DAM SAFETY
INSPECTION REPORT

Sippo Creek Reservoir Dam
Class I
Stark County, Perry Township
File Number: 0614-012
February 21, 2006

In accordance with Ohio Revised Code Section 1521.062, the owners of dams <u>must</u> monitor, maintain, and operate their dams safely. Negligence of owners in fulfilling these responsibilities can lead to the development of extremely hazardous conditions to downstream residents and properties. In the event of a dam failure, owners can be subject to liability claims.

The Division of Water, Dam Safety Engineering Program, has the responsibility to ensure that human life, health, and property are protected from the failure of dams. Conducting periodic safety inspections and working with dam owners to maintain and improve the overall condition of Ohio dams are vital aspects of achieving this purpose.

This inspection was conducted to evaluate the condition of the dam and its appurtenances under authority of Ohio Revised Code Section 1521.062. In accordance with Ohio Administrative Code Rule 1501:21-21-03, the owners of dams <u>must</u> implement all remedial measures listed in the enclosed report.

Division of Water • 2045 Morse Road, Bldg. B-2 • Columbus, Ohio 43229-6693
www.dnr.state.oh.us/water

Table of Contents

Section 1

Section 2

Section 3

Section 1

Required Remedial Measures

The requirements listed below are based on observations made during this inspection, calculations performed following the inspection, and requirements of the Ohio Administrative Code (OAC). A checklist noting all observations made during the inspection has been enclosed in Section 3. References to right and left in this report are oriented as if you were standing on the dam crest and looking downstream.

Engineer Repairs and Investigations: The owner must retain the services of a professional engineer to address the following items. Plans, specifications, investigative reports, and other supporting documentation, as necessary, must be submitted to the Division of Water for review and approval prior to construction. **The items listed below are past due and must be implemented as soon as possible.** A record of all repairs should be included in the operation, maintenance, and inspection manual.

1. The dam's discharge/storage capacity must be sufficient to safely pass the required design flood. Perform a hydrologic and hydraulic study to determine the adequacy of the dam's discharge/storage capacity to safely pass the required design flood. Prepare plans and specifications as necessary to increase the discharge/storage capacity to pass the required design flood. In accordance with OAC Rule 1501:21-13-02, the minimum design flood for Class I dams is 100% of the Probable Maximum Flood or the critical flood. Also see the Flood Routing Summary Section of this report. In addition, incorporate in the plans the investigation and repair for the brick cutoff wall and the leveling of the dam crest.

2. The erosion on the upstream slope and crest of the embankment must be repaired and the upstream slope and crest must be protected from erosion. Prepare plans and specifications for repairing the erosion and installing erosion protection. See the "Upstream Slope Protection" and "Ground Cover" fact sheet included in this section for additional information.

3. The entire spillway system must be repaired. Prepare plans and specifications for repair of the seepage through the sidewalls, the undermining of the upstream and downstream end of each sidewall, the loose and missing stones that comprise the spillway, the erosion around the sides of the apron of the spillway, and proper outlet erosion protection. The condition of the spillway system must be monitored for further deterioration. See the "Open Channel Spillways (Concrete Chutes and Weirs)", the "Outlet Erosion Control Structures (Stilling Basins)", and the "Seepage Through Earthen Dams" fact sheets included in this section for additional information.

4. The lake drain must operate properly. Investigate the integrity of the drain, and as necessary, prepare plans and specifications for the repair or replacement of the lake drain. See the "Lake Drains" fact sheet included in this section for additional information.

Owner Repairs: The owner must address the following items. The owner may hire a contractor or perform the work him or herself. Repair activities should be documented in the operation, maintenance, and inspection manual.

1. Remove the trees, the tree roots, and the brush from the upstream slope, crest, and downstream slope. Re-seed all disturbed areas to establish a proper grass cover. See the "Trees and Brush" and "Ground Cover" fact sheets included in this section for additional information.

2. Repair the erosion gullies on the right side of the downstream slope near the principal spillway sidewall. See the "Ground Cover" fact sheet included in this section for additional information.

