Mosquito Surveillance
and
Response Plan

City of Frisco, Texas

2013

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The City of Frisco Mosquito Surveillance and Response Plan incorporates integrated pest management concepts advocated by the CDC, EPA, Texas Department of State Health Services officials and nationwide mosquito control associations to provide a systematic way to consider and balance the risks associated with mosquito control measures in order to respond in an appropriate, just, and timely manner for the betterment of the citizens of Frisco.

I. Objectives

The City of Frisco Mosquito Surveillance and Response Plan herein called "The Plan" was developed to meet several objectives. Specifically, The Plan:

- Provides information on mosquito populations, prevalence of disease, and control strategies;
- Provides Best Management Practices (BMP) in the approach for utilizing mosquito sampling and human disease data to establish Risk Levels;
- Establishes actions that will be undertaken for each Risk Level;
- Provides municipal staff and elected officials with a decision-support system; and,
- Outlines the roles and responsibilities of municipal staff and/or authorized agents.

II. West Nile Virus (WNV) Concerns

WNV is permanently established in the United States. It is likely the virus survives the winter either within birds that remain in the area (House Sparrow, Mourning Doves) or within mosquitoes that survive the winter. When spring returns, the virus recrudesces within the birds and is readily passed to early season mosquitoes. As mosquito populations increase, mosquitoes begin to feed more frequently on birds, causing an increasing number of birds and mosquitoes that are infected. If environmental conditions are favorable for transmission, the virus will amplify to a theoretical point of spillover. At spillover, the virus can bridge out of its preferred bird-mosquito cycle through mosquitoes that feed on birds, humans, and other animals. At the point of spillover, transmission to humans becomes more likely. Currently, mosquito control is the only practical method of protecting the human population from WNV infection. There are no known specific treatments or cures for the disease caused by this virus, and vaccines are currently not available for public use.

Weather plays a major role in the prevalence of WNV, and the relatively warm winter and spring experienced in North Texas during 2011 to 2012 may have been a significant factor in the prevalence of the disease during the 2012 mosquito season. Understanding the types of mosquitoes in the area that transmit the disease is also a crucial consideration for directing control responses and public education activities. Since not all mosquitoes carry the virus, enacting mosquito control efforts that attempt to non-selectively reduce all mosquito populations will not necessarily reduce the risk of WNV.

It is reported from the Texas Department of State Health Services and other Federal agencies that the predominate mosquito that serves as a vector for this disease in this area is *Culex quinquefasciatus ('Culex q'.)*, commonly known as the southern house mosquito. The control efforts enacted by the City are therefore focused on this one particular type of mosquito.

Numerous agencies including the The Centers for Disease Control, the American Mosquito Control Association, and the recorded experience of numerous mosquito control districts suggest a mosquito control program should be based on the principals of Integrated Pest Management (IPM). The principals are:

- Knowledge of mosquito biology and the epidemiology of the mosquito-borne diseases;
- Surveillance and monitoring efforts for the detection and status assessment of mosquito populations and/or mosquito-borne diseases;
- A multifaceted prevention and control program comprised of a system of control tactics which are compatible with each other and which are proven effective;
- Continued program evaluations and updates to ensure the best methods are being used to meet the prevention and control objectives of the program; and,
- Continued education of the public to create awareness, understanding, and support.

This has ultimately evolved in to a strategy termed Integrated Mosquito Management (IMM). IMM has been developed to encourage a balance of control with environmental impact. When properly practiced it is specifically designed to accomplish the following:

1. Protect human, animal and environmental health,
2. Promote a rational use of pesticides,
3. Reduce environmental contamination to soil, ground water, surface water, pollinators, wildlife and endangered species,
4. Utilize natural biological controls to conserve and augment other control methods,
5. Use target specific pesticides to the extent possible,
6. Emphasize the proper timing of applications; and,
7. Minimize pesticide resistance problems.

These guidelines have been used to develop the responses of The Plan.

The circumstances necessitating formation of a mosquito control program are unique for each jurisdiction in terms of available resources, topography, hydrology, and the mosquito species to be controlled.

