease on people's lives, continues to be MMCD's main service. Over the years other needs arose as well:

- As water quality in the region's major rivers improved, biting gnats returned as a major nuisance and a control program was begun.
- The arrival of Lyme and other tick-borne diseases and their vectors led to monitoring and public information to help prevent these diseases.
- Most recently, the arrival of West Nile virus (WNV) led to exploration of mosquito control in the urban stormwater environment.

In 2007, not only were there collections of *Aedes albopictus*, but also the first collection in Minnesota of *Ae. japonicus*, another potential vector that is spreading across the United States, suggesting that new challenges will continue to arise.

MMCD continues to be committed to providing cost-effective service in an environmentally sound manner. This report presents our efforts to accomplish that through surveillance, disease monitoring, mosquito and black fly control, new product testing, data management, and public information.

Surveillance – Record high temperatures in March, 2007, created heavy snow melt and resulted in early production of the spring *Aedes* mosquito species. For the rest of the season, drought conditions prevailed, and rain produced relatively few egg-hatch events ("broods") of floodwater *Aedes* mosquitoes. The major peak of floodwater species actually occurred in September, much later than usual.

Unusually high populations of *Culex tarsalis* were detected in late May and again at the end of July and into early August. A District record of 3,008 *Cx. tarsalis* were captured in a single CO_2 trap placed on August 2, 2007. *Culex tarsalis* is an important vector of WNV and western equine encephalitis (WEE) in the District; therefore, we are re-evaluating our trap networks to ensure reliable detection of the species.

Disease – Of 2,474 pooled mosquito samples tested from the District, 85 were positive for WNV, and illness from WNV was confirmed in 19 District residents in 2007. As in 2006, drought contributed to WNV amplification as vector habitats improved and warm weather aided dissemination of infections in mosquitoes. No cases of La Crosse encephalitis (LAC), WEE, or eastern equine encephalitis (EEE) were reported. MMCD staff continued efforts to collect waste tires and reduce water-holding containers that can serve as larval habitat for vectors of both LAC and WNV, and treated about 62,000 storm drain catch basins three times during the summer. Larger underground structures were treated through a cooperative program with 23 cities. Research continues as we seek to improve monitoring and control of *Culex* species serving as WNV vectors.

Tick-borne disease reports from MN Dept. of Health from 2006 (most recent available data) show human cases of Lyme disease and human granulocytic anaplasmosis remain high, continuing the record-setting trend since 2000 statewide. Case totals in the Twin Cities metropolitan area have also risen over time but not as dramatically as the state-wide totals. Populations of the vector tick *Ixodes scapularis* appear to have rebounded, and MMCD sampling now has detected the tick in all 7 metropolitan counties. MMCD tick surveillance began to show a rise in *I. scapularis* collections in 1998, and the 2006 distribution study results seemed to provide continued evidence of an elevated population. Numbers of positive sites (i.e., sites where at least one *I. scapularis* was collected) and percentages of *I. scapularis* in overall tick collections have also remained high since 2000. Full details of 2007 tick surveillance will be available in a report on the District website – www.mmcd.org – in June, 2007.

Control – MMCD continues to use two biological materials for larval mosquito control: the soil bacterium *Bti* (*Bacillus thuringiensis* var. *israelensis*) and the insect growth regulator methoprene. These materials come in immediate or slow-release formulations and are applied by hand or by helicopter. The District applied larvicide to 157,039 acres to control larval floodwater mosquitoes (*Aedes vexans*) and cattail mosquitoes (*Coquillettidia perturbans*), 36,460 fewer acres in 2007 than in 2006. MMCD staff also made 168,314 larvicide treatments to catch basins to control vectors of WNV.

Adult mosquito control is performed when surveillance indicates that specific disease-vectoring mosquito populations are increasing, when the District is notified of a mosquito-borne disease case, or when thresholds of adult mosquito catches are exceeded in high-density human-populated areas. The primary materials used are the synthetic pyrethroids resmethrin and sumithrin, applied as ultra-low-volume (ULV) fog, and permethrin, applied to vegetation as a barrier treatment. In 2007 the District applied adulticides to 33,607 acres – 6,734 fewer acres than in 2006.

For the past several years MMCD has been testing strategies to improve control by using more slow-release materials in sites with known history of mosquito production, and improving efficiency of aerial treatments applied in the short time span larvae are susceptible after a rain. In 2008, we plan to maximize the area within the District that receives larvicide treatments by further refining how treatments are targeted. Alternative materials may also enable expanded treatments, as described below.

Product and Equipment Testing – In 2007 we conducted tests of alternate larval control materials to expand our *Cq. perturbans* and *Culex* control programs. We also evaluated the effectiveness of barrier and ULV adulticides, especially against *Culex*.

Coquillettidia perturbans habitats are currently treated primarily with methoprene in the form of Altosid® briquets or pellets, and the cost of these materials tends to limit the area we can treat. Tests in 2007 of another methoprene formulation, Altosid® XR-G sand, verified earlier results that this material can provide effective control at lower cost, potentially enabling treatment of 25-33% more acres. We plan to gradually expand our cattail mosquito control program by treating some sites with Altosid XR-G sand, including some sites that have been previously treated with Altosid pellets.

Catch basins are currently treated with Altosid pellets, which provide only four weeks of consistent control and thus requires repeated applications over the entire season. A primary goal of tests in 2007 was to find a longer lasting material. We tested three control materials and found Fourstar™ briquets [active ingredient (AI) = *Bti and B. sphaericus*] and Valent BioSciences' *Bti* "donuts" controlled WNV vectors for at least five weeks. Efficacy of Altosid XR briquets was inconsistent. We plan further tests in 2008 to try to achieve six-week control which could lead to two treatments per season in 2009, a 33% reduction of work compared to the current operational strategy

Adulticide research in 2007 included evaluating two alternatives to current materials. One was a water-compatible pyrethroid formulation called Onslaught™ that is microencapsulated, which should limit material penetration of foliage and thereby minimize potential risk to non-target organisms in treated areas. Both permethrin and Onslaught applied as barrier treatments significantly suppressed mosquitoes compared to the untreated control for at least one week (83-85% control two days after treatment, 70-84% control seven days after treatment), in the one test completed (further testing is planned for 2008). The other material, Pyrocide®, a natural pyrethrum product that can be used in agricultural areas (unlike resmethrin or sumithrin), achieved good control in three tests including consistent suppression of *Culex* mosquitoes.

Black Fly Program – MMCD maintained its ongoing larval and adult surveillance levels for control of black flies (biting gnats) in 2007. The amount of *Bti* used was well below average in 2007 as it was in 2006 due to below average discharge levels observed on the Rum, Mississippi, Minnesota, Crow, and South Fork Crow rivers.

Field samples for the Mississippi River non-target invertebrate monitoring program were collected in 2007. Processing of these samples, which includes taxonomic identification, will be conducted throughout 2008.

Data Management and Public Information – As recommended by the Technical Advisory Board at its 2007 meeting, MMCD has continued to explore new applications of information technology to improve District programs. The field data input and management system developed over the last several years, linked with our digital mapping, has provided the ability to transfer scheduled treatment site boundaries to GPS guidance units in the helicopters, and review treatments recorded. The Ag-Nav® guidance and tracking system installed by our helicopter contractor in each aircraft was used throughout 2007, and many improvements in software and procedures made.

Daily field data and maps for larval mosquito treatments were also set up in a publicly-available web site which received steady use throughout the summer. Reports from previous research, including nontarget studies on larval controls and adult controls, were presented at both professional meetings and on the web, and web downloads of reports continues to increase from previous years. Calls from the public requesting service again generally reflected the decline in mosquito populations seen in MMCD's regular surveillance. District staff continued to provide educational materials and presentations to local schools.

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Chapter 1 *Mosquito Surveillance*

2007 Highlights

- Record high temps in March created heavy snow melt, resulting in an early spring mosquito brood
- Drought conditions existed for most of the season
- Rainstorms produced only 5 broods of mosquitoes
- The major mosquito peak occurred in September
- Staff identified 18,002 larval samples
- First occurrence of *Aedes japonicus* in Minnesota

2008 Plans

- Continue *Aedes* surveillance strategies as in 2007
- Re-evaluate placements of both CO_2 traps and gravid traps
- Work to improve *Culex* larval and adult surveillance strategies
- Continue to improve relay of surveillance results from lab to field

2007 Mosquito Surveillance Results

Background

The MMCD conducts larval and adult mosquito surveillance to determine levels of mosquitoes present, measure annoyance, and to detect the presence of disease vector species. Since different species of mosquitoes have different habits and habitat preferences, a variety of surveillance methods are used. Knowing what species are present in an area, and at what levels, helps the District direct its control measures effectively.

Rainfall

Rainfall surveillance is an important tool used to estimate the amount of larval breeding and to determine the areas to dispatch work crews following a rain event. The District operates a network of 79 rain gauges from May to September. The Minnesota Department of Natural Resources (MnDNR) also uses this information to augment their rain gauge network.

Average rainfall in the District from May 1 through September 30, 2007 was 17.83 inches (Table 1.1). This is 0.82 inches less than last year and 1.72 inches below the 49-year District average. The eastern counties of Washington and Dakota received the most rain.

Warm temperatures in early March melted the snow from storms in February, producing a brood of spring mosquito species. March had record high temperatures, followed by cool weather, which prolonged larval development and allowed more time to apply control materials. Typically, a rain event $\geq$ 1 inch can produce a brood of floodwater mosquitoes. There were five major District-wide broods in 2007 (Figure 1.1). April had average temperatures and not much rain. May, June, and July were warmer than usual with below average rainfall that produced only one District-wide brood. August was the wettest on record in the Twin Cities, bringing relief from the heat and drought. There were two major broods in August and two in September that kept us busy later in the season than usual. Mosquito surveillance was extended to monitor the results of the late-season broods.

Table 1.1 Average rainfall received in each county from May through September, 2003-2007 and 49-year District average

	Anoka	Carver	Dakota	Hennepin	Ramsey	Scott	Wash.	District
2003	17.30	14.15	14.72	17.59	18.07	13.34	18.00	16.79
2004	20.26	25.22	21.89	22.18	20.73	23.50	20.62	21.65
2005	22.20	22.75	21.53	22.75	23.00	24.25	23.87	23.60
2006	19.78	17.90	17.46	18.71	19.06	19.50	17.21	18.65
2007	16.01	17.26	20.89	17.92	16.93	16.58	19.02	17.83
49-Year Avg	19.01	*20.36	19.83	19.75	19.93	19.42	20.18	19.55

*25-year average

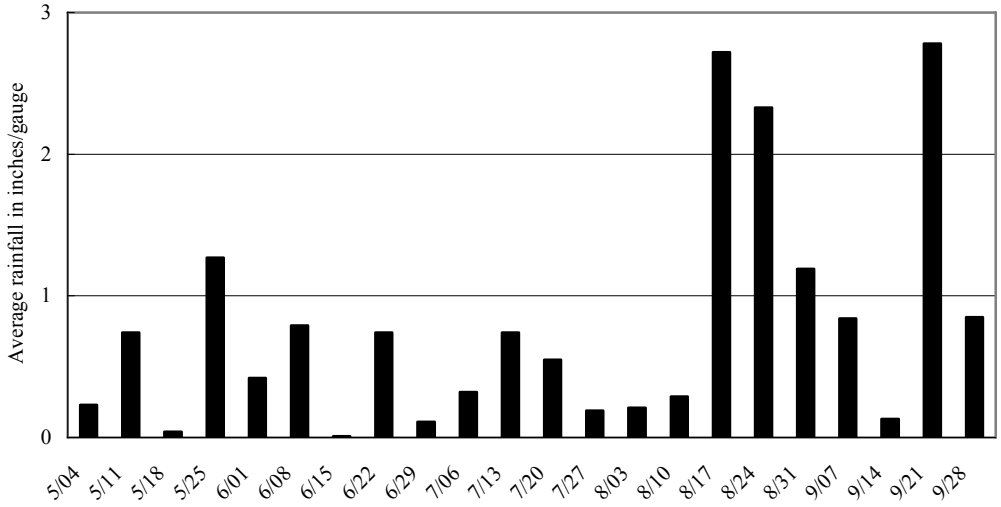


Figure 1.1 Average rainfall per gauge per week, 2007.

Larval Collections

Larval mosquito collections are taken to determine if targeted species are present at threshold levels or to obtain species history in a breeding site. In 2007, staff identified 18,002 larval collections. To accelerate the identification of samples from sites to be treated by helicopter, *Culex* larvae were identified to species, but all other larvae were identified to genus only. Lower priority samples were identified to species. Table 1.2 shows the results of the 11,679 samples identified to species and calculated as the percent of samples in which the species was present.

Table 1.2 Percent of samples where larval species occurred in natural and man-made larval habitats by facility and District total, 2007; the total number of samples processed to species is in parentheses

	Percent of samples where species occurred by facility							
Species	North (1,060)	East (2,046)	South Rosemount (2,770)	South Jordan (1,647)	West Plymouth (2,767)	West Maple Grove (1,056)	Main Office (333)	District (11,679)
Aedes abserratus	1.2	0.5	0.5	0.8	0.5	0.4		0.6
aurifer	<			<				<
canadensis	0.7	0.7	0.4	1.2	0.3	0.5		0.5
cinereus	7.9	7.4	3.0	9.7	7.3	9.8		6.7
dianteus		<						<
dorsalis		0.1	<	0.4	0.1			0.1
excrucians	13.3	19.0	6.0	7.1	8.5	10.0		9.9
fitchii	5.3	5.9	3.3	1.3	1.7	2.6		3.1
implicatus	0.9	1.1	0.7	0.5	1.4	0.9		0.9
nigromaculis		<	<					<
punctor	0.4	4.3	0.1	0.2	0.4	0.3		1.0
riparius	0.9	0.5	0.4	1.6	1.3	2.4		1.0
sticticus	0.2	<	0.9	0.2	0.4	0.3		0.4
stimulans	7.3	13.0	9.8	9.8	16.7	9.8		11.5
provocans		0.9	<	<	<			0.2
triseriatus		0.2	0.6		0.2		0.3	0.2
trivittatus	0.4	2.2	1.3	1.8	1.7	0.4		1.4
vexans	37.6	36.3	28.7	31.1	29.5	22.9	0.9	30.0
Ae. species	16.7	16.1	12.9	12.3	14.8	16.7		14.1
Anopheles earlei	0.2	<	<	<	<	<		<
punctipennis	3.1	0.7	1.3	0.4	0.5	<	0.9	0.9
quadrimaculatus	1.1	0.7	0.6	0.8	<	<		0.5
walkeri	<	0.1			<			<
An. species	10.8	2.0	3.9	3.0	2.0	0.6	1.5	3.2
Culex pipiens	3.6	4.2	12.3	3.2	5.0	11.2	45.0	7.9
restuans	18.0	16.1	38.5	15.2	32.0	19.3	85.6	27.5
salinarius	0.4	0.3	0.9	0.8	0.5	0.5	0.9	0.6
tarsalis	7.4	3.5	8.2	8.0	3.8	5.9	2.7	5.8
territans	20.4	15.5	20.5	20.3	11.9	17.1	1.5	16.7
Cx. species	6.1	3.2	15.5	6.4	8.1	7.5	69.7	10.3
Culiseta inornata	8.2	13.3	14.2	16.9	12.0	11.9	1.2	12.8
melanura								
minnesotae	<	0.9	0.4	0.2	0.9	1.1	0.3	0.6
morsitans						<		<
Cs. species	0.6	1.3	0.4	0.7	0.7	2.0		0.8
Psorophora ferox					0.2			<
Ps. species		<	<		0.1			<
Uranotaenia sapphirina	3.8	3.2	2.3	2.8	0.7	1.9		2.2

< = percent of total is less than 0.1%

This season, Technical Services hired three seasonal Inspectors, based at the Main Office, to treat and inspect storm water catch basins in St. Paul that are normally the responsibility of other field facilities. This allowed those facilities more time to perform other duties and also provided an opportunity for more intensive catch basin sampling to be completed. Sample results are included in Table 1.2.

The floodwater species, *Ae. vexans,* was the most abundant species in larval collections. The spring species, *Aedes stimulans* and *Aedes excrucians* came in fifth and sixth place. With the dry weather this season, there was more opportunity to sample *Culex* breeding habitats, both natural and man made. This resulted in higher than usual percentages of *Culex* in larval samples. *Culex restuans*, which prefers to bite birds, was the second most common species overall. *Culex territans* prefers cold-blooded hosts and ended up in third place. The typically non-human biting species, *Culiseta inornata*, had the fourth highest frequency overall. *Culex tarsalis* larvae occurred in 5.8% of the samples, ranking eighth. The high amount of "*Aedes* species" and "*Culex* species" is normal and represents 1st instar larvae that are unidentifiable to species.

The most exciting event in the Technical Services Lab this season was the identification of the first *Ae. japonicus* larvae in Minnesota. The larvae were reared from eggs collected in an ovitrap in Scott County. *Aedes albopictus* larvae were also identified from ovitrap samples for the third consecutive year. Since these larvae were not collected using standard dipper methods, they are not listed in Table 1.2.

The number of larval collections taken is usually related to the amount of rainfall. The data for the past 50 years shows a time span when this was not true (Figure 1.2). Most larval samples are taken from air sites prior to treatment to confirm the presence of targeted species at threshold levels. In the years from 1975 to the early 1990s, we used pre-hatch control materials in air sites, reducing the need to sample prior to treatment. Dursban® and Abate® were used from 1975-1983, and were subsequently replaced with methoprene briquets and *Bti* in 1984. In 1990, sampling prior to treatment.

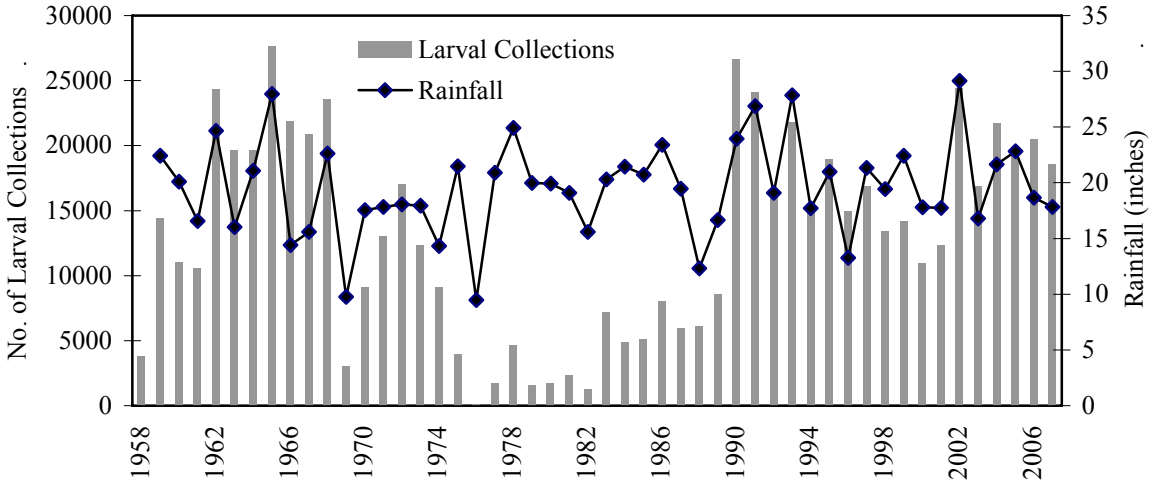


Figure 1.2 Number of larval collections and average rainfall amounts, 1958-2007.

Adult Collections

There are 50 species of mosquitoes known to occur in Minnesota and different species exhibit a variety of host preferences. About 45 of these species, 20 of which are human biting, occur in the District. Other species prefer to feed on birds, large mammals, reptiles, or amphibians. Additionally, species of mosquitoes differ in their peak activity periods and in how strongly they are attracted to humans or trap baits (e.g., light or CO_2). Therefore, a variety of adult mosquito collection methods are used in order to capture targeted species.

Most of the mosquitoes collected are identified to species, but in some cases, species are grouped together to expedite sample processing. *Aedes* mosquitoes can be grouped by their seasonal occurrence (spring, summer). Some vector species are grouped because species-level separation is very difficult (*Cx. pipiens/restuans*).

Spring *Aedes* larvae hatch as a result of snow melt and adults emerge in late April to early May. They have one generation each season and adults can live for three months. The summer *Aedes* (*Ae. vexans, Aedes sticticus, Aedes trivittatus*) begin hatching in early May as a result of rainfall. They can have several generations throughout the summer. *Coquillettidia perturbans*, develop in cattail marshes, has one generation per year, and populations peak in early July. Appendix A provides more detailed descriptions of the District's mosquito fauna.

The sweep net and CO_2 trap data reported in this chapter are weekly collections referred to as the Monday night network. Employees took 2-minute sweep net collections and/or set overnight CO_2 traps in their yards every Monday night for 21 weeks.

Sweep Net Collections The District uses sweep net collections to monitor human annoyance during the peak mosquito activity period, which is 35-40 min after sunset for most mosquito species. The number of collectors varied from 72-153 per evening. Sweep net collection locations in 2007 are shown in Figure 1.3.

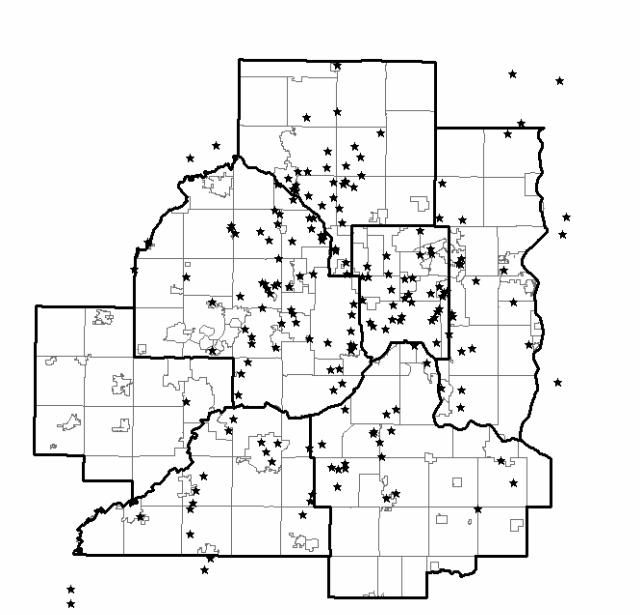


Figure 1.3 Locations of weekly evening sweep net collections, 2007.

A total of 2,403 collections were taken containing a total of 1,242 mosquitoes. Summer *Aedes* species and *Cq. perturbans* tied for the predominant species in the evening sweep net collections (Table 1.3). Summer *Aedes* were at their lowest levels in five years and spring *Aedes* levels were also very low. *Culex tarsalis* is uncommon in sweep net collections and this is reflected in their very low abundance.

Table 1.3 Average number of mosquitoes collected per evening sweep net collection within the District, 2003-2007

Year	Summer *Aedes*	*Cq. perturbans*	Spring *Aedes*	*Cx. tarsalis*
2003	4.7	0.8	0.2	0.01
2004	3.4	0.3	0.02	0.01
2005	1.1	0.3	0.04	0.01
2006	0.3	0.3	0.03	0.004
2007	0.2	0.1	0.1	0.01

CO_2 Trap Collections CO_2 traps baited with dry ice are used to monitor mosquito population levels and the presence of disease vector species. In 2007, staff operated 131 traps to allow maximum coverage of the District. Some of these traps were placed in specific locations to collect the vector species *Cx. tarsalis* for WNV testing and *Culiseta melanura* for eastern equine encephalitis (EEE) testing (Figure 1.4). The number of traps operated per night varied from 109-123. A total of 2,491 trap collections were processed, containing 246,497 mosquitoes.

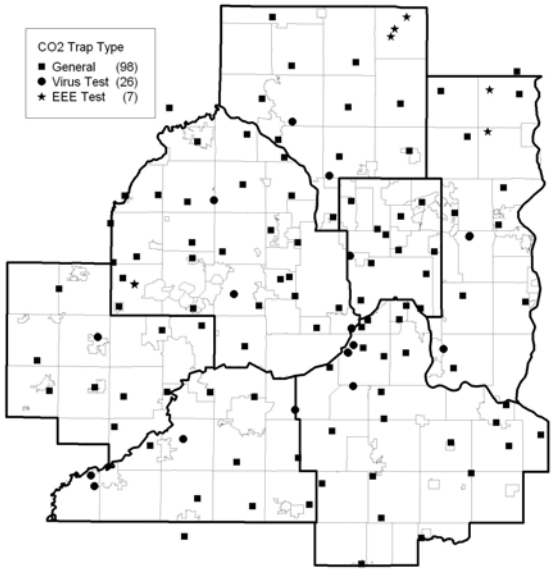


Figure 1.4 Locations of CO_2 traps to monitor general mosquito populations, WNV vectors and the EEE vector, 2007.

Summer *Aedes* were the predominant species captured in the traps this season and were the lowest of the past 5 years (Table 1.4). *Coquillettidia perturbans* is in second place with populations also the lowest of the past five years. The spring *Aedes* remained elevated this

season due to record high temperatures in March and the resulting heavy snow melt. *Culex tarsalis* numbers were quite high this season and are discussed later in this chapter.

Table 1.4 Average numbers of mosquitoes collected in CO_2 traps within the District, 2003-2007

Year	Summer *Aedes*	*Cq. perturbans*	Spring *Aedes*	*Cx. tarsalis*
2003	457.8	103.7	6.9	1.2
2004	391.9	35.3	1.5	2.3
2005	201.5	42.0	6.9	1.6
2006	51.7	75.8	10.2	1.5
2007	43.7	31.9	10.2	5.2

Geographic Distribution The geographic distribution of mosquitoes collected in sweep nets (Figure 1.5) and CO_2 traps (Figure 1.6) indicates tolerable levels of annoyance in the interior areas of the District throughout the season. Most of the higher populations were near the District boundaries. Collections on September 4 were moderately high District-wide, displaying the results of heavy rains in August.

Seasonal Distribution Sweep net and CO_2 trap collections detected one major peak of *Aedes* mosquitoes in 2007 (Figures 1.7 and 1.8). The occurrence of a major peak in September is very rare, but it reflects the unusually high rainfall amounts in August. Populations of *Cq. perturbans* peaked late June.

CO_2 trap, New Jersey light trap, and sweep net sampling

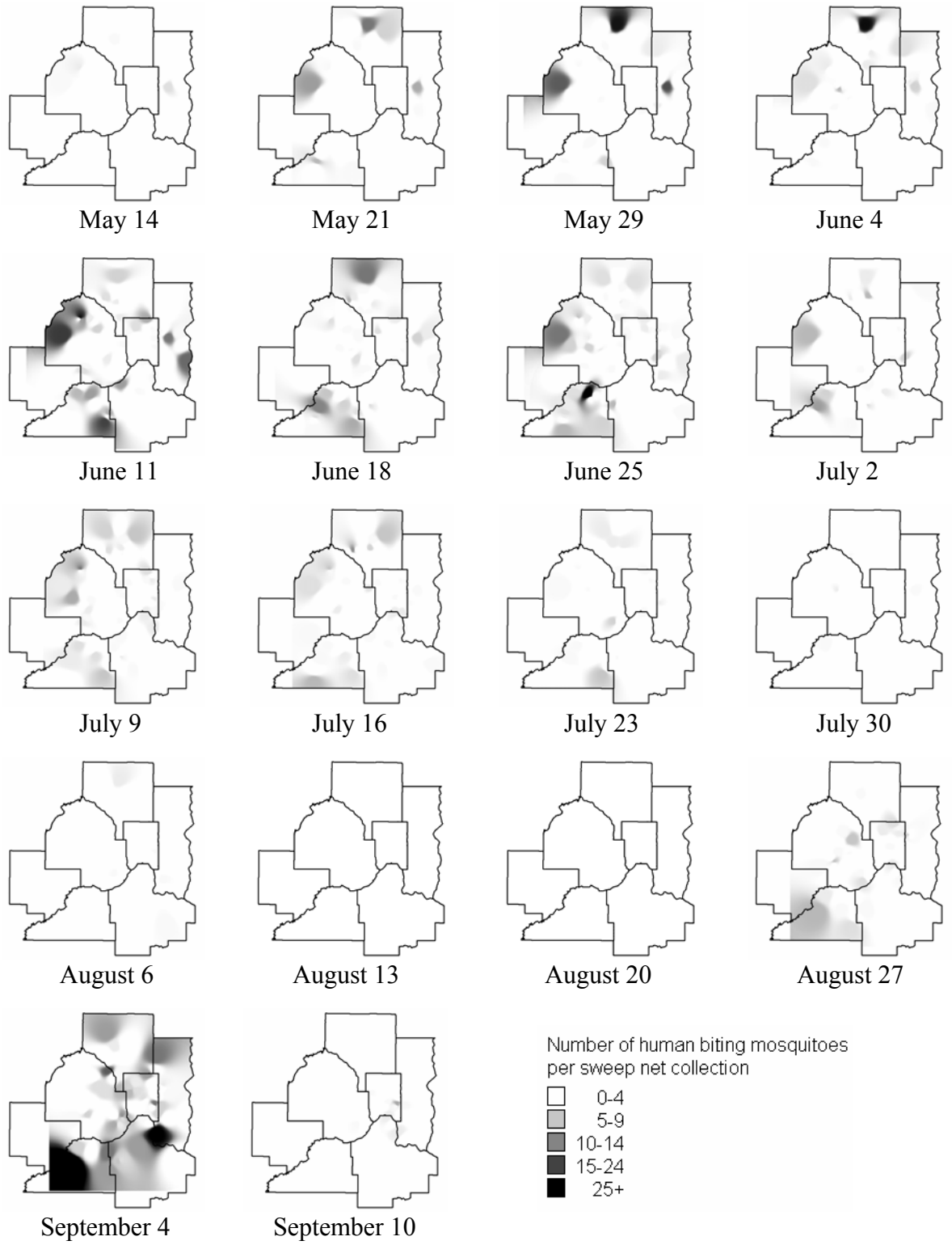


Figure 1.5 Number of human-biting mosquitoes in District sweep net collections, 2007. The grid surface represents varying number of sweep collections sampled each week, ranging from 72-153 collections.

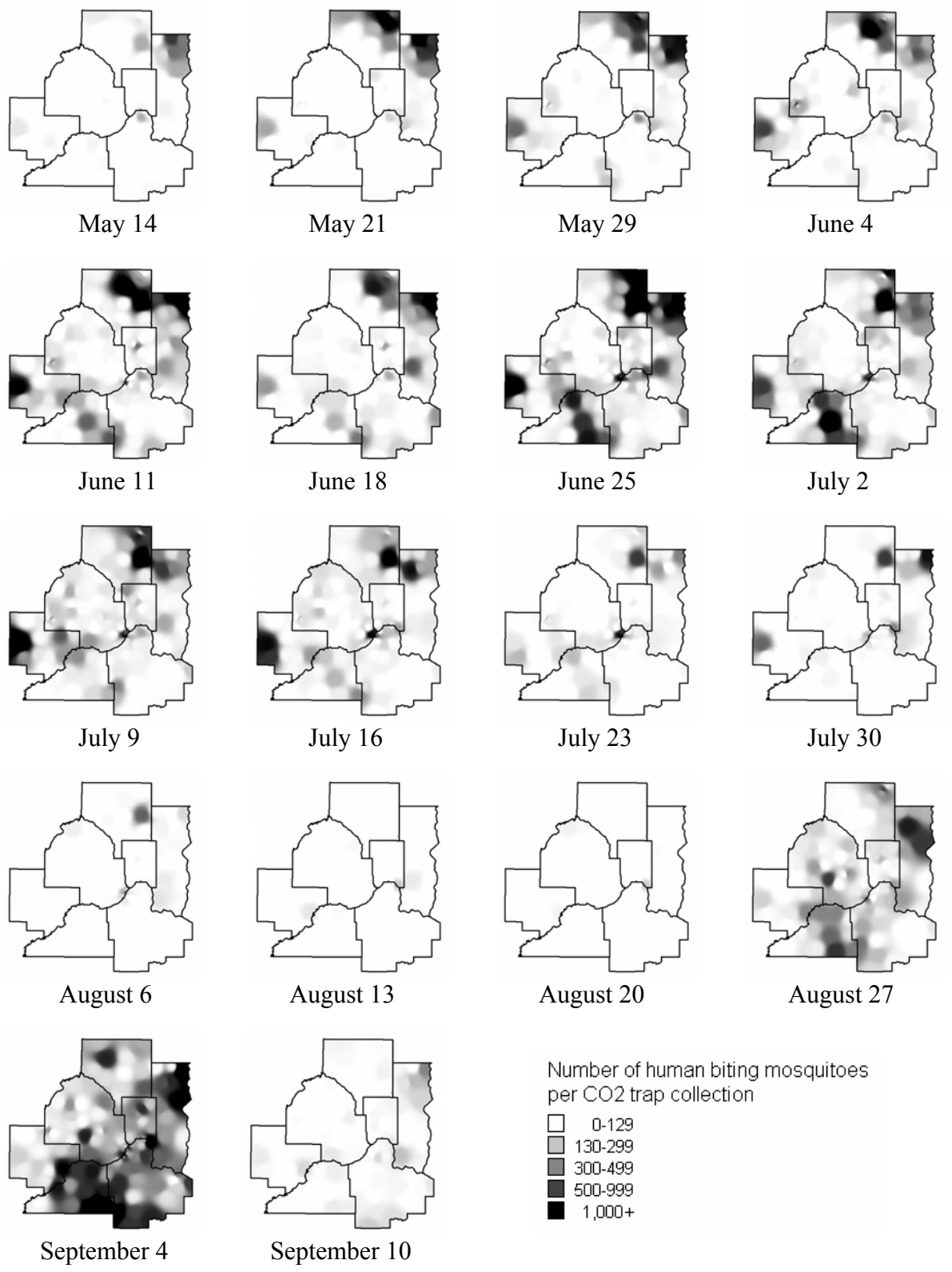


Figure 1.6 Number of human-biting mosquitoes in District CO_2 trap collections, 2007. The number of traps operated per night varied from 109-123.

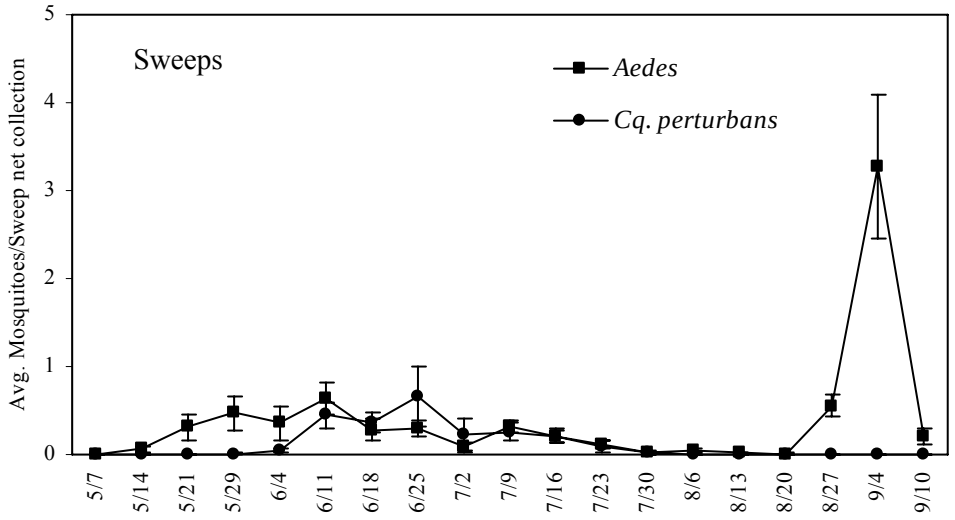


Figure 1.7 Average numbers of *Aedes* and *Cq. perturbans* per evening sweep net collection, 2007. Error bars equal ± 1 standard error of the mean.

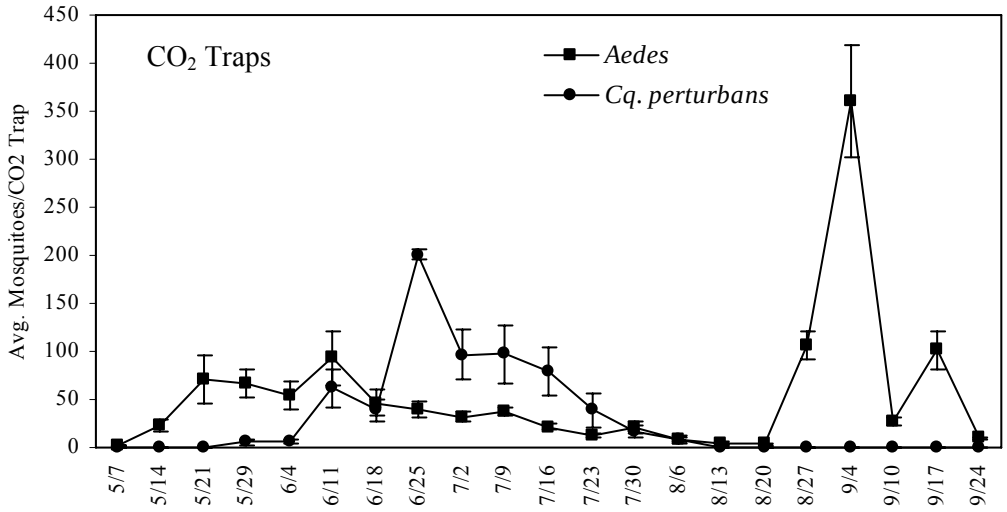


Figure 1.8 Average numbers of *Aedes* and *Cq. perturbans* per CO_2 trap, 2007. Error bars equal ± 1 standard error of the mean.

New Jersey Light Traps Data collected from New Jersey light traps are used to compare mosquito species population levels from year to year. These are the only collections where all adult female mosquitoes are identified to species. Traps are run nightly from May to September. The District operated 6 traps in 2007. Trap 1 was located in St. Paul, trap 9 in Lake Elmo, trap 13 in Jordan, trap 16 in Lino Lakes, trap CA1 in Carlos Avery Wildlife Refuge, and trap AV at the Minnesota Zoo in Apple Valley (Figure 1.9). Traps 1, 9, and 16 have operated each year since 1960.

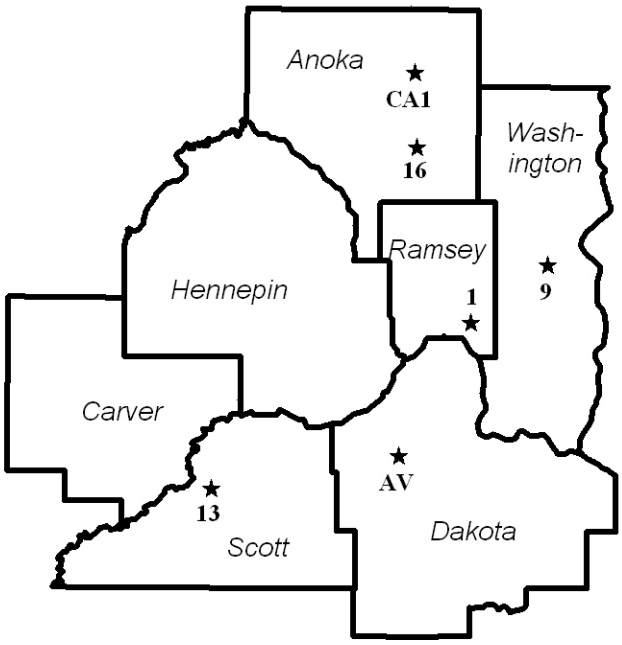


Figure 1.9 New Jersey light trap locations, 2007.

Due to mechanical and operator errors, the data for the AV trap location was not included in this summary. The most numerous species collected in New Jersey traps this season was *Cq. perturbans*, with *Ae. vexans* coming in second (Table 1.5). Typically, *Ae. vexans* is the number one pest, but prevailing drought conditions this season kept the populations very low. In third place was the spring species combination of *Ae. abserratus* and *Ae. punctor*. These two species are combined together because they are morphologically very similar and thus difficult to identify separately to species. *Aedes cinereus* was the fourth most common species, occurring in both spring and summer.

Anopheles quadrimaculatus and *Culex erraticus* are two species that are considered rare in the District. In recent years, they have been collected in traps more frequently. *Culex erraticus* were first found in 1988 and have occurred sporadically since then in low numbers (Figure 1.10). *Anopheles quadrimaculatus* occurred in the early years, were absent for a long span of years, then began appearing again in 1988. In 2007, there was an especially large peak in the number collected. We are investigating the reasons for this change in occurrence. It may be a result of changing weather patterns that have allowed this species to expand its range.

Table 1.5 Total numbers and frequency of occurrence for each species collected in New Jersey light traps, May 5-September 21, 2007

	Trap Code, Location, and Number of Collections					Summary Statistics		
	1	9	13	16	CA1	Season		
	St. Paul	Lk. Elmo	Jordan	Lino Lakes	Carlos	Total	% Female	Avg per
Species	140	138	137	139	135	689	Total	Night
1. Ae. abserratus	0	0	0	1	362	363	0.89%	0.53
3. aurifer	0	0	0	0	0	0	0.00%	0.00
6. canadensis	0	0	0	0	4	4	0.01%	0.01
7. cinereus	3	21	8	116	1,331	1,479	3.61%	2.15
10. dorsalis	0	0	1	1	0	2	0.00%	0.00
11. excrucians	0	13	0	1	233	247	0.60%	0.36
12. fitchii	0	2	0	0	8	10	0.02%	0.01
13. flavescens	0	0	0	0	0	0	0.00%	0.00
14. implicatus	0	0	0	0	0	0	0.00%	0.00
16. nigromaculus	0	0	0	2	0	2	0.00%	0.00
18. punctor	0	0	0	1	195	196	0.48%	0.28
19. riparius	0	0	0	0	6	6	0.01%	0.01
20. spenceri	0	0	0	0	0	0	0.00%	0.00
21. sticticus	0	0	5	0	1	6	0.01%	0.01
22. stimulans	0	11	0	0	8	19	0.05%	0.03
23. provocans	0	0	0	0	1	1	0.00%	0.00
24. triseriatus	1	2	0	0	0	3	0.01%	0.00
25. trivittatus	1	3	0	0	1	5	0.01%	0.01
26. vexans	1,086	1,030	403	2,270	3,957	8,746	21.34%	12.69
118. abs/punct.	2	2	1	8	2,901	2,914	7.11%	4.23
261. species	32	22	8	46	355	463	1.13%	0.67
262. Spring *Aedes*	1	7	0	71	419	498	1.22%	0.72
264. Summer *Aedes*	0	0	0	0	0	0	0.00%	0.00
27. An. barberi	0	0	0	0	0	0	0.00%	0.00
28. earlei	0	0	0	1	17	18	0.04%	0.03
29. punctipennis	7	19	11	8	82	127	0.31%	0.18
30. quadrimac.	53	74	39	68	164	398	0.97%	0.58
31. walkeri	0	2	85	4	936	1,027	2.51%	1.49
311. An. species	12	14	18	19	175	238	0.58%	0.35
32. Cx. erraticus	0	0	0	0	0	0	0.00%	0.00
33. pipiens	0	0	1	0	0	1	0.00%	0.00
34. restuans	24	48	6	69	86	233	0.57%	0.34
35. salinarius	3	1	5	32	9	50	0.12%	0.07
36. tarsalis	27	17	20	78	33	175	0.43%	0.25
37. territans	5	18	3	11	8	45	0.11%	0.07
371. Cx. species	27	10	5	26	58	126	0.31%	0.18
372. Cx. pip/rest	66	89	13	71	253	492	1.20%	0.71
38. Cs. inornata	52	78	16	68	283	497	1.21%	0.72
39. melanura	0	0	0	0	0	0	0.00%	0.00
40. minnesotae	1	2	1	12	31	47	0.11%	0.07
41. morsitans	1	2	0	3	6	12	0.03%	0.02
411. Cs. species	0	0	1	3	22	26	0.06%	0.04
42. Cq. perturbans	128	26	61	308	21,550	22,073	53.86%	32.04
44. Ps. ciliata	0	0	0	0	0	0	0.00%	0.00
47. horrida	0	0	0	0	0	0	0.00%	0.00
471. Ps. species	0	0	0	0	0	0	0.00%	0.00
48. Ur. sapphirina	25	173	28	11	37	274	0.67%	0.40
501. Unident.	11	5	2	3	139	160	0.39%	0.23
Female Total	1,568	1,691	741	3,312	33,725	40,983	74.12%	59.48
Male Total	551	1,513	334	2,544	9,368	14,310	25.88%	20.77
Grand Total	2,119	3,204	1,075	5,856	43,093	55,293	100.00%	80.25

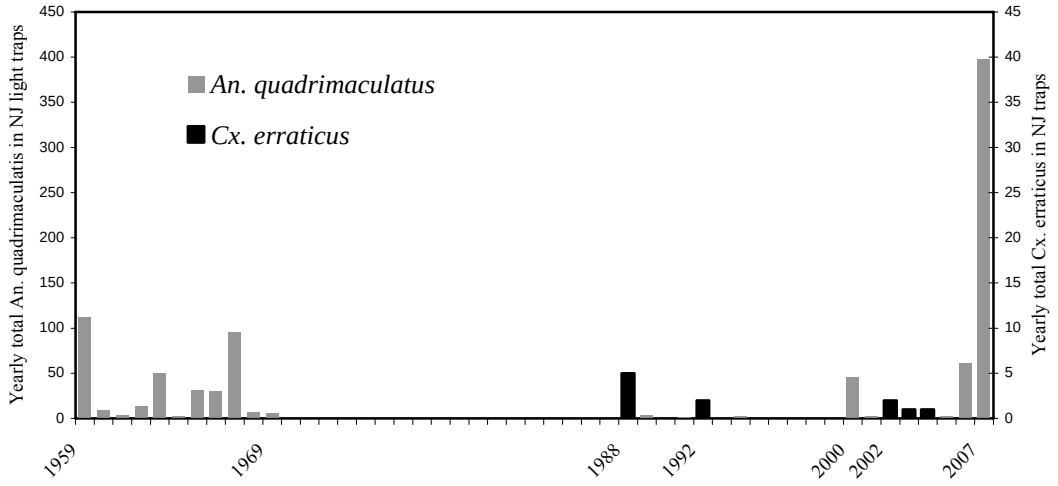


Figure 1.10 Totals of *Anopheles quadrimaculatus* and *Culex erraticus* in New Jersey light traps, 1958-2007.

