

## **Treatment Control Design Guidance for Vector Control**

The following information has been extracted from SMCWPPP's Vector Control Plan dated June 1, 2004. The term vector is used primarily to mean mosquitoes.

### **2.2 Design Guidance for Vector (Mosquito) Control**

#### **2.2.1 Type and Location of Treatment Control Measures**

When selecting and installing stormwater treatment devices, project proponents need to consider factors such as the projected runoff for a given area, the available or allocated space, cost, and pollutants of concern. Elements that may influence the mosquito breeding potential in any given location include a variety of environmental, construction, and local factors operating singly or in combination.

#### **2.2.2 Design Considerations for Treatment Control Measures**

The design considerations listed below are adapted from Metzger M.E. (2004). These considerations are identified for SMCWPPP municipalities to use when reviewing and approving post-construction stormwater treatment measures. Municipalities should also convey information regarding these design considerations to developers, builders, property owners and other entities responsible for the selection, design, construction, and maintenance of stormwater treatment measures.

### **GENERAL DESIGN PRINCIPLES**

- Preserve natural drainage. Better site design measures reduce the amount of stormwater runoff and provide for natural on-site runoff control. This will reduce the number of treatment measures required.
- In flat areas, where standing water may occur for more than 72 hours under existing conditions, consider grading to make minor increases in slope to improve surface drainage and prevent standing water.
- Select stormwater management measures based on site-specific conditions. Designs that take into account site conditions tend to improve drainage and limit the occurrence of stagnant water.
- Attend to ponds that temporarily impound water. Careful consideration should be made before intermittently flooded stormwater treatment measures are selected for handling stormwater. Facilities that pond water for an extended period (e.g., extended detention basins) should be designed to drain water completely within 72 hours of a storm event. Avoid placement of extended detention basins and underground structures in areas where they are likely to remain wet (i.e., high water tables). The principal outlet should have positive drainage.

- When a new stormwater treatment system is being installed, a selection of a type that does not require a wet pond or other permanent pool of water should be considered.
- Properly design storm drain measures. The sheltered environment inside storm drains can promote mosquito breeding. Pipes should be designed and constructed for a rate of flow that flushes the system of sediment and prevents water backing up in the pipe. Storm drains should be constructed so that the invert out is at the same elevation as the interior bottom to prevent standing water.
- Use grouted rock energy dissipaters instead of loose rock.
- In practice, many stormwater treatment measures, not only wet ponds, hold water for over 72 hours, sometimes due to their outdated designs, and possibly due to improper construction and maintenance. To ensure that public health and safety are maintained, the following suggestions should be considered for any structure that holds water for over 72 hours:
  - Select or design an alternative (or modified) device that provides adequate -pollutant removal and complete drainage in 72 hours. This is the most reliable and cost-effective choice.
  - Contact state or local public health or vector control agencies to determine whether local mosquito species and local factors may preclude rapid mosquito emergence, thus safely allowing water residence times to exceed 72 hours. In some areas this may require a detailed study that should be funded by the soliciting party.

## **GENERAL ACCESS REQUIREMENTS**

The following requirements are necessary to provide mosquito abatement personnel access to treatment measures for inspection and abatement activities.

- Design stormwater treatment devices to be easily and safely accessible without the need for special requirements (e.g., OSHA requirements for “confined space”).
- If utilizing covers, include in the design spring-loaded or light-weight access hatches that can be opened easily for inspection.
- Provide all-weather road access (with provisions for turning a full-size work vehicle) along at least one side of large above-ground structures that are less than 25 feet wide. For structures that have shoreline-to-shoreline distances in excess of 25 feet, a perimeter road is required for access to all sides.

## **DRY SYSTEM DESIGN PRINCIPLES**

- Structures should be designed so they do not hold standing water for more than 72 hours.
- Incorporate features that prevent or reduce the possibility of clogged discharge orifices (e.g., debris screens). The use of weep holes is not recommended due to rapid clogging.
- Use the hydraulic grade line of the site to select a treatment system that allows water to flow by gravity through the structure. Pumps are not recommended

- because they are subject to failure and often require sumps that hold water.
- Design distribution piping and containment basins with adequate slopes to drain fully and prevent standing water. The design slope should take into consideration buildup of sediment between maintenance periods. Compaction during grading may also be needed to avoid slumping and settling.
  - Avoid the use of loose riprap or concrete depressions that may hold standing water.
  - Avoid barriers, diversions, or flow spreaders that may retain standing water.
  - Use mosquito net to cover sand media filter pump sumps.
  - Use aluminum “smoke proof” covers for any vault sedimentation basins.
  - Properly design storm drain measures. The sheltered environment inside storm drains can promote mosquito breeding. Pipes should be designed and constructed for a rate of flow that flushes the system of sediment and prevents water backing up in the pipe.