III. The Role of Residents

Residents play an important role in reducing the number of adult mosquitoes by eliminating standing water that may support the development of mosquito larva and pupa. For example, residents can properly dispose of discarded tires, cans, buckets, maintain pools correctly, unclog blocked gutters and drains, dump water from bird baths and pet dishes at least every 2-3 days, ensure air conditioning condensate is not pooling for several days, control irrigation so standing water is not produced, irrigate so runoff is not produced, and perform similar activities around homes and businesses. Water that cannot be eliminated should be treated with a biological mosquito larvicide such as *Bacillus Thuringiensis Israelensis* (Bti), in accordance with manufacturer's recommendations.

Residents should be aware that *Culex q.*, the target mosquito for control, tends to prefer to lay its eggs in "artificial" sources of water such as those listed above, as opposed to laying eggs in wetland areas, streams, and ponds. Generally, this mosquito cannot fly long distances, so emerging adult mosquitoes often remain near the habitat where they lived as larva and pupa. Adults will rest during the daytime in vegetation, particularly in areas where humidity is high. Irrigated urban and suburban landscapes can offer an excellent habitat, especially if there is standing water present. Underground storm drains that receive runoff from irrigation and have yard waste are also good habitats for these mosquitoes. Often these same areas have bird baths, bird feeders, trees, and other vegetation that serve to attract birds, especially during drier times of the year when food and water become scarce. The opportunities for WNV disease amplification in urban and suburban areas can become more pronounced during summer months. The role of residents and business owners in controlling larval habitat is therefore *a crucial component of reducing local WNV risk.*

IV. The City of Frisco Plan for Mosquito Surveillance

The risk of mosquito-borne diseases depends upon the size of mosquito populations and the incidence rate of disease, as well as the prospect of the mosquito population changing in response to environmental factors.

These are the areas involved in a comprehensive surveillance program.

A. Determination of potential mosquito breeding habitats through topographical and drainage maps and as directly observed through 'boots on the ground' surveying.
B. Bird mortality recording.
C. Adult mosquito counts.
D. Captured mosquitoes must be species-typed (target species) and sex-classified (females are the biters).
E. Specimens are sent to the Texas Department of State Health Services for arboviral testing.
F. Mapping of results.
G. Employing testing protocols for early detection of resistance.

If targeted mosquito controls are implemented at the early stages (amplification), the likelihood of bridging from preferred host to incidental can be minimized, thus reducing the risk of human transmission. Depending on weather patterns and monitoring results, trapping can be expanded or contracted and the trapping season may be lengthened or shortened. Also, trapping data may be used for evaluating the effectiveness of control measures.

The overall goal of the mosquito surveillance program is to use data on mosquito populations and mosquito virus infections rates to:

- Assess the threat of human disease;
- Determine the geographical areas of highest risk;
- Determine the need for intervention events, and the timing of these events;
- Identify larval habitats that are in need of targeted control; and,
- Monitor the effectiveness of control measures.

Best Management Practices for Mosquito Management (American Mosquito Control Association, December 2009).

Excerpts of BMP components listed below:

1. Surveillance – The backbone of all IMM programs. Identifies problem species and population trends in order to direct and evaluate control methods.

a. Determine species to ensure that the most appropriate control methodologies are chosen.

i. Visually check jurisdiction for potential large-scale larval habitat and larval populations themselves that could contribute to unacceptable adult mosquito populations and determine if larval control is appropriate within resource constraints. Urban - flower pots, tires, trash containers holding water, gutters, tree holes, septic ditches, roadside ditches, lawn swales, non-functional swimming pools, stagnant bird baths, street catch basins, junk yards, depressions in tarp covers, etc.

ii. Determine population levels of adult mosquitoes using professionally acceptable techniques to establish needs for action.

b. Monitor fluctuations in mosquito populations.

2. Mapping – Utilize maps to continually monitor major sources of larval/adult mosquitoes in addition to areas where control measures have been instituted.

3. Set Action Thresholds – Decisions to apply public health pesticides should be based on the analysis of either larval or adult mosquito surveillance data. Programs must establish a mechanism on which decisions to institute control measures are based.

a. For larval mosquito control this methodology can consist of numbers of larvae observed in larval dip counts or observation of larval presence in water sources.

b. Adult surveillance methods can include number and pattern of complaints, a visual count called a landing rate and counts of female mosquitoes collected. Both fixed and flexible trap locations should be used if possible. Fixed positions allow for the development of a database so year to year comparisons are possible. Flexible sites allow for responses to epidemiological and natural events. The adult mosquito surveys are designed to determine the relative abundance of various species present, the gender of each as well as the incidence of virus/diseases within the captured specimens. Using this information, personnel determines the need for various control measures, and can conduct more effective searches for larval breeding places, assess the extent of the problem, and potentially gauge the effectiveness of control measures.