Vector Mosquito Surveillance

Aedes triseriatus Aspirator surveillance for the La Crosse encephalitis vector, *Aedes triseriatus,* began during the week of May 20. The peak rate of capture of just over 0.7 *Ae. triseriatus* per sample occurred during the week of June 17 (Figure 1.11). A second consecutive summer of drought resulted in extremely low rates of capture throughout the season.

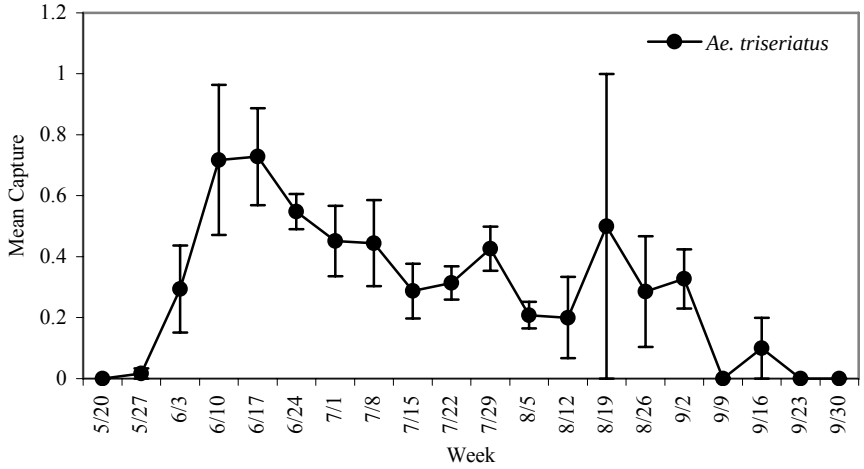


Figure 1.11 Mean number of *Ae. triseriatus* adults in aspirator samples, plotted by week. Dates listed are the first sampling day of each week. Sites sampled varied by week, although several locations were monitored repeatedly during the season. Error bars equal ± 1 standard error of the mean.

Culiseta melanura District staff monitored six locations for *Cs. melanura* using seven CO_2 traps. Three of the sites are located in Anoka County, two in Washington County and one site in Hennepin County. The Hennepin County location had a ground level trap and a canopy level trap. *Culiseta melanura* have been collected from each of the locations in the past. In addition, 106 aspirator samples were collected from wooded habitats surrounding potential *Cs. melanura* larval habitat (i.e., tamarack bogs).

Culiseta melanura adults were collected in CO_2 traps at both of the Washington County sites, one Anoka County site, and at the Hennepin County site. Aspirator sampling did not capture *Cs. melanura* specimens in 2007.

The rate of *Cs. melanura* capture by CO_2 traps was low in 2007. The species was collected by CO_2 traps in late May through mid-June and again in late July through the end of the season (Figure 1.12). As in 2006, hot, dry conditions may have suppressed the mid-summer population below detectable levels.

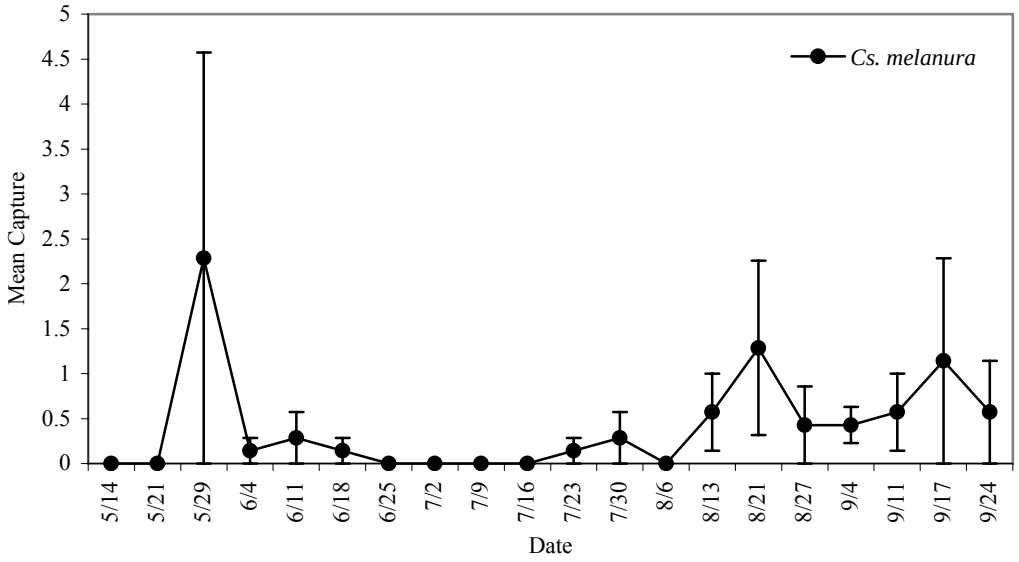


Figure 1.12 Mean number of *Cs. melanura* adults in CO_2 trap samples, plotted by week. Error bars equal ± 1 standard error of the mean.

***Culex* Surveillance** *Culex* species are important for the amplification and transmission of West Nile virus (WNV) and western equine encephalitis virus (WEE) in our area. In addition to CO_2 traps, gravid traps are used to monitor *Culex* adults. The gravid trap is designed to attract female mosquitoes that are seeking oviposition sites while the CO_2 trap is used for collecting female mosquitoes in their host-seeking phase. The District operated 131 CO_2 traps and 35 gravid traps in 2007.

Culex tarsalis has been identified as the most likely vector of WNV to humans in our area. All of the *Cx. tarsalis* captured in aspirator samples, Monday night sweeps, Monday night CO_2 traps, and gravid traps were tested for WNV (see Chapter 2, Table 2.2). As is typical, very few *Cx.*

tarsalis were collected by gravid trap in 2007. There were two occasions when Monday collections by CO_2 trap were unusually high, May 21 with a mean capture of 33.98 and July 30 at 20.92 per trap (Figure 1.13). On August 2, there was also a record high *Cx. tarsalis* collection for a single CO_2 trap in the District, 3,008.

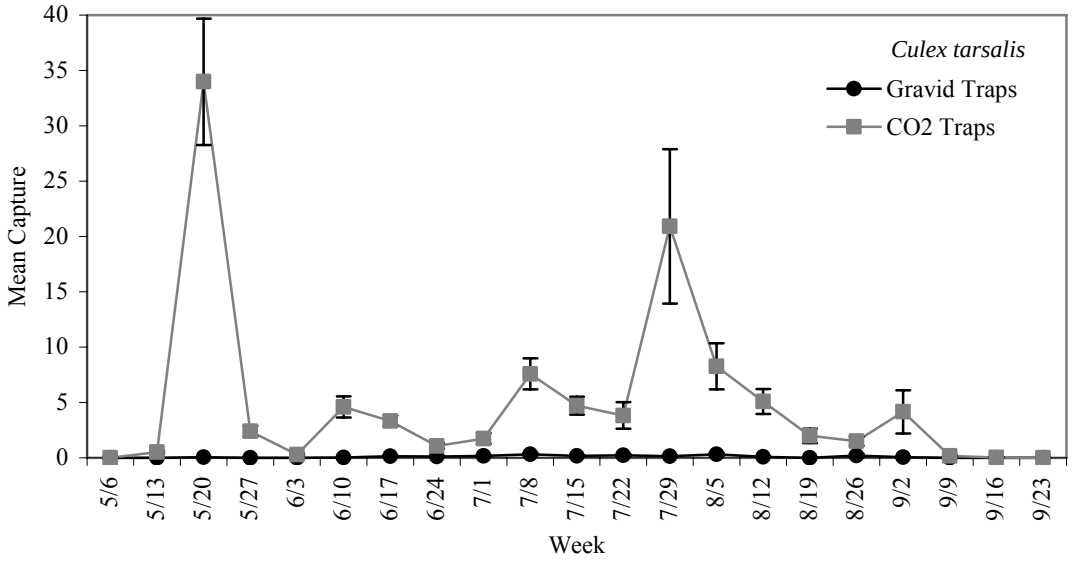


Figure 1.13 Average numbers of *Cx. tarsalis* in CO_2 traps and gravid traps, 2007. Error bars equal ± 1 standard error of the mean.

Culex restuans is another important vector of WNV in Minnesota. The species appears to be largely responsible for the early season amplification of the virus and possibly for season-long maintenance of the WNV cycle. *Culex restuans* collected in CO_2 traps were highest during the last two weeks of May (Figure 1.14). Collections by CO_2 trap were low for the rest of the season. Gravid trap collections of *Cx. restuans* reflected the May peak observed in CO_2 traps with elevated captures late May and early June. Unlike observations from CO_2 traps, the peak collection from the gravid trap network occurred during the first week of July and captures remained high through early August.

Culex pipiens has been an important vector of WNV in much of the United States. The species prefers warmer temperatures than *Cx. restuans*; therefore, populations of *Cx. pipiens* in the District tend to peak late in the summer when temperatures are typically warmer. Collections of *Cx. pipiens* were low in CO_2 traps (Figure 1.15). Mid-summer gravid trap collections were higher than observed in previous seasons. This coincided with the height of the 2007 drought. The season peak gravid trap collection occurred during the week of July 29 which is a month earlier than observed in 2006. Gravid trap captures fell in August as cooler, wet weather prevailed.

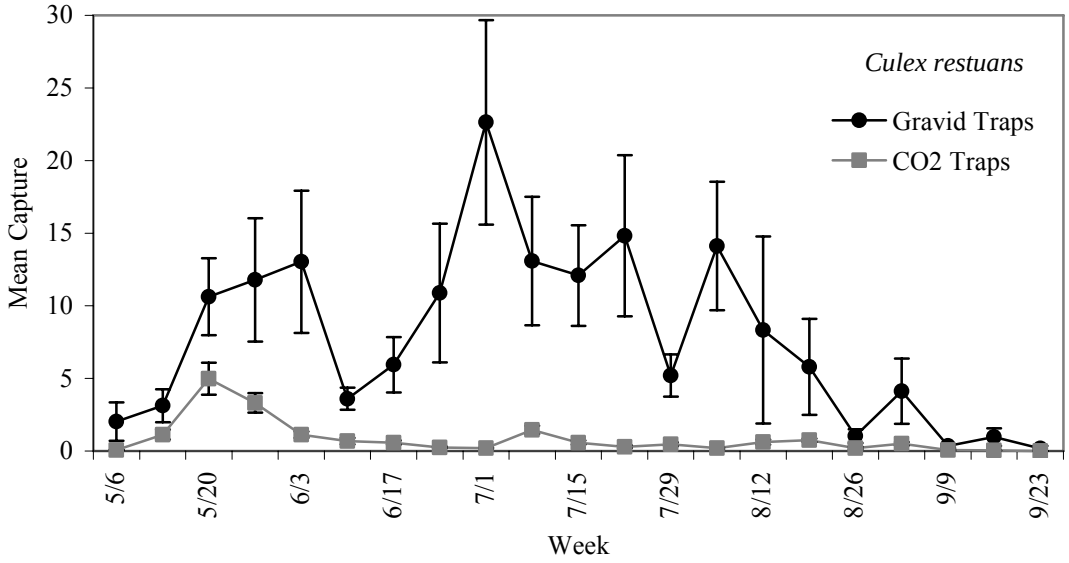


Figure 1.14 Average numbers of *Cx. restuans* in CO_2 traps and gravid traps, 2007. Error bars equal ± 1 standard error of the mean.

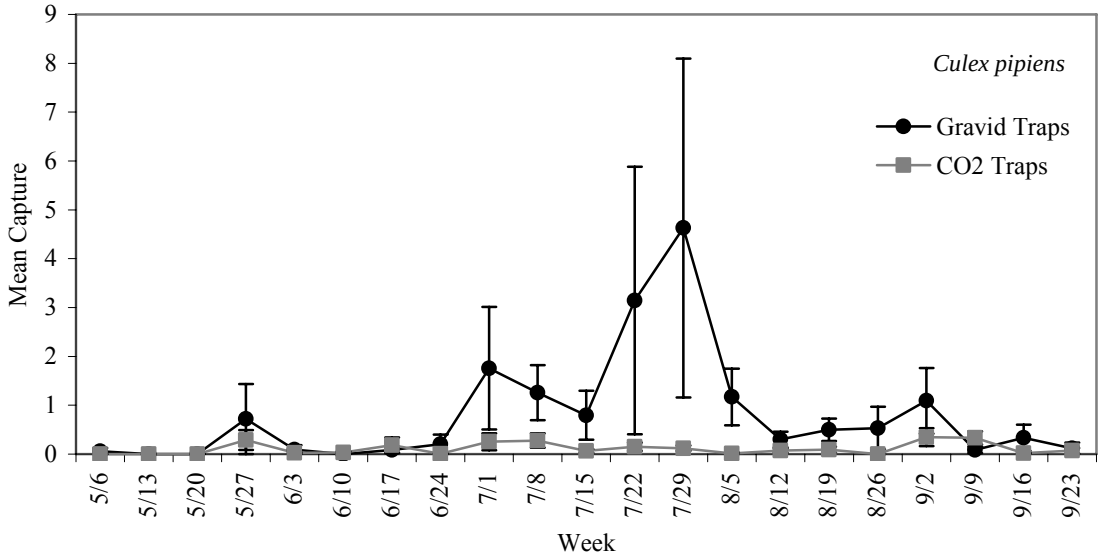


Figure 1.15 Average numbers of *Cx. pipiens* in CO_2 traps and gravid traps, 2007. Error bars equal ± 1 standard error of the mean.

In the interest of reducing time requirements and also to help reduce testing costs, we altered our process for pooling *Culex* mosquito samples for viral analysis in 2007. More samples tested for WNV consisted of mixed pools of *Culex* species than in previous years. These were identified as either *Cx. pipiens/restuans* or as *Culex* species. Both groups likely consisted largely of *Cx. restuans*. When graphed, the patterns of gravid trap collections and CO_2 trap collections for both groups resemble the patterns for *Cx. restuans* collections (Figure 1.16).

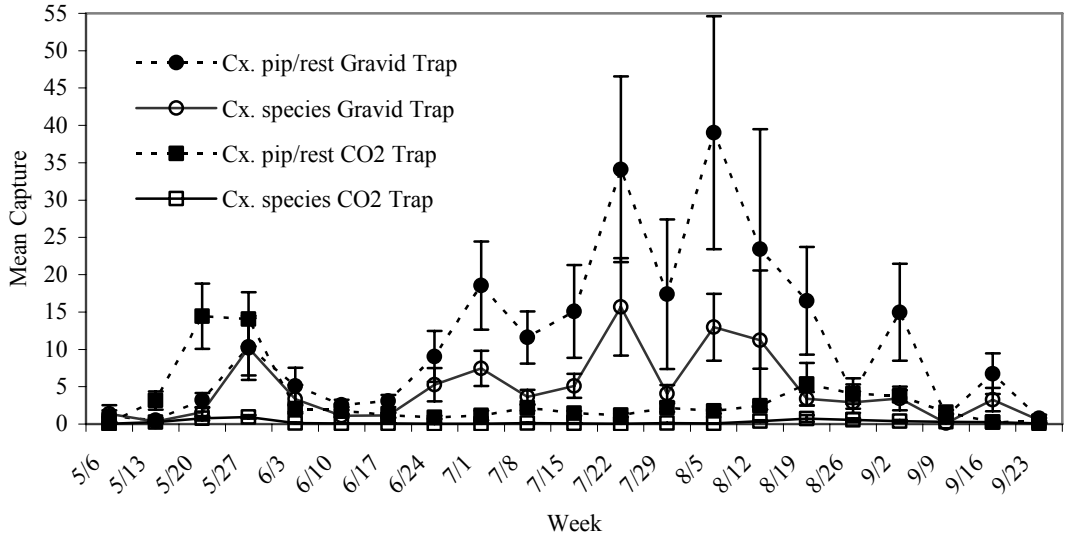


Figure 1.16 Average numbers of *Cx. pipiens/restuans* and *Culex* species in CO_2 traps and gravid traps, 2007. Error bars equal ± 1 standard error of the mean.

Culex salinarius is captured infrequently in the District. During most seasons only a few adults are collected. Although they were not abundant throughout the District, abnormally high numbers of *Cx. salinarius* were observed in 2007, particularly through the Monday night CO_2 trap network (Figure 1.17). Captures increased each week in August and peaked in the first collection of September. Few *Cx. salinarius* were collected by gravid trap in 2007, eight in total; however, the species had not been collected in a District gravid trap since 2004 when a single specimen was captured.

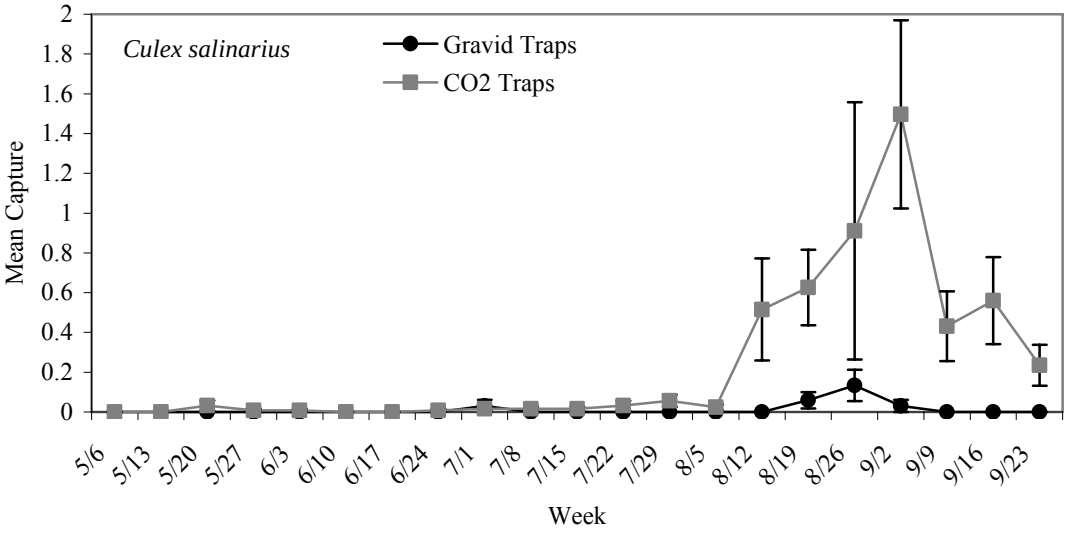


Figure 1.17 Average numbers of *Cx. salinarius* in CO_2 traps and gravid traps, 2007. Error bars equal ± 1 standard error of the mean.

Exotic Species Each season, MMCD staff watches for exotic or introduced mosquito species. MMCD laboratory technicians are trained to recognize exotic species in their adult and larval forms so that the mosquitoes can be spotted in any of the thousands of samples processed each year. In addition, field staff place ovitraps and conduct aspirator surveillance in areas with elevated potential for introduction.

The two exotic species most likely to be found in the District are *Ae. albopictus* and *Ae. japonicus*. Both are native to Asia and both have adapted to survival in tires and other artificial containers. This allows them to be transported over great distances. Both of these species have the potential to transmit disease. *Aedes albopictus* has been established in the continental US since 1985 and is now common in the southeastern states, along the East Coast, as well as in southern portions of the Midwest. *Aedes japonicus* was first identified in the US in 1999 in New Jersey and has now advanced westward beyond the Mississippi River in several locations. Another *Ae. japonicus* introduction occurred in the Seattle area in 2001 and it has since been detected in four counties in Washington and one in Oregon.

For the first time, MMCD's exotic species surveillance detected *Ae. japonicus*. A single ovitrap collected on August 6 near a Scott County tire recycling facility contained *Ae. japonicus* eggs. Of the mosquitoes that hatched and developed to an age when speciation is possible, 13 were *Ae. japonicus*.

Aedes albopictus were collected in the District for the third consecutive year. Larvae were identified from ovitrap samples collected on August 15 and August 28 in Scott County near the same tire recycling facility where *Ae. japonicus* were collected. This was the sixth introduction of *Ae. albopictus* identified in Scott County (1991, 1996, 1999, 2005, 2006) and the seventh in Minnesota (Wright County, 1997).

The initial discoveries of *Ae. japonicus* and *Ae. albopictus* were each made on August 27 this year. Intensive surveillance for both species began on August 28 and continued into October. Crews inspected 351 properties in the area surrounding the tire recycling facility. Three hundred forty-four container habitats were eliminated and 723 were treated with larvicides. The treated containers were primarily tires awaiting grinding at the recycling facility. One hundred thirteen larval samples were collected from container habitats. Eighty-one aspirator samples were collected from surrounding woodlots and two gravid traps were placed outside the recycling facility. There were no *Ae. japonicus* or *Ae. albopictus* larvae or adults collected. One of 63 ovitraps placed following detection of the exotic species contained *Ae. albopictus* eggs. It was placed on September 20 and collected on September 27. This may have been a new, late season, introduction rather than the result of the original 2007 introduction or a subsequent generation since no adults or larvae were collected between the August and September ovitrap detections.

Crews will begin to re-inspect properties surrounding the tire recycling facility in the spring of 2008. Routine ovitrap and aspirator surveillance will begin in mid to late May.

Plans for 2008

The surveillance strategies used in 2008 will continue as in 2007 (i.e., collections using sweep-nets, CO_2 traps, NJ light traps, gravid traps, and aspirators). Staff will however, re-evaluate placements of both CO_2 traps and gravid traps, as well as evaluate the need to sample additional areas. Staff will work to improve *Culex* larval and adult surveillance strategies. District staff will also continue to monitor known introduction sites of *Ae. albopictus* and *Ae. japonicus*. Finally, improvements to the relay of surveillance results from the lab to the field will continue to be made.

Chapter 2 Vector-borne Disease

2007 Highlights

- There were no La Crosse encephalitis cases in the District
- WNV illness confirmed in 101 Minnesotans, 19 are District residents
- WNV detected in 85 District mosquito samples and 21 other samples statewide
- Conducted surveillance projects to evaluate storm water structures as *Culex* larval habitats
- Made 168,314 catch basin treatments
- Collected and recycled 14,499 waste tires
- Most recent study results are from 2006. The season mean was 0.637 *Ixodes scapularis*/mammal - lower than recent elevated averages, but still higher than 1990 - 1999 and 2003
- 2006 human case totals of tick-borne disease remained high, similar to 2005 levels
- There were 914 Lyme disease cases and 177 human granulocytic anaplasmosis cases in 2006. *Source: MDH*
- *I. scapularis* populations appear to have rebounded in 2007 (0.876 preliminary season mean). Fewest number of larval *I. scapularis* since 1998 collected, but 178 *I. scapularis* nymphs –2nd highest nymph total since 1990 (comparable to 2002)
- 1st collection of *Ixodes marxi* since the mid-1990s (not a known Lyme disease transmitter)

Background

District staff provides a variety of disease surveillance and control services, as well as public education, to reduce the risk of mosquito-borne illnesses such as La Crosse encephalitis (LAC), western equine encephalitis (WEE), eastern equine encephalitis (EEE), and West Nile (WNV) encephalitis, as well as tick-borne illnesses such as Lyme disease and human granulocytic anaplasmosis (HGA, formerly ehrlichiosis). Past District efforts have also included determining metro-area risk for infections of Jamestown Canyon virus, babesiosis, Rocky Mountain spotted fever, and Sin Nombre virus (a hantavirus).

La Crosse encephalitis prevention services were initiated in 1987 to identify areas within the District where significant risk of acquiring this disease exists. High-risk areas are defined as having high populations of the primary vector *Aedes triseriatus* (eastern tree-hole mosquito) or history of LAC cases. MMCD targets these areas for intensive control efforts including public education, mosquito breeding site removal, and limited adult mosquito treatments. Additionally, routine surveillance and control activities are conducted at past LAC case sites. Surveillance for the exotic species *Aedes albopictus* (Asian tiger mosquito) and *Aedes japonicus* routinely occurs to detect infestations of these potential disease vectors.

MMCD monitors adult mosquitoes of the species *Culex tarsalis* for presence of WEE, which can cause severe illness in Minnesota horses and humans.

Eastern equine encephalitis was detected for the first time in Minnesota in 2001. Since then, MMCD has conducted surveillance for the enzootic vector, *Culiseta melanura.*

Since the arrival of WNV in Minnesota in 2002, MMCD has investigated a variety of mosquito control procedures to be used to enhance our comprehensive integrated mosquito management strategy for the prevention of West Nile illness. MMCD is involved in statewide and national efforts to monitor WNV and to reduce the risks it poses.

2008 Plans

- Continue to provide surveillance and control for La Crosse encephalitis prevention
- Evaluate control materials in stormwater structures providing *Culex* larval habitat
- Continue catch basin larvicide treatments to manage WNV vectors
- Communicate treatment strategies to other local governments
- Continue surveillance for WNV and other mosquito-borne viruses
- Be watchful for *Ae. albopictus* and *Ae. japonicus*; intensify surveillance at sites of introduction in 2007
- Surveillance at 100 sampling locations for *I. scapularis* will continue
- Continue with tick-borne disease education, tick identifications, and homeowner consultations
- Target education activities to specific metro townships based on higher human case totals and/or numbers of *I. scapularis* collected

In 1989, the District was mandated by the state legislature "*to consult and cooperate with the MDH in developing management techniques to control disease vectoring ticks*." The District responded by beginning tick surveillance and forming the Lyme Disease Tick Advisory Board (LDTAB) in 1990. The LDTAB includes MMCD and Minnesota Department of Health (MDH) staff, local scientists, and agency representatives who offer their expertise to the tick-borne effort.

MMCD initiated tick surveillance to determine the range and abundance of the black-legged tick (*Ixodes scapularis*, also known as the deer tick) and the Lyme disease spirochete, *Borrelia burgdorferi,* within the District. To date, MMCD has mapped the current distribution of black-legged ticks (545 total sites sampled) and continues to monitor their populations in the metropolitan area. Additionally, District employees have assisted with spirochete and ehrlichiosis (now known as anaplasmosis) studies with the University of Minnesota. All collected data are summarized and presented to the MDH for their risk analysis.

Because wide-scale tick control is neither ecologically nor economically feasible, tick-borne disease prevention is limited to public education activities which emphasize tick-borne disease awareness and personal precautions. District employees continue to provide tick identifications upon request and are used as a tick referral resource by agencies such as the MDH and the Minnesota Department of Natural Resources (MnDNR).

2007 Mosquito-borne Disease Services

Breeding Source Reduction

Water-holding containers such as tires, buckets, tarps, and even plastic toys provide developmental habitat for many mosquito species including the La Crosse virus vector *Ae. triseriatus*, the exotic species' *Ae. albopictus* and *Ae. japonicus,* and other probable vectors of WNV.

Container habitat elimination is an effective strategy for preventing mosquito-borne illnesses. District staff recycled 14,499 tires that were collected from the field in 2007. Since 1988, the District has recycled 454,864 tires. In addition, MMCD eliminated 1,267 containers and filled 107 tree holes.

This reduction of breeding sources occurred while conducting a variety of mosquito, tick, and black fly surveillance and control activities, including the 1,814 property inspections by MMCD staff in 2007.

La Crosse Encephalitis

***Aedes triseriatus* Surveillance and Control** *Aedes triseriatus* is a container inhabiting floodwater species and the vector of La Crosse encephalitis (LAC) in our area. *Aedes triseriatus* populations were restricted naturally by a second consecutive summer with drought conditions. This was documented in the District's aspirator surveillance (see Ch. 1). MMCD staff sample wooded mosquito habitats by vacuum aspirator to monitor adult *Ae. triseriatus* populations and to direct adult and larval control efforts.

In 2007, MMCD staff collected 2,345 aspirator samples to monitor *Ae. triseriatus* populations. The District's treatment threshold of at least two adult *Ae. triseriatus* was met in 178 of these samples. Inspections of wooded areas and surrounding residential properties were provided as follow-up service when samples reached threshold. Additionally, 111 adulticide applications to wooded areas were prompted by collections of *Ae. triseriatus* in aspirator samples.

Adult *Ae. triseriatus* were captured in 402 of 1,767 individual wooded areas sampled. This ratio was low, as was the mean number of *Ae. triseriatus* captured per sample compared to most recent seasons (Table 2.1).

Table 2.1 Individual wooded areas sampled by aspirator and the number of those where *Ae. triseriatus* were captured, 2000 – 2007

Year	Total areas surveyed	No. with *Ae. triseriatus*	% with *Ae. triseriatus*	Mean no. per aspirator sample
2000	1,037	575	55.4	1.94
2001	1,222	567	46.4	1.32
2002	1,343	573	42.7	1.70
2003	1,558	470	30.2	1.20
2004	1,850	786	42.5	1.34
2005	1,993	700	35.1	0.84
2006	1,849	518	28.0	0.78
2007	1,767	402	22.8	0.42

La Crosse Encephalitis in Minnesota One case of La Crosse illness was reported to MDH in 2007. An 11 year-old boy from Wright County was diagnosed with La Crosse encephalitis after a July 24 onset of illness. There were no LAC illnesses in District residents in 2007.

Eastern Equine Encephalitis

In 2007, EEE virus was detected in 22 states, primarily on the East Coast, along the Gulf of Mexico, and in Great Lakes states east of Lake Michigan. There were four human illnesses diagnosed, three in New Hampshire and one in Alabama. One hundred ninety-four horses from 15 states were diagnosed with EEE. The nearest cases were found in Michigan and Indiana.

Eastern equine encephalitis virus is most common in areas near the habitat of its primary vector, *Cs. melanura*. These habitats include many coastal wetlands, and in the interior of North America, tamarack bogs and other bog sites. The last record of EEE in Minnesota was in 2001 when three horses were infected with the virus including one from Anoka County.

***Culiseta melanura* Surveillance** *Culiseta melanura* is relatively rare in the District and is restricted to a few bog-type larval habitats. The greatest concentration of this type of habitat is in the northeast part of MMCD in Anoka and Washington counties. Still, *Cs. melanura* is occasionally collected in other areas of the District. Surveillance results are found in Chapter 1.

Western Equine Encephalitis

Western equine encephalitis circulates among mosquitoes and birds in Minnesota, although normally below detectable levels. Occasionally, the virus causes illness in horses and less frequently in people. *Culex tarsalis* is the species most likely to transmit the virus to people and horses. In both 2004 and 2005, the virus was detected in *Cx. tarsalis* specimens collected in southern Minnesota. The virus has not been detected in Minnesota since then.

In 2007, *Cx. tarsalis* adults collected in the District during weekly CO_2 trap, gravid trap, sweep net, and aspirator sampling were submitted to MDH for virus analysis. One hundred thirty-six pools of *Cx. tarsalis* were tested for WEE; none of these samples returned positive results. The last record of WEE in the District was from a sentinel chicken sample collected in September, 2001.

West Nile Virus

WNV in the United States West Nile virus (WNV) transmission was documented in 47 states in 2007. There were no WNV findings in Alaska, Hawaii, or Maine. The US Centers for Disease Control and Prevention received reports of 3,623 WN illnesses from 43 states. Fatalities occurred in 121 of the cases. Colorado reported the greatest number of WNV illnesses with 576. Rates of WNV illness were greatest in North Dakota, Wyoming, South Dakota, and Montana, respectively. Screening of the American blood supply detected WNV in 335 donors from 30 states and Puerto Rico. West Nile illness was also diagnosed in 467 equines from 33 states.

WNV in Minnesota MDH reported 101 WNV illnesses in residents of 41 Minnesota counties. There were two fatalities related to WNV infections. The first WNV case was confirmed on July 12. The earliest onset of a WNV illness in the state was June 25. Fifteen Minnesota blood donors from 13 counties screened positive for WNV in 2007. Additional WNV detections in Minnesota included 17 illnesses in horses, 60 birds, and 106 mosquito samples. The WNV positive mosquito samples consisted of 43 pools of *Cx. tarsalis*, eight pools of *Cx. restuans*, one pool of *Cx. pipiens*, 44 mixed pools of *Cx. restuans* and *Cx. pipiens*, and ten pools of *Culex* species.

West Nile Illness in the District Nineteen residents of the District were diagnosed with WNV illnesses; 11 cases occurred in Hennepin County; three in Ramsey County; two in Dakota

County; and one each in Anoka, Carver and Washington counties. There were no WNV fatalities in the District in 2007.

Surveillance for WNV MMCD conducted surveillance for WNV in mosquitoes and wild birds. Several mosquito species from 33 CO_2 traps (12 elevated into the tree canopy) and 35 gravid traps were processed for viral analysis weekly. In addition, all *Cx. tarsalis* collected in Monday night CO_2 trap, aspirator, and sweep collections were processed for viral analysis. The minimum infection rate (MIR), used as a measure of a virus' prevalence in the mosquito population, was calculated by dividing the number of virus positive samples by the total number of mosquitoes tested. The rate is usually expressed in numbers per 1000. MMCD tested 441 mosquito pools using Response Biomedical Corporation's RAMP® method and submitted 2,033 mosquito pools to MDH for viral analysis by PCR. Eighty-five pools were positive for WNV. Table 2.2 is a complete list of mosquitoes processed for viral analysis.

Table 2.2 Number of mosquito samples processed for viral analysis and MIR by species; data from both RAMP® test and PCR are included

Species	Number of mosquitoes	Number of pools	WNV+ pools	MIR per 1000
Aedes triseriatus	283	112	0	0.00
Culex pipiens	575	51	1	1.74
Culex restuans	3,925	261	8	2.04
Culex salinarius	354	62	0	0.00
Culex tarsalis	9,589	1,218	22	2.30
Culex species	2,841	188	10	3.52
Culex pipiens/restuans	9,900	563	44	4.44
Culiseta melanura	43	19	0	0.00
Total	27,510	2,474	85	3.09

Bird mortality, especially among corvids, is often a sensitive indicator of WNV activity. MMCD conducted surveillance for WNV in wild birds with help from the public. Citizens reported dead birds to MMCD and some of those birds were selected for WNV analysis. Reports of 1,258 dead birds were received by telephone, internet, or from employees. RAMP® tests were done on 88 birds, 60 were positive for WNV. Results of testing are displayed by the week of bird deaths in Figure 2.1.

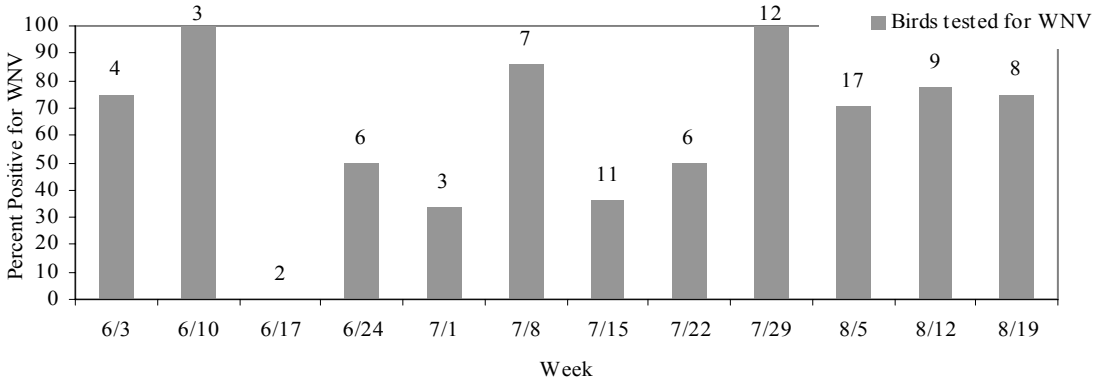


Figure 2.1 Percentage of birds collected by MMCD for WNV analysis that returned positive results by week of bird death. Labels indicate the number of birds tested.

Surveillance results for WNV in both birds and mosquitoes indicated that amplification of the virus occurred early in the 2007 season. Three of four birds were WNV positive during the first week of bird sampling. Sixty percent of the birds collected in June returned WNV positive results. The first mosquito samples that returned WNV positive results were collected during the first week in July. Infection rates in mosquitoes (Figure 2.2) increased steadily through August. As in 2006, drought conditions contributed to the rate of WNV amplification as vector habitats improved and warm weather aided dissemination of infections in mosquitoes.

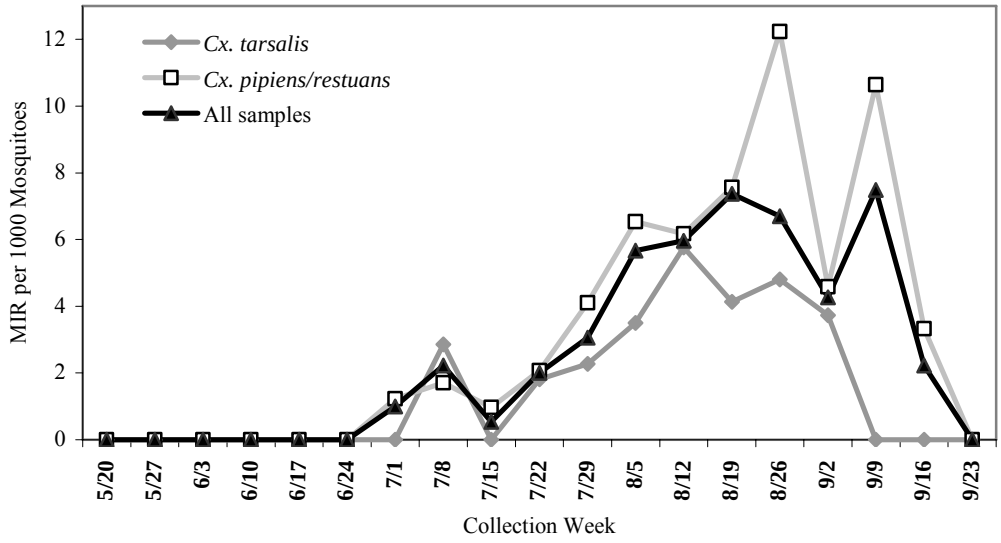


Figure 2.2 Weekly WNV minimum infection rates for all mosquito samples collected, *Cx. tarsalis*, and the *Cx. pipiens/restuans* group which includes pools of *Cx. pipiens*, *Cx. restuans*, and combined pools with both species.

West Nile Virus Research

MMCD staff researched WNV vector habits, habitat preferences, and control strategies in 2007. Efforts were directed toward improving the District's understandings of some of the more likely vectors of WNV, including *Cx. tarsalis, Cx. restuans, Cx. pipiens,* and *Cx. salinarius* and how to control their populations.

Larval *Culex* Surveillance

Culex tarsalis, Cx. restuans, Cx. pipiens, and *Cx. salinarius* lay rafts of eggs on the surface of standing water. Larvae will not be present in a wet habitat unless adult, egg-laying females have been recently active, the area was wet and attractive for oviposition, and the characteristics of the site allow for survival of newly hatched mosquitoes. *Culex* larvae can be difficult to find because they are typically much less abundant than other types of mosquitoes in our area. Furthermore, they can disperse over a wide area in large wetlands or they may clump together in small portions of large wetlands. They are generally easier to locate in small habitats where greater concentrations of larvae tend to be more evenly dispersed.

Mapping *Culex* Larval Habitats in Stormwater Management Structures Prior to 2006, MMCD focused its *Culex* surveillance and control services on catch basins and natural wetlands. These habitats were mapped using MapInfo® GIS software. Many water-holding stormwater management structures and erosion control measures were not identified on field maps since they cannot be classified as either catch basins or wetlands. A pilot project was initiated in the spring of 2006 to locate undocumented stormwater structures, evaluate habitat, and provide larval control. A classification system was devised to categorize these potential habitats. Types of structures included culverts, washouts, rip/rap, risers (pond level regulators), underground structures, and intermittent streams. In 2007, the pilot project was expanded. Crews documented stormwater structures throughout the District and control material evaluations were conducted.

When field staff discovered a habitat that fit one of the stormwater categories, its location was recorded along with other descriptive information and the site was assigned a number code. Mosquito samples were collected from many locations when sites were first identified. Staff returned later to survey some sites for mosquitoes, as well. However, the primary objective was to locate, describe, and map potential mosquito habitats.

Inspectors surveyed and mapped 14,080 structures in 2007. Over 20% of 10,395 structures holding water were found to contain mosquito larvae at the time they were inspected. Inspectors collected 1,823 larval samples from stormwater structures, erosion control devices, and pools in eroded areas. West Nile virus vector *Culex* species were found in 90.2 % of the samples (Table 2.3). Other species commonly collected were *Ae. triseriatus, Ae. vexans, Anopheles punctipennis, Culex. territans, Culiseta inornata,* and *Uranotaenia sapphirina.*

For 2007, pilot studies were conducted to test Altosid® XR briquets and VectoMax® CG (*B. sphaericus*) granules in stormwater structures. Risers were selected for Altosid XR briquet tests and culverts were used to test VectoMax CG granules. Results of these material tests are in Chapter 5.

Table 2.3 *Culex* vector species collected from habitats in stormwater management systems

Samples collected (N=1,823)	% occurrence
With *Cx. pipiens*	16.8
With *Cx. restuans*	73.5
With *Cx. salinarius*	0.8
With *Cx. tarsalis*	8.9
With ≥ 1 *Culex* species	90.2

Community Cooperation Treating Underground Stormwater Structures Many stormwater management systems include large underground chambers to trap sediments and other pollutants. There are several designs in use that vary in dimension and name, but collectively, they are often referred to as BMPs from *Best Management Practices for Stormwater* under the US Environmental Protection Agency's National Pollution Discharge Elimination System (NPDES). MMCD has worked with city crews to survey underground BMPs since 2005. In 2006, we initiated a pilot project for cooperative larval control where MMCD provided

larvicides and city staff made control applications. The cities of Bloomington and Maplewood participated in 2006.

In 2007, District staff solicited participation of additional cities in this cooperative mosquito control plan for underground habitats. Twenty-three communities volunteered their staff to assist with material applications (Table 2.4). As in 2006, Altosid XR briquets were used at the label rate of one briquet per 1,500 gallons of water retained. Briquets were placed in 975 underground habitats.