### **SUMPS, WET VAULTS, AND CATCH BASIN DESIGN PRINCIPLES**

- Completely seal structures that retain water permanently or longer than 72 hours to prevent entry of adult mosquitoes. Adult female mosquitoes may penetrate openings as small as 1/16 inch (2 mm) to gain access to water for egg laying. Screening (24 mesh screens) can exclude mosquitoes, but it is subject to damage and is not a method of choice.
- If covers are used, they should be tight fitting with maximum allowable gaps or holes of 1/16 inch (2 mm) to exclude entry of adult mosquitoes. Gaskets are a more effective barrier when used properly.
- Any covers or openings to enclosed areas where stagnant water may pool must be large enough (2 feet by 3 feet) to permit access by vector control personnel for surveillance and, if necessary, abatement activities.
- If the sump, vault, or basin is sealed against mosquitoes, with the exception of the inlet and outlet, use a design that will submerge the inlet and outlet completely to reduce the available surface area of water for mosquito egg-laying (female mosquitoes can fly through pipes).
- Creative use of flapper or pinch valves, collapsible tubes and “brush curtains” may be effective for mosquito exclusion in certain designs.
- Design structures with the appropriate pumping, piping, valves, or other necessary equipment to allow for easy dewatering of the unit, if necessary.

### **WET PONDS AND WETLANDS DESIGN AND PLANNING PRINCIPLES**

- If a wet pond or constructed, modified, or restored wetland must be built, appropriate and adequate funds must be allocated to support long-term site maintenance as well as routine monitoring and management of mosquitoes by a qualified agency.
- Long-term management of mosquitoes in wet ponds and wetlands should integrate biological control, vegetation management and other physical practices, and chemical control as appropriate.
- Provide for regular inspection of sites for detection of developing mosquito populations. Local factors may influence the overall effectiveness of certain

approaches for mosquito reduction.

- Wet ponds and wetlands should maintain water quality sufficient to support surface-feeding fish such as mosquito fish (*Gambusia affinis*), which feed on immature mosquitoes and can aid significantly in mosquito control.
- If large predatory fish are present (e.g., perch and bass), mosquito fish populations may be negatively impacted or eradicated. In this case, careful vegetation management remains the only nonchemical mosquito control system.
- Where mosquito fish are not allowed, careful vegetation management remains the only nonchemical mosquito control system. Other predators such as dragonflies, diving beetles, birds, and bats feed on mosquitoes when available, but their effects are generally insufficient to preclude chemical treatment.
- Perform routine maintenance to reduce emergent plant densities. Emergent vegetation provides mosquito larvae with refuge from predators, protection from surface disturbances, and increased nutrient availability while interfering with monitoring and control efforts.
- Whenever possible, maintain wet ponds and wetlands at depths in excess of 4 feet to limit the spread of invasive emergent vegetation such as cattails (*Typha* spp.). Deep, open areas of exposed water are typically unsuitable for mosquito immatures due to surface disturbances and predation. Deep zones also provide refuge areas for fish and beneficial macroinvertebrates should the densely vegetated emergent zones be drained.
- Build shoreline perimeters as steep and uniform as practicable to discourage dense plant growth.
- Use concrete or liners in shallow areas to discourage unwanted plant growth where vegetation is unnecessary.
- Eliminate floating vegetation conducive to mosquito production, such as water hyacinth (*Eichhornia* spp.), duckweed (*Lemna* and *Spirodela* spp.), and filamentous algal mats.
- Make shorelines accessible to maintenance and vector control crews for periodic maintenance, control, and removal of emergent vegetation, as well as for routine mosquito monitoring and abatement procedures, if necessary.
- Improve designs of permanent pools. Minimize shallow depths and increase circulation in ponds. Permanently flooded measures should be stocked with native *Gambusia* minnows to foster biological predation on mosquito larvae.
- Do not use stormwater structures to meet endangered species mitigation requirements. Aquatic habitat for endangered species should not be created near areas populated by humans.