Advantages of using adult mosquito surveys include:

- Ability to provide early evidence of viral activity in an area;
- Helpful for determining if viral activity is local;
- Providing information on potential mosquito vector species
- Providing an estimate of vector species abundance and prevalence;
- Providing information on the potential risks to humans and animals;
- Providing baseline data that can be used to guide emergency controls.

Disadvantages of using adult mosquito surveys include:

- Amount of labor required, and associated expenses;
- Need for substantial expertise to ensure proper collection and handling of mosquitoes;
- Delays associated with receiving mosquito arbovirus screening results.

c. Larvicides, if used, should be specific for mosquitoes, minimize impacts to non-target organisms and must, in many instances, be capable of penetrating dense vegetative canopies. Larvicide formulations (e.g., liquid, granular, solid) must be appropriate to the habitat being treated, accurately applied and based on surveillance data.

d. Adulticides, if used, should be based on surveillance data. In fact, the general public typically associates basic mosquito control programs with spray trucks or "foggers," not realizing the existence or importance of the other parts of the integrated program. Adulticides are applied so as to impinge upon the mosquito target in flight or at rest on vegetation.

Adult mosquitoes may also be targeted by "barrier treatments", which involve application of a residual insecticide to vegetation where mosquitoes are known to rest.

Adulticides should only be applied when established spray thresholds have been exceeded.

V. Mosquito Control Strategies

Human activities can greatly affect the ecology of mosquito populations. Large concentrations of people or animals, for example, can increase exposure rates and the probability of disease outbreak. The use of irrigation, development of drainage networks, elimination of mosquito predators, prevalence of improperly maintained birdbaths and other water holding containers can increase the numbers of certain types of mosquitoes. Mosquito control strategies have changed dramatically over the last few decades. With the growth of ecological consciousness and environmental science, people began to realize the environmental damage that accompanied the use of broad-spectrum chemical control agents, particularly those that did not readily break down in nature. Concerns were also raised because many mosquito populations also appeared to develop resistance to the more commonly utilized chemical control agents.

Over the past few years, major advances have been made in the areas of biological mosquito control. Biological control strategies will include using natural predators like bacterial agents such as Bti. Biological control agents have certain benefits and restrictions. In order to use a biological control agent successfully, the applicator must have a basic knowledge of biology associated with the control agent. Some biological control mechanisms, for example, are limited by salinity, temperature, or organic pollution, and some mosquito species are much more susceptible to specific types of biological control agents. The Gambusia fish, another example, is limited in that it cannot reach shallow areas to access the eggs/larvae. All these factors must be considered when choosing and applying biological control agents.

Agencies applying pesticides directly to waters of the United States, or where deposition may enter waters of the United States, are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit from the Texas Commission on Environmental Quality (TCEQ). This permit is titled "General Permit to Authorize Point Source Discharge of Biological Pesticides and Chemical Pesticides that Leave a Residue in Water". Agencies must comply with all applicable provisions of this Permit (see TCEQ General Permit TXG87000).

A. Larviciding vs. Adulticiding. In the past, many mosquito control programs have relied heavily upon adult mosquito controls using chemical agents. However, even near-continuous exposures to pesticides may not kill all mosquitoes. Those mosquitoes that are genetically able to resist higher pesticide concentrations may survive and pass on this resistance to future generations. Eventually, the pesticide becomes less effective as resistance increases in the mosquito populations.

All mosquitoes begin their lives in water. Mosquito breeding can therefore be prevented by either eliminating the source of water (source reduction) or by killing larvae (larviciding). Larviciding programs use a combination of source reduction, biological, and possibly chemical measures to control mosquito larvae before they develop into biting adults. If properly implemented, this strategy can be the most effective, economical, and safest method for mosquito control because mosquito larvae are minimized, thus reducing the need for adult mosquito control. Subsequently, this reduces the impacts of control measures on non-target organisms and lessens the risk of chemical exposures to the public. Using biological controls also minimizes the chance of pesticide resistance in mosquito populations. Inarguably, the most effective and economical way to reduce mosquito populations is by larval source reduction. The goal of this program should be to monitor mosquito populations and initiate controls before diseases are transmitted to humans or domestic animals (CDC, 2001).

