

OPERATION AND MAINTENANCE PLAN

The operation and maintenance plan's objective is to outline all the operation and maintenance procedures, including periodic inspections, that are required to ensure the integrity of the dam, spillway, training walls, drawdown system, and all other components of the dam. A monitoring program should be implemented to ensure the dam's structure is in good working order and to prevent deteriorating conditions to the extent where major rehabilitation would be necessary. It is important that all inspections be documented to maintain control of the inspection program and to provide record information for the continued evaluation of the dam's structures.

General

The following are required maintenance procedures essential for keeping the dam and its components in good working order.

1. The crest and downstream slope of the dam should be mowed at least every two months during the growing season to prevent underbrush and other harmful vegetative growth.
2. Trees and underbrush on the crest of the dam, on the upstream and downstream slopes, within 15 feet of the downstream toe, and in the spillway outlet channel should be removed.
3. Any portion of the dam that has eroded due to weathering, animals, vandalism, or other circumstances shall be replaced and seeded. Periodic inspection shall follow to ensure that the seed has germinated and has taken root. Fertilizer, mulch or erosion lining may be added as required.
4. Eliminate any burrowing animals from the dam embankments and fill and re-seed their holes.
5. All riprap, including the riprap located on the upstream slope and in the spillway channel, should be checked and upgraded or replenished as necessary.
6. Fallen trees, brush, and debris shall be removed from the reservoir storage area, spillway area, downstream outflow channel and outlet of the drawdown system.
7. Check the toe drain outlets and spillway weep holes and clean as necessary.
8. The sluice gate should be opened and closed at least twice a year to ensure it is functioning properly. The threads on the stem must be cleaned and lubricated. Grease fittings on the manual screw stem hoist shall be lubricated. These items may need to be performed more than twice a year if the grease dries out or becomes soiled.

9. Examine wall mounted chain link fencing for damage, loose connections, or other deficiencies. Repair as necessary.
10. Inspect the pedestrian bridge for loose connections, decay, rot, or other deficiencies and repair as necessary.
11. Inspect the weir boards for damage, leaks or vandalism. Replace damaged boards. Small leaks can be plugged by dropping sawdust upstream of the leak and allowing the seeping water to carry the sawdust into the leak.

Along with the maintenance procedures discussed above, periodic inspections should also be performed at the dam site. The inspection of the dam can be categorized into three distinct phases based on the elapsed time between inspections. Informal examinations shall be performed at least quarterly, formal reviews conducted at least every two years, and special inspections completed as required.

Informal Inspections

Informal inspections should be conducted by an individual who has a working knowledge of dam operations and understands the importance of performing careful inspections and record keeping. Informal surveys should be performed quarterly and can be done during maintenance operations. Any observed abnormal conditions should be accurately recorded and reported to those assigned to be responsible for the dam and the reservoir. Particular attention should be given to the following items:

1. The crest of the dam should be reviewed for settlement, evidence of sinkholes, subsidence, cracks or any abundant amount of wear from vehicle or pedestrian traffic.
2. The general condition of the dam embankments should be inspected and evidence of erosion, leakage, sink holes, vegetative growth or boils should be noted.
3. The general condition of the downstream channel, spillway, and the drawdown system should be examined.
4. The condition of the riprap on the upstream face of the dam and in the spillway channel should be reviewed.
5. The spillway channel and the drawdown system should be checked for evidence of blockages.

Formal Inspections

A detailed inspection should be made by a registered professional engineer at intervals not to exceed two years. The inspection will cover any pertinent items related to the working ability of the dam. The inspection must include but not necessarily be limited to the following:

1. An investigation of the concrete structures, including the spillway, training walls, and drawdown structure shall be conducted, recording any adverse conditions that may effect the performance of the dam.
2. The surfaces of the dam shall be reviewed for evidence of erosion, leakage, settlement, or boils. It is a good practice to perform the inspection at various impoundment capacities. Inspections performed under high flows may reveal areas of seepage not previously seen. Likewise, an inspection performed while the reservoir is drawn down provides the engineer an opportunity to thoroughly inspect the upstream slope, particularly the reservoir rim area.
3. The drawdown system shall be analyzed for evidence of leaks and to ensure it is functioning properly.
4. Items that are listed under *Informal Inspections* are also to be reviewed under this formal inspection section. In addition, the review should include any other items that the inspecting engineer deems pertinent to record and be monitored for future inspections.