Table 2.4 Cities that assisted in treating underground stormwater habitats; 975 structures were treated and a total of 1,267 briquets were applied

City	Structures treated	Briquets used	City	Structures treated	Briquets used
Blaine	6	19	Minneapolis	164	164
Bloomington	98	122	Moundsview	5	5
Columbia Heights	2	2	New Brighton	3	6
Crystal	2	6	New Hope	6	12
Eagan	20	20	Plymouth	150	335
Eden Prairie	12	20	Prior Lake	286	306
Edina	17	17	Roseville	11	14
Fridley	10	21	Savage	10	17
Lauderdale	13	13	Shoreview	22	30
Lino Lakes	10	10	Spring Lake Park	2	2
Mahtomedi	1	1	White Bear Lake	50	50
Maplewood	75	75			

MMCD staff was able to complete 32 inspections of underground structures on six dates. Structures in Bloomington were inspected on June 8, June 25, and July 31. Structures in Crystal were inspected on June 27. Structures in Fridley were inspected on June 28 and August 1. Mosquito larvae were found in 21 of the 32 site inspections. Eighteen larval samples were collected. All of the samples contained *Cx. restuans*, six contained *Cx. pipiens*, two contained *Cx. tarsalis*, and one contained *Ae. triseriatus*.

Six bioassays were collected from five structures (Table 2.5). All bioassays were from treated sites. Attempts to collect pupae from untreated underground structures were not successful. Three of the bioassays show some control was achieved; however, the other three had unacceptable levels of adult emergence.

Table 2.5 Underground structure bioassay results

Date collected	Sitecode	% emergence
6/25/07	270330-728	92
7/31/07	270330-728	74
7/31/07	270321-733	41
7/31/07	270319-736	21
8/01/07	021115-708	38
8/01/07	021115-707	74

Prolific mosquito development has been documented in local underground BMPs. The majority of mosquitoes found in BMPs are *Culex* species and successfully controlling their emergence from underground habitats will remain an objective in MMCD's comprehensive strategy to manage WNV vectors. We plan to continue working with municipalities to limit mosquito development in stormwater systems. In 2008, options for larval control materials in underground habitats in addition to Altosid XR briquets will be explored.

Larval *Culex* Control in Catch Basins Three extended efficacy larvicides were evaluated for use in catch basins in 2007. In 2006, staff tested a *Bacillus thuringiensis israelensis* (*Bti*) briquet called FourStar®. This product was reformulated to include both *Bti* and *B. sphaericus*; therefore, its ability to control mosquitoes in catch basins was evaluated. A *Bti* donut from Valent BioSciences Corporation was also tested. The third product tested was the Altosid XR briquet, which has been used operationally in catch basins with increased frequency over the past two seasons. A review of this research is in Chapter 5.

Surveillance of catch basins demonstrated that the warm, dry conditions of 2007 benefited mosquitoes found in these habitats. Larvae were found during 543 of 824 catch basin inspections (65.9%). Rates of larval presence by week are displayed as Figure 2.3.

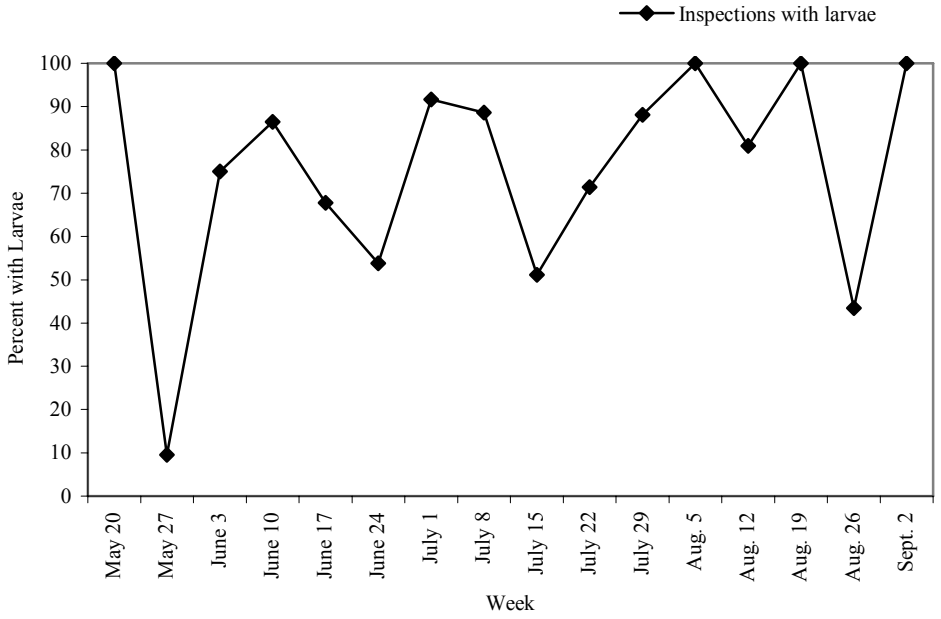


Figure 2.3 Weekly ratios of catch basins inhabited by mosquitoes.

Mosquito larvae were identified from 508 catch basins samples (Figure 2.4). The predominant species was *Cx. restuans*, as is usually the case in our area. *Culex restuans* were found in 85.8% of catch basin larval samples. *Culex pipiens* were identified more frequently in catch basin larval samples than has been documented in the past, 45.1% of samples contained the species. *Culex tarsalis* and *Cx. salinarius* were found on occasion in catch basins, 3.0% and 0.2% of samples, respectively.

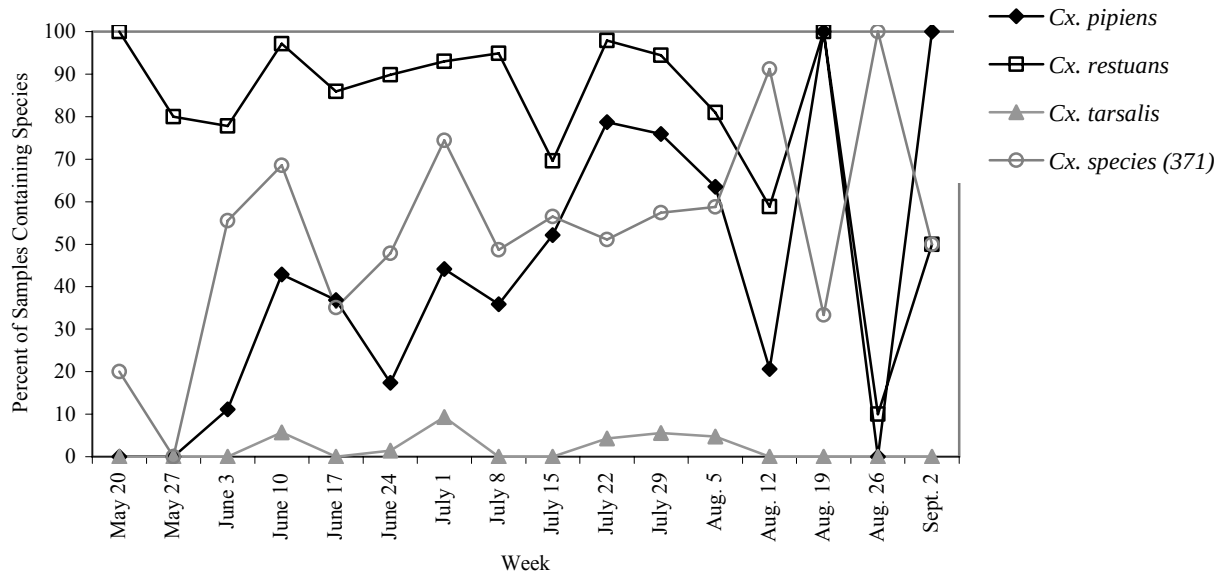


Figure 2.4 Composition of *Culex* mosquito species in catch basin larval samples by week.

Adult *Culex* Research

In 2006, the question arose as to how well a single CO_2 trap collection represented the *Culex* mosquito populations over a larger area. For a preliminary study, staff conducted additional sampling near four Monday night collection locations that had high counts of *Culex* (15 or more). Six CO_2 traps were placed radiating up to 3 mi from the Monday night trap location. Adult control applications in these selected areas were delayed until additional surveillance was complete. Results in three of the four sets showed that the majority of other traps also had *Culex*, but there was not usually a clear relationship with distance.

The radial trapping strategy was used in 2007 to address this question once again. Eleven trials were completed, seven on August 2 and one each on August 7, August 9, August 16, and September 8. Evaluations were done on collections of *Cx. tarsalis,* and *Culex* vectors minus *Cx. tarsalis* (*Cx*4-*Cx. tarsalis*). When traps were grouped in two categories, 2 mi or more from the reference trap and less than 2 mi from the reference trap, there was a significant relationship observed between distance and *Cx. tarsalis* capture but not for *Culex* vectors minus *Cx. tarsalis*.

Traps were coded according to distance from the reference trap (reference [Dist=0], traps closer than 2 mi from reference [Dist=1], and traps 2+ mi from the reference [Dist=2]). Below or above threshold levels were also evaluated (Table 2.6).

Table 2.6 Number of traps and % of total within each distance code that were above and below threshold for *Cx. tarsalis* and for other *Culex* (*Cx*4-*Cx. tarsalis*)

	Culex tarsalis				Other *Culex*			
Trap	Number of traps		% of total		Number of traps		% of total	
Distance	< thresh	≥ thresh	< thresh	≥ thresh	< thresh	≥ thresh	< thresh	≥ thresh
Dist=0	3	8	27	73	9	2	82	18
Dist=1	14	20	41	59	28	6	82	18
Dist=2	19	12	61	39	24	7	77	23
All traps	36	40	47	53	61	15	80	20

CO_2 traps closer than 2 mi from reference traps were significantly more likely to capture above-threshold levels of *Cx. tarsalis* if the reference trap also captured above-threshold *Cx. tarsalis* levels (Chi-square=14.81, p=0.0001) than would be expected to occur by chance alone (Table 2.7). There was no such association for traps ≥2 mi from the reference trap (Chi-square=0.29, p=0.59) (Table 2.7).

Table 2.7 Similarity of *Cx. tarsalis* caught by reference traps (above or below threshold) and traps closer than two or two or more miles from the reference trap

	Distance=1 (<2 mi)			Distance=2 (≥2 mi)		
	Same as Reference	Lower than Reference	Higher than Reference	Same as Reference	Lower than Reference	Higher than Reference
No. Traps	25	5	2	14	15	2
	78%	16%	6%	45%	48%	6%
	Same	Different from Reference		Same	Different from Reference	
	78%	22%		45%	55%	
	Different from chance? YES			Different from chance? NO		
	Chi-square= 14.81143			Chi-square= 0.293067		
	p= 0.000119			p= 0.588262		

This pattern was not observed for the number of *Cx. restuans*, *Cx. pipiens* and *Cx. salinarius* (Table 2.8) captured by CO_2 traps. *Culex restuans* comprised the majority of these mosquitoes. Overall, 80% of the CO_2 traps caught below-threshold numbers of *Cx*4-*Cx. tarsalis*. The high degree of agreement between reference traps and surrounding traps apparently is because four of five traps were below threshold. No associations with distance were observed. The precise cause (e.g., this trapping method not optimal for *Cx. restuans*, the distances examined were too great, too few mosquitoes were present) is unknown.

Table 2.8 Similarity of *Cx*4-*Cx. tarsalis* caught by reference traps (above or below threshold) and traps closer than two or two or more miles from the reference trap

	Distance=1 (<2 mi)			Distance=2 (≥2 mi)		
	Same as Reference	Lower than Reference	Higher than Reference	Same as Reference	Lower than Reference	Higher than Reference
No. Traps	25	3	4	22	4	5
	78%	9%	13%	71%	13%	16%
	Same	Different from Reference		Same	Different from Reference	
	78%	22%		71%	29%	
	Different from chance? NO			Different from chance? NO		
	Chi-square= 0.085603			Chi-square= 1.300042		
	p= 0.769843			p= 0.254206		

Plans for 2008 – Mosquito-borne Disease

District staff will continue to provide mosquito surveillance and control services for the prevention of La Crosse encephalitis. Preventive measures include adult sampling, adult control, and tree hole and container habitat reduction along with property inspections. The District will continue to survey aquatic habitats for *Culex* larvae for use in design and improvement of larval control strategies. *Culex tarsalis* will remain a species of particular interest. Staff will expand evaluations of larvicides to control *Culex* species in habitats that result from storm water management practices. District staff will continue to refine catch basin larviciding operations. The scale of new product evaluations will increase. Cooperative work with municipalities within the District to treat underground stormwater structures that produce mosquitoes will continue.

MMCD will continue to conduct surveillance for WNV and other mosquito-borne viruses in coordination with MDH and others involved in surveillance for WNV in Minnesota. District staff will continue to monitor *Cs. melanura* in the District with attention focused on areas in Anoka and Washington counties where the species has been encountered in the past. Finally, MMCD staff will remain watchful for the introduction of exotic mosquito species, especially *Ae. albopictus* and *Ae. japonicus*. Intensive surveillance near previous sites of introduction will begin in the spring of 2008.

2007 Tick-borne Disease Services

Ixodes scapularis Distribution

The District continued to sample the network of 100 sites set up in 1991-1992 to monitor potential changes in tick distribution over time. As in previous years, the primary sampling method involved capturing small mammals from each site and removing any attached ticks from them. Collections from the northeastern metropolitan area, primarily Anoka and Washington

counties, have consistently detected *I. scapularis*, and in 1998 *I. scapularis* was detected in Hennepin and Scott counties for the first time. The 2007 report will be available on our website (www.mmcd.org) in June. Following are the latest data compilations available which include 2006 results and preliminary 2007 results.

The 2006 distribution study results seemed to provide continued evidence of an elevated *I. scapularis* population. Even though our overall average of 0.637 was lower compared to the elevated averages (all $\geq$ 0.806) compiled for 2000 – 2002, 2004 and 2005, it was still higher than the averages compiled for any other year. Also, the number of positive sites, sites where at least one *I. scapularis* was collected, was tabulated in the 50's for only the fourth time (all since 2000) since the inception of this study, and *I. scapularis* comprised $\geq$ 50% of our overall collections for only the fourth time. In fact, the 2006 percentage of 58% *I. scapularis* in our overall tick collections equaled 2005 and is the highest recorded percentage in our database (Table 2.9).

Similarly, beginning in 2000 the MDH has been tabulating record-setting human tick-borne disease case totals. Their all-time high, statewide Lyme disease case total occurred in 2004 (1,023 cases) with the Lyme case totals in 2000 (463 cases), 2001 (465 cases), and 2003 (473 cases) being comparable. In the same period, human granulocytic anaplasmosis (HGA) cases also rose, ranging from 78 to 152 compared with an average of roughly 15 cases per year through 1999. In 2005, MDH recorded Minnesota's second highest Lyme case total (918) as well as the highest HGA case total (186); 2006 case totals were similar (Lyme disease 914 and HGA 177). Human disease case data for 2007 is not yet available.

In preliminary 2007 distribution study results, the overall 2007 *I. scapularis* per mammal season mean is currently calculated at 0.876, a rebound to an elevated level from our lower 2006 average. We collected the fewest number of larval *I. scapularis* since 1998 but collected 178 *I. scapularis* nymphs – technically the second highest nymph total since 1990 but comparable to the 177 collected in 2002 – and a nymphal total in the hundreds for only the fourth time (all since 2000) since the inception of this study. Although historically it has been typical for *Dermacentor variabilis* to comprise the majority of our tick collections (Table 2.9), we collected a higher percentage of *D. variabilis* than *I. scapularis* in 2007 for the first time since 2003.

Of general interest was the removal of seven *Ixodes marxi* nymphs from a male chipmunk (*Tamias striatus*) collected in Scott County on June 1. This chipmunk was also infested with eight *I. scapularis* nymphs and one larval and one nymphal *D. variabilis*. Although *I. marxi* has not been associated with Lyme disease transmission, we felt it to be a noteworthy observation as we had not collected *I. marxi* locally since the mid-1990s.

Table 2.9 Numbers and percentages of tick species collected by stage and year

Year	No. sites	Total ticks collected	*Dermacentor variabilis* Percent larvae (n)	*Dermacentor variabilis* Percent nymphs (n)	*Ixodes scapularis* Percent larvae (n)	*Ixodes scapularis* Percent nymphs (n)	Other species[b] percent (n)
1990 [a]	250	9957	83 (8289)	10 (994)	6 (573)	1 (74)	0% (27)
1991	270	8452	81 (6807)	13 (1094)	5 (441)	1 (73)	0% (37)
1992	200	4130	79 (3259)	17 (703)	3 (114)	1 (34)	0% (20)
1993	100	1785	64 (1136)	12 (221)	22 (388)	1 (21)	1% (19)
1994	100	1514	53 (797)	11 (163)	31 (476)	4 (67)	1% (11)
1995	100	1196	54 (650)	19 (232)	22 (258)	4 (48)	1% (8)
1996	100	724	64 (466)	20 (146)	11 (82)	3 (20)	1% (10)
1997	100	693	73 (506)	10 (66)	14 (96)	3 (22)	0% (3)
1998	100	1389	56 (779)	7 100)	32 (439)	5 (67)	0% (4)
1999	100	1594	51 (820)	8 128)	36 (570)	4 (64)	1% (12)
2000	100	2207	47 (1030)	10 (228)	31 (688)	12 (257)	0% (4)
2001	100	1957	54 (1054)	8 (159)	36 (697)	2 (44)	0% (3)
2002	100	2185	36 (797)	13 (280)	42 (922)	8 (177)	0% (9)
2003	100	1293	52 (676)	11 (139)	26 (337)	11 (140)	0% (1)
2004	100	1773	37 (653)	8 (136)	51 (901)	4 (75)	0% (8)
2005	100	1974	36 (708)	6 (120)	53 (1054)	4 (85)	0% (7)
2006	100	1353	30 (411)	10 (140)	54 (733)	4 (58)	1% (11)
2007	100	1700	47 (807)	8 (136)	33 (566)	10 (178)	1% (13)

[a] 1990 data excludes one *Tamias striatus* with 102 *I. scapularis* larvae and 31 nymphs
[b] other species mostly *Ixodes muris.* 1999 – 2nd adult *I. muris* collected

Tick Identification Services/Outreach

The overall scope of tick-borne disease education activities and services were maintained in 2007 using previously described methods and tools. Several new projects complimenting these outreach efforts were completed as well. A Lyme video comprising all aspects of Lyme disease and HGA, created in collaboration with the Public Affairs department in 2006, was formatted to DVD and it aired on local cable television outlets on several summer dates. Also, a tick poster was created that coordinates with MMCD's tick brochure. This poster is being disbursed in conjunction with brochures and is also being distributed as a stand alone product.

2008 Plans for Tick-borne Services

Metro Surveillance

The metro-based *I. scapularis* distribution study that began in 1990 is planned to continue unchanged.

Tick Identification Services/Outreach

Tick-borne disease education activities and services (including tick identifications and homeowner consultations) using previously described methods and tools will continue. Since

I. scapularis collections as well as the MDH's tabulated human tick-borne disease case totals remain elevated, staff will continue to stock local parks and other appropriate locations with tick cards, brochures and/or posters along with targeting specific metropolitan area townships based on higher human case totals and/or numbers of *I. scapularis* collected. Staff will also distribute materials at local fairs and the Minnesota State Fair, set up information booths at events as opportunities arise, and offer an encompassing slide presentation.

Chapter 3 Mosquito Control

2007 Highlights

- 36,460 fewer acres worth of larvicides were applied to wetlands than in 2006
- Significantly improved priority ranking of larval breeding sites using breeding histories
- 6,733 fewer acres worth of adulticides were applied in 2007 than in 2006
- A cumulative total of 168,314 catch basin treatments were made in three rounds to control vectors of WNV

2008 Plans

- Expand surveillance and control of *Coquillettidia perturbans* (cattail mosquitoes) including Altosid® XR-G sand treatments
- Continue to review the storm water management structure treatment program to maintain efficacy and reduce workload to enable staff to provide additional mosquito control services

Background Information

The mosquito control program targets the principal summer pest mosquito *Ae. vexans*, several species of spring *Aedes*, the cattail mosquito *Cq. perturbans*, the eastern treehole mosquito *Ae. triseriatus* (La Crosse encephalitis vector), and the vector of western equine encephalitis *Culex tarsalis*. The arrival of West Nile virus (WNV) in Minnesota in 2002 elevated the importance of controlling *Cx. tarsalis* and three other *Culex* species (*Cx. pipiens, Cx. restuans,* and *Cx. salinarius*) which are potential vectors of WNV. Larval control is the main focus of the program but is supplemented by adult mosquito control when necessary.

Aedes larvae hatch in response to snow melt or rain with adults emerging at various times during the spring and summer. Cattail mosquito larvae develop in cattail marshes over twelve months and emerge as adult mosquitoes in June and July. *Culex* species also develop during periods of greater precipitation but inhabits more permanent waters and therefore are not as dependent upon rainfall. Stormwater catch basins can also provide habitat for *Cx. pipiens* and *Cx. restuans.* This type of mosquito habitat can be the primary source of WNV vectors in heavily urbanized areas. Such was the case in the WNV epidemics in Chicago in 2002 and 2005.

MMCD uses "Priority Zones" to focus service in areas where it will benefit the highest number of citizens. Priority Zone 1 contains the majority of the population of the Twin Cities metropolitan area and has boundaries similar to the Metropolitan Urban Service Area (MUSA, Metropolitan Council). Priority Zone 2 includes sparsely populated and rural parts of the District. Small towns or population centers in Priority Zone 2 are considered satellite communities and receive services similar to Priority Zone 1.

Adult mosquito control supplements the larval control program. Adulticide applications are performed after sampling detects mosquito populations meeting threshold levels, primarily in high use park and recreation areas, for public events, or in response to citizen mosquito annoyance reports. Three synthetic pyrethroids are used: resmethrin, permethrin, and sumithrin. A description of the control materials is found in Appendix C. Appendix D indicates the dosages of control materials used by MMCD, both in terms of amount of formulated (and in some cases diluted) product applied per acre and the amount of active ingredient (AI) applied per acre. Appendix E contains a historical summary of the number of acres treated with each control material. Pesticide labels are located in Appendix F.

2007 Mosquito Control

Larval Mosquito Control

The threshold for treatment with *Bti* was 0.1 larvae per dip for spring *Aedes* in Priority Zone 1. A higher threshold of 0.5 larvae per dip was used in Priority Zone 2 to target limited control materials to sites with the most intense larval production. After mid-May, the threshold was increased to control the summer floodwater mosquitoes and *Culex*. For sites with only *Culex* (*Cx. restuans*, *Cx. pipiens*, *Cx. salinarius*, *Cx. tarsalis*), the threshold was 1 per dip in all priority zones. For sites with both *Culex* and floodwater mosquitoes, the threshold was 2 per dip in Priority Zone 1 and 5 per dip in Priority Zone 2.

Below average precipitation in 2007, especially in June and July, resulted in five District-wide broods and six small-medium broods of spring *Aedes* and *Aedes vexans*. Almost one third of the total aerial *Bti* treatments were completed in April (33,780 acres) and over half in August and September (63,460 acres) (Figure 3.1). Dry conditions in early to mid-summer resulted in 36,460 fewer acres worth of larvicides applied to wetlands than in 2006 (Table 3.1).

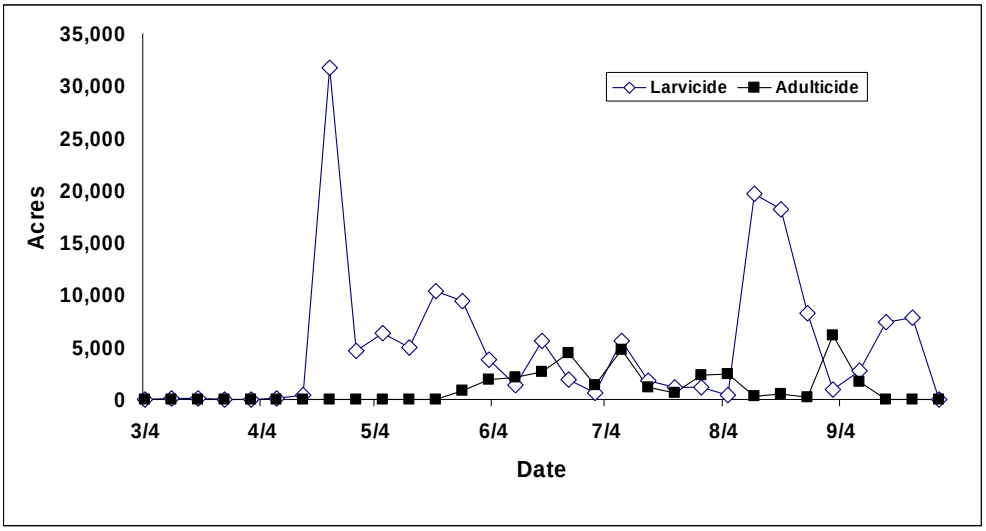


Figure 3.1 Acres of larvicide and adulticide treatments each week (March-September 2007).

Staff use site histories to prioritize which sites to visit first during a brood and which to treat with longer lasting larvicides (Altosid® pellets). We initiated this in 2005 by treating about 4,500 acres worth of the most highly productive air sites with Altosid pellets twice each season. The amount of inspection data available is greatest for air sites, one reason for targeting them first. Each year since 2005, we have reviewed inspection data from ground sites to assign a priority rank to each site. Sites assigned a "red" rank are sites we are most concerned with, either because we have data indicating that *Ae. vexans* is likely to develop in that site after rainfall or because we have insufficient information from that site and want to collect more. Sites assigned the rank "yellow" are less likely to produce larvae and sites ranked as "blue" are least likely to produce larvae.

Tests of Altosid XR-G sand conducted in 2007 verified earlier results indicating that XR-G sand can effectively control the cattail mosquito (details in Chapter 5). The per acre material cost of XR-G sand is lower than Altosid pellets meaning that the same funds spent on XR-G sand as pellets can purchase enough material to treat 25-33% more acres with XR-G sand.

Stormwater catch basin treatments began in early June and ended in early September. Most catch basins were treated three times with Altosid pellets (3.5 grams per catch basin) to control *Culex* mosquitoes from June through mid-September. A significant number were treated with Altosid briquets which, in part, resulted in 4,693 fewer catch basin treatments compared to 2006 because the briquets should control WNV vectors longer than four weeks, the length of time Altosid pellets can achieve consistent control (Table 3.1). The primary goal of control material tests in 2007 was to find a longer lasting material and decrease the number of times per season catch basins require treatment to control WNV vectors.

Table 3.1 Comparison of larval control material usage in wetlands and stormwater catch basins for 2007 and 2006

	2007		2006	
Material	Amount used	Area treated	Amount used	Area treated
Wetlands				
Altosid briquets	464.93 cases	290 acres	617.66 cases	352 acres
Altosid pellets	125,721.97 lb	36,818 acres	107,608.91 lb	31,827 acres
Altosid XR-G	17,760.00 lb	1,776 acres	0.00 lb	0 acres
VectoLex® CG	216.73 lb	27 acres	4,320.00 lb	540 acres
Bti corncob	945,104.87 lb	118,128 acres	1,286,076.36 lb	160,780 acres
Larvicide subtotals		157,039 acres		193,499 acres
Catch basins				
Altosid briquets	29.26 cases	6,438 CB[1]	23.68 cases	5,210 CB[1]
Altosid pellets	1,339.16 lb	161,876 CB	1,351.51 lb	167,797 CB
Larvicide subtotals		168,314 CB		173,007 CB

[1]CB=catch basin treatments

Studies of how to reduce the amount of time and personnel required to achieve effective season-long control of WNV vectors in other storm water management structures continued. In 2007, improvements were made to mapping the various kinds of storm water management structures. Staff also began developing WNV vector control programs for pond water regulators and culverts, two of the most common storm water management structures (catch basins are the most common).

Adult Mosquito Control

In 2007, MMCD applied adulticides to 6,733 fewer acres than in 2006 (Table 3.2). Adulticide treatments began in early June, peaked in late June, and continued at low levels until another small peak in early September (Figure 3.1). Floodwater mosquito (*Ae. vexans*) abundance was generally lower than in 2006. Populations of the permanent water species *Cq. perturbans* were closer to average during June and July and *Culex* levels were moderately elevated throughout the season compared to 2006. Adult mosquito control operations were considered when mosquito levels rose above established thresholds of two mosquitoes in a 2-minute sweep, or 2-minute slap count, or 130 mosquitoes in an overnight CO_2 trap.

In 2004, we established treatment thresholds for adult control specific to four *Culex* species: *Cx. restuans*, *Cx. pipiens*, *Cx. salinarius*, and *Cx. tarsalis*. The thresholds are one of any of these *Culex* species in a 2-minute sweep, five in an overnight CO_2 trap, five in an overnight gravid trap, and one *Cx. tarsalis* in a vacuum aspirator sample. Adulticide treatments were also considered when two or more *Ae. triseriatus* were captured in a vacuum aspirator sample.

Table 3.2 Comparison of adult control material usage in 2007 and 2006

	2007		2006	
Material	Amount used	Area treated	Amount used	Area treated
Permethrin	761.16 gal	3,897 acres	930.56 gal	5,114 acres
Resmethrin	299.19 gal	24,102 acres	377.15 gal	29,876 acres
Sumithrin	131.43 gal	5,608 acres	119.85 gal	5,350 acres
Total		33,607 acres		40,340 acres

2008 Plans for Mosquito Control Services

Larval Control

Cattail Mosquitoes In 2008, control of *Cq. perturbans* will use a strategy similar to that employed in 2007 except that we plan to increase the proportion of funds allocated to purchase Altosid XR-G sand which will enable MMCD to treat additional acres of cattail sites compared to 2007 and provide more resources for other larval control operations. MMCD will focus control activities on the most productive cattail marshes near human population centers. Altosid briquet applications will start in early March to frozen sites (e.g., floating bogs, deep water cattail sites, remotely located sites). Beginning in late May, staff will treat with Altosid pellets applied by helicopter at a rate of 4 lb/acre and Altosid XR-G sand at 10 lb/acre.

Floodwater Mosquitoes and *Culex* Species MMCD has expanded control of four *Culex* species since the arrival of WNV in 2002. Ground and aerial larvicide treatments of wetlands have been increased to control *Culex*. Catch basin treatments control *Cx. restuans* and *Cx. pipiens* larval habitats in urban areas. We will continue tests of longer lasting larvicides with the goal of decreasing the number of treatments required per season to control WNV vectors.

The primary control material will again be *Bti* corn cob granules. Forecasted *Bti* (VectoBac® G) and Altosid pellet needs in 2008 are similar to 2007 requirements. As in previous years, to minimize shortfalls, control material use may be more strictly rationed during the second half of the season, depending upon the amount of the season remaining and control material supplies. Regardless of annoyance levels, MMCD will maintain sufficient resources to protect the public from potential disease risk.

Staff will treat ground sites (i.e., sites that are ≤3 acres) with methoprene products (Altosid pellets, Altosid briquets) or *Bti* corn cob granules. Sites in highly populated areas will receive treatments first during a wide-scale mosquito brood. The District will then expand treatments into less populated areas where treatment thresholds are higher. In 2008, larval treatment thresholds will be the same as in 2007.

Review of ground site histories to identify those sites that produce larvae most often will continue. This will enable staff to better prioritize which sites to inspect before treatment, which sites to treat with Altosid products prior to a brood, and which sites to not visit. The ultimate aim is to provide larval control services to a larger part of the District by focusing on the most prolific sites.

In 2008, catch basins will be treated with Altosid pellets and *Bti*/*B. sphaericus* briquets. Catch basins selected for treatment include those found holding water, those that potentially could hold water based on their design, and those for which we have insufficient information to determine whether they will hold water. Treatments could begin as early as the end of May and no later than the third week of June. The first round of pellet treatments is planned to be completed by June 25 and subsequent Altosid pellet treatments will be made every 30 days thereafter. Catch basins treated with *Bti*/*B. sphaericus* briquets will be treated by June 25 and retreated if larval surveillance indicates a cessation of control.

Adult Mosquito Control

Forecasted permethrin, resmethrin, and sumithrin requirements in 2008 are similar to 2007. MMCD will direct adult mosquito control treatments to provide the greatest customer benefit, generally higher risk disease areas and human populated areas that have high levels of mosquitoes. Also, MMCD will provide service in high-use park and recreation areas and for public functions. A supply of natural pyrethrins will be maintained to respond to adult WNV vectors in agricultural areas.

Vector Mosquito Control

Employees will routinely monitor and control *Ae. triseriatus*, *Cs. melanura*, *Cx. tarsalis*, *Cx. pipiens*, *Cx. restuans*, *Cx. salinarius*, and *Aedes albopictus* populations. See Chapter 2, Vector-borne Disease of this report for more details**.**

Chapter 4 Black Fly Control

2007 Highlights

- Larval mortality following *Bti* treatment on the large rivers averaged 96%
- Completed 2005 Mississippi River non-target monitoring report. Results indicate no large scale impacts from *Bti* treatments on the invertebrate community
- Monitored adult populations weekly using mosquito surveillance CO_2 traps

2008 Plans

- Thresholds for treatment will be the same as previous years
- Monitor adult populations by the overhead net sweep and CO_2–baited trap methods
- Process non-target monitoring samples collected in 2007
- Complete statistical review of multiplate samples in the Mississippi River for the non-target monitoring program

Background

The goal of the black fly program is to reduce pest populations of adult black flies within the MMCD to tolerable levels. Black fly larval populations are monitored at about 140 small stream and 27 large river sites using standardized sampling techniques during the spring and summer. Liquid *Bti* is applied to sites when the target species reaches the treatment threshold.

The small stream program began in 1984. The large river program began with experimental treatments and non-target impact studies in 1987. A full-scale large river treatment program did not go into effect until 1996. The large river treatment program was expanded in 2005 to the South Fork of the Crow River in Carver County.

2007 Program

Small Stream Program - *Simulium venustum* Control

One human-biting black fly species that develops in small streams is targeted for control (*Simulium venustum)*. It has one early, spring generation. *Simulium venustum* larvae are found in small streams throughout the District, with the largest population in Anoka County.

One hundred twenty-two potential *S. venustum* breeding sites were sampled in April to determine larval abundance using the standard grab sampling technique developed by the MMCD. The treatment threshold was 100 *S. venustum* per sample. A total of 68 sites on 16 streams met the threshold and were treated once with VectoBac® 12AS formulation of *Bti*. A total of 46.7 gallons of *Bti* was used (Table 4.1).

Table 4.1 Summary of *Bti* treatments for black fly control by the MMCD in 2006 and 2007

	2006			2007		
Water body	No. treatment sites	No. treatments	Gallons of *Bti* used	No. treatment sites	No. treatments	Gallons of *Bti* used
Small Stream Total	58	58	35.1	68	68	46.7
Large River						
Mississippi	2	8	503.2	2	8	570.1
Crow	3	5	147.5	2	3	32.0
South Fork Crow	5	13	176.2	5	12	59.1
Minnesota	0	0	0.0	5	7	628.2
Rum	5	31	178.6	4	27	58.9
Large River Total	15	57	1005.5	18	57	1348.3
Grand Total	70	115	1040.5	86	125	1395.0

Large River Program

Large rivers are habitats for three black fly species that the MMCD targets for control. *Simulium luggeri* develops mainly in the Rum and Mississippi rivers, although it also occurs in smaller numbers in the Minnesota and Crow rivers. Depending on stream flow, *S. luggeri* is abundant from mid-May through September. *Simulium meridionale* and *Simulium johannseni* are found primarily in the Crow, South Fork Crow, and Minnesota rivers. These species are most abundant in May and June, although *S. meridionale* populations will remain high throughout the summer if stream flow is also high.

The black fly larval population was monitored weekly between May and early September using artificial substrates at the 27 sites permitted by the MnDNR on the Rum, Mississippi, Crow, South Fork Crow and Minnesota rivers. The treatment thresholds were the same as those used since 1990. Fifty-seven *Bti* treatments totaling 1348.3 gallons of VectoBac 12AS were used to control black fly larvae in large rivers in 2007 (Table 4.1). Amounts of *Bti* used in 2006 and 2007 were well below the yearly average of approximately 3,000 gallons.

Bti treatment effectiveness was excellent in 2007. The average post-*Bti* treatment larval mortality (measured at least 250 m downstream of the point of the *Bti* application) was 99% on the Crow River, 98% on the Mississippi River, 92% on the Rum River, 95% on the Minnesota River, and 97% on the South Fork Crow River. The average post-treatment mortality recorded on all 5 large rivers was 96%.

Adult Population Sampling

The adult black fly population was monitored in 2007 at 53 standard stations throughout the MMCD using the District's standard black fly over-head net sweep technique that was established in 1984. Samples were taken once weekly from early May to mid-September, generally between 8:00 AM and 10:00 AM. The average number of all species of adult black flies

captured in 2007 was 0.82 (Table 4.2). The average number of adult black flies captured per net sweep sample from 1984 to 1986 when no large river *Bti* treatments were done was 14.8. Between 1987 and 1995 when experimental *Bti* treatments were conducted on the large rivers the average number of adult black flies captured per sample was 3.6. The average number of adult black flies captured per sample since the start of the District's full-scale large river larval black fly control program in 1996 is 1.45 (1996-2007).

The most abundant black fly collected in the overhead net-sweep samples in 2007 was *S. luggeri*, comprising 73% of the total black flies captured. The overall average number of *S. luggeri* captured per net-sweep sample in 2007 was 0.60 (Table 4.2). This was the sixth lowest number of *S. luggeri* collected in the net-sweep samples since the black fly program began in 1984. *Simulium luggeri* was most abundant in Anoka County in 2007, as it has been since the program began. The average number of *S. luggeri* captured in Anoka County was 3.18 in 2007. The higher number of *S. luggeri* captured in Anoka County compared to other counties within the MMCD is most likely due to the close proximity of prime *S. luggeri* larval habitat in the nearby Rum and Mississippi rivers.

The second most abundant black adult species captured in 2007 was *S. meridionale*, averaging 0.12 per sample (Table 4.2) and comprising 15.2% of the total black flies collected. *Simulium meridionale* was most abundant in Carver and Dakota counties in 2007. An average of 0.23 was captured per sample in Carver County and 0.37 per sample in Dakota County.

Adult black fly populations were also monitored in 2007 between mid-May and late June with CO_2-baited traps at 13 stations in Anoka, Scott and Carver counties. The stations in Anoka and Scott counties have been monitored with CO_2 traps since 1998; monitoring in the Carver County expansion area began in 2004.

CO_2 trap data from Anoka, Scott, and Carver counties are shown in Table 4.3. The most abundant black fly species captured in the CO_2 traps were *S. venustum, S. johannseni* and *S. meridionale.* The average number of *S. venustum* captured per trap in 2007 was 37.6 in Anoka County, 35.6 Scott County, and 75.7 in Carver County. The average number of *S. venustum* captured per trap between 1998 and 2006 was 9.1 in Anoka County, 2.3 in Scott County, and 1.0 in Carver County. The reason for the higher numbers of *S. venustum* captured in the CO_2 traps in 2007 is not known. The average number of *S. johannseni* captured per trap in 2007 was 0.20 in Anoka County, 32.5 in Scott County and 112.8 in Carver County. The average number of *S. johannseni* captured per trap between 1998 and 2006 was 0.2 in Anoka County, 13.0 in Scott County, and 75.1 in Carver County. The average number of *S. meridionale* captured per CO_2 trap in 2007 was 0.51 in Anoka County, 172.5 in Scott County, and 388.6 in Carver County. The average number of *S. meridionale* captured per trap between 1998 and 2006 was 1.0 in Anoka County, 15.3 in Scott County, and 209.2 in Carver County.

Table 4.2 Annual mean number of black fly adults captured in over-head net sweeps in samples taken at standard sampling locations throughout the MMCD between mid-May and mid-September; samples were taken once weekly beginning in 2004 and twice weekly in previous years

Year[1]	All species[2]	*Simulium luggeri*	*Simulium johannseni*	*Simulium meridionale*
1984	17.95	16.12	0.01	1.43
1985	14.56	13.88	0.02	0.63
1986	11.88	9.35	0.69	1.69
1987	6.53	6.33	0.02	0.13
1988	1.60	1.54	0.05	0.00
1989	6.16	5.52	0.29	0.18
1990	6.02	5.70	0.01	0.24
1991	2.59	1.85	0.09	0.60
1992	2.63	2.19	0.12	0.21
1993	3.00	1.63	0.04	1.24
1994	2.41	2.31	0.00	0.03
1995	1.77	1.34	0.32	0.01
1996	0.64	0.51	0.01	0.07
1997	2.91	2.49	0.00	0.25
1998	2.85	2.64	0.04	0.04
1999	1.63	1.34	0.04	0.06
2000	2.38	2.11	0.01	0.02
2001	1.30	0.98	0.04	0.18
2002	0.61	0.43	0.01	0.14
2003	1.96	1.65	0.01	0.20
2004	0.97	0.35	0.02	0.39
2005	0.74	0.58	0.01	0.08
2006	0.55	0.45	0.01	0.34
2007	0.82	0.60	0.00	0.12

[1]The first operational treatments of the Mississippi River began in 1990 at the Coon Rapids Dam. 1988 was a severe drought year and limited black fly production occurred.

[2]All species includes *S. luggeri*, *S. meridionale*, *S. johannseni*, and all other species collected.

Table 4.3 Mean number of adult *S. venustum*, *S. johannseni*, and *S. meridionale* captured in CO_2-baited traps set twice weekly between May and mid-June

County	Year	*Simulium venustum*	*Simulium johannseni*	*Simulium meridionale*
Anoka	1998	15.34	2.42	0.08
	1999	1.53	0.26	0.30
	2000	4.83	0.08	0.35
	2001	6.22	0.37	0.29
	2002	4.77	0.26	1.09
	2003	18.29	1.35	2.61
	2004	0.89	5.11	14.09
	2005	2.31	0.03	1.23
	2006	22.80	0.75	0.75
	2007	37.62	0.20	0.51
Scott	1998	3.16	1.08	2.56
	1999	6.58	5.50	35.35
	2000	0.51	1.71	11.17
	2001	8.30	4.70	611.27
	2002	0.62	0.41	53.82
	2003	1.76	12.93	109.57
	2004	2.25	0.17	0.65
	2005	3.40	3.50	23.25
	2006	3.38	38.07	10.50
	2007	35.59	32.50	172.48
Carver	2004	0.25	32.93	327.29
	2005	0.84	99.04	188.02
	2006	1.82	98.75	107.53
	2007	75.67	112.77	388.64

Black flies captured in District-wide CO_2 traps operated weekly for mosquito surveillance (see Chapter 1) were counted, but not identified to species, in 2007. Results are represented geographically in Figure 4.1. The areas in dark gray and black represent the highest numbers collected, ranging from 250 to more than 500 per trap. The highest number of black flies was observed in the early season in parts of Anoka County, northwest Hennepin County, Scott County, and Carver County (Figure 4.1). These results are similar to those obtained from the standard adult net sweep and CO_2 trap sampling that is conducted annually to monitor adult black fly populations in the District.