When larval control is not possible, or more immediate control measures are needed, adult mosquito control may be required to diminish populations of infected mosquitoes and interrupt viral transmission.

B. Rationale for different treatment methods. Chemical usage should not be viewed as a long-term control strategy, and should be only implemented when there are occasional episodes of heavy, uncontrolled breeding concurrent with a high degree of public health risk. The most efficient and effective program is one in which mosquito larvae are prevented from becoming biting adults through the use of biological control agents. The bacterium Bti is considered to be the among the most environmentally acceptable, commercially available biological control agent. For these reasons, the City of Frisco relies heavily on source reduction and larviciding for mosquito control.

C. Integrated Pest Management (IPM).
Integrated pest management dictates that control efforts should be dependent on threshold levels. This means simply that a certain defined risk needs to exist before particular control measures are recommended. Levels of risk are based on knowledge of mosquito biology, the epidemiology of the mosquito-borne diseases, and monitoring efforts for the status assessment of mosquitoes and/or mosquito-borne diseases. Risks levels are then used to design a strategic prevention and control program that are comprised of a system of tactics which are compatible with each other and which are proven for their effectiveness.

Continual program evaluations and updates are used to ensure the best methods are being used to meet the prevention and control objectives of the program and continued public education is used to create awareness, understanding, and support. Frequent mosquito population assessments allow analysts to map potential mosquito breeding grounds and determine overall disease transmission risks. Using this information, more targeted efforts towards habitat disruption, source reduction, larviciding operations, and other control mechanisms are possible.

VI. The City of Frisco Plan for Mosquito Control

The primary objective of mosquito control is to decrease the risk of mosquito-borne human diseases. This objective should be accomplished by:

- Stressing the importance of source reduction as a viable means of control, both by residents and on municipal properties, including enforcement actions for stagnant water located on private property.
- Aggressively larviciding where such activities are feasible, practical, and likely to be effective.
- Promoting the use of personal mosquito protection measures, especially for the elderly and those individuals with compromised immune systems, through public education and outreach.
- Providing public information so citizens are informed about the current Risk Level, areas of the City where WNV has been located, current municipal control measures, and what can be done by the public to help reduce risks.
- If warranted, implement adult mosquito control measures through targeted ultra-low volume (ULV) pesticide applications (adulticiding).
- Adulticiding should and will be considered a supplemental control measure. The decision to spray shall be based on the considerations listed (in no particular order) below.

1. **Triggers for adulticides**. Adulticiding shall be considered only when there is evidence of WNV activity at a level suggesting a high probability of human infection. In general, finding an isolated WNV-positive mosquito pool does not by itself constitute evidence of an imminent threat to human health and does not warrant adulticiding.

Physicians and laboratories are required by Title 25 of the Texas Administrative Code (Pt. 1, Ch. 97, Subch A, §97.3) to report cases of WNV infection or positive test results in humans to the State and County Health Departments. Positive human WNV cases are investigated by County Health Department officials. During an investigation, the County Health Department collects demographic and clinical information from the patient and attempts to determine date of onset, whether the infection was acquired locally or imported from a region outside of the patient's residence, and whether the infection may have been acquired by a non-mosquito route of transmission such as a blood transfusion or organ transplant. To help aid control measures, the County Health Department may provide some of this information to municipal officials within the municipality where the patient resides.

Human case information is used by municipal officials as one of the trigger conditions for the risk levels outlined in this Plan.

2. When to use adulticides. The goal of spraying is to reduce the risk of human diseases by decreasing the number of target adult mosquitoes as much as possible. However, today's pesticides tend to only be effective when physically contacting the mosquito, which is most likely to happen when mosquitoes are actively flying. This typically will mean that spraying should be conducted between dusk and dawn. Since the target mosquito, *Culex quinquefasciatus*, is thought to be most active soon after dusk, spraying should be timed to strike the best balance between impacting the target mosquito during its most active time and minimizing impacts on non-target organisms. It is also important to realize that weather conditions, including air temperature, have a large influence on the effectiveness of adulticides. Spray events should be cancelled and rescheduled if conditions are not conducive for effective spraying.

