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MEMORANDUM

To: James Clauson

From: George O'Meara

Re: FDACS Contract # 010976 – Reducing costs of controlling mosquitoes in stormwater catch basins through precise targeting of control operations (UF project # 00061321)

Final Report *

The recent establishment of West Nile Virus (WNV) in Florida has greatly increased the importance of preventing or reducing mosquito production from stormwater catch basins (SCBs). In Florida and neighboring states, two Florida mosquito species (*Culex quinquefasciatus* and *Culex nigripalpus*), which transmit WNV to birds and mammals, can occur in large numbers in water-holding SCBs. Climatic conditions in Florida are conducive for year-round mosquito production from SCBs. At higher latitudes in the temperate zone, *Culex pipiens* and related species usually can be controlled in SCBs with a single, yearly larvicide treatment because these mosquitoes have a relatively short breeding season. By contrast, multiple larvicide treatments are often necessary for the effective control of catch basin inhabiting mosquitoes in the southern temperate and subtropical regions. SCBs are ubiquitous numbering in the hundreds to thousands in small cities and in the tens of thousands in large cities. The proximity of SCBs to areas where humans are present on a daily basis enhances the pest and disease vectoring potential of mosquitoes emerging from these sites. The main objective of this research was to improve our understanding of the biotic and abiotic factors that influence mosquito production in SCBs and thereby provide mosquito control operations with the resources needed for the development of procedures for rapidly distinguishing the SCBs that are likely to be major mosquito producers from those that rarely cause problems.

(a) Impact of water sprinkler systems for irrigating lawns and ornamental plants on mosquito production in nearby stormwater catch basins

During the first six months of 2007, a period when rainfall events and amounts were minimal in southern Florida, many stormwater catch basins in the Vero Beach remained dry for several months. Exceptions to this general pattern were found at sites where water sprinkler systems were used for maintaining lawns, scrubs and trees. At a large municipal parking lot that was divided in ten sections each separated by an elevated section of green space planted with oak trees and Saint Augustine grass, we sampled all the catch basins (n = 10) for immature mosquitoes on several occasions. Not only did these catch basins hold appreciable amounts of water throughout the dry season, but they also frequently contained large numbers of mosquito larvae and pupae, primary *Culex quinquefasciatus*. A major factor contributing to the mosquito production in these catch basins was the regular and possibly excessive use water sprinklers on the green spaces separating each section of the parking lot. The runoff of the irrigation water into catch basins was clearly evident on each site visit. Similar results were obtained from catch basins which were situated in grassy areas along a residential street where many of the homeowners had lawn sprinkler systems in operation with some of the sprinkler heads

located within a few meters of the catch basins. When these lawns are mowed, some of the grass cuttings invariably fall into the catch basins and decay rapidly; thus providing an ideal environment for mosquito production. From these catch basins, we collected larvae of both *Culex quinquefasciatus* and *Aedes albopictus*.

Mosquito production in stormwater catch basins due to lawn water systems in urban and suburban areas can be greatly limited by reducing water usage, by using drought resistant plants and by diverging runoffs away from catch basins.

(b) Effects of the type street level access to SCBs on mosquito species composition

There are two common types SCBs based on street level access. One type is covered with a metal grate and may also have a small vertical opening on the curb; whereas in the other type the metal grate is absent and stormwater flows only through a large cut in the curb. In a large outdoor screened cage (aka, the roundhouse) at the Florida Medical Entomology Lab, we have been testing the oviposition behavior of gravid *Culex nigripalpus* females in response to artificial grates that differ in opening size. Preliminary results indicate that *Cx. nigripalpus* prefers to oviposit in habitats with larger openings. Undoubtedly, this behavior influences the general prevalence of *Cx. nigripalpus* in SCBs. Whether or not *Cx. nigripalpus* is more likely to invade SCBs with large curb cut access rather than those with just grate covers is still under investigation. *Cx. nigripalpus* is found in both types SCBs. However, assessing the presence and abundance of immature mosquitoes in systems with just a curb cut opening is more tedious and time consuming since solid metal covers must be removed before sampling can be done. Nevertheless both types SCBs need to be monitored for mosquito production.

(c) Clustering of high mosquito producing SBC in same neighborhood

Although this condition often occurs when SCBs have underground connections, other factors may be contributing to the high levels of mosquito production.

(d) Are SCBs, which drain slowly during, immediately following rainfall events, are likely to harbor mosquitoes more frequently and in greater numbers than those which drain quickly?

The answer is yes. To protect water quality conditions in estuaries, streams and lakes from the adverse effects of stormwater runoffs many communities in Florida are retrofitting stormwater systems in ways that slow the movement of stormwater to these receiving aquatic systems. A negative effect of this approach often is increased mosquito production in SCBs.

A recent EPA Document (# EPA 833-F-05-003, Office of Water, August 2005) entitled, "Stormwater Structures & Mosquitoes" states, "If designed properly, stormwater structures should not promote mosquito breeding. Ensuring that these structures are properly designed and maintained is the key to limiting mosquito production". Nowhere in this document is there any information on just what is meant by the proper design for mosquito abatement and some the maintenance and other activities recommended are totally impractical or could actually increase mosquito production. Local communities in any effort meet EPA water quality requirements under the Clean Water Act, National Pollutant Discharge Elimination System (NPDES) permit program have implemented a number of stormwater management projects which have created mosquito friendly aquatic habitats.

(e) Do moderate salinity levels inhibit oviposition by *Cx. quinquefasciatus*?

In tests conducted in outdoor cages, gravid *Cx. quinquefasciatus* females seldom deposited egg rafts into containers with nutrient-rich water when the salinity levels were greater than 12 ppt. On-going tests are comparing the ovipositional activities of *Cx. quinquefasciatus* to a lower range of salinity levels.

(*) Since this project was given a 6 month no cost extension with an end date of December 31, 2007, field and lab studies on some aspects of the overall study are still under investigation.