3. Remove the flower planters from left and right half of the downstream slopes. See the "Earth Dam Failures" fact sheet

Owner Dam Safety Program: In accordance with Ohio Revised Code (ORC) Section 1521.062, the owner of a dam shall preserve or improve the safety of the structure and its appurtenances through inspection, maintenance, and safe operation. A dam, like any other part of the infrastructure, will change and deteriorate over time. Appurtenances such as gates and valves must be routinely exercised to ensure their operability. Inspection and monitoring of the dam identifies changing conditions and problems as they develop, and maintenance prevents minor problems from developing into major ones. In addition, inspection of the dam and downstream areas during flood events or when the lake level is high helps to ensure that the dam is performing adequately. Dams must have these procedures documented in an operation, maintenance, and inspection manual (OMI).

Despite efforts to provide sufficient structural integrity and to perform inspection and maintenance, dams can develop problems that can lead to failure. Early detection and appropriate response are crucial for maintaining the safety of the dam and downstream people and property. The ORC requires the owner to fully and promptly notify the Division of Water of any condition which threatens the safety of the structure. A rapidly changing condition may be an indication of a potentially dangerous problem. The Dam Safety Engineering Program can be contacted at 614/265-6731 during business hours or at 614/799-9538 after business hours. Dams must have emergency preparedness procedures documented in an emergency action plan (EAP).

The owner must address the following items.

1. This dam must have an operation, maintenance, and inspection manual (OM&I) and an emergency action plan (EAP) in accordance with OAC Rule 1501:21-21-04. Prepare an OM&I and an EAP including an inundation map. Guidelines for the preparation of these documents are included with this report. A registered professional engineer must prepare the inundation map and Section IV of the EAP. It is recommended that your engineer contact the Division of Water prior to undertaking the engineering study for the inundation map.

Tina Lombardi	4/7/06	Dena Barnhouse	4-7-06
Tina Lombardi, P.E. Project Manager Dam Safety Engineering Program Division of Water	Date	Dena Barnhouse, P.E. Project Engineer Dam Safety Engineering Program Division of Water	Date

This inspection was performed pursuant to the authority granted to the Chief of the Division of Water in ORC Section 1521.062.

April 7, 2006

Keith R. Banachowski, P.E. Date
Program Manager
On behalf of Richard S. Bartz, Chief
Division of Water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 99–52

Dam Safety: Upstream Slope Protection

Slope protection is usually needed to protect the upstream slope against erosion due to wave action. Without proper slope protection, a serious erosion problem known as "beaching" can develop on the upstream slope.

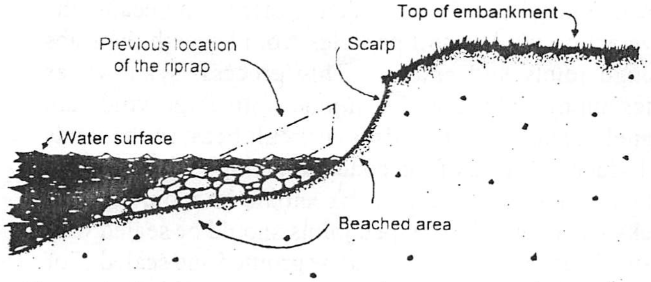


Figure 1 - Beaching

The repeated action of waves striking the embankment surface erodes fill material and displaces it farther down the slope, creating a "beach." The amount of erosion depends on the predominant wind direction, the orientation of the dam, the steepness of the slope, water level fluctuations, boating activities, and other factors. Further erosion can lead to cracking and sloughing of the slope which can extend into the crest, reducing its width. When erosion occurs and beaching develops on the upstream slope of a dam, repairs should be made as soon as possible. However, an erosion scarp less than 1 foot high may be stable and not require repair.

The upstream face of a dam is commonly protected against wave erosion by placement of a layer of rock riprap over a layer of bedding and a filter material. Other material such as concrete facing, soil-cement, fabri-form bags, slush grouted rocks, steel sheet piling, and articulated concrete blocks can also be used. Vegetative protection combined with a berm on the upstream slope can also be effective.