3. Where to use adulticides. The terrain of the proposed spraying area has a major impact on the pesticide effectiveness. If there is substantial vegetation, dense shrubbery, trees, or hedges, pesticide applications can be rendered ineffective. The density of houses and other physical obstructions can also influence the effectiveness of pesticides. Applications should be made so the maximum penetration into these types of obstructions is achieved. In some cases, a mild breeze may be able to help distribute the pesticide.

4. Human population density considerations. The human population density in an area where there is evidence of intense epizootic activity should also be considered. If the area in question is rural and does not contain many people, the cost and potential risk associated with spraying may not justify its use.

5. Mosquito population considerations. Information from mosquito surveillance is important in determining when to conduct mosquito control and in determining the effectiveness of control measures. It is also important to know the numbers, species, and gender of the vector populations in specific localities. The best way to obtain this information is through mosquito trapping efforts.

While trapping efforts are crucial for assessing mosquito populations and the prevalence of disease, it is important to realize surveillance specimens require some processing time after collection. In the time between the collection date and the date of test results, circumstances may have occurred which would alter a decision to spray. For example, weather conditions may have adversely affected mosquito populations, local mosquito habitats may have been altered, or larviciding efforts may have reduced the number of newly emerged adults. All of these occurrences may result in a reduced need to spray, and should be taken into consideration during control efforts.

Surveillance information should also be evaluated through time to determine the progress of diseases and the relative risk of disease transmission. In all cases, the available surveillance information should be evaluated as a part of the decision-making process for enacting adulticidal activities.

6. Local perspectives on spraying. Different communities have different perspectives on the benefits and risks associated with adulticiding activities. While these perspectives are valid and should be considered, individuals are likely to have strong opinions on either side of the issue. The City of Frisco has focused on a Mosquito Surveillance and Response Plan (The Plan) that is designed to be protective of both human health and the environment. The decision to spray, however, is a complex issue that will likely be faced without complete information. Thus, there will be citizens that do not believe the City of Frisco has done a good job with regards to reducing public health and environmental risks, regardless of the decision. The Plan should therefore remain flexible and should attempt to address citizen complaints through public education and dialogue.

7. Frisco's plan for mosquito adulticiding operation. Once arbovirus activity is detected and the decision is made to implement mosquito control using adulticides, the size of the area to treat must be determined. Unfortunately, there is no simple formula for determining how large of an area to treat, nor is there adequate information to guide decisions about the degree of vector population suppression that must be attained, or for how long this suppression must be maintained to reduce the risk of disease. The CDC (2001) suggests considering the following factors where deciding the scope of the adulticiding effort:

- General ecology of the area;
- Flight range of vectors that are known or are believed to be of importance in the area;
- Population density of the vectors;
- Length of time since virus-positive mosquito pools were collected;
- Potential risk to the human population (including the age demographics of the area) as well as the community perception of the relative risk of pesticides versus the risk of arbovirus infection; and,
- Season of the year - how much time the transmission risk can be expected to persist until the vectors enter dormancy.

It is very likely that some of these factors will be unknown or poorly known, and practical experience in conducting The Plan thoroughly is needed to refine control recommendations.

If the application of adulticides is deemed necessary, the public must be informed. The following actions / activities will take place prior to adulticide applications:

- Information will be released,
- Press releases prepared and shared with the appropriate media,
- Bandit street signs indicating that spraying will occur in the neighborhood be placed at major roadways entering and exiting the targeted area, and
- Lighted message boards placed at major intersections as determined by Traffic Engineers.

VII. Plan for Public Education Concerning Mosquitoes

Public education is a key component of a successful mosquito control program. The City of Frisco has produced and aired many public service announcements, given numerous presentations, and provides information on the City webpage concerning this disease. Techniques used to disseminate information may include any, or all, of the following:

- Televised public service announcements using the local cable channel,
- Brochures for public use placed in municipal buildings,
- Postings describing the current risk level placed in municipal buildings,
- Brochures and / or fact sheets to be distributed to community-based organizations, community boards, elected officials, schools, nursing homes and libraries,
- Presentations to elected officials and / or community groups concerning the current risk level, mosquito population and disease status, and mosquito control activities, and
- Press releases describing West Nile virus response activities.

VIII. City of Frisco Response Plan

The City of Frisco will provide continuous information on the city web page concerning West Nile virus, including a Frequently Asked Questions (FAQs) section, disease symptoms, personal preventative measures, and sources of additional information. If a sampled mosquito pool tests positive for virus/diseases, information describing the location of the sampling event, the date, and other pertinent information will be provided.