Special Inspections

Special inspections are a type of formal inspection that shall be conducted after the dam has been subjected to unusually large floods, hurricanes, earthquakes or other unusual events. These reviews are necessary to observe potential problems in the dam that may have resulted from conditions not experienced by the dam during normal flow operations. The same items that are listed in the *Formal Inspection* section shall also be investigated here.

EMERGENCY OPERATION PLAN

GENERAL

Emergency action plans are designed to provide for a defined course of action to be followed by all affected parties during a flood or threatening flood period. Preliminary inundation mapping determined no structures were inundated during the ½ PMF design storm. However, future development or increased runoffs may alter the inundation mapping. The following scheme will describe procedures and means for assuring reliable identification, and evaluation of existing or potential emergencies. It will also describe the procedures and proper channels required for prompt notification of appropriate parties regarding existing or potential emergencies. Emergency operation inspections by the dam owner should be undertaken when a "Flood Watch" alert is issued by the National Weather Service for Hartford County or the Farmington/Burlington area, or when heavy runoff circumstances are experienced at the dam site. The review procedure should be instituted immediately and at three-hour intervals afterward. If the "Flood Watch" is upgraded to a "Flood Warning", the dam should be inspected hourly. The surveillance procedures may be halted if the "Flood Watch" alert is lifted or if in the opinion of the inspector the rain and runoff have diminished to below a potentially dangerous rate.

The following observations are to be made and a written record maintained by the inspector during any emergency review procedures:

1. The rainfall total and water level of the lake should be measured and noted.
2. The spillway, outlet structures, downstream channel, and box culvert under Burlington Road should be checked for accumulation of debris or blockages that should be removed as necessary.
3. The crest of the dam should be walked to determine if any erosion, settlement, or movement of the embankments has occurred.
4. The slope of the dam embankment should be inspected and all areas of erosion, seepage, or sloughing noted. The seepage locations should be recorded, as well as an estimate of the quantity of the flow, and clarity of the water flowing from any seeps or toe drains. Discolored water flowing from a seep or toe drain indicates that piping is occurring.

The owner shall provide the inspector with any available equipment, materials or personnel that he can utilize to clean debris, repair surface erosion of an embankment, or any other repair that may be necessary. Basic equipment should include provisions to provide adequate lighting to allow viewing of the dam at night. Also arrangements should be made for communications between the dam inspection personnel and emergency officials, which does not rely solely on telephone service that may be subject to interruption during a flood, storm or other related emergency.

The inspector should be aware that the low level drawdown can be opened to reduce the level of impoundment. However, if there are no deficiencies in the structural integrity of the dam, it need not be utilized. Opening of the drawdown

will only produce a significant difference if the gate is opened well advance of the storm, creating a larger storage capacity for the storm water. The following table illustrates water surface elevation, water inflow, and water outflow for a particular storm event.

<u>Storm Event</u>	<u>Water Surface Elev.</u>	<u>Inflow (cfs)</u>	<u>Outflow (cfs)</u>
-	244.0	-	-
100 year	246.2	712	708
.5 PMF	248.5	1,887	1,884

The inspector may use the following elevation references for an aid in determining the water level of the lake.

Spillway Crest	244.0'
Bottom of bridge structure	248.5'
Crest of dam	250.0'

WARNING NOTIFICATION

If any of the following conditions are observed during the inspection, the inspector shall notify the appropriate local emergency management and executive officials, as well as the DEP Flood Emergency Operations Center in Hartford for an early warning declaration.