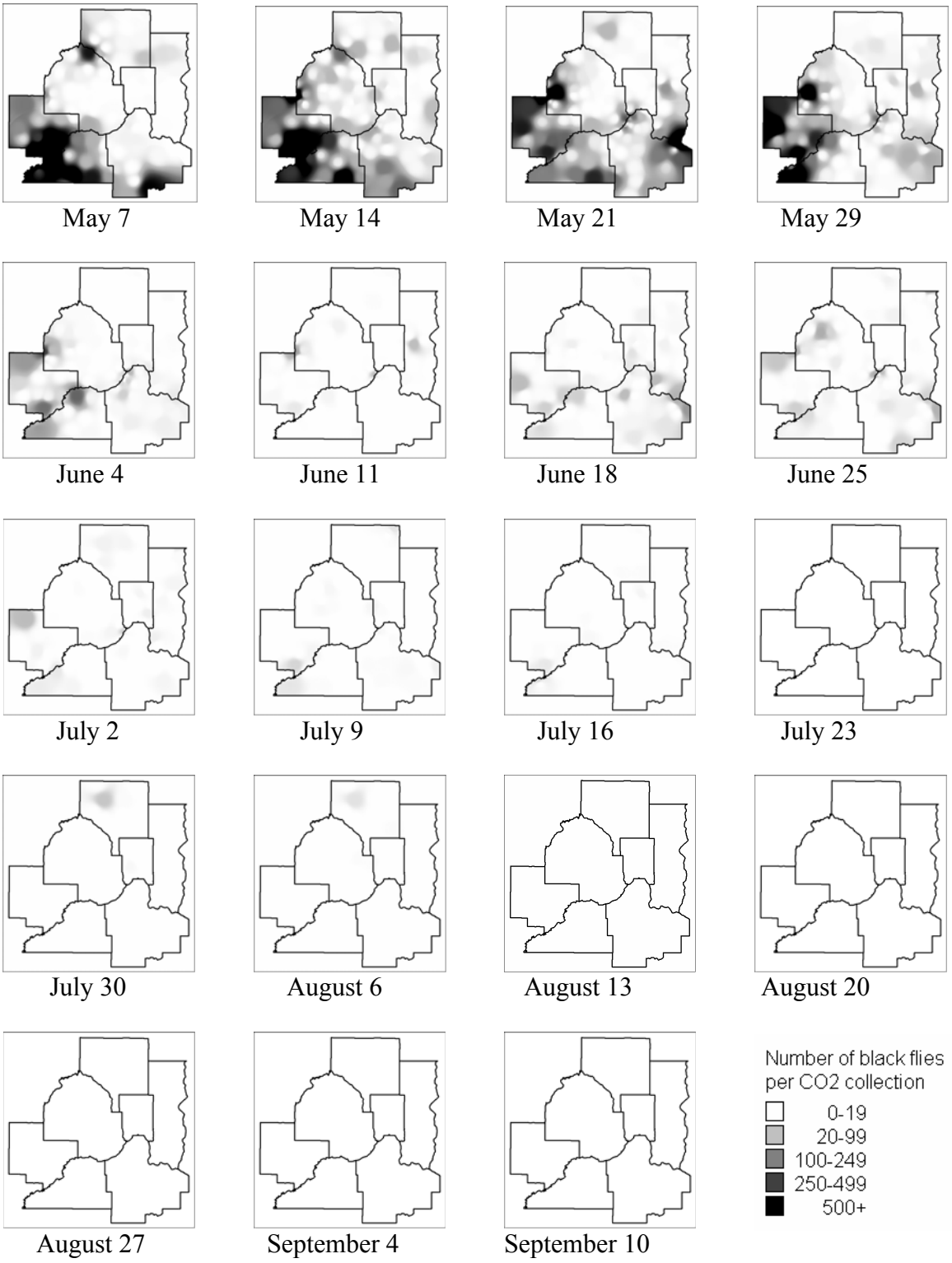


Figure 4.1 Number of black flies collected in mosquito surveillance CO_2 traps in 2007.

Non-target Monitoring

The District conducts biennial monitoring of the non-target invertebrate population in the Mississippi River as part of the permit requirements set by the MnDNR. The study was designed to provide a long-term assessment of the invertebrate community in *Bti*-treated reaches of the Mississippi River. The results from the monitoring work conducted in 1995, 1997, 1999, 2001, 2003, and 2005 have not indicated that any large-scale changes have occurred within the invertebrate community in the *Bti*-treated reaches of the Mississippi River. Sampling was repeated as scheduled on the Mississippi River in 2007. Sample processing and enumeration is underway with a report scheduled for completion in winter 2009.

2008 Plans

Our goal is to continue to effectively monitor and control black flies in the large rivers and small streams. The larval population monitoring program and thresholds for treatment will continue as in previous years. The 2008 black fly control permit application request has been submitted to the MnDNR. Taxonomic identification and enumeration of the non-target samples collected in 2007 will be done. A statistical review of the non-target monitoring dataset collected between 1995 and 2005 that was started in 2007 will be completed in 2008. The goal of this project is to determine if the non-target monitoring protocols can be revised in order to reduce the District's labor cost while providing the same level of monitoring that was established in 1995.

Chapter 5 Product & Equipment Tests

2007 Highlights

- VectoBac® G *Bti* achieved the same high level of control of *Ae. vexans* in air sites as in previous years
- Altosid® XR-G sand effectively controlled *Cq. perturbans* in cattail sites
- Two slow release formulations (*Bti* and *Bti/B. sphaericus*) controlled WNV vector larvae in catch basins for up to five weeks
- Permethrin and Onslaught™ controlled mosquitoes in woodlots for up to seven days after treatment
- Pyrocide® effectively controlled adult mosquito including *Culex* in croplands

2008 Plans

- Continue testing control materials in catch basins with the goal of decreasing the number of treatments per season while maintaining efficacy
- Repeat tests of permethrin and other barrier adulticides in woodlots to evaluate consistency of control and include more mosquito species
- Continue tests of adulticides in different situations emphasizing control of *Culex*

Background

Quality assurance (QA) is an integral part of MMCD services. The QA process focuses on control material evaluations, label compliance, application analysis, calibration, and exploration of new technologies to improve our operations. The Technical Services team provides project management and technical support. The regional process teams coordinate field testing and data collection.

2007 Projects

Quality assurance processes focused on equipment, product evaluations, and waste reduction. Before being used operationally, all products must complete a certification process that consists of tests to demonstrate how to use the product to effectively control mosquitoes. The District continued certification testing of four larvicides and one new adulticide. All four larvicides have been tested in different control situations in the past. Three larvicides were tested to control *Culex* larvae in catch basins, two to control *Culex* developing in wetlands, and one to control the cattail mosquito. The adulticide was tested for use in croplands. These additional materials will provide MMCD with more tools to utilize in its operations.

Acceptance Testing of Altosid® (Methoprene) Briquets and Pellets

Warehouse staff collected random Altosid® product samples from shipments received from Wellmark International (now known as Central Life Sciences) for methoprene content analysis. MMCD contracts an independent testing laboratory, Legend Technical Services, to complete the active ingredient (AI) analysis. Zoecon Corporation, Dallas, Texas, provided the testing methodologies. The laboratory protocol used was CAP No. 311, *Procedures for the Analysis of S-Methoprene in Briquets and Premix*.

All 2007 samples were within acceptable values of the label claim of percent methoprene (Table 5.1).

Table 5.1 Methoprene content of Altosid (methoprene) briquets, ingots, and pellets

Methoprene Product	No. Samples Analyzed	Methoprene Content: Label Claim	Methoprene Content: Analysis	SE
XR-Briquet	8	2.10%	2.09%	0.013
Ingot Briquet	3	2.10%	2.10%	0.003
Pellets	5	4.25%	4.00%	0.076

Evaluation of Active Ingredient (AI) Levels in Adult Mosquito Control Products

MMCD has requested the certificates of AI analysis from the manufacturers to verify product AI levels at the time of manufacture. MMCD incorporated AI analysis as part of a product evaluation procedure and will submit randomly selected samples of adulticide control materials to an independent laboratory for AI level verification. This process will assure that all adulticides (purchased, formulated and/or stored) meet the necessary quality standards. Technical Services is building a database on warehoused adult control materials to assist in inventory management and purchasing decisions. Therefore, voucher samples of the 2006 adulticides were collected and analyzed. Results of this analysis (Table 5.2) have shown that the products have minimal breakdown during the winter storage period and are stable. This data supports our current inventory processes and allows for added flexibility in acquiring products at the best available price.

Table 5.2 Active ingredient content of 2006 adulticides

Product	No. samples analyzed	AI content label claim	AI content analysis
Permethrin 57% Concentrate	1	57.0%	58.20%
Permethrin 5.7% Mix	1	5.7%	5.91%
Resmethrin 4%	1	4.0%	4.21%
PBO 12%	1	12.0%	12.80%
Sumithrin 2%	1	2.0%	1.98%
PBO 2%	1	2.0%	2.11%

In addition, Technical Services randomly sampled adulticide products received in 2007 to assure they met the necessary quality standards and label claims. All 2007 samples were within acceptable values of the label claim of the percentage of active ingredients (Table 5.3).

Table 5.3 Active ingredient content of 2007 adulticides

Product	No. samples analyzed	AI content label claim	AI content analysis	SE
Permethrin 57% Concentrate	2	57.0%	57.20%	0.190
Permethrin 5.7% Mix	2	5.7%	5.86%	0.043
Resmethrin 4%	1*	4.0%	4.17%	NA
PBO 12%	1*	12.0%	12.80%	NA
Sumithrin 2%	1*	2.0%	2.00%	NA
PBO 2%	1*	2.0%	2.22%	NA

* Standard error not calculated

Improvement of Warehouse Operations

Due to limited warehouse space in each region facility and increased pace of control material usage in the District as it expands its larval control program, Technical Services and warehouse staff are developing methods to handle the increased demand for control material transfers. The logistics of warehouse control material transfers in our busiest times can tax the warehouse staff, which needs to maintain adequate levels of 39 products (control materials, calibration materials, and product ingredients) in six field offices and two warehouse locations.

MMCD reduced the direct handling of all control materials by using vendor drop shipments to the regional facilities whenever possible. Technical Services coordinated forecasts of annual product use and arranged for all methoprene products to be prepackaged by vendor. The vendor then directly shipped products to each facility. This new process greatly reduced warehouse requirements to receive, repackage, deliver, and properly account for the transfer of these control materials.

To aid in the tracking of control materials, warehouse operations will continue to standardize shipments whenever possible to reduce possible discrepancies when making control material transfers. By reducing the variability of shipments, staff can more easily account for products and increase the efficiency of the physical inventory process.

To improve tracking the inventory of control materials, Technical Services implemented the use of Personal Digital Assistants (PDA's) to conduct weekly inventory audits. Technical Services developed a specialized control material inventory system that allowed inventory monitors to precisely enter their inventories using these handheld devices while in the storage areas. The program allows each material to be entered as individual units and/or containers and completes all calculations to ease the workload of staff and reduce possible errors. Each facility is able to upload that information into their computer system and produce a detailed report for their use. In addition, the information is downloaded to the District network and is available for use by Technical Services for forecasting District control material needs. This system greatly reduced the paperwork and handling of inventory data. This process has increased efficiency, reduced typographical errors, and provided more detailed records for staff to use in other processes.

Recycling of Pesticide Containers

MMCD continued to use the Minnesota Department of Agriculture's (MDA) pesticide container recycling program. This project focuses on properly disposing of agricultural pesticide waste containers thereby protecting the environment from the related pesticide contamination of ground and water. MDA used Tri-Rinse, Inc., St. Louis, MO for disposal services of their plastic pesticide container-recycling program.

Warehouse personnel arranged for all of MMCD's plastic containers to be collected and properly stored until they could be processed. MMCD staff collected over 6,437 jugs for this recycling program. The control materials that use plastic 2.5-gal containers are sumithrin (113 jugs), *Bti* liquid (558 jugs), and Altosid pellets (5,766 jugs). Twelve MMCD staff members (two employees from each regional facility) assisted in the jug grinding process. Due to the higher

number of plastic jugs in 2007, MMCD arranged for two grinding sessions to reduce the warehousing space required to retain these containers. This jug grinding resulted in approximately 6,446 lb of recycled shredded plastic.

In addition, the warehouse recycles numerous plastic drums and steel containers each season. These 55 or 30 gal drums are brought to a local company to be refurbished and reused.

Efficacy of Control Materials

VectoBac® G Applications VectoBac® G brand *Bti* (5/8 inch mesh size corncob granules) from Valent BioSciences was the primary *Bti* product applied by helicopter in 2007. Efficacy as calculated in terms of pre-treatment and post-treatment larval counts was similar in 2007 and 2006 (Table 5.4).

Table 5.4 Efficacy of aerial VectoBac G applications in 2006 and 2007 (SE=standard error)

Year	n	Mean % mortality	Median % mortality	SE	Min % mortality	Max % mortality
2006	506	90.2	100.0	1.2 %	0.0	100.0
2007	300	92.0	100.0	1.4 %	0.0	100.0

New Control Material Evaluations

The District, as part of its Continuous Quality Improvement philosophy, desires to continually improve its control methods. Much testing has focused upon controlling potential vectors of WNV since its arrival to Minnesota in 2002. Testing in 2007 was designed to evaluate how different segments of mosquito control programs can be modified to deliver more mosquito control services to a greater part of the District area using existing resources.

Cattail Mosquito (*Coquillettidia perturbans*) Control Program The per acre material cost of Altosid® XR-G sand is lower than Altosid pellets meaning that the same funds spent on XR-G sand as pellets can purchase enough material to treat 25-33% more acres with XR-G sand. Tests of XR-G sand completed in 2006 indicated that it controlled *Cq. perturbans* as effectively as Altosid pellets. In 2007, we repeated tests of Altosid XR-G sand to verify these results.

Altosid XR-G Sand Treatments - An emergence cage test conducted in 2007 compared the ability of XR-G sand treatments in two parts of the District (East and North) to suppress emergence of the cattail mosquito, *Cq. perturbans*. The test included nine cattail sites, six of which were treated aerially with XR-G sand (10 lb/acre) and three left untreated. Five emergence cages were placed in each of the nine sites. All mosquitoes that emerged into the cages were collected twice each week beginning on June 1 and continuing through July 30. Altosid XR-G sand effectively suppressed *Cq. perturbans* (Table 5.5). These results are very similar to those of tests conducted in 2006 except that in 2006 emergence from the untreated control was much greater (98.87 mosquitoes per cage) than in 2007.

Table 5.5 Emergence cage test results of Altosid XR-G sand and Altosid pellets against *Cq. perturbans*; the percent reduction is compared to the control treatment

Treatment	Total emerged from all 15 cages	Mean emerged per cage	Percent reduction	No. of cages with *Cq. perturbans*
Control (East)	220	14.67	NA	14 of 15
XR-G (East)	56	3.73	74.5	9 of 15
XR-G (North)	1	0.07	99.5	1 of 15

Control of *Culex* in Catch Basins The primary goal of control material tests in 2007 was to find a longer lasting material and decrease the number of times per season catch basins require treatment to control WNV vectors. Forty catch basins in St. Paul were sampled approximately weekly from mid-June through mid-August. Ten catch basins were treated with FourStar™ briquets, 20 were treated with an experimental Valent BioSciences Corporation product (VBC60092), and 10 were not treated and served as untreated controls.

FourStar™ Bti/B. sphaericus Briquets in Catch Basins - Ten catch basins were treated with 1 FourStar briquet each on June 21. Each FourStar-treated and untreated control catch basin was dipped approximately weekly beginning on June 21 and ending on August 17. There was no difference in the percentage of catch basins that contained larvae after treatment with FourStar briquets compared to untreated catch basins (Table 5.6).

Table 5.6 Percent of catch basins treated with FourStar briquets in 2007 that contained larvae compared to untreated catch basins; n = catch basins sampled

	FourStar briquets		Untreated Control	
Sample dates	Percent containing larvae	n	Percent containing larvae	n
21 June	100	10	90	10
6 July	89	9	100	10
12 July	90	10	100	10
20 July	30	10	40	10
26 July	90	10	100	10
2 August	70	10	100	10
9 August	100	9	100	10
17 August	70	10	100	10

The mean dip count in the untreated control varied greatly between weeks while the mean dip count in FourStar-treated catch basins tended to be lower and not as variable. On July 6 and July 26, the two dates when the untreated control contained the most larvae, the mean dip count for FourStar-treated catch basins seemed lower. The variation (SE) was too great to detect differences on the other sample dates (Figure 5.1).

The developmental stage of larvae was recorded for as many samples as possible to try to detect any instar-specific suppression associated with the FourStar treatment. FourStar briquets are designed to work by releasing *Bti* and *B. sphaericus* that is ingested by mosquito larvae which are then killed sometime afterward. The mean cumulative number of each larval instar and pupae was calculated separately to compare both instar distributions and the number of older instars,

especially pupae. FourStar briquets appeared to significantly suppress the number of older instars, especially pupae which averaged 8.1 per untreated catch basin and 0.2 per FourStar-treated catch basin (Figure 5.2).

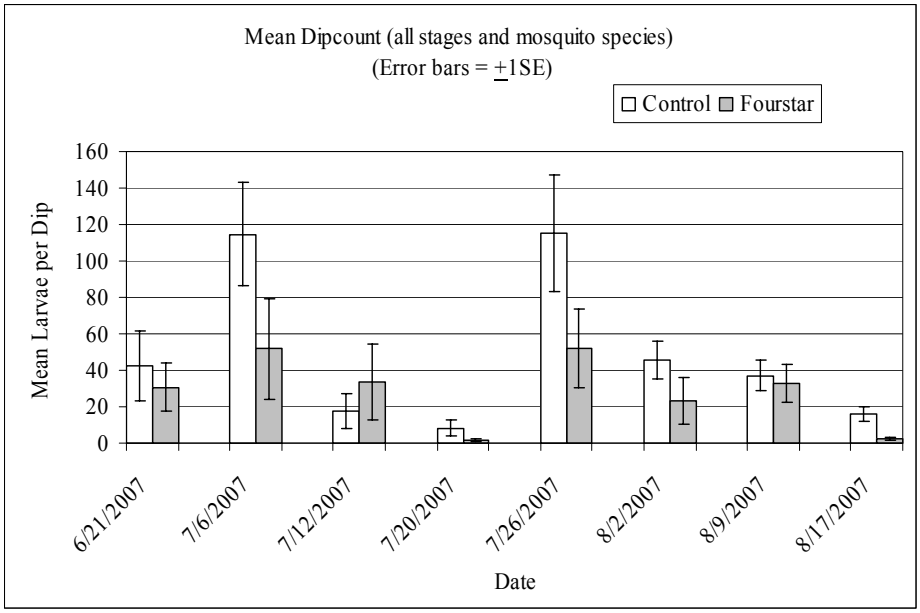


Figure 5.1 Mean dip counts from catch basins treated with FourStar briquets in 2007 compared to untreated catch basins (Control: n=10, FourStar: n=9-10).

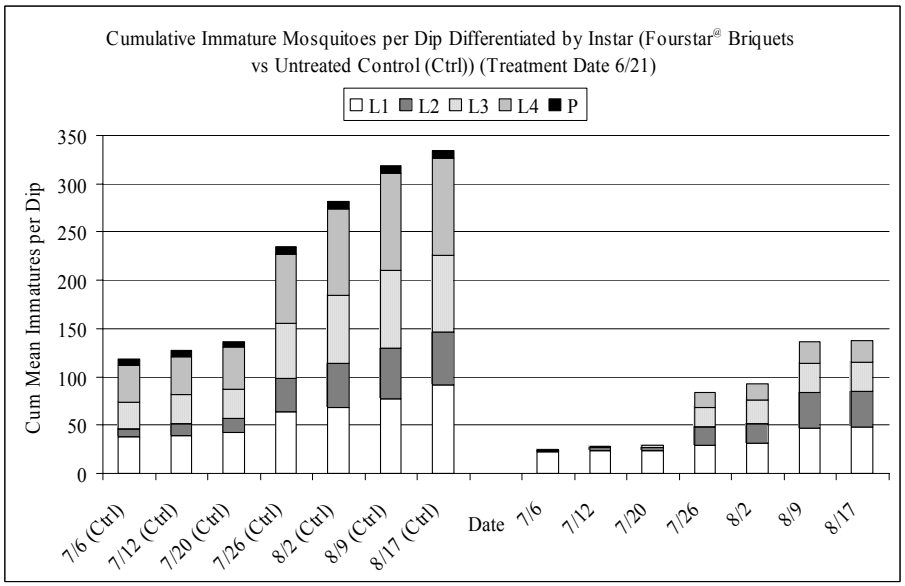


Figure 5.2 Cumulative immature mosquitoes per dip differentiated by instar from catch basins treated with FourStar briquets in 2007 compared to untreated (Ctrl) catch basins (Control: n=9, FourStar: n=5).

Valent VBC60092 Bti "Donut" in Catch Basins Twenty catch basins were treated with one VBC60092 *Bti* "donut" each on June 21. In 10 catch basins, the donuts were tethered using fishing line looped through its center and tied to the catch basin grate (tethered). One free donut was placed in each of the other 10 donut-treated catch basins (untethered). The same 10 untreated catch basins used in the FourStar tests were compared to VBC60092 test results. All catch basins were dipped approximately weekly beginning on June 21 and ending on August 17. All catch basins treated with VBC60092 on June 21 were retreated on July 26 because some of the tethered donuts disappeared by sampling in early July. Animals may have eaten a couple of the tethered donuts. Donuts were placed on July 26 the same way (tethered or untethered) as they were on June 21. Few differences in the percentage of catch basins that contained larvae after treatment with VBC60092 donuts compared to untreated catch basins except between July 20 and July 26 were observed (Table 5.7). None seemed to indicate a consistent treatment effect.

Table 5.7 Percent of catch basins treated with VBC60092 donuts in 2007 that contained larvae compared to untreated catch basins; n = catch basins sampled

	VBC60092 tethered		VBC60092 untethered		Untreated Control	
Sample dates	% with larvae	n	% with larvae	n	% with larvae	n
21 June	100	10	100	10	90	10
6 July	90	10	100	10	100	10
12 July	80	10	80	10	100	10
20 July	80	10	40	10	40	10
26 July	20	10	10	10	100	10
2 August	80	10	70	10	100	10
9 August	100	10	100	10	100	10
17 August	90	10	60	10	100	10

The mean dip count in the untreated control varied greatly between weeks while the mean dip count in VBC60092-treated catch basins tended to be lower and not as variable. On July 6 and July 26, the two dates when the untreated control contained the most larvae, the mean dip count for both tethered and untethered VBC60092-treated catch basins seemed lower. The variation (SE) was too great to detect differences on the other sample dates (Figure 5.3). This pattern is similar to that observed in FourStar-treated catch basins (Figure 5.1).

The developmental stages of larvae were identified in as many samples as possible to try to detect any instar-specific suppression associated with the VBC60092 treatments. VBC60092 donuts are designed to work by releasing *Bti* that is ingested by mosquito larvae which are then killed sometime afterward. The mean cumulative number of each larval instar and pupae was calculated separately to compare both instar distributions and the number of older instars, especially pupae.

VBC60092 donuts (both tethered and untethered treatments) appeared to significantly suppress the number of older instars, especially pupae which averaged 8.1 per untreated catch basin, 0.3 per tethered VBC60092-treated catch basin and 0.3 per untethered VBC60092-treated catch basin (Figure 5.4).

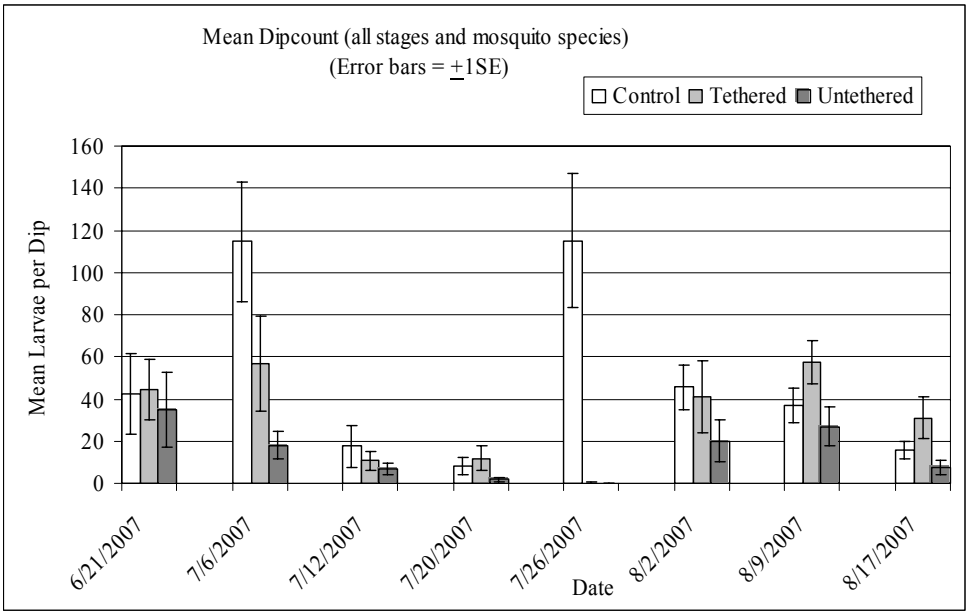


Figure 5.3 Mean dip counts from catch basins treated with VBC60092 (tethered and untethered) in 2007 compared to untreated catch basins (Control: n=10, tethered: n=10, untethered: n=10).

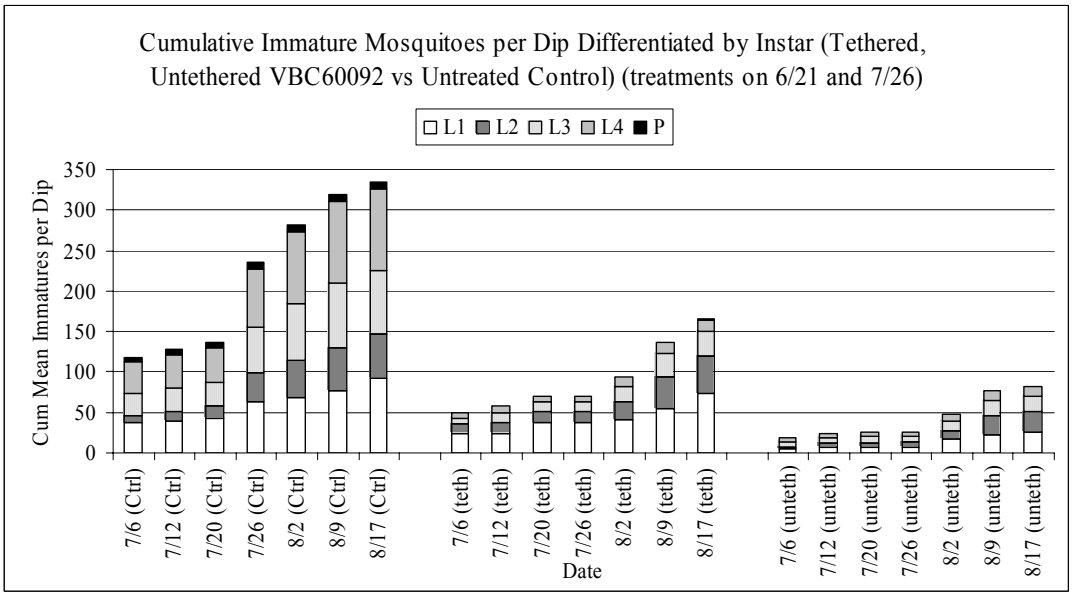


Figure 5.4 Cumulative immature mosquitoes per dip differentiated by instar from catch basins treated with VBC60092 donuts (tethered [teth] and untethered [unteth]) in 2007 compared to untreated (Ctrl) catch basins (Control: n=9, tethered: n=9, untethered: n=8).

In summary, FourStar briquets and VBC60092 donuts seemed to significantly decrease mosquitoes for up to five weeks after treatment. Further tests in 2008 are planned to verify both materials' efficacy, hopefully including a period when heavier rainfall occurs. The goal is to achieve at least six weeks of consistent control which could lead to two treatments per season in 2009, a 33% reduction of work compared to the current operational strategy.

Altosid XR Briquets in Catch Basins **-** 6,438 catch basins were treated with Altosid XR briquets in 2007 as part of a larger scale test to evaluate the consistency and duration of control. XR briquets did not achieve consistent results for any period of time after treatment (Table 5.8, Figure 5.6). Control was excellent in some catch basins several weeks after treatment. In other catch basins, XR briquets never were able to control WNV vectors. Overall control was insufficient to justify large scale treatments of catch basins with XR briquets.

Table 5.8 Results of bioassays from catch basins treated with Altosid XR briquets in 2007 compared to untreated control mortality; briquet emergence inhibition (EI) is corrected for untreated control mortality and SE=standard error

Treatment	n	Mean % EI	Median % EI	SE	Min % EI	Max % EI
Altosid XR briquets	68	47.7	52.0	4.5%	0.0	100.0
Untreated control	13	13.2	8.5	3.7%	3.0	53.0

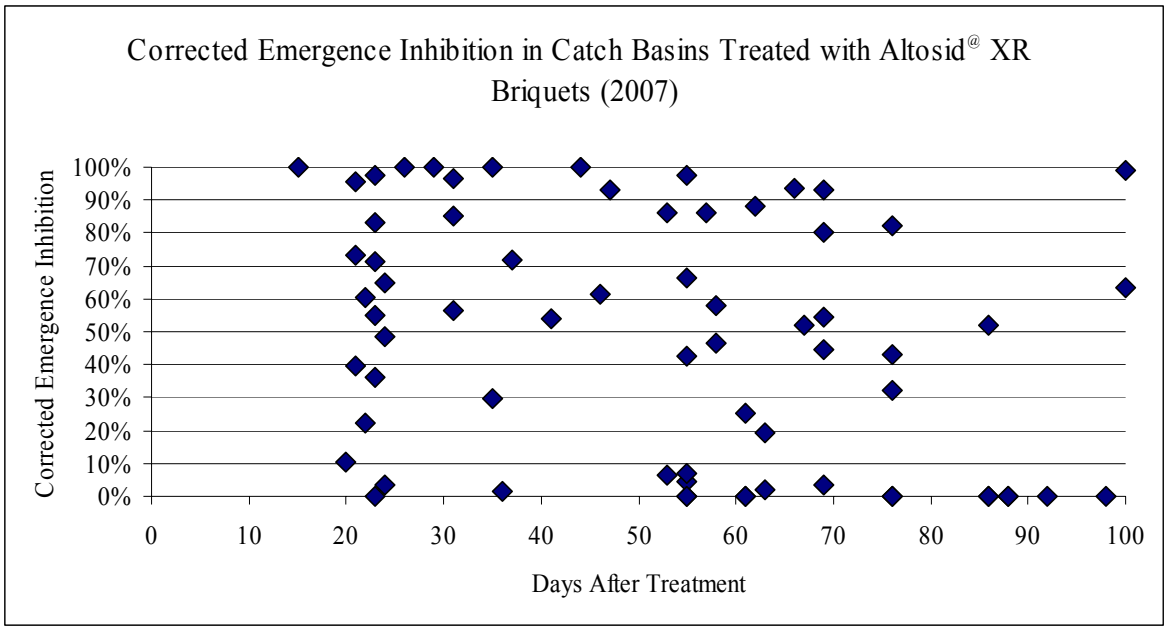


Figure 5.6 Corrected emergence inhibition in catch basins treated with Altosid XR briquets in 2007. Emergence inhibition (EI) is corrected for untreated control mortality and SE=standard error.

Control of *Culex* in Pond Regulators Pond regulators are some of the most common storm water management structures in the District. Sampling in 2006 detected significant levels of *Culex* larvae in pond regulators. The primary goal of control material tests in 2007 was to

determine the duration and consistency of control achieved by candidate products in these types of habitats. Staff chose to compare a methoprene formulation with a *Bti/B. sphaericus* product.

Altosid XR Briquets in Pond Regulators - Fifteen pond regulators were treated with XR briquets (1 briquet per pond regulator) between June 7 and June 13. Bioassays were collected repeatedly from these 15 pond regulators and from five that were not treated through August to evaluate the duration and consistency of control. XR briquets effectively controlled WNV vectors for at least two months (Table 5.9, Figure 5.7) and were visible in several treated pond regulators for at least 60 days.

Table 5.9 Results of bioassays from pond regulators treated with Altosid XR briquets in 2007 compared to untreated control mortality; briquet emergence inhibition (EI) is corrected for untreated control mortality and SE=standard error

Treatment	n	Mean % EI	Median % EI	SE	Min % EI	Max % EI
Altosid XR briquets	20	83.6	100.0	6.4%	18.1	100.0
Untreated control	11	14.0	12.0	3.4%	2.2	37.5

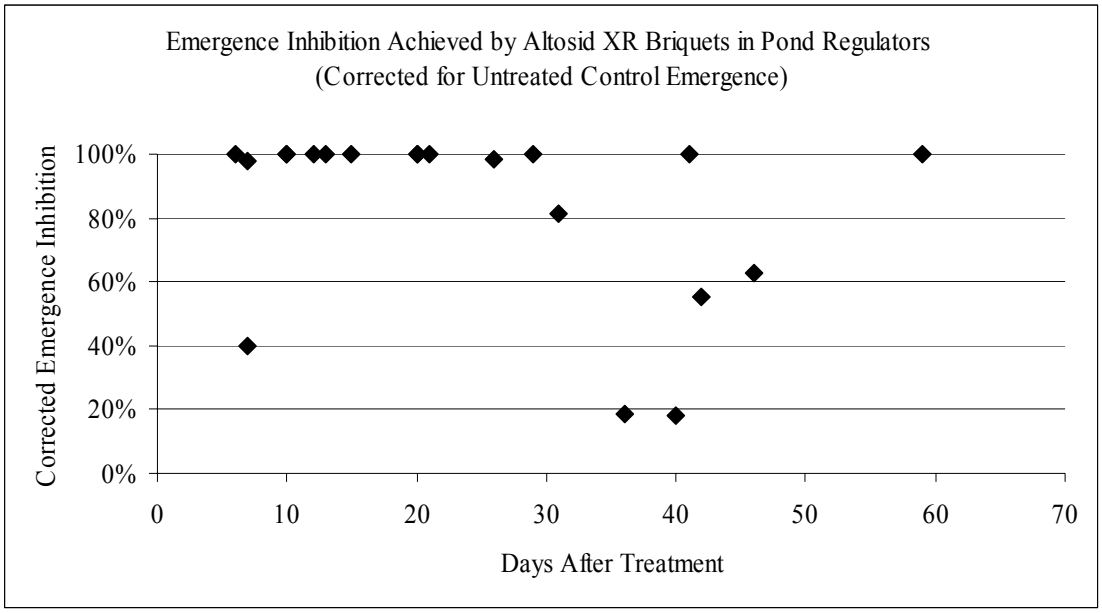


Figure 5.7 Corrected emergence inhibition in pond regulators treated with Altosid XR briquets in 2007.

VectoMax® CG granules in pond regulators - VectoMax® CG is produced by Valent BioSciences Corporation and contains two active ingredients (*Bti* and *B. sphaericus*) formulated on corn cob granules similar to VectoBac G. Eight pond regulators were treated with VectoMax CG (8 lb/acre) between June 25 and June 30. All were dipped for larvae before and approximately weekly through August. The same five untreated pond regulars from which bioassays were collected for use in Altosid XR briquet evaluations were dipped according to the same schedule as those treated with VectoMax CG. VectoMax CG effectively controlled WNV vectors breeding in pond regulators for four weeks (Table 5.10, Figure 5.8).

Table 5.10 Larvae dip counts in pond regulators treated with VectoMax CG in 2007 compared to untreated catch basins; n = dip counts. Percent control was calculated using Mulla's formula (see p 61 of this document) which incorporates untreated control counts to correct for natural mortality.

	VectoMax CG			Untreated Control			
Sample dates	Mean larvae per dip	(n)	SE	Mean larvae per dip	(n)	SE	% Control
18 June	11.5	(2)	3.5	37.3	(8)	8.5	NA[1]
25 June	4.3	(12)	1.1	4.6	(5)	3.0	NA[1]
2 July	0.2	(6)	0.2	54.0	(4)	17.9	99.7%
9 July	3.7	(6)	1.7	29.7	(3)	14.9	86.7%
16 July	3.5	(7)	1.5	60.3	(2)	42.8	93.7%
23 July	0.6	(6)	0.3	16.3	(6)	6.2	96.1%
30 July	1.9	(7)	0.9	0.0	(2)	0.0	0.0%
6 August	0.0	(4)	0.0	4.0	(2)	4.0	

[1]Pretreatment sampling

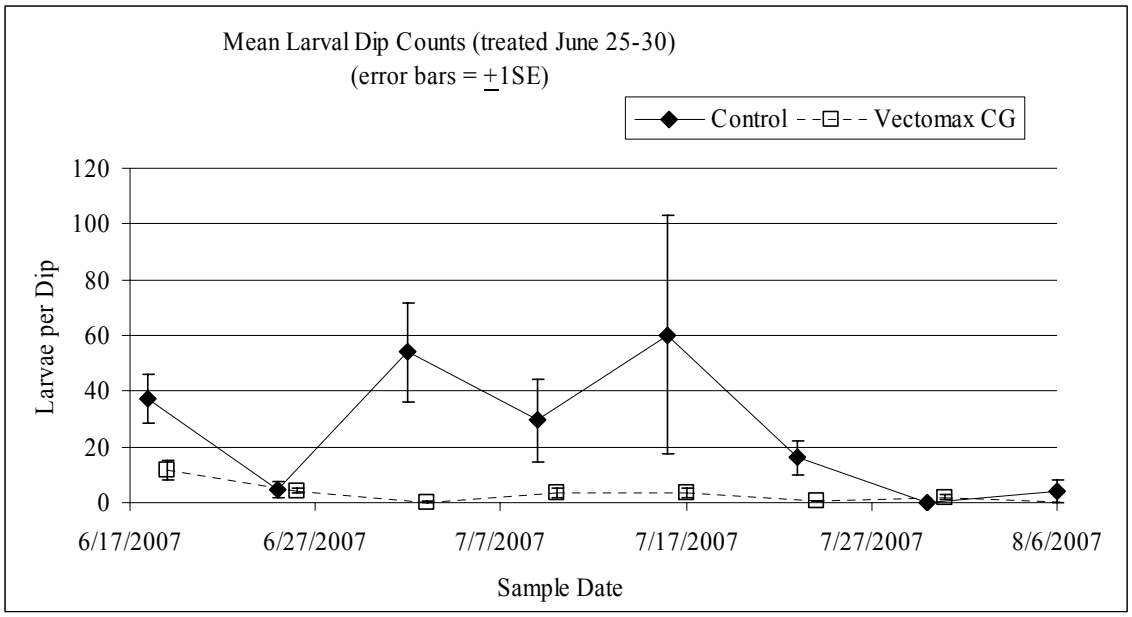


Figure 5.8 Mean dip counts from pond regulators treated with VectoMax CG in 2007 compared to untreated catch basins.

Control of *Culex* in Culverts Tests were conducted in culverts because they are one of the most common storm water management structures in the District. Sampling in culverts in 2006 detected significant levels of *Culex* larvae. The primary goal of control material tests in 2007 was to determine the duration and consistency of control achieved by candidate products. Staff chose to compare a methoprene formulation (Altosid pellets) with a *Bti*/*B. sphaericus* product (VectoMax CG). The dry weather in 2007 hampered collecting samples because the culverts frequently dried up soon after treatment. These tests will be repeated in 2008, perhaps in different culverts and/or earlier in the year.

Adulticide Tests Research in 2007 focused upon evaluating how effectively barrier and ULV (cold fogging) treatments controlled mosquitoes, especially West Nile virus vectors. This research is partially in response to recommendations by the Technical Advisory Board that MMCD demonstrate vector-specific efficacy, especially for barrier permethrin treatments that pose the greatest potential risk to non-target organisms in treated areas. Permethrin may soak into treated foliage and remain toxic to some insects that eat the foliage up to a month after treatment. We chose an alternate pyrethroid (Onslaught™) formulation that is microencapsulated which should limit penetration of foliage. Onslaught is mixed with water before application, thereby eliminating the soybean oil used to dilute permethrin as currently used by MMCD.

Permethrin Barrier - Staff completed two tests in 2007. Both tests were conducted in woodlots where operational permethrin treatments could potentially be made and both included untreated woodlots. Efficacy was evaluated using CO_2 traps. The first was primarily a test of how easily the permethrin barrier alternative, Onslaught, went through the sprayer as well as an indication of efficacy. Applying Onslaught was very similar to applying permethrin. We observed evidence of potential efficacy although too few adult mosquitoes were captured to determine control.

The second test included four woodlots, each sampled with two CO_2 traps collecting for 24 h at 5 ft height. One woodlot was treated with permethrin and one with Onslaught (each at 25 fl oz/acre), and two were left untreated for comparison. In both the permethrin- and Onslaught-treated woodlots mosquito numbers were significantly lower than in the untreated woodlots for at least 7 days (Table 5.11). Virtually all adult mosquitoes captured were *Ae. vexans* (81-98%). We will repeat this test in 2008 to demonstrate consistent control and include more mosquito species.

Table 5.11 Results of a test of permethrin and Onslaught efficacy using Mulla's formula; Mulla's formula (see p 61 of this document) incorporates untreated control trap counts to correct for natural mortality.

Treatment	Collection	Efficacy	Average *Ae. vexans* mosquitoes per trap	SE
Permethrin	Pre-treat	---	177.5	72.5
	Post-treatment (1 day)	85%	50.0	0.0
	Post-treatment (2 days)	85%	88.0	14.0
	Post-treatment (7 days)	80%	9.5	0.5
Untreated control	Pre-treat	---	65.5	26.8
	Post-treatment (1 day)	---	123.3	47.5
	Post-treatment (2 days)	---	121.5	46.3
	Post-treatment (7 days)	---	17.5	6.2
Onslaught	Pre-treat	---	238.0	64.0
	Post-treatment (1 day)	45%	244.5	15.5
	Post-treatment (2 days)	85%	65.5	24.5
	Post-treatment (7 days)	83%	11.0	7.0

Natural Pyrethrum (ULV) in Agricultural Areas - Scourge® and Anvil® label requirements restrict their use to agricultural areas – areas where mosquito surveillance has detected large numbers of WNV vectors. Pyrocide® (a natural pyrethrum product) can be used in agricultural areas. Tests in camp grounds conducted in 2006 demonstrated that Pyrocide controlled adult mosquitoes as well as Scourge. In 2007, ULV Pyrocide achieved good control in three tests including consistent suppression of *Culex* mosquitoes (Table 5.12).

Table 5.12 Results of three tests of ULV Pyrocide using Mulla's formula; Mulla's formula (see p 61 of this document) incorporates untreated control trap counts to correct for natural mortality (n=1 CO_2 trap per site per date).

		All mosquito species		*Cx. tarsalis*, *Cx. restuans*, *Cx. pipiens*, *Cx. salinarius*	
Test	Collection	CO_2 trap catch	Efficacy	CO_2 trap catch	Efficacy
Test 1	Pre-treat	32	---	4	---
25-26 July	Post-treat	11.5	77%	2	31%
Untreated	Pre-treat	35	---	18	---
control	Post-treat	55	---	5	---
Test 2	Pre-treat	94	---	83	---
1-3 Aug	Post-treat	32	86%	29	85%
Untreated	Pre-treat	14	---	14	---
control	Post-treat	34	---	33	---
Test 3	Pre-treat	22	---	20	---
7-9 Aug	Post-treat	1	81%	0	100%
Untreated	Pre-treat	25	---	22	---
control	Post-treat	6	---	6	---

Scourge® 4+12 - A test of Scourge in two campgrounds in July resulted in effective control of all mosquitoes one day after treatment (Table 5.13). Too few *Culex* mosquitoes were captured to evaluate *Culex*-specific efficacy.

Table 5.13 Results of a Scourge efficacy test using Mulla's formula; Mulla's formula (see p. 61 of this document) incorporates untreated control trap counts to correct for natural mortality (n=2 CO_2 traps per site per date).

Treatment	Collection	Efficacy	Average mosquitoes per trap (all species)	SE
Scourge	Pre-treat	---	385.3	116.8
	Post-treatment (1 day)	96%	3.3	2.0
Untreated	Pre-treat	---	215.7	97.3
control	Post-treatment (1 day)	---	45.7	7.3

Equipment Evaluations

Helicopter Swath Analysis and Calibration Procedures for Larvicides Technical Services and field staff conducted eight aerial calibration sessions for dry granular materials during the 2007 season. These computerized calibrations directly calculate application rates and swath patterns for each pass so each helicopter's dispersal characteristics are optimized. Seven sessions were held at the municipal airport in LeSueur, MN and one session was held in Lino Lakes, MN. Staff completed calibrations for seven different operational and experimental control materials. In total, eight helicopters were calibrated and each helicopter was configured to apply an average of three different control materials.

The number of trials increased significantly due to the use of pre-hatch materials (Altosid pellets) in 2007. Altosid pellets are challenging to apply at low dosage rates primarily due to the designs of the control material (extruded pellet) and the application equipment (gravity-fed hoppers). The pellets inter-lock, bridge, and do not flow freely through metering gates. Therefore, equipment settings must be accurately readjusted just prior to application to apply the desired treatment rate.

In 2007, Technical Services worked with a control material manufacturer on the aerial applicability of experimental products. This trial assisted the manufacturer in aspects of product development and will hopefully create new products that work well in future MMCD operations.

Evaluation of Fixed Wing Aircraft for Use in Northern Regions of MMCD As the District expands the acres treated by larvicides, Technical Services staff continue to explore methods to increase the efficiencies of District control operations. Application of granular larvicides by fixed-wing aircraft in the large continuous acreage of mosquito habitat holds promise for the northernmost portion of the District (Washington, Anoka, and Hennepin counties).