Rock Riprap

Rock riprap consists of a heterogeneous mixture of irregular shaped rocks placed over gravel bedding and a sand filter or geotextile fabric. The smaller rocks help to fill the spaces between the larger pieces forming an interlocking mass. The filter prevents soil particles on the embankment surface from being washed out through the spaces (or voids) between the rocks. The maximum rock size and weight must be large enough to break up the energy of the maximum anticipated wave action and hold the smaller stones in place. If the rock size is too small, it will eventually be displaced and washed away by wave action. If the riprap is sparse or if the filter or bedding material is too small, the filter material will wash out easily, allowing the embankment material to erode. Once the erosion has started, beaching will develop if remedial measures are not taken. Technical Release No. 69 developed by the USDA, Natural Resources Conservation Service can be used to help design engineers develop a preliminary or detailed design for riprap slope protection.

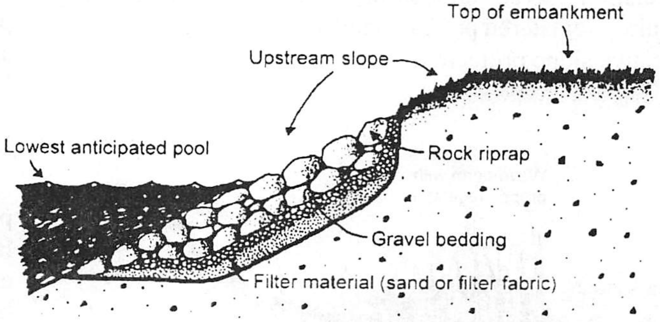


Figure 2 - Rock Riprap

The dam owner should expect some deterioration (weathering) of riprap. Freezing and thawing, wetting and drying, abrasive wave action, and other natural processes will eventually break down the riprap. Its useful life varies with the characteristics of the stone used. Stone for riprap should be rock that is dense and well cemented. In Ohio, glacial cobbles or boulders, most limestone, and a few types of sandstone are acceptable for riprap. Most sandstones and shales found in Ohio do not provide long-term protection. Due to the high initial cost of rock riprap, its durability should be determined by appropriate testing procedures prior to installation. Vegetative growth within the slope protection is undesirable because it can displace stone and disturb the filter material. Heavy undergrowth prevents an adequate inspection of the upstream slope and may hide potential problems. For additional information, see the "Trees and Brush" fact sheet.

Continued on back!

Sufficient maintenance funds should be allocated for the addition of riprap and the removal of vegetation. Severe erosion or reoccurring problems may require a registered professional engineer to design a more effective slope protection.

Vegetated Wave Berm

Vegetated wave berms dissipate wave energy and protect the slope from erosion. Berms are constructed on the upstream slope at the normal pool level and should be no less than 20 feet wide. This method of slope protection will not work well where the water surface fluctuates regularly from normal pool. If improper or sparse vegetation is present, the wave berm may not adequately dissipate the wave energy, allowing erosion and beaching to develop on the upstream slope. Technical Release No. 56 developed by the USDA, Natural Resources Conservation Service provides design and layout information.

The vegetation on the wave berm should be monitored regularly to verify adequate growth. Sufficient funds should be allocated for the regular maintenance of the vegetation. Severe erosion or reoccurring problems may require a registered professional engineer to design a more effective slope protection.

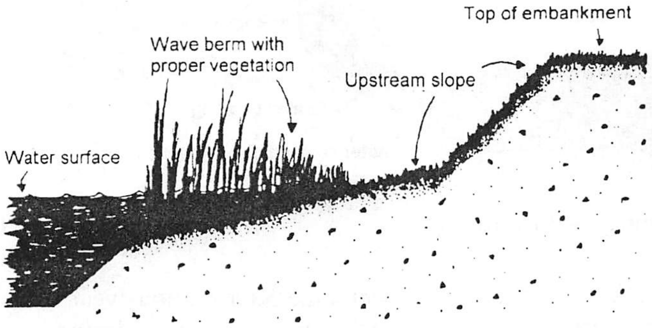


Figure 3 - Vegetated wave berm

Concrete Facing

Concrete facing can be used if severe wave action is anticipated, however, settlement of the embankment must be insignificant to insure adequate support for the concrete facing. A properly designed and constructed concrete facing can be expensive. This slope protection should extend several feet above and below the normal pool level. It should terminate on a berm or against a concrete curb or header. Granular filter or filter fabric (geotextile) is required under the concrete facing to help reduce the risk of undermining.