The Plan is divided into five (5) levels based on the risk of human disease. Each risk level is described below, along with specific recommended responses in accordance with the principals of Integrated Pest Management Control measures recommended for each level. Generally, there are four (4) surveillance/observational factors that are evaluated to determine if the trigger condition has been met for a particular risk level. These factors are:

1. Environmental / climatic conditions (temperature, rainfall, and season),
2. Adult *Culex q.* abundance,
3. Virus infection rates in *Culex q.* and other mosquito vectors, and
4. Confirmed infections in humans, including epidemiological information.

Risk Level 1 - Normal Response

Condition: Probability of human outbreak is none or remote.
Trigger: Normal mosquito activity with no evidence of virus.

Recommended Response:

Surveillance:

Coordinate surveillance with other communities. Under the normal response, mosquitoes are considered to be only a nuisance without significant influences on public health. Complaint calls and informal surveys of larva and adults will be used to direct mosquito control efforts.

Public Information / Education:

Publicize methods for mosquito reduction and personal protection prior to the main season for mosquito activity and outdoor human activities.

Control Measures:

Use public information to promote source reduction and personal protection. Conduct standard larviciding approaches using Bti .

Rationale:

Larviciding and source reduction/elimination are considered to be the most effective long-term solutions for mosquito control. The control measures are designed to accomplish mosquito control by preventing larval mosquitoes from becoming biting adults.

Risk Level 2 - Enhanced Response

Condition: Probability of human outbreak is low.
Trigger: Normal mosquito activity with recent presence of virus in vectors, humans, or other hosts within the vicinity of Frisco (approximately 70 square miles).

Recommended Response:

Surveillance:

Conduct routine physical surveillance of areas of suspect low-lying and/or outfall drainage areas. Coordinate surveillance with other communities. Conduct surveillance, minimum once per week, of adult mosquito populations using gravid traps. Collected mosquito species should be identified to species level and gender, and mosquito pools should be screened for the presence of arboviruses. Positive tests, if obtained should be performed to determine what type of arbovirus is present.

Public Information/Education:

Implement all steps for public information established by Communications and Media Relations for this Risk Level. Generally, this will reflect routine public information concerning methods for mosquito reduction and the importance of personal protection.

This information should be disseminated at the beginning of the mosquito season.

Control Measures:
Use public information to promote source reduction and personal protection. Conduct standard larviciding approaches using Bti.

Rationale:
Larviciding and source reduction/elimination are considered to be the most effective long-term solutions for mosquito control. The control measures are designed to accomplish mosquito control by preventing larval mosquitoes from becoming biting adults.

Risk Level 3 - Public Health Concern

Condition: Probability of human outbreak is low to moderate
Trigger: Virus isolated from mosquitoes collected during trapping activities at a single monitoring site.

Recommended Response:
Surveillance:
Continue to conduct routine surveillance of mosquito populations and coordinate efforts with other communities. If resources allow, increase surveillance in the area where the positive sample was collected. Use geographic information systems to plot the location of the positive sample and provide this information to the public via the City's webpage.

Public Information/Education:
Implement all steps for public information established by Communications and Media Relations for this Risk Level, which includes public notification, press releases, and the City of Frisco webpage updates along with a map of the positive trap location.

Control Measures:
Use public information to promote source reduction and personal protection. Conduct enhanced larviciding using Bti. Increase efforts in areas where positive mosquito pools were detected. Control measures will be implemented based on the following IPM criteria: Time of year, Extent of previous mosquito control activities, Current level of mosquito activity, Weather conditions, and Surveillance results.

Prepare for ground level spraying activities using ULV applications of pyrethriods. Ensure adequate funding and personnel are in place for conducting ULV applications.

Rationale:
Larviciding and source reduction / elimination are considered to be the most effective long-term solutions for mosquito control. Increasing these measures in areas where positive mosquito pools are detected offers an additional degree of risk reduction.

Risk Level 4 - Public Health Warning

Condition: Probability of human outbreak is moderate to high.

Trigger: Multiple mosquito pools collected at different times and locations test positive for virus/diseases.
Single human case confirmed with laboratory testing.

Recommended Response:

Surveillance:

Continue to conduct routine surveillance of mosquito populations and coordinate efforts with other communities. Increase surveillance in areas where virus positive samples were collected. Use geographic information systems to plot the location of positive mosquito samples and provide this information to the public via the City's webpage.