In 2007, Technical Services worked directly with a fixed-wing applicator and designed several trials to evaluate this application method in Anoka and Washington counties. A congested area waiver was filed with the Federal Aviation Administration (FAA) to gain all necessary approvals for flying within the metropolitan area. Despite previous discussions, the FAA denied the waiver citing possible risks of flying a large single engine aircraft over homes, property and roads. The FAA stated in the event of engine failure, there were not adequate areas to safely conduct an emergency landing. The applicator would need a multiple engine aircraft to gain the necessary approvals. Currently, there are no multiple engine aircraft designed for granular application available in the industry. The FAA also suggested MMCD could file for an exemption of the congested area waiver with their Washington, DC headquarters, but that procedure is currently a 6-9 month process. Since the MMCD evaluations were in some of the least populated rural areas of the District, Technical Services determined that this application method would be extremely limited by the FAA and would no longer be pursued for District operations as a viable option.

Droplet Analysis of Ground-based Spray Equipment Technical Service staff optimized 59 ultra low-volume (ULV) insecticide generators (truck-mounted, ATV-mounted, or handheld) using the KLD Model DC-III portable droplet analyzer. Staff uses this analyzer to fine-tune equipment to produce an ideal droplet spectrum of 8-20 microns. Adjusting the ULV sprayers to

produce a more uniform droplet range maximizes efficacy by creating droplets of the correct size to impinge upon flying mosquitoes. In addition, more uniform swaths allow staff to better predict ULV application patterns and swath coverage throughout the District.

Evaluation of a Utility Vehicle-mounted Cold Fog Generator Historically**,** MMCD has used all-terrain vehicles (ATV's) to reach remote areas and access off-road trail systems. In recent years, the District has moved to using more utility vehicles (i.e., golf carts) for their broader applicability. These utility vehicles can carry multiple employees, have a broader wheel base, have slower speeds and can carry additional payloads. These vehicles allow more types of equipment to be carried in their open beds. These beds allow MMCD to use different types of ULV sprayers that previously could be mounted on an ATV.

Technical Services arranged for a season long evaluation of Clarke's Cougar ULV cold fog generator. This fogger was mounted on the utility vehicle to be used in larger park areas. This sprayer allowed for more efficient use of our staff time since this unit has a larger swath width than previous ATV units and thus can cover more acres in the same amount of time. The unit worked well in these applications and the District purchased this unit at the end of the evaluation period.

Plans for 2008

Quality assurance processes will continue to be incorporated into the everyday operations of the regional process teams. Technical Services will continue to support field operations to improve their ability to complete their responsibilities most effectively. A primary goal will be to continue to assure the collection of quality information for all evaluations so decisions are based upon good data. We will continue to improve our calibration techniques to optimize all of our mosquito control equipment.

In 2008, tests of Altosid XR-G sand against the cattail mosquito (*Cq. perturbans*) will be repeated if sampling for larvae in the spring detects sufficient larval densities. Testing control materials in catch basins with the goal of decreasing the number of treatments per season while maintaining efficacy will continue. Staff plans to repeat tests of permethrin barrier treatments to include more mosquito species in more areas. Finally, evaluations of the effectiveness of adulticide treatments against vectors of WNV or other mosquito-borne diseases will continue, potentially including more tests with high and low traps and repeat tests of Pyrenone® and Pyrocide in croplands.

References

Mir S. Mulla, R. Lee Norland, Dean M. Fanara, Husam A. Darwazeh and Donald W. McKean. 1971. Control of Chironomid Midges in Recreational Lakes. J. Econ. Ent. 64(1): 300-307.

$$\text{Percent Efficacy} = 100 - \left(100 \times \left(\frac{\text{CntlPre}}{\text{TrtPre}}\right) \times \left(\frac{\text{TrtPost}}{\text{CntlPost}}\right)\right)$$

CntlPre = Mean pretreatment count of untreated control TrtPost = Mean post-treatment count of treated group
TrtPre = Mean pretreatment count of treated group CntlPost = Mean post-treatment count of untreated control

Chapter 6 Supporting Work

2007 Highlights

- Worked with AG-NAV® Guía GPS system for aerial treatments to develop a usable and reliable system
- Used rapid data handling to support Ag-Nav, web site
- Updated wetland maps and expanded stormwater structure mapping
- Promoted public web site with access to larval inspection and treatment data
- Obtained funding from outside sources to support shared web tools and services
- Continued education efforts on stormwater and mosquitoes
- Presented adulticide nontarget effect studies and other results to broad audience of mosquito control professionals

2008 Plans

- Continue to improve data handling for Ag-Nav and other GPS tracking, and test mobile access
- Develop new customer call data system to replace aging software and improve links to maps
- Conduct biennial public opinion survey

2007 Projects

Aerial Treatment Tracking and Guidance

As reported last year, MMCD required an aircraft-mounted GPS system in the mosquito larvicide aerial application contract starting in 2006. Our helicopter contractor, Scott's Helicopter Service, installed AG-NAV® Guía systems (Figure 6.1) during the 2006 season, and staff and pilots began learning how to work with the units.

Figure 6.1 Ag-Nav GPS guidance system in aircraft.

It quickly became clear these units had both great potential and (at least initially) some serious flaws. MMCD and Scott's staff worked with the manufacturer extensively starting in fall of 2006 and throughout 2007 to try to improve usability and output, and by the end of 2007 it appeared the units were working as expected.

Using the Ag-Nav required that MMCD staff prepare a GIS file of the boundaries of sites to be treated. Choosing sites based on larval sample results has always required quick turn-around from field to lab and back. With Ag-Nav, MMCD's electronic data and mapping systems became a key part of quickly producing map files to load into the helicopter units.

With development of new specialized software, plus intense staff and pilot training and testing, staff were able to successfully create and load "To Fly" site map files onto flash drives

and then onto the helicopter Ag-Nav units for about 85% of flights. The most common limitations included lack of time before flight, hardware problems, and training issues. Staff also provided marked paper maps as in the past. Several pilots said having sites displayed on-screen helped them find sites more quickly and verify that they were at the correct location. About half of MMCD staff members working with aerial treatments felt Ag-Nav increased productivity by helping pilots find sites.

The primary goal of these systems for MMCD was to have a clear record of treatments. In 2005 and 2006 tests using basic hand-held GPS units in the helicopters we found track files were useful for verifying flight paths, but did not verify treatment. The Ag-Nav units were wired into the control material hopper switch, so hopper open/shut was recorded, giving a better description of treatment area. Staff were able to successfully retrieve treatment path data from the Ag-Nav units for about 80% of flights in 2007 (the units could track treatment even if we had not been able to load 'To Fly' site boundaries). If it was known in advance that the units were not working, a hand-held GPS was placed in the helicopter to verify the path. Examples of tracks are shown in Figures 6.2 and 6.3.

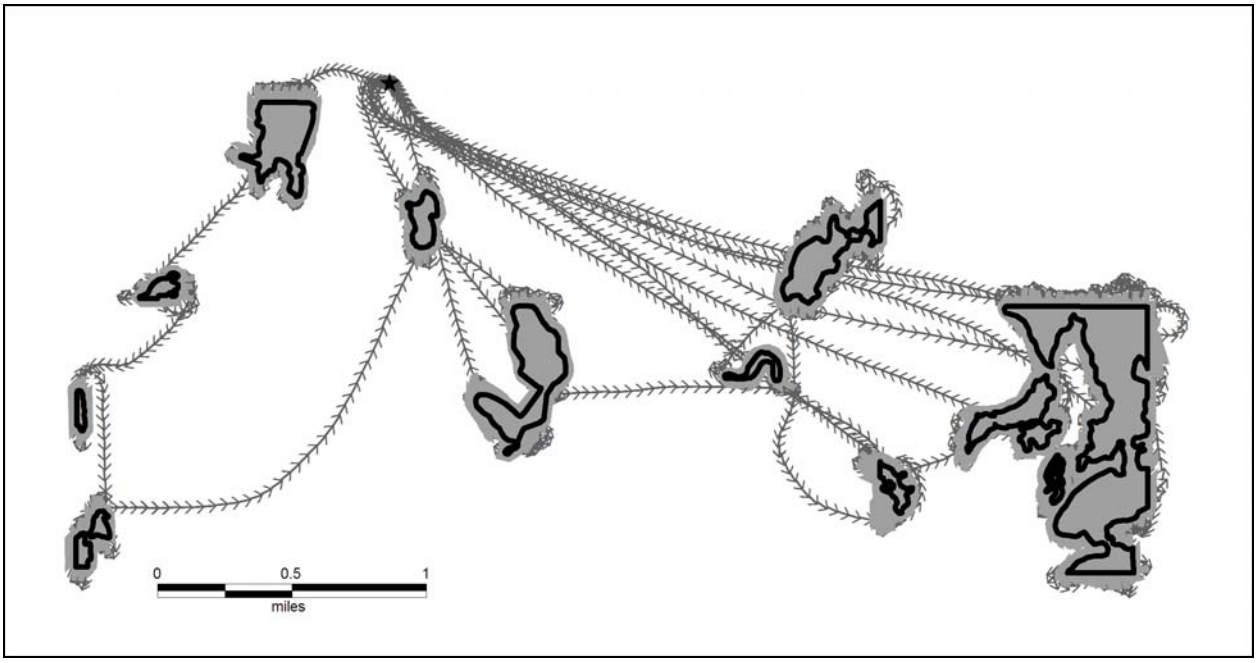


Figure 6.2 'To Fly' site boundaries, with track of path flown by helicopter, showing treatment (hopper on/off) (from 9/27/2007).

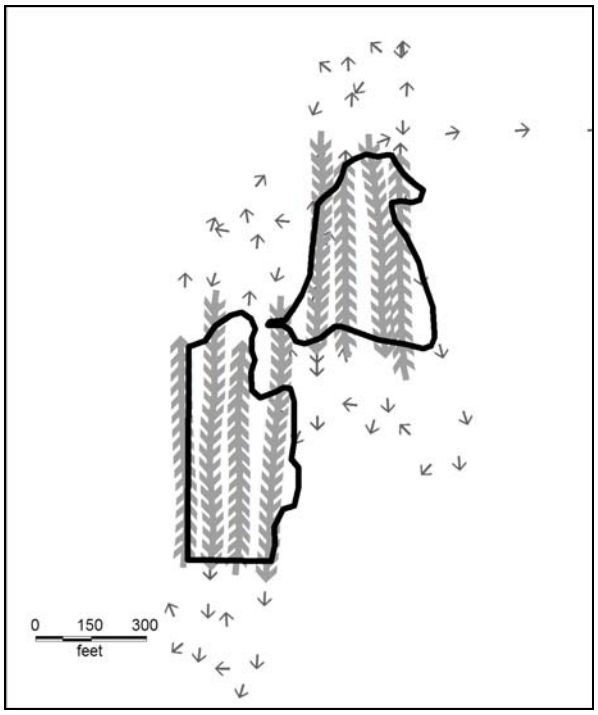


Figure 6.3 Treatment tracks, recorded at 0.4 sec between points, plus non-treatment tracks, at 2.0 sec between points. Arrow shows direction of travel. Tracks often show hoppers open shortly before reaching site edge; pilot allows for aircraft motion in accurately placing material.

In almost all cases we found the pilots were treating the correct sites. When we could review tracks promptly we occasionally found sites that were missed and were able to ask pilots to go back or we would treat the site by hand if it was small. It also appeared that the system sometimes made it easier for pilots to find and correct problems themselves. On some occasions problems with the Ag-Nav hardware or software made it appear as though sites had been missed, when they had actually been treated.

Staff contacted a number of other mosquito control agencies from throughout the US and Canada to find out more about how they are using GPS guidance and tracking systems like Ag-Nav in the aerial treatments, as part of an effort to organize a symposium on this topic for the American Mosquito Control Association (AMCA) annual meeting in March. Although there are relatively few systems available, different agencies have developed various ways to use them and we are looking forward to learning more and potentially improving results for both MMCD and our contractor, Scott's Helicopters.

Field & Lab Data Entry and Reporting

We continued to use the electronic field and lab data entry system, "DataGate", for all mosquito and black fly larval and adult inspection, treatment, and sample data, and much of the physical inventory entry and reporting. The importance of rapid and accurate data access increased as

staff started to use electronic data for helicopter treatment plans (see Ag-Nav, above). Field data continue to be entered using Palm OS-based Personal Digital Assistants (PDAs), and data records are uploaded into the network when field staff return to their base.

Wetland and Stormwater Mapping

Staff finished a major update of wetland mapping in winter of 2006-2007 using 2005 aerial photos obtained cooperatively with the Metropolitan Council GIS office, and is doing updating in areas with changes in winter of 2007-2008. High-quality 2006 aerial photography for much of the metropolitan area was made available in fall 2007 by the USGS, Hennepin and Ramsey counties, and the MN Land Management Information Center (LMIC). These photos were accessed directly through the web, which eliminated the need for storing the very large set of photos locally. Through an agreement with Scott County, staff have been able to obtain spring 2007 digital aerial photography which will be very helpful, especially in the rapidly growing Credit River - New Market area. Scott County is also considering making this photography available through LMIC as a web service, which would make it easier for our users to work with.

A pilot project conducted by the Rosemount facility showed that stormwater control structures such as pond regulators and culverts often provide productive habitat for *Culex* species, so a District-wide effort was launched to map these structures so that they can be effectively treated. Field notes are being digitized in the winter of 2007-2008.

Digital wetland files were provided on request to other units of government, including:

- WSB & Associates for City of St. Paul project
- Rice Creek Watershed District
- Metropolitan Council, Water Supply Planning
- City of Hassan Parks Department

MMCD staff continue to participate in MetroGIS, including serving on the committee setting up a strategic directions workshop and business plan for the next 5 years, working with local governments on plans for a metro-wide property address dataset, and providing project management for the Geocoding project (see below). Staff also participated in the Minnesota GIS/LIS Conference and the Governer's GIS Council Hydrography Committee, where we continue to monitor efforts to update the National Wetlands Inventory (NWI) and find ways MMCD can contribute to that work.

Web Map and Geocoder

The updated wetland boundaries were used in a new web-based mapping system developed by Houston Engineering for MMCD that made wetland maps and larval treatment records for the entire District readily available (Figure 6.4, Figure 6.5). Larval treatment records (Figure 6.6) were updated daily from MMCD's DataGate system.

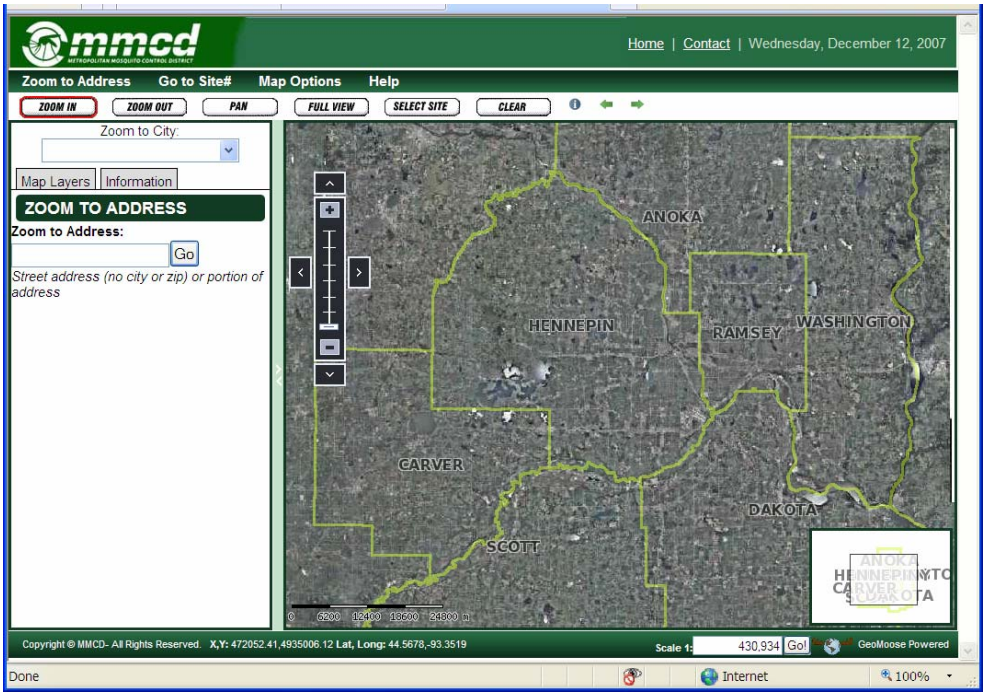


Figure 6.4 MMCD's web map site, opening page (after disclaimer page). Developed by Houston Engineering, using GeoMoose software.

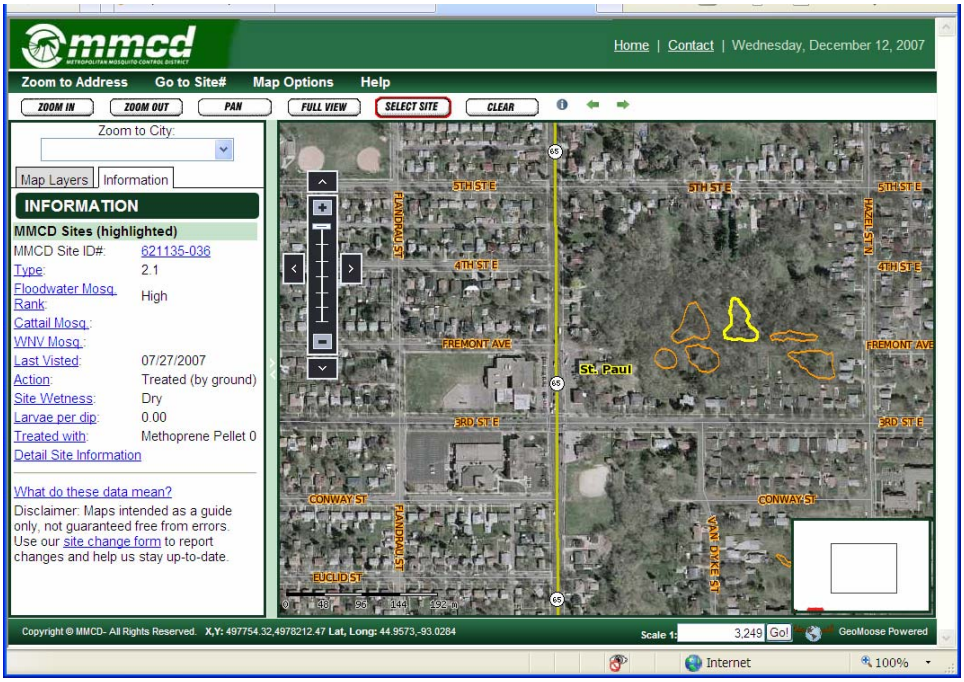
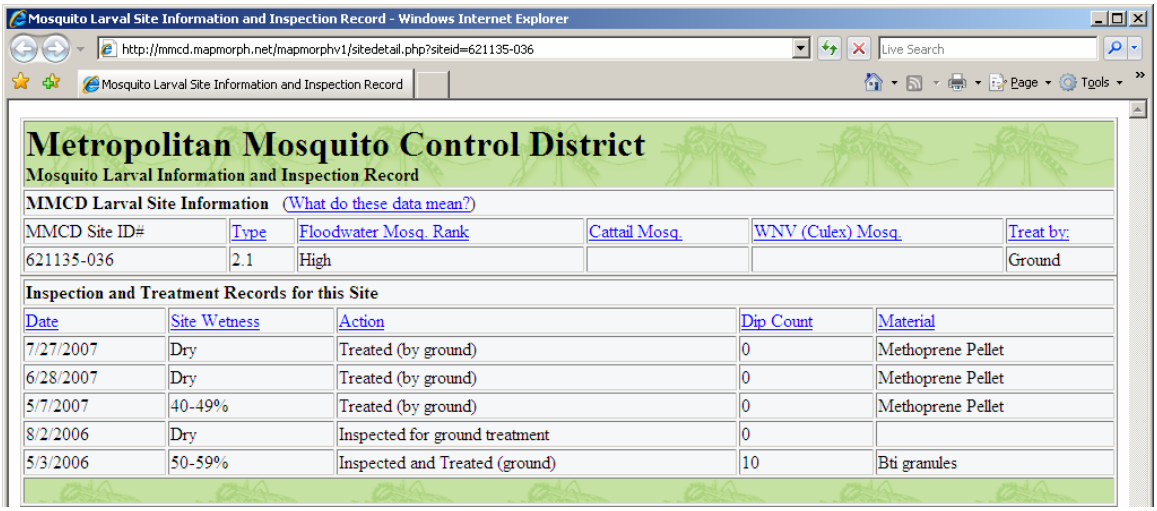


Figure 6.5 MMCD's web map site, showing a wetland selected and initial information on most recent larval treatment.



Metropolitan Mosquito Control District

Mosquito Larval Information and Inspection Record

MMCD Larval Site Information (What do these data mean?)

MMCD Site ID#	Type	Floodwater Mosq. Rank	Cattail Mosq.	WNV (Culex) Mosq.	Treat by:
621135-036	2.1	High			Ground

Inspection and Treatment Records for this Site

Date	Site Wetness	Action	Dip Count	Material
7/27/2007	Dry	Treated (by ground)	0	Methoprene Pellet
6/28/2007	Dry	Treated (by ground)	0	Methoprene Pellet
5/7/2007	40-49%	Treated (by ground)	0	Methoprene Pellet
8/2/2006	Dry	Inspected for ground treatment	0	
5/3/2006	50-59%	Inspected and Treated (ground)	10	Bti granules

Figure 6.6 MMCD's web map site, showing detailed history of inspection and treatments for mosquito larval control.

The public version of the web map site, available from MMCD's home page, www.mmcd.org, under Mosquito Control – Larval Control, was unveiled in April. In May it was featured in a mosquito control piece broadcast on WCCO TV, resulting in thousands of visitors that briefly overwhelmed the web server. Peaks were also evident after other news stories (Figure 6.7). The web map site averaged 35 visitors per day for the year, and was hit from 3,578 unique IP addresses. About 2,000 visitors used the address look-up feature on the site. An internal version with greater detail is available from MMCD computers.

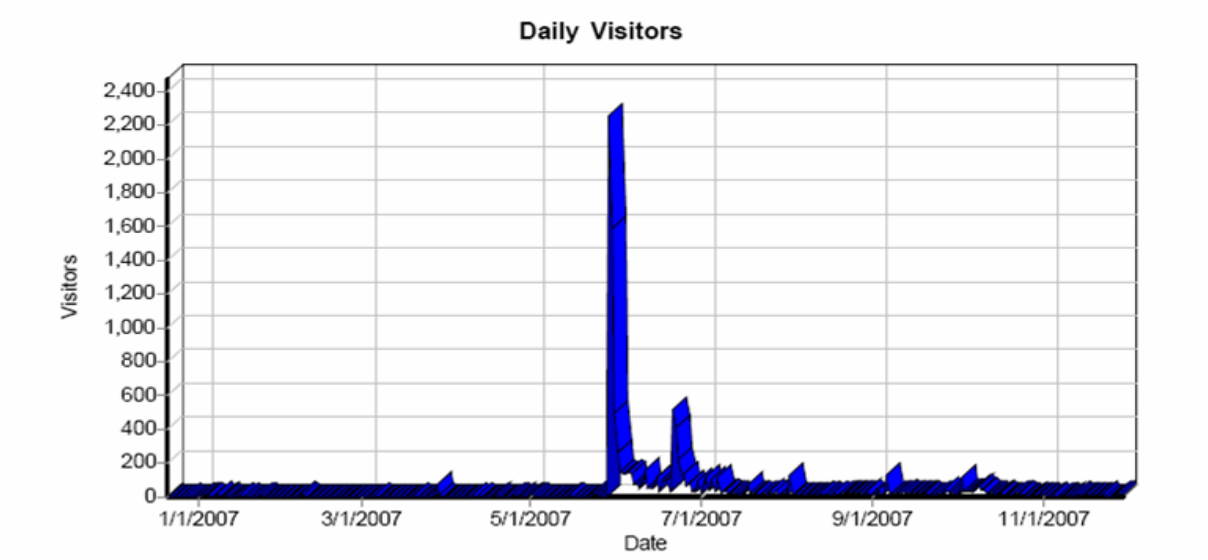


Figure 6.7 Daily visitors at MMCD's web map starting page, 2007.
Source: *Houston Engineering*

One of the map layers available on the web map site is Nexrad estimates of precipitation, including current (Figure 6.8) and storm total maps, provided as a free web service by Iowa State University. Although it only shows current and very recent data, it may be of some use to field

staff tracking areas most likely to need floodwater mosquito control. We hope to find other sources of archived rainfall maps that would make this function more useful.

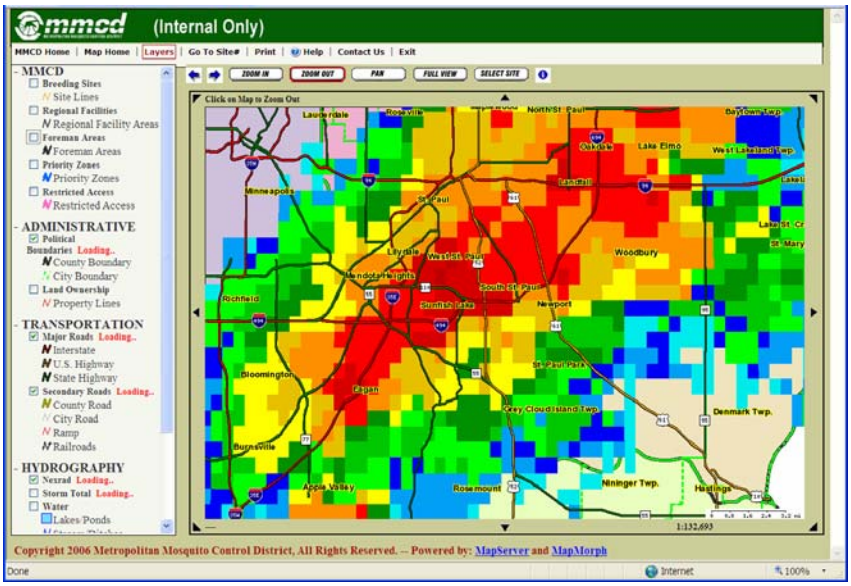


Figure 6.8 MMCD web map showing current Nexrad rainfall (July 26, 2007).

In August, Houston Engineering revised the site to use GeoMoose software, an "open source" (freely available) package developed by a consortium of Minnesota and North Dakota government units (including MMCD) funded through a Federal Geographic Data Committee grant. The new software provides a stable, customizable base for providing maps and data on the web at minimal cost.

MMCD's site opens with a place for people to look up the location of a particular street address ("geocoding"). This function currently does not work as well at finding all variants of addresses as we would like it to. Staff worked with other agencies that need similar functionality for their web sites to organize a project to build a free web service to do this for the metropolitan area using street and parcel layers available through MetroGIS. The project was awarded funding through the Metropolitan Council's support of MetroGIS regional projects and is expected to be completed by April 2008. We look forward to adding this web service to MMCD's site.

Stormwater Management, Wetland Design, and Mosquitoes

Local units of government and private developers continue to expand stormwater management efforts in order to meet federal requirements and reduce effects on state impaired waters. Although concerns about mosquitoes, especially WNV vectors, initially led designers to seek out information on mosquito prevention or control, other issues regarding water quality and quantity now generally dominate planning.

MMCD staff have tried to maintain awareness of mosquito issues within the stormwater design and regulatory community by activities such as attending meetings of the Board of Soil and Water Resources (BWSR) staff, and presenting a poster "Stormwater Management Structure Maps for Mosquito Control" at MN Water Resources Conference (civil engineers, city &

watershed district staff, U of M researchers). The "Stormwater and Mosquitoes" fact sheet on the MMCD web site recorded 76 downloads.

MMCD staff also continues to stay in contact with Minnesota Pollution Control Agency (MPCA) Stormwater Steering Committee regarding current activities and updates to the *Minnesota Stormwater Manual*, a best management practices guidance document produced by MPCA, MN DNR, Minnesota Department of Transportation (Mn/DOT), Minnesota Department of Health (MDH), and soil and water conservation districts for meeting runoff pollution requirements. See http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html to view the *Manual* and the section on Mosquitoes and Stormwater is in Chapter 6.

Staff continue to seek ways to communicate with designers and engineers on this issue and appreciate any suggestions from TAB members.

MMCD staff continues to monitor efforts by the Society of Wetland Scientists (SWS) to develop an SWS Position Statement on West Nile virus, mosquitoes, and wetlands. The development team for this paper is attempting to revive the work, which stalled in 2006 due to irreconcilable differences among the authors. Staff provided information on our mosquito and wetland design efforts to workers from Kansas and Massachusetts.

Nontarget Studies

Results of previous adulticide nontarget studies organized by the TAB subgroup (Karen Oberhauser, Roger Moon, Nancy Read, and Stephen Manweiler) were presented at the Michigan Mosquito Control meeting and the American Mosquito Control Association national meeting (see Presentations). These results are also summarized in the 2004 and 2005 TAB reports, and the studies on permethrin on monarch (*Danaus plexippus* (L.)) larvae appeared in the December 2006 issue of the journal Environmental Entomology. Results of the study of milkweed distribution relative to MMCD adulticide treatments are being submitted to the same journal for publication. MMCD has chosen to explore other possible adulticides as a result of these studies (see Chapter 5 – Adulticide Tests).

Previous Larvicide Nontarget Impact Studies Staff continues to receive requests for earlier publications, including reports on Wright County Long-term Study and other studies on *Bti* and methoprene done under the direction of the Scientific Peer Review Panel (SPRP) assembled by MMCD. These reports are available on the MMCD web site, and download totals for 2007 are given in Table 6.1 (note that these PDF files also end up "downloaded" in order to be read).

Table 6.1 Larvicide nontarget impact study report downloads from www.mmcd.org

Document topic		2006	2007
SPRP Final Report, 1996		89	195
Long-term study brief overview		72	88
Results summary (1991-1998) with graphs		119	157
Balcer et al. 1999 Report:	text	104	136
	figures	66	98
	tables	61	87
	appx. – cores	48	97
	appx. – substrates	41	77

Staff periodically contacts Dr. Richard Anderson, former chair of the SPRP, and is trying to continue efforts to assemble a peer-reviewed journal publication from the 1997-1998 results of the Wright County Long-term Study.

Notification

The District continues to post daily adulticide information on its web site (www.mmcd.org) and on its "Bite Line" (651-643-8383), a pre-recorded telephone message interested citizens can call to get the latest information on scheduled treatments. The District also publishes a three column by nine-inch ad in local daily and weekly newspapers, just prior to Memorial Day weekend, advising citizens how to find out where and when District adulticiding will take place throughout the season. This ad also describes the process for opting out of treatment.

Calls Requesting Service

Calls requesting treatment early in the season generally followed the seasonal pattern shown by sweep net counts for human-biting mosquitoes. Calls requesting service from early May through mid June continue to reflect a high demand for treatment. People planning outdoor activities, such as picnics, outdoor weddings and graduation open houses are responsible for many early season calls, as are actual mosquito numbers. A post Labor Day spike in sweep net numbers appears to have been extreme enough to have generated a significant increase in requests for adulticide treatments (See figure 6.9).

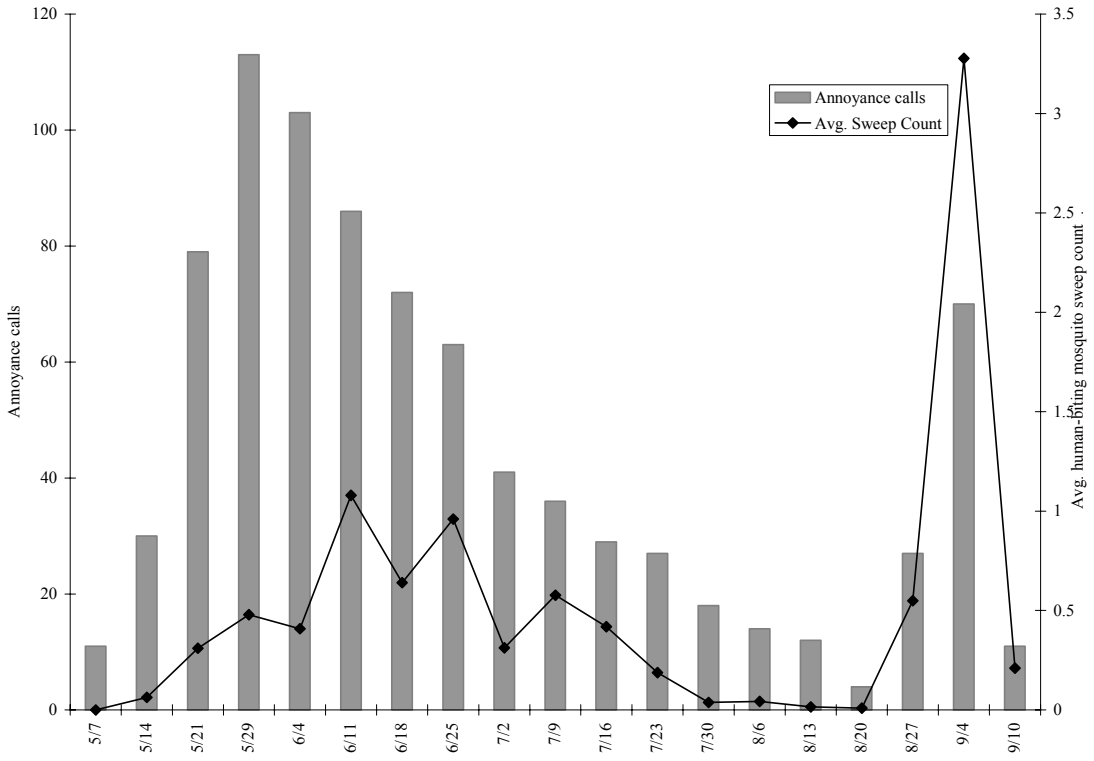


Figure 6.9 Calls requesting service and sweep net counts by week, 2007.

Other calls received are listed in Table 6.2. Total call volume declined from 1,929 calls in 2006 to 1,441 calls in 2007, continuing a downward trend from the high of 4,185 calls recorded during 2003. Lower than average mosquito levels again precipitated fewer calls. Calls requesting a dead bird pick-up for WNV testing were not included in this table. There were 814 phone reports of dead birds and 186 reports sent to MMCD via its web-based reporting form.

Table 6.2 Yearly comparisons of citizen calls tallied by service request from 2002 to 2007

	No. Calls/Year					
Caller Concern	2007	2006	2005	2004	2003	2002
Check a breeding site	393	610	633	984	1,516	1,307
Request adult treatment	867	854	1,094	2,506	2,714	3,062
Public event, request treatment	60	72	100	135	132	171
Request tire removal	208	170	242	255	236	321
Request or confirm limited or no treatment	49	*171	36	38	60	*190

* - years where confirmation postcards sent

Curriculum in Schools

MMCD continued to deliver "Mosquito Mania," a three-day curriculum for upper elementary and middle school students. This curriculum was introduced to metro-area schools during 2005. "Mosquito Mania" builds on MMCD's relationship with schools by offering a standards-based approach to the subject of mosquitoes and their relationship to the environment. Regional facilities together with Main Office staff reached a total 5,585 students in 55 schools during 2007.

Presentations, Posters, and Publications

MMCD staff attends a variety of scientific meetings throughout the year. Following is a list of papers and posters presented during 2007 and those scheduled for 2008. Also included are publications that have MMCD staff as authors or co-authors.

2007

Beadle, K., S. Grant, E. Sell, J. Osborne, and J. Peterson. 2007. Larval control of West Nile virus vectors in storm water management structures. Presentation at the Annual Meeting of the American Mosquito Control Association. Orlando, FL. and North Central Mosquito Control Meeting, Fargo, ND.

Beadle, K., J. Peterson, and N. Read. 2007. Stormwater management structure maps for mosquito control. Poster at Minn. GIS/LIS Consortium Conference, Rochester, MN and Minn. Water Resources Conference, Brooklyn Park, MN.

Crane, D., S. Brogren, and C. LaMere. 2007. Unusual increases in two rare species, *Anopheles quadrimaculatus* and *Culex erraticus*, in Minnesota. Presentation at the Annual Meeting of the American Mosquito Control Association, Orlando, FL.

Grant, S., J. Walz and C. LaMere. 2007. Overview of black fly control in Minnesota, and overview of operations at the Metropolitan Mosquito Control District. Presentation at the Pennsylvania Vector Control Association Annual Conference, State College, PA.

Griemann, L. and J. Jarnefeld. 2007. Sixteen years of *Ixodes scapularis* surveillance in the Twin Cities area, Minnesota. Presentation at the Annual Meeting of the American Mosquito Control Association, Orlando, FL.

Johnson, K. 2007. West Nile virus in the Metropolitan Mosquito Control District, Minnesota. Presentation at the Annual Meeting of the American Mosquito Control Association, Orlando, FL.

Johnson, K., K. Beadle, S. Grant, J. Osborne, J. Peterson, E. Sell, and S. Manweiler. 2007. Mosquito development in Minnesota stormwater management structures. Presentation at the Society of Vector Ecology meeting, Springfield, IL.

Manweiler, S., N. Read, K. Oberhauser, and R. Moon. 2007. Evaluating potential non-target effects of pyrethroid mosquito adulticides using monarch butterflies as sentinel. Presentation at the Annual Meeting of the Michigan Mosquito Control Association, Traverse City, MI.

McLean, M. and N. Read. 2007. Citizen use of wetlands on the web: First year results. Presentation at the Minn. GIS/LIS Consortium Conference, Rochester, MN and at MetroGIS Policy Board Meeting, St. Paul, MN.

Sell, E. and K. Beadle. 2007. Larval control of West Nile virus vectors in storm water management structures. Presentation at the Annual Meeting of the Michigan Mosquito Control Association, Traverse City, MI.

Sell, E., J. Jarnefeld and S. Manweiler. 2007. Sixteen years of *Ixodes scapularis* surveillance in the Twin Cities area. Presentation at the Annual Meeting of the Michigan Mosquito Control Association. Traverse City, MI.

Stevens, C. and N. Read. 2007. Integrating Ag-Nav technology into MMCD's aerial larvicide program. Presentation at the Annual Meeting of the Michigan Mosquito Control Association, Traverse City, MI.

Smith, M. 2007. Control material inventory management at the Metropolitan Mosquito Control District. Presentation at the Annual Meeting of the American Mosquito Control Association, Orlando, FL.

Smith, M. 2007. Overview of operations at the Metropolitan Mosquito Control District. Presentation at the North Central Mosquito Control Meeting, Fargo, ND.

Smith, M. 2007. Larval control of West Nile virus vectors in storm water management structures. Presentation at the North Central Mosquito Control Meeting, Fargo, ND.

Smith, M. 2007. Mosquito control update. Presentation at the Minnesota Aerial Applicator Association meeting. Minnesota Dept. of Agriculture re-licensing training, Fargo, ND.

Stith, D. 2007. MMCD *Cq. perturbans* control overview. Presentation at North Central Mosquito Control Meeting, Fargo, ND.

Read, N. and D. Bitner. 2007. Metro geocoding web service/application project. Presentation at MN. GIS/LIS Consortium Conference, Rochester, MN.

Read, N. R., Manweiler, S., K. Oberhauser, and R. Moon. 2007. Nontarget effects of permethrin and resmethrin on monarch butterflies: Toxicity and exposure studies. Presentation at the Annual Meeting of the American Mosquito Control Association, Orlando, FL.

Walz, J. 2007. MMCD Black Fly Control Program. Presentation at North Central Mosquito Control Meeting, Fargo, ND.

Walz, J., A. Benson, and C. LaMere. 2007. What's going on in Minnesota? Black fly monitoring and control in the greater metropolitan area of the Twin Cites of Minneapolis and St. Paul, Minnesota, USA. Presentation at the North American Black Fly Association annual meeting, Athens, GA.

2008 (planned)

Brogren, S., D. Crane, and C. LaMere. 2008. You've come a long way *Aedes*: A historical review of surveillance methods and the mosquito fauna in the metropolitan area of Minnesota. Presentation at the Annual Meeting of the Michigan Mosquito Control Association, Kalamazoo, MI.

Crane, D., S. Brogren, and C. LaMere. 2008. You've come a long way *Aedes*: A 50-year review of surveillance methods and the mosquito fauna in the metropolitan area of Minnesota. Presentation at the Annual Meeting of the American Mosquito Control Association, Sparks, NV.

Manweiler, S., D. Stith, and M. Kirkman. 2008. Incorporation of Altosid XR-G sand into MMCD's *Coquillettidia perturbans* control program. Presentation at the Annual Meeting of the Michigan Mosquito Control Association, Kalamazoo, MI.

Peterson, J., K. Beadle, and N. Read. 2008. Surveillance and control of *Culex* vectors in storm water structures. Poster at the Annual Meeting of the American Mosquito Control Association, Sparks, NV.

Prather, B. and K. Johnson. 2008. Managing WNV Vectors: Larval and adult control in urban environments. Presentation at the Annual Meeting of the Michigan Mosquito Control Association, Kalamazoo, MI.

Read, N., B. Fischer, M. McLean, and J. Peterson. 2008 Web map connects citizens, staff, and data. Presentation at the Annual Meeting of the American Mosquito Control Association, Sparks, NV.

Read, N. 2008. Larviciding in Minneapolis/St. Paul, MN. In Symposium: Aerial Treatment Guidance/Tracking GPS - Experience From the Field. Presentation at the Annual Meeting of the American Mosquito Control Association, Sparks, NV.

Smith, M. and S. Manweiler. 2008. Evaluation of Altosid XR-G sand for expansion of control of *Coquillettidia perturbans* mosquitoes in MN. Presentation at the American Mosquito Control Association Annual Meeting, Sparks, NV.

Walz, J., K. Simmons, and C. LaMere. 2008. Black fly larval control with *Bti* and long-term non-target monitoring in the Mississippi River. Presentation at the North American Black Fly Association annual meeting, Laughlin, NV.

APPENDIX A Mosquito Biology

There are 50 species of mosquitoes in Minnesota. Thirty-nine species are found within the MMCD. Species can be grouped according to their habits and habitat preferences. For example, the District uses the following categories when describing the various species: Disease vectors, spring snow melt species, summer flood water species, permanent water species, and the cattail mosquito.

Disease Vectors

Aedes triseriatus Also known as the eastern treehole mosquito, *Ae. triseriatus*, is the vector of La Crosse encephalitis. The preferred larval habitats are tree holes and artificial containers, especially discarded tires. The adults are found in wooded or shaded areas and stay within ¼ to ½ miles from where they emerged. They are not aggressive biters and are not attracted to light. Vacuum aspirators are best for collecting this species.

Culex tarsalis *Culex tarsalis* is the vector of western equine encephalitis (WEE) and a vector of West Nile virus (WNV). In late summer, egg laying spreads to temporary pools and artificial containers, and feeding shifts from birds to horses or humans. MMCD monitors this species using New Jersey light traps and CO_2 traps.

Other *Culex* Three additional species of *Culex* (*Cx. pipiens, Cx. restuans, Cx. salinarius*) are vectors of WNV. All three develop in permanent and semipermanent sites and *Cx. pipiens* and *Cx. restuans* breed in storm sewers and catch basins as well. Gravid traps and CO_2 traps are used to monitor these mosquitoes.

Culiseta melanura *Culiseta melanura* is the enzootic vector of eastern equine encephalitis (EEE). Its preferred larval habitat is spruce tamarack bogs. Adults do not fly far from their breeding sources. MMCD monitors *Cs. melanura* abundance with CO_2 traps and vacuum aspirators. Adults are tested for eastern equine encephalitis virus.

Floodwater Mosquitoes

Spring Snow Melt *Aedes* Spring snow melt mosquitoes are the earliest mosquitoes to hatch in the spring. They develop in woodland pools, bogs, and marshes that are flooded with snow melt water. There is only one generation per year and overwintering is in the egg stage. Adult females live throughout the summer and can take up to four blood meals. These mosquitoes do not fly very far from their larval sites, so localized hot spots of biting can occur both day and night. Our most common spring species are *Ae. abserratus*, *Ae. excrucians* and *Ae. stimulans*. Adults are not attracted to light, so human or CO_2-baited trapping is recommended.

