**TIM
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April 11, 2019

Mr. Max Ferentinos, Vice President
Artis Senior Living, LLC
1651 Old Meadow Road
Suite 100
McLean, Virginia 22102

Re: Artis Tarrytown (Westchester) Detention Basin Concerns

Dear Mr. Ferentinos:

In response to our recent conversation about the potential for mosquito problems at the existing detention basin at the proposed Artis site in the Village of Tarrytown, I visited the site on April 4, 2019. The basin has an existing standing pool and native wetland vegetation growing in it. Two geese were foraging in the pool during my site visit.

Mosquito Habitat Requirements

There are almost 200 species of mosquitoes in the US, within the family *Culicidae*. There are several genera, with the most common being the *Aedes*, *Culex* and *Anopheles*. More than 50 species are known to be found in Southeast New York and Connecticut, with less than half of those being known to feed on humans. While there are a variety of different habitat requirements for these species, there is one important factor in common ï all of the species need to find standing water, either permanent or temporary, for the egg hatching and larval development phases of their life cycles.

After feeding, female mosquitoes will, depending on the species, find either standing open water or moist soil near water in which to deposit their eggs. In general, such water must be a minimum of 10 to 20 millimeters (.4 to .8 inches) deep, but less than 60 centimeters (two feet) deep. The volume of water is not necessarily critical; larvae can hatch out in as little as a cup of water. For those species that deposit eggs on soil, the eggs may survive for some time until the wet season or a flooding event submerges the eggs, at which time they may hatch. The critical factor is that the area must remain inundated and still for a minimum of seven days for the hatched larvae to go through the metamorphosis process to reach adulthood.

This is critical for two reasons. The larvae are highly susceptible to dessication, so will die if they dry out. Also, the mosquito larvae are filter feeders, and are dependent on floating organic material and microorganisms for food. If the environment dries out before the complete metamorphosis process can take place (generally 7 to 14 days), the larvae either dry out or die of starvation.

The depth of water is also an issue. In deeper water, the ponded area can become a habitat for fish, amphibians and predatory insects that feed on the larvae. If the water is too shallow (less

than 10 mm), the submerged larvae do not have the ability to stay submerged and feed. Mosquito larvae are equipped with siphon tubes that can be extended to the surface periodically to breathe, but the larvae themselves prefer to remain submerged.

Artis Site, Tarrytown

At the Artis site, then, the questions are whether the basin stays wet for more than 7 days, that water remains stagnant for that time period, and if other mitigating factors exist that could control mosquito populations.

Detention basins are designed to fill up with stormwater then discharge excess volumes slowly over a relatively short period of time. With each storm event comes a flushing of the system, dilution of the standing water and recirculation. The five to seven day typical storm period is shorter in duration than the reproductive cycle of moquitoes, and therefore not optimal for mosquito breeding.

The existing basin at the Artis site receives inflow from the northern end of the basin, and discharge at the southern end, thereby ensuring that water movement and flushing occurs throughout the whole basin. Currently the basin is only receiving a small percentage of the water that it was designed to contain, and therefore the flushing is minimal. With the added flows from the impervious areas of the new Artis development the rate of flushing will be considerably higher.

This basin was designed to have a minimum standing pool depth of three feet, which is considered to be too deep for a viable mosquito population. A pool this deep also promotes the presence of amphibians and predatory insects, which by their nature feed on mosquito larvae. Green frogs and spring peepers were observed at the site on the day of a recent site walk (April, 2019). The wetland vegetation and naturalized landscape around the basin also invite predatory birds and bats to the area, which also feed heavily on flying insects including mosquitoes.

Additional Preventive Measures

It is recommended that additional mitigation, including enhanced landscape to invite more birds to the site and the use of bird and bat boxes, be considered as part of the overall landscape plan. While native vegetation is becoming established within the basin, periodic removal of dead material should be part of a routine maintenance plan.

I hope this addresses the current concerns about the stormwater basin on this property. If you have any additional questions, feel free to contact me.

Sincerely,

Steve Marino, PWS
Senior Wetland Ecologist
Tim Miller Associates, Inc.