Public Information/Education:

- Implement all steps for public information established by Communications and Media Relations for this Risk Level, which includes public notification, press releases, and City's webpage updates along with a map of the WNV positive trap location(s).
- Update webpage map for all subsequent WNV positive trap location(s).

Control Measures:

Use public information to promote source reduction and personal protection. Intensify enhanced larviciding efforts using Bti in targeted areas. Consider using insect growth regulators (IGRs) in areas where positive mosquito pools were detected, if applicable. Control measures will be implemented based on IPM criteria.

Rationale:

Larviciding and source reduction/elimination are considered to be the most effective, long-term solutions for mosquito control. Increasing these measures in areas where positive mosquito pools are detected offers an additional degree of risk reduction.

Risk Level 5 - Public Health Alert

Condition: Human outbreak is confirmed.

Trigger: Multiple human cases. Cases must be confirmed by laboratory testing.

Recommended Response:

Surveillance:

Continue to conduct routine surveillance of mosquito populations and coordinate efforts with other communities. Increase surveillance in areas where virus positive samples were collected. Use geographic information systems to plot the location of WNV positive mosquito samples, and provide this information to the public.

Public Information/Education:

- Implement all steps for public information established by Communications and Media Relations for this Risk Level, which includes public notification, press releases, and City's webpage updates along with a map of the WNV positive trap location(s).
- Update webpage map for all subsequent WNV positive trap location(s).

- Increase public education, emphasizing source reduction, personal protection, and disease symptoms.

Control Measures:
Use public information to promote source reduction and personal protection. Intensify larviciding efforts using Bti in targeted areas. Consider targeted adulticide applications using ground-based Ultra-Low Volume (ULV) equipment. Ground spraying ULV applications by truck should be implemented in the vicinity (approximately 1 mile) of areas where positive human cases were detected.

Control measures will be implemented based on the following IPM criteria:
- Time of year,
- Extent of previous mosquito control activities,
- Current level of mosquito activity,
- Weather conditions,
- Species of mosquitoes that test positive for disease,
- Number of local mosquito pools which test positively for disease,
- Likely time until a killing frost,
- Density of roads or other access to mosquito breeding grounds,
- The density of human populations, and
- Data associated with reported human cases, if known.

In general, if an area has been sprayed, that area will not be sprayed again in response to an additional human case, unless the date of onset of the new case indicates exposure occurred after the previous spraying event. Also, areas will not be sprayed in response to a reported human case if epidemiological information clearly indicates that exposure did not occur within the City of Frisco. Aerial spraying will only be considered once data is confirmed for the City entirely and if the science is evident.
If public health emergencies are declared at the County or State level, the recommended responses associated with the declaration will take precedence over the control Plan of the City of Frisco.

Rationale:
Larviciding and source reduction/elimination are considered to be the most effective, long-term solutions for mosquito control. Increasing these measures in areas where positive mosquito pools are detected offers an additional degree of risk reduction. However, at this Risk Level, applications of adulticides are needed to rapidly reduce mosquito populations and halt disease transmission. The objective is to kill a high enough proportion of older adult mosquitoes to break the disease transmission cycle. There will be no option to opt-out should adulticiding measures be implemented. The approaches for adulticiding outlined in this Plan are effective and are designed to minimize adverse effects to the environment and to non-target organisms.

Glossary:

Acronyms

AMCA	**American Mosquito Control Association**
BMP	**Best Management Practices**
Bti	**Bacillus Thuringiensis Israelensis**
CDC	**Centers for Disease Control**
IGR	**Insect Growth Regulator**
IMM	**Integrated Mosquito Management**
IPM	**Integrated Pest Management**
NPDES	**National Pollutant Discharge Elimination System**
TCEQ	**Texas Commission on Environmental Quality**
UTV	**Utility Vehicle**
ULV	**Ultra-Low Volume**
WNV	**West Nile virus**

Terms

Culex Q.	**Culex quinquefasciatus**
Laboratory Testing	**State lab or State approved laboratory**

References:

- **American Mosquito Control Association**
  Best Management Practices for Integrated Mosquito Management, December 2, 2009
- **Association of State and Territorial Health Officials (ASTHO)**
  Before the Swarm: Guidelines for the Emergency Management of Mosquito-Borne Disease Outbreaks:
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