Summer Flood Water *Aedes* Summer flood water eggs hatch in late April and early May. Eggs are laid at the margins of grassy depressions, marshes, and along river flood plains. There are multiple generations per year resulting from rainfalls greater than one inch. Overwintering is in the egg stage. Adult females live about three weeks. Most species can fly great distances and are highly attracted to light. Peak biting activity is as at dusk.

The floodwater mosquito, *Ae. vexans*, is our most numerous pest. Other summer species are *Ae. cinereus*, *Ae. sticticus,* and *Ae. trivittatus*. New Jersey light traps, CO_2-baited traps, and human-baited sweep net collections are effective methods for adult surveillance of these species.

Cattail Mosquito

Coquillettidia perturbans This summer species develops in cattail marshes and is called the cattail mosquito. A unique characteristic of this mosquito is that larvae can obtain oxygen by attaching a specialized siphon to the roots of cattails and other aquatic plants. They overwinter in this manner. Adults begin to emerge in late June, with peak emergence around the first week of July. They are very aggressive biters, even indoors, and will fly up to five miles from the breeding site. Peak biting activity is at dusk and dawn. Surveillance of adults is best achieved with CO_2 traps.

Permanent Water Species

Other mosquito species not previously mentioned develop in permanent and semipermanent sites. These mosquitoes comprise the remaining *Anopheles*, *Culex*, and *Culiseta* species. These mosquitoes are multi-brooded and lay their eggs in rafts on the surface of the water. The adults prefer to feed on birds or livestock but will bite humans. The adults overwinter in places like caves, hollow logs, stumps or buildings. The District targets four *Culex* species and one *Culiseta* species for surveillance and/or control.

APPENDIX B Average Number of Specimens of the Most Common Mosquitoes Collected per Night in New Jersey Light Traps 1965-2007

Year	*Aedes abs/punc*	*Aedes cinereus*	*Aedes sticticus*	*Aedes trivittatus*	*Aedes vexans*	*Culex tarsalis*	*Coquillettidia perturbans*	All species	Average Rainfall
1965	1.03	0.77	0.19	0.08	89.00	4.70	1.43	111.74	27.97
1966	1.29	0.13	0.00	0.02	33.70	0.69	17.66	61.78	14.41
1967	0.64	0.24	0.65	0.12	75.40	1.61	14.37	101.55	15.60
1968	0.14	1.60	0.04	0.77	119.30	1.25	2.43	136.54	22.62
1969	0.70	0.19	0.02	0.17	19.90	0.65	4.27	30.82	9.75
1970	0.17	0.57	0.06	0.33	73.10	0.76	2.78	83.16	17.55
1971	0.69	0.55	0.15	0.33	52.10	0.28	3.51	62.93	17.82
1972	0.98	2.13	0.41	0.35	124.50	0.39	8.12	142.35	18.06
1973	1.29	0.70	0.11	0.06	62.20	0.41	25.86	95.14	17.95
1974	0.17	0.32	0.14	0.12	30.30	0.15	7.15	40.09	14.32
1975	0.28	0.63	0.44	0.17	40.10	6.94	4.93	60.64	21.47
1976	0.10	0.05	0.04	0.00	2.30	0.23	4.42	9.02	9.48
1977	0.20	0.16	0.01	0.02	17.50	2.44	1.16	25.17	20.90
1978	0.17	0.74	0.33	0.24	51.40	1.35	1.04	62.63	24.93
1979	0.07	0.24	0.10	0.21	18.30	0.13	4.39	25.59	19.98
1980	0.02	0.26	0.33	0.77	47.40	0.25	13.87	65.28	19.92
1981	0.01	0.10	0.25	1.03	57.00	0.44	3.98	65.30	19.08
1982	0.01	0.21	0.08	0.03	23.10	0.15	8.63	34.60	15.59
1983	0.03	0.24	0.08	0.14	55.60	0.58	8.72	69.71	20.31
1984	0.08	0.16	0.14	0.35	65.40	1.82	1.60	92.42	21.45
1985	0.05	0.17	0.05	0.02	21.20	0.21	5.07	28.51	20.73
1986	0.40	0.23	0.12	0.03	25.80	0.92	2.61	34.30	23.39
1987	0.00	0.11	0.01	0.15	29.10	0.96	3.37	37.77	19.48
1988	0.01	0.51	0.00	0.00	21.00	0.72	1.40	27.28	12.31
1989	0.66	1.60	0.01	0.12	14.40	1.01	0.12	26.35	16.64
1990	0.83	11.37	1.22	0.34	125.80	2.65	0.99	159.45	23.95
1991	1.17	2.67	1.55	0.51	90.80	1.37	6.03	14.44	26.88
1992	0.09	0.09	0.02	0.24	36.00	0.49	38.31	79.81	19.10
1993	0.54	0.50	1.01	1.50	71.20	1.20	34.10	120.45	27.84
1994	0.70	0.47	0.46	0.33	29.70	0.15	68.45	104.52	17.72
1995	2.13	1.62	0.25	0.40	129.01	0.37	48.28	193.26	21.00
1996	0.82	0.62	0.58	0.47	25.82	0.09	40.65	72.05	13.27
1997	1.53	1.91	0.19	4.46	72.66	0.10	48.47	132.48	21.33
1998	1.86	0.66	0.08	0.54	53.93	0.05	36.16	89.89	19.43
1999	2.48	0.93	0.31	0.37	60.73	0.04	28.71	82.64	22.41
2000	0.38	0.30	0.00	1.33	56.61	0.15	20.61	89.85	17.79
2001	1.20	2.65	1.38	6.05	76.77	0.23	10.93	114.23	17.73
2002	0.30	1.07	0.07	2.18	92.77	0.39	5.07	108.35	29.13
2003	6.54	1.69	1.00	2.31	76.80	0.17	51.13	149.75	16.79
2004	0.49	1.79	0.53	0.72	29.91	0.14	11.39	48.34	21.65

Year	*Aedes abs/punc*	*Aedes cinereus*	*Aedes sticticus*	*Aedes trivittatus*	*Aedes vexans*	*Culex tarsalis*	*Coquillettidia perturbans*	All species	Average Rainfall
2005	1.42	2.03	0.11	0.37	29.04	0.18	12.16	49.21	23.60
2006	6.29	1.16	0.14	0.01	12.63	0.08	20.61	44.41	18.65
2007	4.23	2.15	0.01	0.01	12.69	0.25	32.04	59.48	17.83

APPENDIX C Description of Control Materials

The following is an explanation of the control materials currently used by MMCD in 2007, including specific product names. The generic products will not change in 2008, although the specific formulator may change.

Altosid (methoprene) 150-day briquets Zoecon/Central Life Sciences
(Altosid® XR Extended Residual Briquet)

Altosid briquets are typically applied to larval mosquito habitats which are three acres or less. Briquets are applied to the lowest part of the site on a grid pattern of 14-16 ft apart at 220 briquets per acre. Sites which may flood and then dry up (Types 1 & 2) are treated completely. Sites which are somewhat permanent (Types 3, 4, 5) are treated with briquets to the perimeter of the site in the grassy areas. Pockety ground sites (i.e., sites without a dish type bottom) may not be treated with briquets due to spotty control achieved in the uneven drawdown of the site.

Cattail mosquito (*Cq. perturbans*) larval habitats are treated at 330 briquets per acre in rooted sites or 440 briquets per acre in floating cattail stands. Applications are made in the winter and early spring.

Altosid (methoprene) pellets (Altosid® Pellets) Zoecon/Central Life Sciences

Altosid pellets consist of methoprene formulated in a pellet shape. Altosid pellets are designed to provide up to 30 days control but trials have indicated control up to 40 days. Applications will be made to ground sites (less than three acres in size) at a rate of 2.5 lb per acre for *Aedes* control and 4-5 lb per acre for *Cq. perturbans* control. Applications will also be done by helicopter in sites which are greater than three acres in size at the same rate as ground sites, primarily for *Cq. perturbans* control.

Altosid (methoprene) XR-G sand (Altosid® XR-G Sand) Zoecon/Central Life Sciences

Altosid XR-G sand consists of methoprene formulated in a sand-sized granule designed to provide up to 20 days control. Applications will be made to ground sites (less than three acres in size) at a rate of five lb per acre for *Aedes* control. Experimental applications for control of *Cq. perturbans* are being evaluated at 10 lb per acre.

***Bacillus thuringiensis israelensis* corn cob** (VectoBac® G) Valent BioSciences Corporation

Bacillus thuringiensis israelensis (*Bti*) corn cob may be applied in all types of sites where mosquitoes develop. *Bti* can be effectively applied during the first 3 instars of the mosquito breeding cycle. Typical applications are by helicopter in sites which are greater than three acres in size at a rate of 5-10 lb per acre. In sites less than three acres, *Bti* is applied to pockety sites with cyclone seeders or power back packs.

***Bacillus thuringiensis israelensis* liquid** (VectoBac® 12AS) Valent BioSciences Corporation

Bacillus thuringiensis israelensis liquid is applied directly to small streams and large rivers to control black fly larvae. Treatments are applied when standard Mylar sampling devices collect threshold levels of black fly larvae. Maximum dosage rates are not to exceed 25 ppm of product

as stipulated by the MnDNR. *Bti* is applied at pre-determined sites, usually at bridge crossings applied from the bridge, or by boat.

Bacillus sphaericus (VectoLex® CG) Valent BioSciences Corporation

Bacillus sphaericus corn cob may be experimentally applied in all types of *Culex* mosquito breeding. *Bacillus sphaericus* can be effectively applied during the first three instars of the mosquito breeding cycle. Typical experimental applications are by helicopter in sites which are greater than three acres in size at a rate of 5-10 lb per acre. In sites less than three acres, *B. sphaericus* is applied to pockety sites with cyclone seeders or power back packs at rates of 7 lb per acre. This product is also being evaluated as a control material for catch basin applications.

Bti*/*B. sphaericus (VectoMax® CG) Valent BioSciences Corporation

VectoMax CG contains two active ingredients, *Bti* and *B. sphaericus*, and is formulated on corn cob granules similar to VectoBac G. VectoMax CG is being tested in pond level regulators and culverts at a rate of 8 lb per acre.

Bti*/*B. sphaericus (FourStar™ *Bti*/*B. sphaericus* Briquets 150) Meridian LLC

FourStar briquets are designed to work by releasing *Bti* and *B. sphaericus* that is ingested by mosquito larvae which are then killed sometime afterward. FourStar briquets are being tested in catch basins at a rate of 1 briquet per catch basin.

Esfenvalerate (Onslaught™ Microencapsulated Insecticide) Mc Laughlin Gormley King Co.

Esfenvalerate (also known as fenvalerate) is a pyrethroid formulation (Onslaught) that is microencapsulated which should limit its penetration into foliage. Onslaught is mixed with water before application, thereby eliminating the soybean oil used to dilute permethrin as currently used by MMCD.

Onslaught is being tested to control adult mosquitoes in known daytime resting or harborage areas (the same barrier method employed for permethrin treatments). Harborage areas are defined as wooded areas with good ground cover to provide a shaded, moist area for mosquitoes to rest during the daylight hours. In tests, Onslaught is applied to wooded areas with a power backpack mister at a rate of 25 oz of mixed material per acre (0.0004 lb AI per acre). Onslaught is a non-restricted use compound.

Permethrin (Permethrin 57% OS) Clarke Mosquito Control Products

Permethrin is used by the District to treat adult mosquitoes in known daytime resting or harborage areas. Adult control is initiated when MMCD surveillance (sweep net and CO_2 trap collections) indicates nuisance populations of mosquitoes, when employee conducted landing rate collections document high numbers of mosquitoes, or when a large number of citizen complaints of mosquito annoyance are received from an area. In the case of citizen complaints, MMCD staff evaluates mosquito levels to determine if treatment is warranted. MMCD also treats functions open to the public and public owned park and recreation areas upon request and at no charge if the event is not-for-profit.

The District mixes permethrin with soybean and food grade mineral oil and applies it to wooded areas with a power backpack mister at a rate of 25 oz of mixed material per acre (0.0977 lb active ingredient per acre).

Resmethrin (Scourge® 4+12) Bayer Environmental Science

Resmethrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Resmethrin is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand-held cold fog machines that enable the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Resmethrin is applied at a rate of 1.5 oz of mixed material per acre (0.0035 lb AI per acre). Resmethrin is a restricted use compound and is applied only by Minnesota Department of Agriculture licensed applicators.

Sumithrin (Anvil® 2+2) Clarke Mosquito Control Products

Sumithrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Sumithrin is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enable applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Sumithrin is applied at a rates 1.5 and 3.0 oz of mixed material per acre (0.00175 and 0.0035 lb AI per acre). Sumithrin is a non-restricted use compound.

Natural Pyrethrin (Pyrenone® 25-5) Bayer Environmental Science

Pyrenone is used by the District to treat adult mosquitoes in known areas of concentration or nuisance where crop restrictions prevent treatments with resmethrin or sumithrin. Pyrenone is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enables the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Pyrenone is applied at a rate of 1.5 oz of mixed material per acre (0.00172 lb active ingredient per acre). Pyrenone is a non-restricted use compound.

Natural Pyrethrin [Pyrocide® 7396 (5+25)] Mc Laughlin Gormley King Co.

Pyrocide is used by the District to treat adult mosquitoes in known areas of concentration or nuisance where crop restrictions prevent treatments with resmethrin or sumithrin. Pyrocide is applied from truck or all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enables the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Pyrocide is applied at a rate of 1.5 oz of mixed material per acre (0.00217 lb AI per acre). Pyrocide is a non-restricted use compound.

APPENDIX D 2007 Control Materials: AI Identity, Percent Active Ingredient (AI), Per Acre Dosage, AI Applied Per Acre and Field Life

Material	AI	% AI	Per acre dosage	AI/acre (lb)	Field life (days)
Altosid briquets [a]	Methoprene	2.10	220 briq	0.4481	150
			330 briq	0.6722	150
			440 briq	0.8963	150
			1* briq	0.0020*	150
Altosid pellets	Methoprene	4.25	2.5 lb	0.1063	30
			4 lb	0.1700	30
			0.0077 lb* (3.5 g)	0.0003*	30
Altosid SR-20 [b]	Methoprene	20.00	20 ml	0.0091	10
Altosid XR-G	Methoprene	1.50	10 lb	0.1500	20
Altosand	Methoprene	0.05	5 lb	0.0025	10
VectoBac G	*Bti*	0.20	5 lb	0.0100	1
			8 lb	0.0160	1
VectoLex CG	*B. sphaericus*	7.50	8 lb	0.6000	7-28
			0.0077 lb* (3.5 g)	0.0006*	7-28
Permethrin 57%OS [c]	Permethrin	5.70	25 fl oz	0.0977	5
Scourge [d]	Resmethrin	4.14	1.5 fl oz	0.0035	<1
Anvil [e]	Sumithrin	2.00	3.0 fl oz	0.0035	<1
			1.5 fl oz	0.00175	<1
Pyrenone [f]	Pyrethrins	2.00	1.5 fl oz	0.00172	<1
Pyrocide [g]	Pyrethrins	2.50	1.5 fl oz	0.00217	<1

[a] 44 g per briquet total weight (220 briquets=21.34 lb total weight)
[b] 1.72 lb AI per 128 fl oz (1 gal); 0.45 lb AI per 1000 ml (1 liter)
[c] 0.50 lb AI per 128 fl oz (1 gal) (product diluted 1:10 before application, undiluted product contains 5.0 lb AI per 128 fl oz)
[d] 0.30 lb AI per 128 fl oz (1 gal)
[e] 0.15 lb AI per 128 fl oz (1 gal)
[f] 0.147 lb AI per 128 fl oz (1 gal) (product diluted 1:1.5 before application, undiluted product contains 0.367 lb AI per 128 fl oz)
[g] 0.185 lb AI per 128 fl oz (1 gal) (product diluted 1:1 before application, undiluted product contains 0.37 lb AI per 128 fl oz)
* Catch basin treatments—dosage is the amount of product per catch basin

APPENDIX E Acres Treated with Control Materials Used by MMCD for Mosquito and Black Fly Control for 1999-2007; the actual geographic area treated is smaller because some sites are treated more than once

Control Material	1999	2000	2001	2002	2003	2004	2005	2006	2007
Altosid XR Briquet 150-day	533	533	589	628	323	398	635	352	290
Altosid Sand-Products	3,968	786	1,889	1,822	0.5	0	0	0	1,776
Altosid SR-20 Liquid	355	29	91	51	33	0	0	0	0
Altosid Pellets 30-day	13,775	11,121	14,791	16,521	18,458	19,139	29,965	31,827	36,818
Altosid Pellets Catch Basins	0	0	0	0	135,978	148,023	145,386	167,797	161,876
Altosid XR Briquet Catch Basins	0	0	0	0	0	0	0	5,210	6,438
VectoLex CG granules	0	0	0	0	0	0	810	540	27
Bti Corn Cob granules	118,733	84,521	90,527	202,875	113,198	166,299	176,947	160,780	118,128
Bti Liquid Black Fly (gallons used)	4,343	821	4,047	3,169	3,408	2,813	3,230	1,035	1,348
Permethrin Adulticide	4,865	4,066	3,444	5,734	6,411	8,292	7,982	5,114	3,897
Resmethrin Adulticide	51,582	42,986	41,311	43,302	68,057	71,847	40,343	29,876	24,102
Sumithrin Adulticide	0	0	8,423	32,230	14,447	15,508	25,067	5,350	5,608

APPENDIX F Control Material Labels

Altosid® XR Extended Residual Briquets

Altosid® Pellets

Altosid® Liquid Larvicide Concentrate

Altosid® XR-G

VectoBac® 12AS

VectoBac® G

VectoBac® WDG

VectoLex® CG

VectoMax® CG

FourStar™ Bti Briquets 150

Permethrin 57% OS

Scourge® 4+12

Anvil® 2+2 ULV

Pyrenone® 25-5

Pyrocide®

Onslaught™ Microencapsulated Insecticide

Altosid® XR
EXTENDED RESIDUAL BRIQUETS

A SUSTAINED RELEASE PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

SPECIMEN LABEL

ACTIVE INGREDIENT:

(S)-Methoprene (CAS #65733-16-6) (Dry Weight Basis)	2.1%
OTHER INGREDIENTS:	97.9%
Total	100.0%

This product contains water; therefore the weight of the briquet and percent by weight of active ingredient will vary with hydration. The ingredient statement is expressed on a dry weight basis.

EPA Reg No. 2724-421

KEEP OUT OF REACH OF CHILDREN
CAUTION

INTRODUCTION

ALTOSID® XR BRIQUETS are designed to release effective levels of methoprene insect growth regulator over a period up to 150 days in mosquito breeding sites. Release of methoprene insect growth regulator occurs by dissolution of the briquet. Soft mud and loose sediment can cover the briquets and inhibit normal dispersion of the active ingredient. The product may not be effective in those situations where the briquet can be removed from the site by flushing action.

ALTOSID XR BRIQUETS prevent the emergence of adult mosquitoes including: *Anopheles, Culex, Culiseta, Coquillettidia,* and *Mansonia* spp., as well as those of the floodwater mosquito complex (*Aedes* and *Psorophora* spp.) from treated water. Treated larvae continue to develop normally to the pupal stage where they die.

NOTE: Methoprene insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION
ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

APPLICATION TIME

Placement of **ALTOSID XR BRIQUETS** should be at or before the beginning of the mosquito season. **ALTOSID XR BRIQUETS** can be applied prior to flooding when sites are dry, or on snow and ice in breeding sites prior to spring thaw. Under normal conditions, 1 application should last the entire mosquito season, or up to 150 days, whichever is shorter. Alternate wetting and drying will not reduce their effectiveness.

APPLICATION RATES

Aedes and *Psorophora* spp.: For control in non-(or low-) flow shallow depressions (≤ 2 feet in depth), treat on the basis of surface area, placing 1 briquet per 200 ft². Briquets should be placed in the lowest areas of mosquito breeding sites to maintain continuous control as the site alternately floods and dries up.

Culex, Culiseta, and *Anopheles* spp.: Place one **ALTOSID XR BRIQUET** per 100 ft².

Coquillettidia and *Mansonia* spp.: For application to cattail marshes and water hyacinth beds. For control of these mosquitoes, place 1 briquet per 100 ft².

Culex sp. in storm water drainage areas, sewers, and catch basins: For catch basins, place 1 briquet into each basin. In cases of large catch basins, follow the chart below to determine the number of briquets to use. For storm water drainage areas, place 1 briquet per 100 feet square of surface area up to 2 ft deep. In areas that are deeper than 2 feet, use 1 additional briquet per 2 feet of water depth.

Large water flows may increase the dissolution of the briquet thus reducing the residual life of the briquet. Regular inspections (visual or biological) in areas of heavy water flow may be necessary to determine if the briquet is still present. The retreatment interval may be adjusted based on the results of an inspection.

Altosid XR Briquets Application Chart

Number of Briquets	Catch Basin Size (Gallons)	Surface Area/ Water Depth (ft)
1	0 – 1500	0 – 2
2	1500 – 3000	2 – 4
3	3000 – 4500	4 – 6
4	4500 – 6000	6 – 8

APPLICATION SITES

ALTOSID XR BRIQUETS are designed to control mosquitoes in treated areas. Examples of application sites are: storm drains, catch basins, roadside ditches, fish ponds, ornamental ponds and fountains, other artificial water-holding containers, cesspools and septic tanks, waste treatment and settling ponds, flooded crypts, transformer vaults, abandoned swimming pools, tires, construction and other manmade depressions, cattail marshes, water hyacinth beds, vegetation-choked phospate pits, pastures, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, treeholes, woodland pools, floodplains, and dredging spoil sites. For application sites connected by a water system, i.e., storm drains or catch basins, all of the water-holding sites in the system should be treated to maximize the efficiency of the treatment program.

STORAGE AND DISPOSAL

STORAGE

Store in a cool place. Do not contaminate water, food, or feed by storage or disposal. Do not reuse empty container.

DISPOSAL

Dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For information, or in case of an emergency, call **1-800-248-7763** or visit our web site: **www.altosid.com**

Wellmark

ZOËCON Professional Products

Wellmark International
Schaumburg, Illinois U.S.A.

January 2002
Schaumburg, IL

22 - 24 - 001

Made in the U.S.A.

Altosid® Pellets
MOSQUITO GROWTH REGULATOR

A GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

SPECIMEN LABEL

ACTIVE INGREDIENT:
(S)-Methoprene (CAS #65733-16-6) 4.25%
OTHER INGREDIENTS: 95.75%
Total 100.00%

EPA Reg No. 2724-448
EPA EST. NO. 39578-TX-1

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION
ENVIROMENTAL HAZARDS

This product is toxic to aquatic dipteran (mosquitoes) and chironomid (midge) larvae. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

INTRODUCTION

ALTOSID® Pellets release ALTOSID® Insect Growth Regulator as they erode. The pellets prevent the emergence of adult standing water mosquitoes, including *Anopheles*, *Culex*, *Culiseta*, *Coquillettidia*, and *Mansonia* spp., as well as adults of the floodwater mosquitoes, such as *Aedes* and *Psorophora* spp. from treated sites.

GENERAL DIRECTIONS

ALTOSID Pellets release effective levels of ALTOSID Insect Growth Regulator for up to 30 days under typical environmental conditions. Treatment should be continued through the last brood of the season. Treated larvae continue to develop normally to the pupal stage where they die. NOTE: This insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

APPLICATION SITES AND RATES

MOSQUITO HABITAT	RATES (Lb/Acre)
Floodwater sites	
Pastures, meadows, ricefields, freshwater swamps and marshes, salt and tidal marshes, cattail marshes, woodland pools, flood-plains, tires, other artificial water-holding containers	2.5-5.0
Dredging spoil sites, waste treatment and settling ponds, ditches and other manmade depressions	5.0-10.0
Permanent water sites	
Ornamental ponds and fountains, fish ponds, cattail marshes, water hyacinth beds, flooded crypts, transformer vaults, abandoned swimming pools, construction and other manmade depressions, treeholes, other artificial water-holding containers	2.5-5.0
Storm drains, catch basins, roadside ditches, cesspools, septic tanks, waste settling ponds, vegetation-choked phosphate pits	5.0-10.0

Use lower rates when water is shallow, vegetation and/or pollution are minimal, and mosquito populations are low. Use higher rates when water is deep (>2 ft), vegetation and/or pollution are high, and mosquito populations are high.

APPLICATION METHODS

Apply ALTOSID Pellets up to 15 days prior to flooding, or at any stage of larval development after flooding, or in permanent water sites. Fixed wing aircraft or helicopters equipped with granular spreaders capable of applying rates from 2.5 to 10.0 lb/acre may be used to apply ALTOSID Pellets. The pellets may also be applied using ground equipment which will achieve good even coverage at the above rates. ALTOSID Pellets may be applied to artificial containers, such as tires and catch basins, etc.

Do not contaminate water, food, or feed by storage or disposal.

STORAGE

Store closed containers of ALTOSID Pellets in a cool dry place.

PESTICIDE DISPOSAL

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL

Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For information call 1-800-248-7763 or visit our web site: www.altosid.com.

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Schaumburg, Illinois U.S.A.

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20 - 24 - 001

Made in the USA

November 1999
Bensenville, IL

Altosid® Liquid Larvicide CONCENTRATE

PREVENTS EMERGENCE OF ADULT FLOODWATER MOSQUITOES

SPECIMEN LABEL

ACTIVE INGREDIENT:

(S)-Methoprene*	20.0%
OTHER INGREDIENTS:	80.0%
Total	100.0%

* CAS # 65733-16-6

Formulation contains 1.72 lb/gal (205.2 g/l) active ingredient.

EPA Reg No. 2724-446

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE ADDITIONAL PRECAUTIONARY STATEMENTS

Because of the unique mode of action of **A.L.L.**™, successful use requires familiarity with special techniques recommended for application timing and treatment evaluation. **See Guide to Product Application** or consult local Mosquito Abatement Agency.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS

CAUTION

Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

CHEMIGATION

Refer to supplemental labeling entitled "**Guide to Product Application**" for use directions for chemigation. Do not apply this product through any irrigation system unless the supplemental labeling on chemigation is followed.

MIXING AND HANDLING INSTRUCTIONS

1. **SHAKE WELL BEFORE USING. A.L.L.** may separate on standing and must be thoroughly agitated prior to dilution.
2. Do not mix with oil; use clean equipment.
3. Partially fill spray tank with water; then add the recommended amount of **A.L.L.**, agitate and complete filling. Mild agitation during application is desirable.
4. Spray solution should be used within 48 hours; always agitate before spraying.

RECOMMENDED APPLICATIONS

INTRODUCTION

A.L.L. must be applied to 2nd, 3rd, or 4th larval instars of floodwater mosquitoes to prevent adult emergence. Treated larvae continue normal development to the pupal stage where they die. This insect growth regulator **has no effect when applied to pupae or adult mosquitoes. A.L.L.** has sufficient field life to be effective at recommended rates when applied to larval stages under varying field conditions. For further information, see **Guide to Product Application**.

METHODS OF APPLICATION

AERIAL
Use the recommended amount of **A.L.L.** listed below in sufficient water to give complete coverage. One-half to 5 gallons of spray solution per acre is usually satisfactory. Do not apply when weather conditions favor drift from areas treated.

GROUND
Determine the average spray volume used per acre by individual operators and/or specific equipment. Mix **A.L.L.** in the appropriate volume of water to give the rate per acre recommended below.

APPLICATION RATE
Apply ¾ to 1 fl oz of **A.L.L.** per acre (55 to 73 ml/hectare) in water as directed.

APPLICATION SITES

PASTURES
A.L.L. may be applied after each flooding without removal of grazing livestock.

RICE
A.L.L. must be applied to 2nd, 3rd, and/or 4th instar larvae of mosquitoes found in rice, usually within 4 days after flooding. **A.L.L.** treatment may be repeated with each flooding.

INTERMITTENTLY FLOODED NONCROP AREAS
A.L.L. may be applied as directed above when flooding may result in floodwater mosquito hatch. Typical sites include: freshwater swamps and marshes, salt marshes, woodland pools and meadows, dredging spoil sites, drainage areas, waste treatment and settling ponds, ditches and other natural and manmade depressions.

CROP AREAS
A.L.L. may be applied to irrigated croplands after flooding to control mosquito emergence. Examples of such sites are: vineyards, rice fields (including wild rice), date palm orchards, fruit and nut orchards, and berry fields and bogs. Irrigated pastures may be treated after each flooding **without** the removal of livestock.

DENSE VEGETATION OR CANOPY AREAS
Apply an **A.L.L.** sand mixture using standard granular dispersal equipment. For detailed preparation instructions, refer to **Guide to Product Application**.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

STORAGE
Store in cool place away from other pesticides, food, and feed. In case of leakage or spill, soak up with sand or another absorbent material

PESTICIDE DISPOSAL
Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL
Triple rinse or equivalent. Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

For information call 1-800-248-7763

Always read the label before using the product.

Wellmark

ZOËCON Professional Products

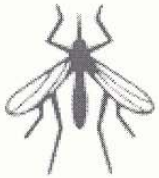
Wellmark International
Schaumburg, Illinois U.S.A.

21-24-004

Made in the U.S.A.

October 2000
Schaumburg, IL

Altosid® XR-G



AN EXTENDED RESIDUAL GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

SPECIMEN LABEL

ACTIVE INGREDIENT:	
(S)-Methoprene (CAS #65733-16-6)	1.5%
OTHER INGREDIENTS:	98.5%
Total	100.0%

EPA Reg No. 2724-451

EPA Est. No. 2724-TX-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Avoid contact with skin or eyes. Due to the size and abrasiveness of the granule, use protective eyewear and clothing to minimize exposure during loading and handling.

FIRST AID

In case of contact, immediately flush eyes or skin with plenty of water. Get medical attention if irritation persists.

ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran (mosquitoes) and chironomid (midges). Using it in a manner other than that described by the label could result in harm to aquatic dipteran (mosquitoes) and chironomid (midges). Do not contaminate water when disposing of rinsate or equipment washwaters.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

GENERAL DIRECTIONS

ALTOSID® XR-G releases effective levels of ALTOSID® insect growth regulator for up to 21 days after application. Applications should be continued throughout the entire season to maintain adequate control. Treated larvae continue to develop normally to the pupal stage where they die.

Rotary and fixed-wing aircraft equipped with granular spreaders capable of applying rates listed below may be used to apply ALTOSID XR-G. Ground equipment which will achieve even coverage at these rates may also be used. Apply ALTOSID XR-G uniformly and repeat application as necessary.

NOTE
ALTOSID insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

APPLICATION TIME

Apply ALTOSID XR-G at any stage of larval mosquito development. Granules may be applied prior to flooding (i.e., "pre-hatch" or "pre-flood") in areas which flood intermittently. In such areas, one application of ALTOSID XR-G can prevent adult mosquito emergence from several subsequent floodings. The actual length of control depends on the duration and frequency of flooding events.

APPLICATION RATES

Aedes, Anopheles, and *Psorophora* spp.: Apply ALTOSID XR-G at 5-10 lb/acre (5.6-11.2 kg/ha). *Culex, Culiseta, Coquillettidia,* and *Mansonia* spp.: Apply ALTOSID XR-G at 10-20 lb/acre (11.2-22.4 kg/ha). Within these ranges, use lower rates when water is shallow [<2 feet (60 cm)] and vegetation and/or pollution are minimal. Use higher rates when water is deep [≥2 feet (60 cm)] and vegetation and/or pollution are heavy.

APPLICATION SITES

NON-CROP AREAS

ALTOSID XR-G may be applied as directed above to temporary and permanent sites which support mosquito larval development. Examples of such sites include: snow pools, salt and tidal marshes, freshwater swamps and marshes (cattail, red cedar, white maple marshes), woodland pools and meadows, dredging spoil sites, drainage areas, ditches, wastewater treatment facilities, livestock runoff lagoons, retention ponds, harvested timber stacks, swales, storm water drainage areas, sewers, catch basins, tree holes, water-holding receptacles (e.g., tires, urns, flower pots, cans, and other containers), and other natural and manmade depressions.

CROP AREAS

ALTOSID XR-G may be applied as directed above to temporary and permanent sites which support mosquito larval development. Examples of such sites include: irrigated croplands, pastures, rangeland, vineyards, rice fields (domestic and wild), date palm, citrus, fruit, nut orchards, berry fields and bogs.

NOTE

Application of ALTOSID XR-G to sites subject to water flow or exchange will diminish the product's effectiveness and may require higher application rates and/or more frequent applications.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

STORAGE

Store closed containers of ALTOSID XR-G in a cool dry place.

PESTICIDE DISPOSAL

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL

Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For information call 1-800-248-7763 or visit our web site: www.altosid.com.

Wellmark

ZOECON Professional Products

Wellmark International
Bensenville, Illinois U.S.A.

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20 - 24 - 023

Made in the USA

January, 2000
Bensenville, IL

VectoBac® 12AS

Biological Larvicide
Aqueous Suspension

Active Ingredient:
Bacillus thuringiensis, subspecies *israelensis*, 1200 International Toxic Units (ITU) per mg (Equivalent to 4.84 billion ITU per gallon; 1.279 billion ITU per liter) 1.2%
Inert Ingredients 98.8%
Total 100.0%

EPA Reg. No.73049-38
EPA Est. No. 33762-IA-001 List No. 5605

INDEX:

1.0 Statement of Practical Treatment
2.0 Precautionary Statements
2.1 Hazard to Humans (and Domestic Animals)
2.2 Physical and Chemical Hazards
3.0 Directions for Use
3.1 Chemigation
4.0 Storage and Disposal
5.0 Ground and Aerial Application
6.0 Application Directions
7.0 Chemigation
7.1 Rice-Flood (Basin) Chemigation
8.0 Small Quantity Dilution Rates
9.0 Notice to User

KEEP OUT OF REACH OF CHILDREN

CAUTION

For MEDICAL and TRANSPORT Emergencies ONLY Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.

1.0 STATEMENT OF PRACTICAL TREATMENT

If In Eyes: Flush with plenty of water. Get medical attention if signs of irritation persists.

If on Skin: Wash thoroughly with plenty of soap and water. Get medical attention if signs of irritation persists.

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARD TO HUMANS (AND DOMESTIC ANIMALS)

CAUTION

Hazards to Humans

Harmful if absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash contaminated clothing before reuse.

2.2 Physical and Chemical Hazards

Diluted or undiluted VectoBac 12AS can cause corrosion if left in prolonged contact with aluminum spray system components. Rinse spray system with plenty of clean water after use. Care should be taken to prevent contact with aluminum aircraft surfaces, structural components and control systems. In case of contact, rinse thoroughly with plenty of water. Inspect aluminum aircraft components regularly for signs of corrosion.

3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply directly to finished drinking water reservoirs or drinking water receptacles.

Do not apply when weather conditions favor drift from treated areas. Do not apply to metallic painted objects, such as automobiles, as spotting may occur. If spray is deposited on metallic painted surfaces, wash immediately with soap and water to avoid spotting.

3.1 Chemigation

Do not apply this product through any type of irrigation system unless labeling on chemigation is followed.

4.0 STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

STORAGE: Store in a cool [59°-86° F (15°-30° C)], dry place.

PESTICIDE DISPOSAL: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Do not reuse container.

5.0 GROUND AND AERIAL APPLICATION

VectoBac 12AS may be applied in conventional ground or aerial application equipment with quantities of water sufficient to provide uniform coverage of the target area. The amount of water needed per acre will depend on weather, spray equipment, and mosquito habitat characteristics. Do not mix more VectoBac 12AS than can be used in a 72-hour period.

For most ground spraying, apply in 5-100 gallons per acre using hand-pump, airblast, mist blower, etc., spray equipment.

For aerial application, VectoBac 12AS may be applied either undiluted or diluted with water. For undiluted applications, apply 0.25 to 2.0 pt/acre of VectoBac 12AS through fixed wing or helicopter aircraft equipped with either conventional boom and nozzle systems or rotary atomizers.

For diluted application, fill the mix tank or plane hopper with the desired quantity of water. Start the mechanical or hydraulic agitation to provide moderate circulation before adding the VectoBac 12AS. VectoBac 12AS suspends readily in water and will stay suspended over normal application periods. Brief recirculation may be necessary if the spray mixture has sat for several hours or longer. AVOID CONTINUOUS AGITATION OF THE SPRAY MIXTURE DURING SPRAYING.

CONTINUED

[redacted]

Rinse and flush spray equipment thoroughly following each use.

For blackfly aerial applications, VectoBac 12AS can be applied undiluted via fixed wing or helicopter aircraft equipped with either conventional boom and nozzle systems or open pipes. Rate of application will be determined by the stream discharge and the required amount of VectoBac 12AS necessary to maintain a 0.5 - 25 ppm concentration for VectoBac 12AS in the stream water. VectoBac 12AS can also be applied diluted with similar spray equipment. Do not mix more VectoBac 12AS than can be used in a 72 hour period.

6.0 APPLICATION DIRECTIONS

Do not apply when wind speed favors drift beyond the area of treatment.

Suggested Rate Range*

Mosquito Habitat	VectoBac 12AS
(Such as the following examples):	
Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields.	0.25 - 1 pt/acre

In addition, standing water containing mosquito larvae, in fields growing crops such as: Alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts, may be treated at the recommended rates.

When applying this product to standing water containing mosquito larvae in fields growing crops, do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Polluted water (such as sewage lagoons, animal waste lagoons).	1 - 2 pts/acre

*Use higher rate range in polluted water and when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted, and/or algae are abundant.

Suggested Rate Range*

Black flies Habitat	VectoBac 12AS
Streams	
stream water** (=ppm) for 1 minute exposure time	0.5 - 25 mg/liter
stream water** (=ppm) for 10 minutes exposure time	0.05 - 2.5 mg/liter

**Use higher rate range when stream contains high concentration of organic materials, algae, or dense aquatic vegetation.

***Discharge is a principal factor determining carry of Bti. Use higher rate or increase volume by water dilution in low discharge rivers or streams under low volume (drought) conditions.

7.0 CHEMIGATION

Apply this product through flood (basin) irrigation systems. Do not apply this product through any other type of irrigation system.

Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water.

If you have any questions about calibration, you should contact State Extension Service Specialists, equipment manufacturers or other experts.

A person knowledgeable of this chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

7.1 RICE-FLOOD (BASIN) CHEMIGATION

Systems using a gravity flow pesticide dispensing system must meter the pesticide into the water at the head of the field and downstream of a hydraulic discontinuity such as a drop structure or weir box to decrease potential for water source contamination from backflow if water flow stops.

VectoBac 12AS is metered or dripped into rice floodwater at application stations positioned at the point of introduction (levee cut) of water into each rice field or pan. Two to three pints of VectoBac 12AS are diluted in water to a final volume of 5 gallons. The diluted solution is contained in a 5 gallon container and metered or dispersed into the irrigation water using a constant flow device at the rate of 80 ml per minute. Introduction of the solution should begin when 1/3 to 1/2 of the pan or field is covered with floodwater. Delivery of the solution should continue for a period of approximately 4-1/2 hours. Floodwater depth should not exceed 10-12 inches to prevent excessive dilution of VectoBac 12AS which could result in reduced larval kill.

Agitation is not required during the period in which the VectoBac 12AS solution is being dispersed.

Application of VectoBac 12AS into rice floodwater is not permitted using a pressurized water and pesticide injection system.

8.0 SMALL QUANTITY DILUTION RATES

Gallons Spray Solution/Acre (Ounces Needed per Gallon of Spray)

VectoBac 12AS Rate in Pints Per Acre	10 Gal/A	25 Gal/A	50 Gal/A
0.25 (4 oz)	0.4	0.16	0.08
0.5 (8 oz)	0.8	0.32	0.16
1.0 (16 oz)	1.6	0.64	0.32
2.0 (32 oz)	3.2	1.28	0.64

9.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 • 800-323-8597

Valent BioSciences Corporation

VectoBac® G

Biological Larvicide Granules

ACTIVE INGREDIENT:
Bacillus thuringiensis, subspecies *israelensis*, 200 International Toxic Units (ITU) per mg (Equivalent to 0.091 billion ITU per pound) 0.2%
INERT INGREDIENTS 99.8%
TOTAL 100.0%

EPA Reg. No. 73049-10
EPA Est. No. 33762-IA-001 List No. 5108

INDEX:

1.0 Statement of Practical Treatment
2.0 Directions for Use
3.0 Storage and Disposal
4.0 Application Directions
5.0 Notice to User

KEEP OUT OF REACH OF CHILDREN
CAUTION
For MEDICAL and TRANSPORT Emergencies ONLY Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.

1.0 STATEMENT OF PRACTICAL TREATMENT

If in Eyes: Flush eyes with plenty of water. Get medical attention if irritation persists.

2.0 DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles.

3.0 STORAGE AND DISPOSAL

Do not contaminate potable water, food or feed by storage or disposal.

Storage: Store in a cool, dry place.

Pesticide Disposal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

4.0 APPLICATION DIRECTIONS

VectoBac G is an insecticide for use against mosquito larvae.

Mosquitoes Habitat (Such as the following examples):	Suggested Range Rate*
Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields	2.5 - 10 lbs / acre

In addition, standing water containing mosquito larvae, in fields growing alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts may be treated at the recommended rates.

* Use 10-20 lbs. / acre when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted (sewage lagoons, animal waste lagoons), and/or algae are abundant.

Apply uniformly by aerial or ground conventional equipment.

A 7 to 14 day interval between applications should be employed.

5.0 NOTICE TO USER

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VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 - 800-323-9597

VectoBac® WDG

Biological Larvicide

ACTIVE INGREDIENT:

Bacillus thuringiensis, subsp. *israelensis* fermentation solids and solubles	37.4%
INERT INGREDIENTS	62.6%
TOTAL	100.0%

[potency: 3000 International toxic units (ITU) per mg]
Equivalent to 1.36 billion ITU/lb.

EPA Reg. No. 73049-56
EPA Est. No. 33762-IA-001 List No. 60215

INDEX:

1.0 Statement of Practical Treatment
2.0 Precautionary Statements
2.1 Hazards to Humans and Domestic Animals
2.2 Environmental Hazards
3.0 Directions for Use
3.1 Chemigation
4.0 Storage and Disposal
5.0 Application Directions
6.0 Small Quantity Dilution Rates
7.0 Ground and Aerial Application
7.1 Aerial Application
8.0 Notice to User

KEEP OUT OF REACH OF CHILDREN

CAUTION

For MEDICAL and TRANSPORT Emergencies ONLY Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.

1.0 STATEMENT OF PRACTICAL TREATMENT

Inhaled: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

If in Eyes: Flush eyes with plenty of water. Call a physician if irritation persists.

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Harmful if inhaled. Avoid breathing dust. Remove contaminated clothing and wash before reuse. Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling.

As a general precaution when exposed to potentially high concentrations of living microbial products such as this, all mixer/loaders and applicators not in enclosed cabs or aircraft must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95.

2.2 ENVIRONMENTAL HAZARDS

Do not apply directly to treated finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.

3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

3.1 Chemigation

Do not apply this product through any type of irrigation system.

4.0 STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Storage: Store in cool [59-86°F (15-30°C)], dry place.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

5.0 APPLICATION DIRECTIONS

Do not apply when wind speed favors drift beyond the area of treatment.

Mosquito Habitat *(Such as the following examples):*	Suggested Rate Range*
Irrigation ditches, roadside ditches, flood water, standing pools, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields.	1.75 - 7.0 oz/acre (50 - 200 g/acre) (125 - 500 g/ha)

In addition, standing water containing mosquito larvae, in fields growing crops such as: Alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts, may be treated at the recommended rates.

When applying this product to standing water containing mosquito larvae in fields growing crops, do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Polluted water (such as sewage lagoons, animal waste lagoons)	7.0 - 14.0 oz/acre (200 - 400 g/acre) (0.5 - 1.0 kg/ha)

[redacted]

* Use higher rate range in polluted water and when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted, and/or algae are abundant.

6.0 SMALL QUANTITY DILUTION RATES

Gallons Spray Mixture/Acre
(Ounces Needed per Gallon of Spray)

VectoBac WDG

Rates in		Final concentration, ounces/gallon spray		
Ounces/Acre	Grams/A	10 Gal/A	25 Gal/A	50 Gal/A
1.75	50	0.175	0.07	0.04
3.5	100	0.35	0.14	0.07
7	200	0.7	0.28	0.14
14	400	1.4	0.565	0.28

7.0 GROUND AND AERIAL APPLICATION

VectoBac WDG may be applied using conventional ground or aerial application equipment with quantities of water sufficient to provide uniform coverage of the target area. For application, first add the VectoBac WDG to water to produce a final spray mixture.