- 1. An increase in seepage through the embankment.**
- 2. An increase in the water elevation of the lake such that the dam would be over topped within three hours.**

The purpose of an early warning is to notify local officials and authorities that there are conditions at the dam site that may require the evacuation of downstream residents within several hours to avoid loss of life in the event of dam failure. Only the local authorities have the responsibility of alerting the threatened dwellings' occupants or ordering an evacuation if it becomes necessary. It is also the responsibility of the local officials to have a pre-arranged plan in place for alerting residents.

EVACUATION NOTICE

If any of the following conditions is observed during the monitoring of the dam and in the opinion of the inspector a dam failure is likely, then a final warning should be instituted and evacuation of the downstream area be undertaken. **Conditions that indicate failure is imminent include:**

- 1. Substantial erosion or sloughing of dam embankments.**
- 2. A water level within one foot of the top of dam and rising at a rate that would overtop the dam within one half-hour.**

3. **A noticeable increase in the volume of seepage flow through the embankment, especially if piping is occurring.**
4. **Cracking, settlement, or movement of the concrete spillway, spillway channel training walls, or dam structures.**
5. **Any other condition noted by the inspector that would result in a rapid failure of the dam.**

The following is a list of those officials and agencies that should be notified for warning and/or evacuation notices:

Farmington Town Manager's office	673-8219
Farmington Police	911 or 673-2527
State Police (Hartford)	566-5990
Farmington Fire Department &/or Emergency Management	911
DEP/Inland Water Resources Division's Flood Emergency Operations Center	424-3333

Lastly, the Emergency Operation Plan should be reviewed at least annually to update personnel assignments, change in local officials or phone numbers. Also, any activity downstream of the dam that has occurred that may have changed the dam's hazard classification should be noted. For example, construction of houses, buildings, highways, bridges, or any flood control projects.

GLOSSARY

- boil:** A concentration of seepage on the downstream face of the dam or on the terrain of the downstream of the dam's toe such that the velocity of water exiting the boil is readily apparent and is sufficient to lift the soil particles at the ground surface. Typically the displaced particles will form a small cone around the boil.
- crest:** The highest elevation of the earthen dam or spillway surface. The dam crest elevation is 249.00' The spillway crest elevation is 244.00'
- dam:** An artificial barrier, with associated spillways and other appurtenant works across a watercourse or natural drainage area which does (or may) impound or divert water.
- downstream:** The area or slope of the dam farthest from the direction of water flow.
- drawdown structure:** All structures, mechanical devices and other accessories used to lower the level of the impoundment.
- embankment:** The earthen slopes of the dam.
- impoundment:** The water stored within the banks of the reservoir.
- outlet channel:** Depressed area located downstream of the dam or spillway, used to transport water discharged through the spillway or drawdown system.
- pipng:** The migration of soil particles by percolating water within a dam embankment leading to the development of channels.
- PMF:** Probable Maximum Flood. Term used to describe the amount of rainfall in a certain time limit to determine the design storm for the dam. The Lake Garda Dam design storm was set at ½ PMF.
- riprap:** A protective layer of stone or rock placed on an embankment or other slope to prevent erosion or sloughing from water flow or wave action.
- sloughing:** Separation of a portion of the earthen embankment due to erosion.
- sluice gate:** Mechanical device located within the drawdown chamber, that when opened by an operator, enables water to be discharged from the impoundment.
- spillway:** A passageway or channel to carry off excess water from the impoundment.
- subsidence:** The sinking or settlement of a portion of the earthen dam embankment.
- toe:** The juncture of the upstream or downstream face of the dam with the ground surface.

toe drain: A system of under-drains located in the downstream slope to intercept, collect and discharge ground water and seepage located in the earthen embankment.

training walls: Concrete walls located on either side of the downstream channel utilize to confine and contain spillway outflow.

upstream: The area or slope of the dam nearest to the direction of water flow.

weep holes: Drainage holes located in the training walls, allowing the discharge of accumulated ground water.

weir boards: Timber boards placed one on top of another with their ends held in guides, used to close an opening in a channel, dike or spillway. Boards are usually removable and allow the level of impoundment to be raised or lowered.

**OPERATION AND MAINTENANCE PLAN
&
EMERGENCY OPERATION PLAN**

For the
Lake Garda Dam
Farmington, CT

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