The amount of water will depend on weather, spray equipment, and mosquito habitat characteristics. For application, fill the mix tank or plane hopper with the desired quantity of water. **Start the mechanical or manual agitation to provide moderate circulation of water before adding the VectoBac WDG.** Backpack and compressed air sprayers may be agitated by shaking after adding VectoBac WDG to the water in the sprayer. VectoBac WDG suspends readily in water and will stay suspended over normal application periods. Brief recirculation may be necessary if the spray mixture has sat for several hours or longer. Do not mix more VectoBac WDG than can be used in a 48 hour period. AVOID CONTINUOUS AGITATION OF THE SPRAY MIXTURE DURING SPRAYING.

For ground spraying, apply 1.75-14 oz/acre (50-400 g/acre; 123-988 g/ha) of VectoBac WDG in 5-100 gallons of water per acre (47-950 liters/ha) using hand-pump, airblast, mist blower, or other spray equipment.

For aerial application, apply 1.75 - 14 oz/acre (50-400 g/acre; 123-988 g/ha) of VectoBac WDG in 0.25-10 gallons of water per acre (2.4-9.5 liters/ha) through fixed wing or helicopter aircraft equipped with either conventional boom and nozzle system or rotary atomizers to provide uniform coverage of the target area.

7.1 AERIAL APPLICATION

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all of these factors when making decisions.

Rinse and flush spray equipment thoroughly following each use.

8.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 - 800-323-9597

Valent BioSciences Corporation

VectoLex® CG

Biological Larvicide
Granules

ACTIVE INGREDIENT:
Bacillus sphaericus Serotype H5a5b, strain 2362 Technical Powder (670 BsITU/mg) ..... 7.5% w/w
INERT INGREDIENTS ..... 92.5% w/w
TOTAL ..... 100.0% w/w

Potency: This product contains 50 BsITU/mg or 0.023 Billion BsITU/lb.

EPA Reg. No.73049-20
EPA Est. No. 33762-IA-001 List No. 5722

INDEX:

1.0 Statement of Practical Treatment
2.0 Precautionary Statements
2.1 Hazard to Humans (and Domestic Animals)
2.2 Environmental Hazards
3.0 Directions for Use
4.0 Storage and Disposal
5.0 Application Directions
6.0 Notice to User

KEEP OUT OF REACH OF CHILDREN
CAUTION
For MEDICAL and TRANSPORT EmergenciesONLY
Call 24 Hours A Day 1-877-315-9819. For All Other Information Call 1-800-323-9597.

1.0 STATEMENT OF PRACTICAL TREATMENT

If In Eyes: Immediately flush eyes with plenty of water. Get medical attention if irritation persists.

If on Skin: Wash thoroughly with plenty of soap and water. Get medical attention if irritation persists.

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Harmful if absorbed through the skin. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling.

2.2 Environmental Hazards

Do not contaminate water when disposing of equipment washwaters or rinsate.

3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

4.0 STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Do not contaminate water when disposing of equipment washwaters.

Pesticide Storage: Store in a cool, dry place.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

5.0 APPLICATION DIRECTIONS

MOSQUITO CONTROL

I. For control of mosquito larvae species* in the following non-crop sites:

Habitat	Rate Range
Wastewater: Sewage effluent, sewage lagoons, oxidation ponds, septic ditches, animal waste lagoons, impounded wastewater associated with fruit and vegetable processing	5-20 lbs/acre**
Stormwater/Drainage Systems: Storm sewers, catch basins, drainage ditches, retention, detention and seepage ponds	5-20 lbs/acre**
Marine/Coastal Areas: Salt marshes, mangroves, estuaries	5-20 lbs/acre**
Water Bodies: Natural and manmade aquatic sites such as lakes, ponds, rivers, canals and streams	5-20 lbs/acre**
Dormant Rice Fields: Impounded water in dormant rice fields. (For application only during the interval between harvest and preparation of the field for the next cropping cycle.)	5-20 lbs/acre**
Waste Tires: Tires stockpiled in dumps, landfills, recycling plants, and other similar sites.	20-80 lbs/acre(1)

(1) .5-2 lbs/1000 sq. ft

II. For the control of mosquito larvae species* in agricultural/crop sites where mosquito breeding occurs:

Habitats:	Rate Range
Rice, pastures/hay fields, orchards, citrus groves, irrigated crops.	5-20 lbs/acre**

Apply uniformly by aerial or conventional ground equipment. Reapply as needed after 1-4 weeks.

* Mosquito species effectively controlled by VectoLex CG:

Culex spp.	*Psorophora columbiae*
Aedes vexans	*Psorophora ferox*
Aedes melanimon	*Aedes triseriatus*
Aedes stimulans	*Aedes sollicitans*
Aedes nigromaculis	*Anopholos quadrimaculatus*
	Coquillettidia perturbans

**Use higher rates (10 to 20 lbs/acre) in areas where extended residual control is necessary, or in habitats having deep water or dense surface cover.

CONTINUED

[redacted]

6.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING THE USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

VALENT BIOSCIENCES CORPORATION
870 TECHNOLOGY WAY
LIBERTYVILLE, IL 60048 - 800-323-8397

PERMETHRIN 57% OS

CLARKE

For Application Only By Public Health Officials and Trained Personnel of Mosquito Abatement Districts and Other Mosquito Control Programs. A SYNTHETIC PYRETHROID FOR EFFECTIVE CONTROL AND REPELLENCY OF ADULT MOSQUITOES. For Use As An Effective ULV and Barrier Spray for Control of Adult Mosquitoes. Gnats. Biting and Non-Biting Midges. Blackflies. Deer Flies and Other Biting Flies.

Precautionary Statements

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Harmful if swallowed or absorbed through skin. Avoid contact with skin, eyes or clothing. Wash thoroughly after handling.

STATEMENT OF PRACTICAL TREATMENT

If Swallowed: call a physician or Poison Control Center. Do not induce vomiting. This product contains aromatic petroleum solvent. Aspiration may be a hazard.

ENVIRONMENTAL HAZARDS

This product is highly toxic to fish and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated ares may be hazardous to aquatic organisms in neighboring areas. Do not allow spray treatment to drift on pastureland, cropland, poultry ranges or water supplies. Do not contaminate water when disposing of equipment washwaters.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its' labeling.

CONDITIONS and RATES to USE for MOSQUITO CONTROL FOR A BARRIER SPRAY

This product is effective for reducing mosquito annoyance and control of mosquitoes that may transmit diseases such as La Crosse encephalitis, dog heartworm, dengue fever and western encephalitis. Apply product with mist blower, power backpack or ULV machine. If ULV machine is used, adjust pressure to deliver particles from 35-200 microns. Do not allow spray treatment to drift on pasture land, crop land, poultry ranges or water supplies. Do not use on crops used for food, forage or pasture.

Normal use pattern of product requires a residual application on plant and other surfaces where mosquitoes may rest. Product commonly provides sustained control in wooded areas lasting up to 14 days in shaded areas. Secondary activity of product is through repellency. Apply product by ground application equipment such as mist blower, ULV equipment, power backpack or pressure sprayer. Not to be used within 100 feet (30 meters) of lakes and streams. To kill or repel mosquitoes, midges, deer flies and other biting flies, mix with enough oil mixture so as to easily apply 0.1 pounds of Permethrin per acre. The oil-mixture is obtained by mixing one part of soybean oil to two parts of mineral oil. Non-phytotoxic oils must be used. The following chart represents some possible dilutions based on a 2 MPH walking speed with a fifty (50) foot swath. If a different dilution ratio or walking speed is used, adjust flow rate accordingly so as to achieve 0.1 pounds of Permethrin per acre.

For A Two (2) Mile Per Hour Walking Speed And A 50 Foot Application Swath—The Following Are Typical Field Dilutions.

Permethrin 57%	Oil	Fl. oz. Finished Spray Per Acre	Fl. oz./Min.
1 Part	9.0 Parts	25.0	5.0
1 Part	5.8 Parts	17.5	3.5
1 Part	4.0 Parts	12.5	2.5

ACTIVE INGREDIENT:

Permethrin (3-Phenoxyphenyl)methyl (±) cis, trans-3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylate	57.00%
INERT INGREDIENTS	43.00%
	100.00%

Contains petroleum distillates.

Cis/trans isomers ratio: min. 35%(+)cis and max. 65%(+)trans.

Contains 5 lb./gal. Permethrin

CAUTION

KEEP OUT OF REACH OF CHILDREN

MANUFACTURED BY

CLARKE MOSQUITO CONTROL PRODUCTS, INC.
159 N. GARDEN AVENUE
ROSELLE, ILLINOIS 60172

E.P.A. EST. No. 8329IL01
EPA Reg. No. 8329-44

NET CONTENTS_____

LOT NO. _____

NOTICE: Seller makes no warranty, expressed or implied concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when use and/or handling is contrary to label instructions.

This is equivalent to 0.1 lb. of Permethrin/Acre. Apply the product with sufficient carrier to allow distribution over the area to be treated using particle sizes from 35-200 microns mmd. To obtain optimum results, cover the immediate surroundings of housing, buildings including plant surfaces where mosquitoes may rest. For large recreational areas such as football fields, stadiums, racetracks, and public parks, spray the insecticide-oil mixture at the above mentioned application rate on the interface of woods surrounding the main area where the event is to take place. Spray may also be applied in any vegetated area where mosquitoes may rest causing infestations in residential areas.

To Kill Gypsy Moths and Tentcaterpillars infesting woodland and forest areas: Apply the insecticide-oil mixture (as described above) directly to insect nests and vegetation by backpack applicator using 62 Fl. Oz./acre at a walking speed of 2 MPH over a swath of 50 feet, applying 12.6 Fl. Oz./minute. This is equivalent to 0.25 lb. of Permethrin/acre. Apply thoroughly to all foliage and insect nests.

TRUCK MOUNTED –ULV– EQUIPMENT

PERMETHRIN 57% is recommended for application as an ultra low volume (U.L.V.) nonthermal aerosol (cold fog) to control adult mosquitoes in residential and recreational areas where these insects are a problem, such as but not limited to parks, campsites, woodlands, athletic fields, golf courses, residential areas and municipalities, gardens, playgrounds, recreational areas and overgrown waste areas. Do not apply this product within 100 feet (30 Meters) of lakes and streams. Do not allow spray treatment to drift on pastureland, cropland, poultry ranges, or water supplies. For best results treat when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground, e.g. cool temperatures and wind speed not greater than 10 mph. Applications during the cool hours of the night or early morning is usually preferable. Repeat treatment as needed.

U.L.V. Nonthermal Aerosol (Cold Fog) Application: To control Mosquitoes, Midges and Blackflies, apply PERMETHRIN 57% using any standard U.L.V. ground applicator capable of producing a nonthermal aerosol spray with droplets ranging in size from 5 to 30 microns and a mass median diameter (MMD) of 10 to 20 microns. Apply the product undiluted at a flow rate of 0.54 to 3.25 fluid ounces per minute at an average vehicle speed of 10 mph. If a different vehicle speed is used, adjust rate accordingly. These rates are equivalent to 0.0035 to 0.021 pounds of Permethrin per acre. Vary flow rate according to vegetation density and mosquito population. Use higher flow rate in heavy vegetation or when populations are high. An accurate flow meter must be used to ensure the proper flow rate. PERMETHRIN 57% may also be applied by diluting with a suitable solvent such as a non-phytotoxic mineral oil. The following charts represent some suggested dilution and application rates for ground U.L.V. applications. If an alternate dilution rate is used, adjust flow rate accordingly.

FOR A 1:4 PERMETHRIN 57%/SOLVENT DILUTION RATIO
Mix one (1) part PERMETHRIN 57% with four (4) parts solvent and apply at the following rates.

Permethrin pounds/acre	Application Rates Fl. oz./Min. 5MPH	10MPH	15MPH	Fl. oz. finished spray per acre
0.007	2.70	5.40	8.1	0.90
0.0035	1.35	2.70	4.0	0.45
0.00175	.68	1.35	2.0	0.23

FOR A 1:9 PERMETHRIN 57%/SOLVENT DILUTION RATIO
Mix one (1) part PERMETHRIN 57% with nine (9) parts solvent and apply at the following rates.

Permethrin pounds/acre	Application Rates Fl. oz./Min. 5MPH	10MPH	Fl. oz. finished spray per acre
0.007	5.40	10.75	1.80
0.0035	2.70	5.40	0.90
0.00175	1.35	2.70	0.45

FOR A 1:14 PERMETHRIN 57%/SOLVENT DILUTION RATIO
Mix one (1) part PERMETHRIN 57% with fourteen (14) parts solvent and apply at the following rates.

Permethrin pounds/acre	Application Rates Fl. oz./Min. 5MPH	10MPH	15MPH	Fl. oz. finished spray per acre
0.007	8.0	16.0	32.0	2.70
0.0035	4.0	8.0	16.0	1.35
0.00175	2.0	4.0	8.0	0.68

For proper application, mount the fog applicator so that the nozzle is at least 4½ feet above ground level and directed out the back of the vehicle. Failure to follow the above directions may result in reduced effectiveness. Aerial applications should be done by suitable aerial U.L.V. equipment capable of producing droplets with an MMD of 50 microns or less with no more than 2.5% exceeding 100 microns. Flow rate and swath width should be set so as to achieve 0.2 to 0.6 fluid ounces of PERMETHRIN 57% per acre. PERMETHRIN 57% may also be diluted with a suitable diluent such as mineral oil and applied by aerial ULV equipment so long as 0.6 fluid ounces per acre of PERMETHRIN 57% is not exceeded. Both aerial and ground applications should be made when wind is less than 10 MPH.

IN FLORIDA: Do not apply by aircraft except in emergency situations and with the approval of the Florida Department of Agriculture and Consumer Services.

STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE AND SPILL PROCEDURES: Do not store at temperatures below 40°F (4.5°C). If this material has been exposed to temperatures below 40°F (4.5°C), there may be precipitation. Check for crystallization. If evident, warm to 80°F (26.5°C) and thoroughly mix before using. DO NOT USE OPEN FLAME. Store upright at room temperature. Avoid exposure to extreme temperatures. In case of spill or leakage, soak up with an absorbent material such as sand, sawdust, earth, fuller's earth, etc. Dispose of with chemical waste.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved state and local procedures.

CONTAINERS ONE GALLON AND SMALLER: Do not reuse container. Wrap containers in several layers of newspaper and discard in trash.

CONTAINERS LARGER THAN ONE GALLON: Metal Containers—Triple rinse or equivalent. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Plastic Containers—Triple rinse or equivalent. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke. Then dispose of in a sanitary landfill or by other approved state and local procedures.

IN CASE OF EMERGENCY, CALL INFO TRAC 1-800-535-5053

FOR MORE INFORMATION CALL:
1-800-323-5727

12/97

RESTRICTED USE CLASSIFICATION
Due to Acute Fish Toxicity
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicators Certification.

SCOURGE® INSECTICIDE

with SBP-1382®/PIPERONYL BUTOXIDE 4% + 12% MF FORMULA II

Specimen Label

- *A READY TO USE SYNTHETIC PYRETHROID FOR EFFECTIVE ADULT MOSQUITO (INCLUDING ORGANOPHOSPHATE RESISTANT SPECIES), MIDGE (BITING AND NON-BITING), AND BLACK FLY CONTROL*
- *TO BE APPLIED BY MOSQUITO ABATEMENT DISTRICTS, PUBLIC HEALTH OFFICIALS AND OTHER TRAINED PERSONNEL IN MOSQUITO CONTROL PROGRAMS.*
- *CONTAINS 0.3 lb/gal (36 g/L) OF SBP-1382 AND 0.9 lb/gal (108 g/L) OF PIPERONYL BUTOXIDE*
- *FOR AERIAL AND GROUND APPLICATION*

ACTIVE INGREDIENTS:	
* Resmethrin	4.14%
**Piperonyl Butoxide Technical	12.42%
INERT INGREDIENTS†:	83.44%
	100.00%

*Cis/trans isomers ratio: max. 30% (±) cis and min. 70% (±) trans.
**Equivalent to 9.94% (butylcarbityl) (6-propylpiperonyl) ether and 2.48% related compounds.
†Contains Petroleum Distillates.

PRECAUCION AL CONSUMIDOR: Si usted no lee ingles, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.
(TO THE USER: If you cannot read English, do not use this product until the label has been fully explained to you.)

EPA REG. NO. 432-716 EPA EST. NO.

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID

IF SWALLOWED: Call a doctor or get medical attention. Do not induce vomiting. Do not give anything by mouth to an unconscious person. Avoid Alcohol. This product contains aromatic petroleum solvent. Aspiration may be a hazard.
IF ON SKIN: Wash with soap and plenty of water. Get medical attention.

See Side Panel For Additional Precautionary Statements

For product information Call Toll-Free: 1-800-331-2867

In case of *Medical* emergencies or health and safety inquiries or in case of fire, leaking or damaged containers, information may be obtained by calling 1-800-334-7577.

NET CONTENTS:

BAYER ENVIRONMENTAL SCIENCE
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road • Montvale, NJ 07645

PRECAUTIONARY STATEMENTS
Hazards To Humans & Domestic Animals

CAUTION
Harmful if swallowed or absorbed through skin. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling.

Environmental Hazards

This pesticide is highly toxic to fish. For terrestrial uses, do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff from treated sites may be hazardous to fish in adjacent waters. Consult your State's Fish and Wildlife Agency before treating such waters. Do not contaminate water by cleaning of equipment or disposal of equipment wash waters.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

Storage: Store product in original container in a locked storage area.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and Local authorities.

READ ENTIRE LABEL FOR DIRECTIONS
For use only by certified applicators or under the supervision of such applicators, for the reduction in annoyance from adult mosquito infestations and as a part of a mosquito abatement program.

IN THE STATE OF CALIFORNIA: For use only by local districts or other public agencies which have entered into and operate under a cooperative agreement with the Department of Public Health pursuant to Section 2426 of the Health and Safety Code.

This product is to be used for control of adult mosquitoes (including organophosphate resistant species), midges (biting and non-biting) and blackflies by specially designed aircraft capable of applying ULTRA LOW VOLUME of finished spray formulation or by ground application with non-thermal or mechanical spray equipment that can deliver spray particles within the aerosol size range and at specified dosage levels.

NOTICE: This concentrate cannot be diluted in water. Mix well before using. Avoid storing excess formulation in spray equipment tank beyond the period needed for application.

ULTRA LOW VOLUME APPLICATIONS
For use in nonthermal ULV portable backpack equipment similar to the Hudson B.P., mix 70 fl oz (2068 ml) of this product with 1 gal (3.79 L) of refined soybean oil, light mineral oil of 54 second viscosity or other suitable solvent or diluent. Adjust equipment to deliver fog particles of 18-50 microns mass median diameter. Apply at the rate of 4.25-8.50 fl oz of finished formulation per acre (311-621 ml/ha) as a 50 ft (15.2 m) swath while walking at a speed of 2 mph (3.2 kph). This is equivalent to 0.0035-0.0070 lb ai SBP-1382/A (3.92- 7.85 gm/ha) plus 0.0105- 0.0210 lb ai piperonyl butoxide tech./A (11.77-23.54 gm/ha). Where dense vegetation is present, the higher rate is recommended.

For truck mounted nonthermal ULV equipment similar to LECO HD or MICRO-GEN or WHISPERMIST-XL, adjust equipment to deliver fog particles of 8-20 microns mass median diameter. Consult the following chart for application rates.

Treatment lb ai/A of Scourge Wanted SBP-1382/PBO	Fl oz/A of Undiluted Spray to be Applied	Application Rate-Fl oz/Min	
		5 MPH	10 MPH
0.007/0.021	3.0(90 ml)	9.0(266.2ml)	18.0(532.3ml)
0.0035/0.0105	1.5(45 ml)	4.5(133.1 ml)	9.0(266.2 ml)
0.00175/0.00525	0.75(22.5 ml)	2.25(66.6 ml)	4.5(133.1 ml)
0.00117/0.00351	0.50(15 ml)	1.50(45 ml)	3.0(90 ml)

Where dense vegetation is present, the use of the higher rates and/or slower speed is recommended.

For best results, fog only when air currents are 2-8 mph (3.2-12.9 kph). It is preferable to fog during early morning and evening when there is less breeze and convection currents are minimal. Arrange to apply the fog in the direction with breeze to obtain maximum swath length and better distribution. Direct spray head of equipment in a manner to insure even distribution of the fog throughout the area to be treated. Avoid prolonged inhalation of fog.

Where practical, guide the direction of the equipment so that the discharge nozzle is generally maintained at a distance of more than 6 feet (1.83 m) from ornamental plants and 5-15 feet (1.5-4.5 m) or more from painted objects. Temperature fluctuations will require periodical adjustment of equipment to deliver the desired flow rate at the specified speed of travel. The flow rate must be maintained to insure the distribution of the proper dosage of finished formulation.

Spray parks, campsites, woodlands, athletic fields, golf courses, swamps, tidal marshes, residential areas and municipalities around the outside of apartment buildings, restaurants, stores and warehouses. Do not spray on cropland, feed or foodstuffs. Avoid direct application over lakes, ponds and streams.

DIRECTIONS FOR STABLE FLY, HORSE FLY, DEER FLY CONTROL:
Treat shrubbery and vegetation where the above flies may rest. Shrubbery and vegetation around stagnant pools, marshy areas, ponds and shore lines may be treated. Application of this product to any body of water is prohibited.

For control of adult flies in residential and recreational areas, apply this product undiluted at a rate of 178 fl oz/hr (5.26 L/hr) by use of a suitable ULV generator travelling at 5 mph (8 kph) or at a rate of 356 fl oz/hr (10.53 L/hr) while travelling at 10 mph (16 kph). When spraying, apply across wind direction approximately 300 ft (91.4 m) apart.

Apply when winds range from 1-10 mph (1.6-16.0 kph). Repeat for effective control.

DIRECTIONS FOR AERIAL APPLICATIONS
FOR USE WITH FIXED-WING AND ROTARY AIRCRAFT

This product is used in specially designed aircraft capable of applying ultra low volume of undiluted spray formulation for control of adult mosquitoes (including organophosphate resistant species), midges (biting and non-biting) and blackflies.

Aerial application should be made preferably in the early morning or evening. Application should be made preferably when there is little or no wind.

It is not recommended to make application when wind speeds exceed 10 mph (16 kph). Repeat applications should be made as necessary. Apply preferably when temperatures exceed 50°F (10°C).

May be used as a mosquito adulticide in recreational and residential areas, and in municipalities, around the outside of apartment buildings, golf courses, athletic fields, parks, campsites, woodlands, swamps, tidal marshes, and overgrown waste areas.

Do not spray on cropland, feed or foodstuffs. Avoid direct application over lakes, ponds and streams.

lb ai/A Wanted SBP-1382/PBO	Fl oz/A of Undiluted Spray to be Applied
0.007/0.021	3.0 (90 ml)
0.0035/0.0105	1.5 (45 ml)
0.00175/0.00525	0.75 (22.5 ml)
0.00117/0.00351	0.50 (15 ml)

IMPORTANT: READ BEFORE USE

Read the entire Directions for Use, Conditions, Disclaimer of Warranties and Limitations of Liability before using this product. If terms are not acceptable, return the unopened product container at once.

By using this product, user or buyer accepts the following conditions, disclaimer of warranties and limitations of liability.

CONDITIONS: The directions for use of this product are believed to be adequate and should be followed carefully.However, because of manner of use and other factors beyond Bayer Environmental Science's control, it is impossible for Bayer Environmental Science to eliminate all risks associated with the use of this product. As a result, crop injury or Ineffectiveness is always possible. All such risks shall be assumed by the user or buyer.

DISCLAIMER OF WARRANTIES: BAYER ENVIRONMENTAL SCIENCE MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, THAT EXTEND BEYOND THE STATEMENTS MADE ON THIS LABEL. No agent of Bayer Environmental Science is authorized to make any warranties beyond those contained herein or to modify the warranties contained herein. Bayer Environmental Science disclaims any liability whatsoever for special, incidental or consequential damages resulting from the use or handling of this product.

LIMITATIONS OF LIABILITY: THE EXCLUSIVE REMEDY OF THE USER OR BUYER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID, OR AT BAYER ENVIRONMENTAL SCIENCE'S ELECTION, THE REPLACEMENT OF PRODUCT.

Scourge is a registered trademark of Bayer AG.
SBP-1382 is a registered trademark of Valent BioSciences Corporation.

Bayer Environmental Science
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road
Montvale, NJ 07645
S4-12-SL-9/02

ANVIL® 2+2 ULV

CLARKE

Contains An Oil Soluble Synergized Synthetic Pyrethroid For Control of Adult Mosquitoes (Including Organophosphate-Resistant Species) Midges, and Black Flies in Outdoor Residential and Recreational Areas.

Precautionary Statements
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Harmful if absorbed through the skin. Do not induce vomiting because of aspiration pneumonia hazard. Avoid contact with skin, eyes or clothing. In case of contact flush with plenty of water. Wash with soap and water after use. Obtain medical attention if irritation persists. Avoid contamination of food and feedstuffs.

ENVIRONMENTAL HAZARDS

Do not contaminate untreated water by cleaning of equipment. Cleaning of equipment or disposal of wastes must be done in a manner that avoids contamination of bodies of water or wetlands. This product is toxic to fish. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

USE AREAS: For use in mosquito adulticiding programs involving outdoor residential and recreational areas where adult mosquitoes are present in annoying numbers in vegetation surrounding parks, woodlands, swamps, marshes, overgrown areas and golf courses.

IN CALIFORNIA: This product is to be applied by County Health Department, State Department of Health Services, Mosquito and Vector Control or Mosquito Abatement District personnel only.

For best results, apply when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground. i.e. cool temperatures and wind speed not greater than 10 mph.

E.P.A. EST. No. 8329-IL-01
EPA Reg. No.1021-1687-8329

NET CONTENTS

LOT NO.

ACTIVE INGREDIENTS:	
3-Phenoxybenzyl-(1RS, 3RS; 1RS, 3SR)-2,2-dimethyl-3-(2-methylprop-1-enyl) cyclopropanecarboxylate	2.00%
* Piperonyl Butoxide, Technical	2.00%
** INERT INGREDIENTS	96.00%
	100.00%

* Equivalent to 1.60% (butylcarbityl) (6-propylpiperonyl) ether and .40% related compounds

** Contains a petroleum distillate

Contains 0.15 pounds of Technical SUMITHRIN®/Gallon and 0.15 pounds Technical Piperonyl Butoxide/Gallon

SUMITHRIN®- Registered trademark of Sumitomo Chemical Company, Ltd.

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que la etiqueta haya sido explicado ampliamente.

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center immediately. Do not induce vomiting because of aspiration pneumonia hazard.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

IF ON SKIN OR CLOTHING: Remove contaminated clothing and wash before reuse. Wash skin with soap and warm water. Get medical attention if irritation persists.

IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth.

For information regarding medical emergencies or pesticide incidents, call the International Poison Center at 1-888-740-8712.

DISTRIBUTED BY

CLARKE MOSQUITO CONTROL PRODUCTS, INC.

159 N. GARDEN AVENUE • ROSELLE, ILLINOIS 60172

NOTICE: Seller makes no warranty, expressed or implied concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when use and/or handling is contrary to label instructions.

GROUND ULV APPLICATION

APPLICATION AND DILUTION DIRECTIONS: Consult the following table for examples of various dosage rates using a swath width of 300 feet for acreage calculations. This product should be used in cold aerosol generators capable of producing droplets with a MMD of 5 to 25 microns.

Dosage Rate	Flow Rates in fluid oz./minute at truck speeds of:			
lbs.A.I./acre	5MPH	10MPH	15MPH	20MPH
0.0036	9.3 oz.	18.6 oz	27.9 oz	37.2 oz
0.0024	6.2 oz	12.4 oz	18.6 oz	24.8 oz
0.0012	3.1 oz	6.2 oz	9.3 oz	12.4 oz

ANVIL 2 + 2 ULV may be applied undiluted with a non-thermal ULV portable "backpack" spray unit capable of delivering particles in the 5 to 25 micron range. Apply at a walking speed 2 mph, making sure that the same amount of A.I. is applied per acre.

ANVIL 2 + 2 ULV may be applied with suitable thermal fogging equipment. Do not exceed the maximum rates listed above. May be applied at speeds of 5 to 20 mph.

Prohibition on aerial use: Not for aerial application in Florida unless specifically authorized by the Bureau of Entomology, Florida Department of Agriculture and Consumer Services.

AERIAL APPLICATION

Prohibition on aerial use: Not for aerial application in Florida unless specifically authorized by the Bureau of Entomology, Florida Department of Agriculture and Consumer Service.

Dosage Rate	Flow Rates in fluid oz./acre
lbs.A.I./acre	ANVIL® 2 + 2 ULV
0.0036	3.0 oz
0.0024	2.0 oz
0.0012	1.0 oz

Aerial applications should be done by suitable aerial ULV equipment capable of producing droplets with an MMD of 50 microns or less with no more than 2.5% exceeding 100 microns. Flow rate and swath width should be set so as to achieve 1.0 to 3.0 fluid ounces of ANVIL® 2+2 ULV per acre. Both aerial and ground applications should be made when wind is less than 10 MPH. For application by Public Health Officials and personnel of Mosquito Abatement Districts and other mosquito control programs.

ANVIL 2 + 2 ULV cannot be diluted in water. Dilute this product with light mineral oil if dilution is preferred.

STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Store in a cool, dry place. Keep container closed.

CONTAINER DISPOSAL: Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved state and local procedures.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

FOR MORE INFORMATION CALL: 1-800-323-5727

12/11/00

PYRENONE® 25-5

PUBLIC HEALTH INSECTICIDE

Specimen Label

* *FOR USE BY TRAINED PERSONNEL ONLY.*
* *TO BE APPLIED ONLY BY OR UNDER THE SUPERVISION OF PEST CONTROL OPERATORS, MOSQUITO ABATEMENT DISTRICTS, PUBLIC HEALTH ORGANIZATIONS AND OTHER TRAINED PERSONNEL RESPONSIBLE FOR INSECT CONTROL PROGRAMS.*
* *FOR INDOOR AND OUTDOOR APPLICATION AS A SPACE, AREA OR CONTACT SPRAY.*
* *DEPENDENT UPON PESTS TO BE CONTROLLED AND THE AREA TO BE TREATED, MAY BE APPLIED THROUGH MECHANICAL AEROSOL GENERATORS (ULV) OR THERMAL FOGGING EQUIPMENT AS WELL AS CONVENTIONAL FOGGING OR SPRAYING EQUIPMENT.*
* *MAY BE USED OVER ALL CROPS.*
* *THE ACTIVE INGREDIENTS ARE EXEMPT FROM TOLERANCES WHEN APPLIED TO GROWING CROPS [see 40 CFR § 180.1001 (b)]*

ACTIVE INGREDIENTS	
♦Pyrethrins	5.0%
*▲Piperonyl Butoxide, Technical	25.0%
†OTHER INGREDIENTS	70.0%
	100.0%

*Equivalent to 20% (butylcarbityl) (6-propylpiperonyl) ether and 5% related compounds.
†Contains Petroleum Distillate
♦Contains 0.367 pounds of Pyrethrins per gallon.
▲Contains 1.83 pounds of Piperonyl Butoxide per gallon.

KEEP OUT OF REACH OF CHILDREN

CAUTION

See Rear Panel For Additional Precautions

EPA REG. NO. 432-1050 EPA EST. NO.

NET CONTENTS:

BAYER ENVIRONMENTAL SCIENCE
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road • Montvale, NJ 07645

FIRST AID

IF SWALLOWED: Call a doctor or get medical attention. Do not induce vomiting. Do not give anything by mouth to an unconscious person. Avoid Alcohol.

IF INHALED: Remove victim to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. Get medical attention.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention if irritation persists.

In case of Medical emergencies or health and safety inquiries or in case of fire, leaking or damaged containers, information may be obtained by calling 1-800-471-0660.

For Product Information Call Toll-Free: 1-800-331-2867

PRECAUTIONARY STATEMENTS
Hazards To Humans & Domestic Animals

CAUTION

Harmful if swallowed or inhaled. Avoid breathing spray mist. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash clothing before re-use. Remove pets, birds and cover fish aquaria before spraying.

Do not apply as a space spray while food processing is underway. Except in Federally inspected meat and poultry plants, when applied as a surface spray with care and in accordance with the directions and precautions given above, food processing operations may continue. Foods should be removed or covered before treatments. In food processing areas all surfaces must be washed and rinsed in potable water after spraying.

When using in animal quarters, do not apply directly to food, water or food supplements. Wash teats of dairy animals before milking.

Environmental Hazards

This product is toxic to fish. For terrestrial uses, do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment or disposal of wastes. Shrimp and crab may be killed at application rates recommended on this label. Do not apply where these are important resources. Apply this product only as specified on this label.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

Pesticide Storage And Spill Procedures: Store upright at room temperature. Avoid exposure to extreme temperatures. In case of spill or leakage, soak up with an absorbent material such as sand, sawdust, earth, fuller's earth, etc. Dispose of with chemical waste.

Pesticide Disposal: Pesticide, spray mixture or rinse water that cannot be used according to label instructions may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved State and local procedures.

CONTAINERS ONE GALLON AND SMALLER: Do not re-use container. Wrap container in several layers of newspaper and discard in trash.

SPACE AND/OR CONTACT USE AREAS:

Homes	Poultry Houses
Horse Barns	Schools
Hotels	Supermarkets
Industrial Installations	Swine Houses
Motels	Truck Trailers
Office Buildings	Wineries

OUTDOOR USE AREAS:

Recreational areas	Golf courses	Corrals
Drive-in Restaurants	Municipalities	Zoos
Drive-in Theaters	Swine Yards	Parks
Residences	Feedlots	Playgrounds
Vineyards		

PYRENONE® 25-5 Public Health Insecticide is effective in the control of the indicated insects if the applicator follows directions for use as enumerated below:

All Common Diptera	
Deer Flies	***Lice***
Fruit Flies	***Mosquitoes***
Gnats	***Small Flying Moths***
Horn Flies	***Stable Flies***
Horse Flies	***Wasps***
House Flies	

INDOOR USE AS A SPACE SPRAY, DILUTED:
For use in conventional mechanical fogging equipment, to kill ***Flies, Fruit Flies, Mosquitoes and Gnats.*** Cover or remove exposed food and food handling surfaces. Close room and shut off all air conditioning or ventilating equipment. Dilute 1 part of Pyrenone 25-5 plus 49 parts of oil or suitable solvent and mix well. Apply at the rate of 1-2 fl. oz. per 1000 cu. ft. filling the room with mist. Keep area closed for at least 15 minutes. Vacate treated area and ventilate before reoccupying. Repeat treatment when reinfestation occurs.

SURFACE SPRAY: As an aid in the control of ***Mosquitoes, Gnats and Wasps.*** Treat walls, ceilings, moldings, screens, door and window frames, light cords and similar resting places.

ANIMAL QUARTER USE: (cattle barns, horse barns, poultry houses, swine houses, zoos): As a space spray diluted for use in conventional mechanical fogging equipment to kill ***Flies, Mosquitoes, Small Flying Moths and Gnats.*** Dilute 1 part of Pyrenone 25-5 Public Health Insecticide plus 49 parts oil or suitable solvent and mix well. Apply at a rate of 2 fl. oz. per 1,000 cu. ft. of space above the animals. Direct spray towards the upper portions of the enclosure. Keep area closed for at least 15 minutes. Vacate treated area and ventilate before reoccupying. Repeat treatment when reinfestation occurs.

TEMPORARY REDUCTION OF ANNOYANCE from ***Flies, Mosquitoes and Small Flying Moths*** outdoors. The directions for outdoor ground application noted below will afford temporary reduction of annoyance from

these pests in public theaters, golf courses, municipalities, parks, playgrounds and recreational areas. Direct application into tall grass, shrubbery and around lawns where these pests may hover or rest. Apply while air is still. Avoid wetting foliage. Application should be made prior to attendance. Repeat as necessary.
In additional outdoor areas (corrals, feedlots, swine lots and zoos), cover water, drinking fountains and animal feed before use. Treat area with mist, directing application into tall grass, shrubbery and around lawns where these pests may hover or rest. Apply while air is still. Avoid wetting foliage. In zoos, avoid exposure of reptiles to the product. Repeat as necessary.

FOR USE ON ANIMALS: To protect beef and dairy cattle and horses from ***Horn Flies, House Flies, Mosquitoes and Gnats,*** dilute 1 part of Pyrenone 25-5 plus 49 parts oil or suitable solvent, mix well and apply a light mist sufficient to wet the tips of the hair. To control ***Stable Flies, Horse Flies and Deer Flies*** on beef and dairy cattle and horses, apply 2 oz. per adult animal, sufficient to wet the hair but not to soak the hide. Repeat treatment once or twice daily or at intervals to give continued protection.

USE IN MOSQUITO CONTROL

Pyrenone 25-5 Public Health Insecticide may be used for mosquito control programs involving residential, industrial, recreational and agricultural areas as well as swamps, marshes, overgrown waste areas, roadsides and pastures where adult mosquitoes occur. Pyrenone 25-5 Public Health Insecticide may be used over agricultural crops because the ingredients are exempt from tolerance when applied to growing crops. For best results, apply when meteorological conditions create a temperature inversion and wind speed does not exceed 10 miles per hour. The application should be made so the wind will carry the insecticidal fog into the area being treated. Treatment may be repeated as necessary to achieve the desired level of control.

When used in cold aerosol generators that produce a fog with the majority of droplets in the 10-25 micron VMD range, Pyrenone 25-5 Public Health Insecticide should be diluted with light mineral oil or suitable solvent (specific gravity of approximately 0.8 at 60°F; boiling point: 500-840°F). An N.F. grade oil is prefered.

GROUND APPLICATION: To control adult mosquitoes and all common diptera, apply up to 0.0025 pounds of pyrethrins per acre (use a 300 foot swath width for acreage calculations).

Truck-Mounted ULV Application: The delivery rate and truck speed may be varied as long as the application rate does not exceed 0.0025 pounds of pyrethrins per acre (use a 300 foot swath width for acreage calculations).

Backpack Spray Application: Dilute 1 part Pyrenone 25-5 Public Health Insecticide with 10 parts oil or suitable solvent and apply at the rate of 7 ounces per acre (based on a 50 foot swath, 7 ounces should be applied while walking 870 feet).

AERIAL APPLICATION (FIXED WING AND HELICOPTER): To control adult mosquitoes and biting flies, apply up to 0.0025 pounds of pyrethrins per acre with equipment designed and operated to produce a ULV spray application.

IMPORTANT: READ BEFORE USE

By using this product, user or buyer accepts the following conditions, disclaimer of warranties and limitations of liability.

CONDITIONS: The directions for use of this product are believed to be adequate and should be followed carefully. However, because of manner of use and other factors beyond Bayer Environmental Science's control, it is impossible for Bayer Environmental Science to eliminate all risks associated with the use of this product. As a result, crop injury or Ineffectiveness is always possible. All such risks shall be assumed by the user or buyer.

DISCLAIMER OF WARRANTIES: THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, WHICH EXTEND BEYOND THE STATEMENTS MADE ON THIS LABEL. No agent of Bayer Environmental Science is authorized to make any warranties beyond those contained herein or to modify the warranties contained herein. Bayer Environmental Science disclaims any liability whatsoever for incidental or consequential damages, including, but not limited to, liability arising out of breach of contract, express or implied warranty (including warranties of merchantability and fitness for a particular purpose), tort, negligence, strict liability or otherwise.

LIMITATIONS OF LIABILITY: THE EXCLUSIVE REMEDY OF THE USER OR BUYER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID, OR AT BAYER ENVIRONMENTAL SCIENCE'S ELECTION, THE REPLACEMENT OF PRODUCT.

Bayer Environmental Science
A Business Group of Bayer CropScience LP
95 Chestnut Ridge Road
Montvale, NJ 07645

Py 25-5 PH-SL-9/02 Bayer

7396-902

PYROCIDE® Mosquito Adulticiding
Concentrate for ULV Fogging 7396

Recommended for use by Commercial or Governmental Mosquito Control Personnel

	ACTIVE INGREDIENTS:	
	Pyrethrins	5.00%
*	Piperonyl butoxide, Technical	25.00%
**	OTHER INGREDIENTS	70.00%
		100.00%

* Equivalent to 20.00% (butylcarbityl) (6-propylpiperonyl) ether and 05.00% related compounds.
** Contains petroleum distillate
PYROCIDE® - Registered trademark of McLaughlin Gormley King Co.

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID	
IF SWALLOWED:	▪ Immediately call a poison control center or doctor. ▪ Do not give any liquid to the person. ▪ Do not induce vomiting unless told to do so by a poison control center or a doctor. ▪ Do not give anything by mouth to an unconscious person.
IF IN EYES:	▪ Hold eye open and rinse slowly and gently with water for 15-20 minutes. ▪ Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. ▪ Call a poison control center for treatment advice.
IF ON SKIN OR CLOTHING:	▪ Take off contaminated clothing. ▪ Rinse skin immediately with plenty of water for 15-20 minutes. ▪ Call a poison control center or doctor for treatment advice.
IF INHALED:	▪ Move person to fresh air. ▪ If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. ▪ Call a poison control center or doctor for further treatment advice.
NOTE TO PHYSICIAN: This product contains petroleum distillate and may pose an aspiration pneumonia hazard. Have the product container or label with you when calling a poison control center or doctor, or going for treatment. For information regarding medical emergencies or pesticide incidents, call the International Poison Center at 1-888-740-8712.	

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Harmful if swallowed, inhaled, or absorbed through skin. Causes eye irritation. Avoid contact with skin, eyes, or clothing. Avoid breathing vapors or spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

ENVIRONMENTAL HAZARDS

This product is toxic to fish and other aquatic invertebrates. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product
in a manner inconsistent with its labeling.

This concentrate is formulated to be diluted with a suitable oil diluent, such as (but not restricted to) light mineral oil, deodorized kerosene or petroleum distillate, for use in cold fog aerosol generators.

This concentrate may be diluted or used as supplied for mosquito control programs involving residential, industrial, recreational and agricultural areas, swamps, marshes, overgrown waste areas, roadsides and pastures where adult mosquitoes occur.

Use in agricultural areas should be in such a manner as to avoid residues in excess of established tolerances for pyrethrins and piperonyl butoxide on crops or commodities.

Best results are expected from application when the meteorological conditions favor an inversion of air temperatures in the area treated, and when the wind is not excessive. Repeated applications may be made as necessary to obtain the desired reduction in adult mosquitoes.

This pesticide may be applied with equipment designed and operated to produce a suitable ultra low (ULV) spray application, which meets the dosage per acre objective of not more than .0025 pounds of pyrethrins and .0125 pounds of piperonyl butoxide per acre.

Back pack application may require a greater rate of dilution than the dilution used for vehicle or aircraft mounted sprayers, in order to achieve the desired rate of application of active ingredients per acre.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

STORAGE: Store in a cool, dry place. Keep container closed.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse (or equivalent) and offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or by other approved State and Local procedures.

Net Contents _____

Manufactured by:
Mc LAUGHLIN GORMLEY KING COMPANY
8810 Tenth Avenue North
Minneapolis, MN 55427

EPA Reg. No. 1021-1569

EPA Est. No. 1021-MN-2

Onslaught™

MICROENCAPSULATED INSECTICIDE

ACTIVE INGREDIENT:

(S)-cyano (3-phenoxyphenyl) methyl-(S)-4-chloro-alpha-(1-methylethyl) benzeneacetate	6.40%
OTHER INGREDIENTS*	93.60%
	100.00%

*Contains petroleum distillates

KEEP OUT OF REACH OF CHILDREN

CAUTION

See reverse for first aid and precautionary statements.

For pest management professional use

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

Remove pets and birds and cover fish aquariums before spraying.

For control of insects, indoors and outdoors, in food and non-food areas such as, but not limited to: homes, schools, warehouses, office buildings, apartment buildings, theatres, hotels, industrial buildings, motels, kennels, livestock housing, food processing plants, food service establishments, restaurants, supermarkets and grocery stores, transportation equipment, truck trailers, railroad cars, and food manufacturing and warehousing establishments. Also for use on backyards, lawns, trees, ornamental landscaping, recreational areas, parks and athletic fields.

INSECTS CONTROLLED:

Ants
Aphids
Asian Lady Beetles
Bed Bugs
Beetles
Boxelder Bugs
Carpet Beetles
Centipedes
Cockroaches
Crickets
Dog Ticks
Earwigs
Fire Ants
Firebrats
Fleas
Mealy Bugs
Midges
Millipedes
Mites
Pillbugs
Psocids
Scales
Silverfish
Spiders
Springtails
Swarming Termites
Ticks
Waterbugs

FLYING INSECTS INCLUDING:

Blow Flies
Chiggers
Clothes Moths
Crane Flies
Deer Flies
Face Flies
Fruit Flies
Fungus Gnats
Gnats
Horn Flies
Houseflies
Mosquitoes
Small Flying Moths
Whiteflies

BITING AND STINGING PESTS:

Bed Bugs
Bees
Biting Flies
Chiggers
Deer Flies
Deer Ticks
Dog Ticks
Fire Ants
Fleas
Gnats
Hornets
Lice
Mosquitoes
Scorpions
Spiders
Ticks
Wasps
Yellow Jackets

STORED PRODUCT PESTS INCLUDING:

Angoumois Grain Moths
Ants
Cadelles
Cigarette Beetles
Cockroaches
Confused Flour Beetles
Dark Mealworms
Dried Fruit Beetles
Drug Store Beetles
Flat Grain Beetles
Fruit Flies
Grain Mites
Grain Moths
Granary Weevils
Indian Meal Moths
Lesser Grain Borers
Maize Weevils
Meal Moth Larvae
Mediterranean Flour Moths
Merchant Grain Beetles
Red Flour Beetles
Rice Weevils
Rusty Grain Beetles
Saw-toothed Grain Beetles
Skippers
Spider Beetles
Spider Mites
Square-necked Grain Beetles
Tobacco Moths
Yellow Mealworms

LIVESTOCK PREMISE PESTS INCLUDING:

Bed Bugs
Carrion Beetles
Chiggers
Darkling Beetles (lesser meal worm)
Deer Flies
Face Flies
Fleas
Flies
Hide Beetles
Horn Flies
Horse Flies
Lice
Litter Beetles
Mites
Mosquitoes
Stable Flies

WOOD DESTROYING PESTS INCLUDING:

Carpenter Ants
Carpenter Bees
Deathwatch Beetles
Furniture Beetles
Old House Borers
Powder Post Beetles
Round-headed House Borers
Swarming Termites

PLANT PESTS INCLUDING:

Alfalfa Caterpillars
American Plum Borers
Annual Bluegrass Weevils
Aphids
Apple Maggots
Armyworms
Artichoke Plume Moths
Bagworms
Balsam Woolly Adelgids
Beet Armyworms
Billbugs
Blueberry Spanworms
Cherry Fruit Flies
Cherry Fruitworms
Chinch Bugs
Codling Moths
Cowpea Curculios
Cranberry Fruitworms
Cranberry Weevils
Cucumber Beetles
Cutworms
Diamondback Moths
Elm Leaf Beetles
European Pine Sawflies
Fall Webworms
Filbert Worms
Flea Beetles
Grasshoppers
Green Cloverworms
Green Fruit Worms
Gypsy Moth Caterpillars
Hickory Shuckworms
Imported Cabbageworms
Japanese Beetles
Lace Bugs
Leaf Feeding Caterpillars
Leaf Miners
Leaf Rollers
Leaf Tiers
Leafhoppers
Lesser Appleworms
Lesser Peach Tree Borers
Loopers
Lygus Bugs
Mexican Bean Beetles
Mites
Mole Crickets
Naval Orangeworms
Northern Pine Weevils
Oriental Fruit Moths
Painted Lady Caterpillars
Pea Weevils
Peach Tree Borers
Peach Twig Borers
Pear Psyllid
Pear Slugs
Pecan Leaf Phylloxera
Pecan Nut Casebearers
Pecan Spittlebugs
Pecan Stem Phylloxera
Pecan Weevils
Pepper Weevils
Periodical Cicadas
Pickleworms
Pillbugs
Pine Chafers
Pine Coreid Bugs
Plant Bugs
Plum Curculios
Red Pine Sawflies
Red-striped Fireworms
Redheaded Pine Sawflies
Rindworms
Salt Marsh Caterpillars
Sap Beetles
Scales
Sod Webworms
Sowbugs
Spiders
Spittlebugs
Stink Bugs
Tarnished Plant Bugs
Tent Caterpillars
Thrips
Tobacco Hornworms
Tufted Apple Budmoths
Velvet Bean Caterpillars
Walnut Husk Flies
Western Bean Cutworms
Whiteflies

General information:
Do not apply this product in patient rooms or in any rooms while occupied by the elderly or infirm. Do not apply to classrooms while in use. Do not apply in institutions (including libraries, schools, sports facilities, etc.) in the immediate area where occupants are present.

Onslaught™ Microencapsulated Insecticide is a microencapsulated suspension concentrate containing 0.54 pounds active ingredient per gallon.

Onslaught™ Microencapsulated Insecticide is designed to provide long residual activity against pests listed on this label when applied as surface or spot treatments, injected into wall voids, or as a crack and crevice spray in and around residential and commercial structures, as well as on turf and landscaping. Onslaught™ Microencapsulated Insecticide may be sprayed on any surface that will not be stained by water. DO NOT use this product as a fogger or apply it as a space spray. Do not apply in electrical conduits, junction and switch boxes, motor housings, or other electrical equipment due to shock hazard from water-based spray.

Use only in areas described. Remove pets and cover fish aquariums and pets' food and water dishes before spraying. Keep all people (especially children) and pets out of areas being treated and restrict access to these areas until all surfaces are dry. DO NOT leave product where children or pets can come into contact with it. DO NOT allow spray to contact food or food-containing surfaces, feed, or water supplies. Thoroughly wash dishes and food handling utensils with soap and water if they become contaminated with this product. Food utensils such as teaspoons and measuring cups must not be used for food purposes after use with pesticides.

Application in food processing/handling establishments:
Application is permitted within food and non-food areas of food service and handling establishments (places other than private residences) including but not limited to: restaurants, meat processing plants, grocery stores, bakeries, food manufacturing and processing establishments, and food warehousing establishments. Do not treat establishments where livestock feed is present.

Food areas include areas for receiving, storing, packing, canning, bottling, wrapping, boxing, preparing, edible waste storage, and enclosed processing systems, mills, and dairies. Serving areas are places where prepared foods are served, such as dining rooms, but excluding areas where foods may be prepared or held. Non-food areas include garbage rooms, lavatories, floor drains (to sewers), entries and vestibules, offices, locker rooms, machine rooms, garages, mop closets, and storage after canning or bottling.

General surface applications: Do not apply Onslaught™ Microencapsulated Insecticide as a general surface application in food areas of the facility when the facility is in operation or food is exposed. Do not apply directly to food. Cover or remove all food and food processing equipment prior to application. After spraying in meat packing plants, bakeries, and other food processing plants, wash with an effective cleaning compound, and then rinse water all equipment, benches, shelving, etc. where exposed food will be handled with potable water. Repeat applications as needed, but do not exceed more than one (1) application every (14) days.

Spot or crack and crevice applications: Spot or crack and crevice applications may be made while facility is in operation, provided exposed food is covered or removed from the area being treated. Do not apply directly to food or food-handling surfaces. Repeat applications as needed, but do not exceed more than one (1) application every (14) days.

In the home, cover exposed food and do not allow spray to contact food/feed surfaces. If spray does contact these surfaces, clean surfaces with soap and water.

MIXING INSTRUCTIONS

Onslaught™ Microencapsulated Insecticide should be mixed with water and applied with hand pressurized or power operated sprayers. Shake container of Onslaught™ Microencapsulated Insecticide before diluting. Clean spray equipment before use. For dilution, add approximately half the required water to spray tank and then add the appropriate amount of Onslaught™ Microencapsulated Insecticide. Agitate and slowly add the remaining water. Agitate spray thoroughly before using and also occasionally during use to ensure dispersion. If spray filter screens are used, they should be 50 mesh or larger. Use 0.5 fluid ounces (15 cc.) of Onslaught™ Microencapsulated Insecticide in 1 gallon of water to make a spray mix containing 0.025% active ingredient. Use 1.0 fluid ounce (30 cc.) per gallon of water to make a spray containing 0.05% active ingredient. Use 0.025% solution for light infestations or as a maintenance control rate. Use 0.05% for heavy infestations or as an initial clean out rate. Apply two-second bursts of spray per square foot of area being treated. Avoid excessive application. Dampen surfaces but not to the point of saturation or run-off. Only dilute Onslaught™ Microencapsulated Insecticide with water.

Formula for determining the active ingredient content of the finished spray mixture:
The following formula may be used to determine the percent active ingredient that is in the sprayer tank after mixing Onslaught™ Microencapsulated Insecticide:

$$\frac{\text{(6.4) x (number of fl. oz. of concentrate added to tank)}}{\text{(Gallons of finished spray mix) x (128)}} = \text{\% active ingredient of spray mix}$$

Tank mixing:
Onslaught™ Microencapsulated Insecticide may be tank mixed with an insect growth regulator such as NyGuard® IGR Concentrate or pyrethrum-containing products or any other currently registered pesticides unless expressly prohibited by the product label. The resulting tank mix may be applied in areas where these products are allowed to be sprayed. Do not tank mix Onslaught™ Microencapsulated Insecticide with products containing dichlorvos (DDVP).

INDOOR USE

Application rates for indoor structural pests:

Pests	Concentration of active ingredient	Dilution rate in water	Application rate of mixed solution	Application method(s)
Crawling insects Light infestation Heavy infestation	 0.025% 0.050%	 0.5 fl. oz./gallon 1.0 fl. oz./gallon	1 gallon/1,000 sq. ft.	Apply as a coarse, wet spray • Broadcast surface spray • Crack and crevice treatment • Spot treatment • Injected into wall voids
Flying insects	0.025%	0.5 fl. oz./gallon	1 gallon/1,000 sq. ft.	
Stinging insects	0.050%	1.0 fl. oz./gallon	1 gallon/1,000 sq. ft.	
Ticks	0.025%	0.5 fl. oz./gallon	1 gallon/1,000 sq. ft.	
Fleas, Lice and Bed Bugs	0.025%	0.5 fl. oz./gallon	1 gallon/1,000 sq. ft.	Apply as noted above, with a fine particle spray

Crawling insect pests indoors:
Apply as a coarse, wet spray to surfaces where these pests are normally found. Treat floors, baseboards, around doors and windows, in attics, crawl spaces, eaves, corners, closets, walls, utility pipes, storage areas, and all cracks and crevices. Treat underneath sinks, dishwashers, refrigerators, stoves, the underside of shelves, drawers, cabinets, areas behind pipes, and in all places where these insects shelter. Contact as many insects as possible with direct spray. Repeat applications as needed, but do not exceed more than one (1) application every seven (7) days.

For Ant control indoors:
Apply to ant trails, around garbage receptacles, and near food sources. Also apply around doors and windows and wherever these pests may find entrance to the structure. Remove sources of food through basic hygiene practices whenever possible.

Flying insect pests indoors:
Treat insect resting areas such as walls and ceilings, screens, around windows, doors, and light fixtures, and other surfaces that attract flying insects. Initiate treatments at the beginning of fly season, and repeat treatments during periods of heavy infestation.

Stinging insect pests indoors:
Apply spray to nests late in the evening when stinging insects are at rest. Thoroughly spray nest, nest entrance, and surrounding areas where insects land or walk. Treat around doors and windows, in attics, crawl spaces, and possible harborage sites or points of entry.

For control of Brown Dog Ticks:
Thoroughly apply as a spot treatment to infested areas such as pet beds and resting areas, nearby cracks and crevices, along and behind baseboards, window and door frames, and localized areas of floor and floor coverings where these pests may be present. DO NOT SPRAY PETS WITH THIS PRODUCT. Treat dogs and cats with a product registered for use on animals.

For control of Fleas:
Thoroughly apply as a fine particle broadcast spray to infested rugs, carpets, and pet resting areas. Prior to treatment, aquariums and fish bowls should be covered, and pet animals should be removed from the area being treated. Do not permit humans or pets to contact treated surfaces until spray has dried. Old pet bedding should be removed and replaced with clean, fresh bedding after treatment. DO NOT SPRAY PETS WITH THIS PRODUCT. Treat dogs and cats with a product registered for use on animals.

To control Bed Bugs:
Thoroughly clean and sanitize mattresses and box springs. Treat mattresses and box springs with an approved pesticide, such as a pyrethrin aerosol. Apply Onslaught™ Microencapsulated Insecticide as a spot treatment to potential harborage sites and migration paths, and cracks and crevices, around baseboards, floorboards, head-boards, and walls.

For control of stored product pests:
Spray thoroughly around and into floor drains, non-food conveyors, benches, pipes, pallets, moist areas, storage racks, pieces of equipment, and other areas where stored product pests may be found. Tank-mix or sequential use of an insect growth regulator, such as NyGuard® IGR Concentrate, is recommended to break the insect reproduction cycle. Do not apply this spray to surfaces or utensils that may come in contact with food, since excessive residues in food may result.

To treat voids in equipment and structures:
To kill insects harboring in wall voids and other inaccessible spaces in equipment and structures, use injection equipment designed for deep void applications. Follow the injection equipment manufacturer's recommendations for proper set up and air pressures. Place the applicator tip at or into the void space to be treated. For inaccessible voids, it may be necessary to drill an access hole(s). Inject product into the void space in short bursts, allowing air pressure to push insecticide deep into the space. Avoid applying to the point of runoff or drip. Ventilate area thoroughly before re-entry. Do not reapply more than every fourteen (14) days.

To kill the accessible stages of listed granary insects:
Pest management professionals and grain producers may use this concentrate to treat grain storage facilities, and other listed areas, for stored product pest control. For control of exposed adult and immature stages of stored product pests, apply to cracks, crevices, and other surfaces where the pests have been seen or have harborage. Treat areas where products are stored before filling with the product. Apply at the rates listed above, using one gallon of spray mix per 1,000 square feet of surface area to be treated. Cleaning all areas prior to use will increase levels of control. Any foodstuffs infested with pests should be removed and destroyed. Do not apply when food-processing facility is in operation or foods are exposed. Do not apply this spray to surfaces or utensils that may come into contact with food.

Repeat application as needed, but DO NOT exceed more than one application every fourteen (14) days.

USE IN AND AROUND LIVESTOCK HOUSING

For use in and around unoccupied areas of livestock facilities, such as, but not limited to: barns, cow and calf pens and hutches, dairy barns and milk rooms, hog barns, horse barns, sheep barns, poultry houses, and rabbit hutches. Do not contaminate milk, food, or drinking water. Remove animals from area being treated. Cover feeders and waterers. Do not apply or allow insecticide to drift onto animals. Do not allow animals to enter treated areas until spray solution has dried.

Pests	Concentration of active ingredient	Dilution rate in water	Application method(s)
Crawling insects * Including Litter Beetles	0.050%	1.0 fl. oz./gallon **or** 1.0 fl. oz. in sufficient water to cover 1,000 sq. ft.	Apply as a coarse, wet spray • General surface spray • Crack and crevice treatment • Spot treatment • Injected into wall voids
Flying insects	0.025%	0.5 fl. oz./gallon **or** 0.5 fl. oz. in sufficient water to cover 1,000 sq. ft.	

Crawling insect pests in livestock and poultry premises:
Apply as a general surface, spot treatment, and/or crack and crevice treatment. Apply to floors and vertical and overhead surfaces where crawling insects are or may be present. Treat stanchions, pipes, windows, doors, posts, cage framing, gates, under (but not in) feeders, and other areas where insects hide or congregate. To reduce immigration of insects, make a perimeter treatment around the outside of building foundations. Apply in a uniform band 1 to 3 feet up the exterior foundation wall and 3 to 6 feet out from the foundation.

Litter Beetle control in livestock and poultry premises:
To control Litter Beetles (darkling, hide, and carrion beetles), apply Onslaught™ Microencapsulated Insecticide to walls and floors at cleanout and before reintroduction of animals. Treat areas where beetles frequently occur, such as walls, supports, cages, cage framing, stalls, and around feeders. To reduce immigration of insects, make a perimeter treatment around the outside of building foundations. Apply in a uniform band 1 to 3 feet up the exterior foundation wall and 3 to 6 feet out from the foundation.

Flying insect pests in livestock and poultry premises:
For residual control of flying insects, treat insect resting areas such walls, ceilings, screens, around windows, doors, light fixtures, and other surfaces that attract flying insects. Initiate treatments at the beginning of fly season and repeat treatments during periods of heavy infestation.

OUTDOOR USE

Do not spray in or near fish ponds or other bodies of water.

Not for use on plants being grown for sale or other commercial use. Not for use in nurseries, sod farms or golf courses.

Application rates for outdoor pests:

	Concentration of active ingredient	Dilution rate in water	Application method(s)
Treating exterior walls, foundations and structures	0.025% to 0.050%	0.5 to 1.0 fl. oz./gallon **or** 0.5 to 1.0 fl. oz. in sufficient water to cover 1,000 sq. ft.	Apply as a coarse, wet spray • General surface spray • Crack and crevice treatment • Spot treatment
Treating nests and harborage areas of stinging insects	0.050%	1.0 fl. oz./gallon **or** 1.0 fl. oz. in sufficient water to cover 1,000 sq. ft.	
To control Swarming Termites and wood destroying pests	0.050%	1.0 fl. oz./gallon **or** 1.0 fl. oz. in sufficient water to cover 1,000 sq. ft.	
Treating ornamental trees and landscapes	0.005% to 0.050%	0.1 to 1.0 fl. oz./gallon **or** 0.1 to 1.0 fl. oz. in sufficient water to cover 1,000 sq. ft.	Apply as a coarse, wet spray • Broadcast spray treatment • Foliar spray treatment
Mosquito breeding sites	0.025%	0.5 fl. oz./gallon **or** 0.5 fl. oz. in sufficient water to cover 1,000 sq. ft.	
Treating lawns and turf	0.005% to 0.050%	0.1 to 1.0 fl. oz./gallon **or** 0.1 to 1.0 fl. oz. in sufficient water to cover 1,000 sq. ft. **or** 4.3 to 43 fl. oz. per acre	Apply as a coarse, wet spray • Broadcast spray treatment

Treating exterior walls, foundations and structures:
To control infestations of listed pests, treat exterior surfaces of buildings, walls, window frames, around garbage cans, eaves, cracks and crevices, porches, decks, gazebos, patios, carports, garages, fence lines, and other areas where pests are active or may be hiding.

To help prevent insect infestation of buildings: Treat a 2 to 6 foot band of soil or other substrate adjacent to buildings. Treat building foundation to a height of 2 to 3 feet. Treat exterior walls, eaves, cracks and crevices, and other areas where listed pests are active, and may find entrance into building.

Apply with sufficient water to adequately cover the area being treated, but do not allow dripping or run-off to occur. Alternate mixing directions are to use 2 to 4 fluid ounces of concentrate per 50 gallons of water.

Stinging insect control outdoors:
For stinging insects, apply spray solution to nests and harborage areas late in the evening when stinging insects are commonly at rest. Thoroughly spray nest, nest entrance, harborage sites, and surrounding areas where insects land or walk. For nests inside walls, inject sufficient spray to treat nest. Do not use in areas where an electrical shock hazard exists. For applications made when pests are active, applicator should wear protective equipment as required. Repeat application when there are signs of renewed insect activity.

For Yellow Jacket control, Onslaught™ Microencapsulated Insecticide can be mixed with baits in traps. Follow trap instructions for preparation of bait.

For control of Fire Ants, combine broadcast application with mound drenches to control foraging workers and newly mated fly-in queens. Apply Onslaught™ Microencapsulated Insecticide as a broadcast application at a rate of 8 fl. oz. per 1,000 square feet. Treat mounds with a registered fire ant mound treatment.

Insect control in ornamental trees and landscapes:
For residential and commercial trees, shrubs, ground covers, and bedding and foliage plants that will not be harvested for food, apply Onslaught™ Microencapsulated Insecticide in appropriate volumes of water to obtain thorough coverage. Apply as a full-coverage foliar spray, applying to the point of drip but not runoff. Treat active soil pests with an application to surrounding soil. Repeat treatments as necessary to achieve control, using higher application rates as pest pressure and foliage area increases. Repeat applications as necessary, but no more than once every seven (7) days. Certain plants may be sensitive to the final spray solution. A small-scale test is recommended to verify safety to ornamental plants. Spray and observe for one (1) week prior to application of an entire planting.

Insect control on lawns, turf grass and turf:
For best results, lawn or turf grass should be mowed 1 to 2 days before spraying. Treat with spraying equipment or a hand sprayer. Use application volumes of up to 10 gallons per 1,000 square feet to get uniform coverage when treating dense grass foliage. For low volume applications using less than 2 gallons of spray solution per 1,000 square feet, immediate irrigation with at least 0.25 inches of water is recommended to improve effectiveness on sub-surface pests.

When hand spraying, spray using a slow, even sweeping motion, making sure to cover the entire lawn or turf grass area where pests are observed. Spray under ornamentals and trees. Repeat treatments may be necessary at 7 to 14 day intervals.

Rate range:

Use lower rate range for pests that are commonly exposed and will be contacted by spray solution at the time of application. For pests that will not be contacted by spray solution at the time of application, use the upper rate range. Use 1 fl. oz. per 1,000 sq. ft. when treating Mole Crickets and Chinch Bugs.

To kill Swarming Termites: OUTDOORS ONLY.

Apply spray mix as a coarse, wetting spray when Swarming Termites are seen emerging from woodpiles, wooden fence posts, wooden structures, or from the ground. Swarming usually occurs in the spring or at other times when a termite colony becomes overcrowded and new reproductive termites with wings emerge and fly away to mate and establish new colonies. This treatment will control the sprayed termites and will not protect the structure from which the swarm is coming. Use only as a contact spray to kill emerging reproductive (winged) and worker termites emerging from infested wood. This treatment is not a substitute for a comprehensive termite control program.

To kill wood destroying pests: OUTDOORS ONLY.

Apply spray mix as a coarse, wetting spray to exposed pests and to the damaged areas of wood, spraying into galleries or tunnels in the exposed wood. Also spray around doors, window and door frames, and other areas where these pests may hide or enter the house. Spray into cracks and crevices and, if necessary, drill small holes and spray into inaccessible wooden structural voids where these pests are suspected.

Mosquito breeding sites:

Mosquito populations may be reduced by application of Onslaught™ Microencapsulated Insecticide to sites where Mosquitoes rest, harbor, and breed. Apply spray solution into tall grass, shrubbery, and around backyards and lawns where these pests may hover or rest. Apply while air is still.

Not for wide area mosquito use. Do not apply with hand held or truck mounted cold aerosol ULV sprayers and thermal fogging devices.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

STORAGE: Store in a cool, dry, well-ventilated area. Keep container closed.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. In case of spill or leak, soak up with sand, earth, or synthetic absorbents. Do not use alkaline absorbents or clean spill area with alkaline detergents.

CONTAINER DISPOSAL: Do not reuse empty container. Wrap container in several layers of newspaper and discard in trash.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Harmful if swallowed or absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Wear protective eyewear (goggles, face shield or safety glasses with side shields). Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

ENVIRONMENTAL HAZARDS

This product is toxic to fish and other aquatic invertebrates. Do not apply directly to water. Do not contaminate water when disposing of equipment washwaters. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirement of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product into sewer systems without previously notifying sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame. Do not use this product in or on electrical equipment due to the possibility of shock hazard.

FIRST AID

IF SWALLOWED:
- Call a poison control center or doctor immediately for treatment advice.
- Do not give **any** liquid to the person.
- Do not induce vomiting unless told to do so by a poison control center or a doctor.
- Do not give anything by mouth to an unconscious person.

IF IN EYES:
- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first five minutes, then continue rinsing eyes.
- Call a poison control center or doctor for treatment advice.

IF ON SKIN OR CLOTHING:
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

NOTE TO PHYSICIAN:

Contains petroleum distillate—vomiting may cause aspiration pneumonia.

Have the product container or label with you when calling a poison control center or doctor or going for treatment. For information regarding medical emergencies or pesticide incidents, call 1-888-740-8712.

Onslaught™
MICROENCAPSULATED INSECTICIDE

8810 Tenth Avenue North, Minneapolis, MN 55427
037-1305/10M-0407

EPA Reg. No. 1021-1815

EPA Est. No. 1021-MN-2

APPENDIX G Technical Advisory Board Meeting Notes February 20, 2008

TAB Members Present
Robert Koch, Chair, Minnesota Department of Agriculture
Bob Sherman, Independent Statistician
Susan Palchick, Hennepin County Public Health
Vicki Sherry, US Fish and Wildlife Service
Dave Neitzel, MN Department of Health
Roger Moon, University of Minnesota
Rick Bennett, Environmental Protection Agency
Sarma Straumanis, MN Department of Transportation
Steve Hennes, MN Pollution Control Agency
Larry Gillette, Three Rivers Park District
Gary Montz, MN Department of Natural Resources

MMCD Staff Present
Jim Stark
Nancy Read
Sandy Brogren
Diann Crane
Janet Jarnefeld
Kirk Johnson
Carey LaMere
Mike McLean
Mark Smith
John Walz

(TAB member Karen Oberhauser absent due to sabbatical; received materials for review)

Welcome and Call to Order

Meeting Chair Robert Koch of the MN Department of Agriculture called the meeting to order at 12:30 pm. He introduced himself and set a goal of keeping the meeting on schedule. He then introduced MMCD Executive Director Jim Stark and asked him to continue with the welcome and introductions. MMCD staff introduced themselves.

MMCD Strategic Overview

Jim Stark, MMCD's Executive Director, outlined the District's mission and presented the following six strategic objectives.

1. Expand treatment capacity and efficacy through improved strategies, techniques and products
2. Ensure the environmental impacts of treatment are minimized
3. Improve the outreach and notification processes
4. Reduce the incidence of mosquito and tick-borne disease through education, monitoring, inspection and treatment
5. Ensure that service area facilities and staff are sufficient to meet and carry out the mission
6. Ensure a balance between the expectations of citizens and the cost of service

He noted that the District's biennial survey of public attitudes and opinions will be done in 2008. Clear objectives, he said, help us communicate coherently with the public.

The District's Growth Plan is designed to enable larvicide services District-wide by 2012. This provides a framework for MMCD's long term planning. An example of the plan in action is the Anoka facility expansion which will handle additional personnel, equipment and materials for service in that growing area. Construction is being financed by bonding through Anoka County.

Other initiatives include enhancing interaction with elected officials, DNR, USF&W, other agencies, and environmental groups. MMCD is committed to lessening reliance on adult control. Communicating with these groups has led to productive dialog.

Jim Stark also noted that MMCD is celebrating its 50th Anniversary in 2008. Plans include production of a documentary with Twin Cities Public Television, media releases and an open house.

Questions/Comments

Roger Moon asked if larviciding out to District borders will be done at Tier 1 or Tier 2 treatment level. Jim Stark answered that the goal is treatment to the borders but that there may be some threshold differences. The bottom line is that we want to make sure treatment is effective and worthwhile. Larry Gillette suggested that the executive summary might reference "scrutiny by the environmental community." This would show what MMCD has accomplished, and would reflect a changes that have helped the District re-evaluate its environmental emphasis, and attitude, over the last 25 years.

Surveillance

In reference to a question about multi-year data submitted prior to the meeting, District Entomologist Sandy Brogren presented a 50-year overview of District activity including a history of how MMCD has measured mosquito numbers, and showed some examples of 50 year species data. Results of which have been incorporated into the Surveillance chapter of this report.

Questions/Comments

Roger Moon asked why so many *An. quadrimaculatus*, a relatively rare species has been found more frequently in samples.
Larry Gillette asked about the frequency of sampling and the choice of sampling methods.
Sandy Brogren noted that many factors, including climate change, may influence species variability.

Exotic Species Detection

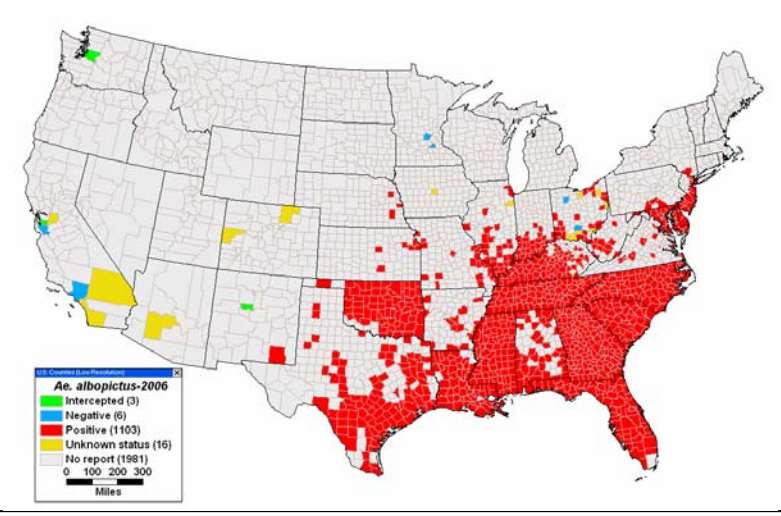
Kirk Johnson discussed the detection of *Ae. albopictus* and *Ae. japonicus* in the District this year (see TAB Report, Chapter 1) and their capacity to act as vectors of local viruses such as LaCrosse encephalitis (LAC), and West Nile virus (WNV) or other viruses not currently present in the US such as Japanese encephalitis and Chikungunya. Maps of observed ranges show the established range of *Ae. albopictus* is probably south of Minnesota unless the climate changes. *Aedes japonicus* is well-established in the northeastern US through Ohio, is also found in Seattle, and seems to be expanding in Iowa and neighboring states. Below are maps of detection of *Ae. albopictus* and *Ae. japonicus* in the United States.

Questions/Comments

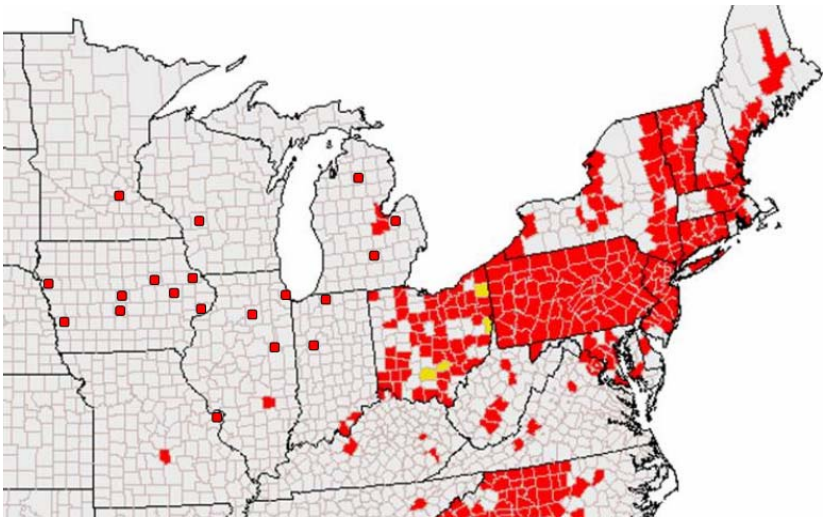
Roger Moon asked if all these concerns in nearby states were associated with tire handling. Kirk Johnson responded that there were a variety of locations including a military base, and other tire transport facilities. Kirk Johnson also detailed the detection of these species in ovitraps at a tire recycling facility in the District this summer and MMCD's response. No adults of these species were found. The tire recycling facility in question is now accepting tires from a 500 mile radius, which includes *Ae. japonicus* endemic territory. The bottom line is that we are likely to get more introductions. Roger Moon asked what options have been identified for dealing with these introductions, and could those efforts be done more efficiently. Kirk Johnson outlined cooperative work with Greenman Tire facility to treat tires as they arrive. MMCD visits once per week, but this may not be often enough. Dave Neitzel asked about the possibility of indoor storage. Kirk Johnson noted that they have not increased their indoor storage and they also now use cage trailers in a large lot, so this may be an issue to revisit. Bob Sherman asked about the

best way to treat the tires, and Kirk Johnson described the efficiency of using adult control. The nooks and crannies in used tires piles would make larviciding difficult.

Aedes albopictus in the U.S., 2006
Source: Chester G. Moore, Colorado State University



Aedes japonicus in the northern U.S., 2007
Source: Chester G. Moore, Colorado State University



Cattail Expansion

Mark Smith presented information on *Cq. perturbans,* the cattail mosquito, and plans for expanding treatments for this species throughout the district. This expansion could require large amounts of materials and helicopter time, especially in late May- early June when methoprene treatments are done to prevent adult emergence in early July. Using XRG-sand, a less expensive material, may enable the District to expand treatments. The sand also is easier to disburse using

helicopters, and provides a more consistent swath than pellets. Emergence trap tests showed the XRG-sand provided good control, comparable with pellets, when application is made in the optimal time window (See TAB Report, Chapter 5). MMCD plans to increase sand use, and continue mapping cattail sites. We would also like to continue looking for other larvicides, especially something that might be effective in the fall when more resources are available.

Questions/Comments

Susan Palchick asked what other active ingredients are being considered. Mark Smith noted *Bacillus sphaericus, Lagenidium* (not currently available), or a mix of Bti/Bs, and other formulations of methoprene might allow a staggered treatment window. Roger Moon asked: if moving treatment times into the fall is a good idea, what prevents moving treatment back in spring? Mark Smith noted that treatment with certain products is more challenging when water is colder. Roger Moon asked about 150-day briquets as an option and asked if MMCD had done efficacy studies on briquets for cattail mosquito treatment. Mark Smith noted that briquets are very expensive and that pellet efficacy is very good. Bob Sherman noted that on our maps it looks as if there are few cattail treatment areas in central cities. Jim Stark noted that the Minneapolis Park Board had in the past asked us not to use methoprene, but that restriction has been lifted.

Steve Hennes asked what is driving the overall desire to increase the treatment area. Is it expanding development? Mark Smith noted that cattail mosquitoes are a major pest species that affect people, and if uncontrolled these mosquitoes can migrate into more populated areas. Jim Stark reiterated the District's concern about the nuisance impact, especially around 4th of July, when elevated levels can be well above people's tolerance. Like the rest of the program, he said, we're looking at "pressure points" where human population is expanding into these habitats. Dave Neitzel added that cattail mosquitoes continue to be a potential bridge vector for EEE.

Culex tarsalis Larval Surveillance and Control

In response to a question submitted before the meeting, Kirk Johnson presented information on *Cx. tarsalis* larval collections and control targeting these larvae. *Culex tarsalis* continue to be difficult to locate as larvae, and about 2 percent of air treatment samples contained this species (Table M1). In attempts to locate *Culex* species in air sites last year, only 48 of 732 larval samples contained *Cx. tarsalis* with only 21 of those in excess of the treatment threshold of one per dip. *Culex* vectors were found in 207 of the 732 samples with 133 in excess of the threshold of one per dip. However, he said, there is a payoff when we decrease these mosquitoes as larvae, and we may be controlling these species incidental to controlling other species, and as part of expansion. In short, he said, MMCD is open to suggestions on this topic.

Table M1 *Bti* treatments (acres) with larval sample submitted

	Total Acres	*Culex* Threshold	*Cx. tarsalis* Threshold	*Cx. tarsalis* Part of Threshold
Air	108,819.91	11,594.40	1,161.50	2,107.50
Ground	1550.04	195.32	44.64	85.75

Questions/Comments

Larry Gillette suggested that if you have 1 per dip in 1000 acres, that figure probably represents more actual mosquitoes than are found in stormwater structures. Roger Moon asked about the

basis for 1/dip threshold. Kirk Johnson noted that staff reviewed prior years' data to see how much additional control we would likely need to do; 1/dip was chosen as something that could be done. Susan Palchick then asked if this was a financial consideration, not necessarily a strictly biological threshold.

WNV Vector Control: Stormwater Systems

Kirk Johnson presented information on the *Culex* habitats presented by various stormwater structures, and MMCD's testing of different materials for control (TAB Report Chapter 5). MMCD, he said, does not plan to continue using methoprene XR briquets in catch basins because of unreliable control. Tests of some other materials are promising, but present challenges when it comes to measurement because of slow kill and continued larval recruitment. MMCD continues to work with a number of cities to apply treatments in underground structures (TAB Report Chapter 2).

Questions/Comments

Susan Palchick asked how often cities need to access stormwater structures. Kirk Johnson said that typically once each spring, city staff cleans out sediment. This works well when treating with briquets if they are applied after cleaning. Working with cities also helps establish relationships with stormwater managers who in turn may consult with MMCD on new structures being built. Briquet efficacy is moderate in these structures, and MMCD is always looking at alternative materials.

Kirk Johnson also described other stormwater structures MMCD is mapping and inspecting, including culverts, washouts, pond water regulators (risers), rip-rap, stagnant streams, and artificial ponds (ornamental). Over 90% of larval samples from these structures had *Culex* species. VectoMax has potential for good control in these structures, and briquets have also worked well.

Larry Gillette noted the report mentioned the frustration working with communities that design structures for water quality, but pay no attention to mosquito production. He asked if MMCD is getting better cooperation, and if we can get control in these structures Kirk Johnson noted that this is improving. For instance, MMCD worked with MPCA on a stormwater manual which emphasized designs to minimize mosquitoes. Larry Gillette asked if developers were receptive to these designs even if it means more dollars out of their pocket. Kirk Johnson replied that there are many different engineering firms, many types of structures, and it's hard to reach them all. That's one reason, he said, why we worked with MPCA. Roger Moon asked about checking efficacy when structures were dry – how often does that happen? And, from a landscape level, how much is coming from these structures? Kirk Johnson said that it depends what else is in the area. We are looking at attacking these problems wherever we can find them. This is a piece of the pie, he said. In some areas these may be a small part, in others they may be a large part. Roger Moon asked about using soybean oil or other oils. Kirk Johnson noted that monomolecular films are a possibility. These sites, he noted, may be more important in dry years than wet. In wet years they flush frequently, in dry years these sites may be the only habitat available for certain species.

Larry Gillette asked about dead bird records as a way to monitor WNV activity. Does the District plan to continue this, or are birds becoming resistant? Kirk Johnson said that MMCD intends to continue monitoring for current virus activity, but we have limited funding for testing. Other

studies are being done on bird blood, but we don't intend to do live bird sero studies as these are not as sensitive an indicator as deaths of sensitive birds such as crows. Dave Neitzel noted that studies show a rapid turnover in bird populations, many are naive, and there is not much evidence of a build up of resistance to WNV.

Adulticide Use for Disease, Events, and Nuisance Control

In response to a question submitted before the meeting, Nancy Read outlined the surveillance and requests underlying the District's adult mosquito control efforts and how much is targeted at vector control. Adult mosquito counts are taken from traps, aspirators, sweep nets, and slap counts, but not all of these are identified to species. Our current data system only records the most recent adult inspection with a treatment, and often a slap count (no ID) is done immediately before treatment to confirm that overall mosquito numbers meet treatment threshold. This then becomes the linked inspection record, even though an identified sample may have been taken the day before.

Of the 1,500 permethrin barrier treatments (3,900 acres), 55% had an identified sample link, and of those, 61% showed vectors (*Ae. triseriatus* or *Cx. tarsalis*) over threshold. Of all the permethrin treatments, records showed 5% events, 9% parks, 24% calls, 28% other, 31% known vector species. Of the 745 ULV fog treatments (resmethrin or sumithrin) (29,000 acres), 46% had an identified sample link, and of those, 47% had vector species over threshold. Of all the fog treatments, records showed 2% events, 14% parks, 20% calls, 35% other, 29% known vector species.

Adulticide Testing

Another submitted question was "How many hours of control (benefit) do people actually get between when MMCD is mobilized to spray and the mosquitoes would die off naturally?" In response to this, Nancy Read presented results of studies led by Stephen Manweiler (who could not be here for the meeting) on efficacy of permethrin barrier treatments, as requested by the TAB in 2006, and on preliminary tests of a possible alternative to permethrin, Onslaught (water-soluble formulation of esfenvalerate) (see TAB Report Chapter 5). The second of these tests showed lower numbers in traps in both treated areas, compared with an untreated area, at 7 days after treatment.

Questions/Comments

Larry Gillette noted that there were a number of reasons cited for adult control: disease control, control for outdoor events, early emergence spring *Aedes* mosquitoes, etc., but mosquitoes are highly mobile. Is the treatment really worth it if the mosquitoes disburse? Several TAB members spoke on their experience and general evidence of the effectiveness of adult control for short-term, local area problems, and Diann Crane noted that she sees an immediate effect in her neighborhood and suggested that adulticide effectiveness – at least in terms of nuisance – can be a very localized issue.

Roger Moon expressed concern that testing other materials in addition to permethrin was detracting from the ability to do rigorous testing of effectiveness with larger sample sizes. He would prefer to see a thorough study of materials we are currently using. Small trials on alternative materials are fine for learning how to use these operationally but should not be construed as full scientific tests.

General Discussion and Questions

Virus Testing - Bob Sherman asked about the kinds of tests used to detect presence of WNV or EEE in mosquitoes. Kirk Johnson explained that there are two methods, an in-house kit for WNV which is antibody-related, and some samples are submitted to MDH for PCR testing. Bob Sherman noted that some of these tests are producing perhaps a 1% positive rate. When you are looking at that small of a positive rate, he asked, are we down in the realm of false positives? Kirk Johnson said that both tests have extremely low false positive rates and that false negatives are really more likely. There was good agreement when samples were double tested. Dave Neitzel said that MDH does positive and negative controls but the bigger concern is timeliness. Susan Palchick asked about turnaround time with in-house tests Kirk Johnson said that RAMP tests could get results same day. They are usually done by Thursday or Friday with samples from Monday.

Roger Moon asked if MMCD has ever initiated a treatment decision based on such an assay. Kirk Johnson answered yes, and added that MMCD tries to always respond, sometimes with adulticide, plus checking for effectiveness of larval control. Roger Moon suggested sticking to a simple approach; thinking about this strategically, he said, MMCD can try to get large sample sizes but it's so variable spatially, it's hard to target treatment. Anything MMCD can do to lower overall vector species is prudent, he added, but he is not convinced reacting to specific surveillance does much. Dave Nietzel said that in greater Minnesota, as soon as *Cx. tarsalis* numbers go up, MDH puts out a general press release. Kirk Johnson noted that generally MDH and MMCD have coordinated public messages. Susan Palchick noted that an advantage of the District is that it is small enough that information can be acted on quickly. In other words, if you have clear signal of infected mosquitoes, you might as well treat them.

No-Treatment Requests - Larry Gillette asked about people calling in to request being placed on the no-treatment list. Jim Stark noted that when WNV first hit, many people asked to be removed from that list, and that it has held fairly low and steady since then. Mike McLean noted that there had a small surge in no-treatment requests before WNV when there were some campaigns, but the number of no-treatment requests has since gone down. Larry Gillette asked about the proportion of these properties with wetlands. Does that have an effect? Jim Stark said that most are no adult control requests; a bigger problem is agencies blocking larval control. We haven't evaluated what impact that's having on the overall program.

Black Fly - Roger Moon asked Gary Montz if the District's Black Fly control program and non-target studies are doing well. Gary Montz said work is progressing on ways to reduce effort required for non-target monitoring, and it looks like there will be a plan that will maintain needed information with less sample processing. John Walz noted this could reduce overall processing time from 3000 to 1000 hours, resulting in real savings.

Plans for 2008 - Susan Palchick asked if the District anticipates any special activity because of the Republican national convention. Jim Stark said that we don't anticipate anything out of the ordinary.

Resolutions

"The Technical Advisory Board expresses satisfaction with manner of data management and control the Metropolitan Mosquito Control District has presented, and commends the District on a very good report."
Bob Sherman moved, Roger Moon second, no discussion. Motion carried.

"The District should continue using adulticide materials currently proven and continue to do rigorous testing on only those materials."
Roger Moon moved, Susan Palchick second, Motion carried.

Jim Stark gave final comments to the TAB and asked everyone to make sure they were receiving his monthly Director's Reports. He encouraged TAB members to contact MMCD anytime throughout the year with questions or comments.

Meeting adjourned at 3:35 p.m.