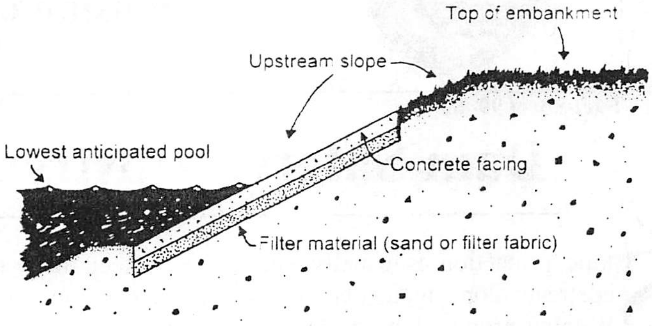


Figure 4 - Concrete facing

As with any type of slope protection, problems will develop if the concrete facing has not been properly designed or installed. Concrete facing often fails because the wave action washes soil particles from beneath the slabs through joints and cracks. This process is known as undermining, which will continue until large voids are created. Detection of voids is difficult because the voids are hidden. Failure of the concrete facing may be sudden and extensive. Concrete facing should be monitored for cracks and open joints. Open joints should be sealed with plastic fillers and cracks should be grouted and sealed. For additional information, see the "Problems with Concrete Materials" fact sheet.

Inspection and Monitoring

Regular inspection and monitoring of the upstream slope protection is essential to detect any problems. It is important to keep written records of the location and extent of any erosion, undermining, or deterioration of the riprap, wave berm or other slope protection. Photographs provide invaluable records of changing conditions. A rapidly changing condition may indicate a very serious problem, and the Dam Safety Engineering Program should be contacted immediately. All records should be kept in the operation, maintenance, and inspection manual for the dam.

Any other questions, comments concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
1939 Fountain Square, Building E-3
Columbus, Ohio 43224-1336
(614) 265-6731 (Voice) (614) 447-9503 (Fax)
http://www.dnr.state.oh.us/water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 99–54

Dam Safety: Ground Cover

The establishment and control of proper vegetation are an important part of dam maintenance. Properly maintained vegetation can help prevent erosion of embankment and earth channel surfaces, and aid in the control of groundhogs and muskrats. The uncontrolled growth of vegetation can damage embankments and concrete structures and make close inspection difficult.

Grass vegetation is an effective and inexpensive way to prevent erosion of embankment surfaces. If properly maintained, it also enhances the appearance of the dam and provides a surface that can be easily inspected. Roots and stems tend to trap fine sand and soil particles, forming an erosion-resistant layer once the plants are well established. Grass vegetation may not be effective in areas of concentrated runoff, such as at the contact of the embankment and abutments, or in areas subjected to wave action.

Common Problems

Bare Areas

Bare areas on an embankment are void of protective cover (e.g. grass, asphalt, riprap etc.). They are more susceptible to erosion which can lead to localized stability problems such as small slides and sloughs. Bare areas must be repaired by establishing a proper grass cover or by installing other protective cover. If using grass, the topsoil must be prepared with fertilizer and then scarified before sowing seed. Types of grass vegetation that have been used on dams in Ohio are bluegrass, fescue, ryegrass, alfalfa, clover, and redtop. One suggested seed mixture is 30% Kentucky Bluegrass, 60% Kentucky 31 Fescue, and 10% Perennial Ryegrass. Once the seed is sown, the area should be mulched and watered regularly.

Erosion

Embankment slopes are normally designed and constructed so that the surface drainage will be spread out in a thin layer as "sheet flow" over the grass cover. When the sod is in poor condition or flow is concentrated at one or more locations, the resulting erosion will leave rills and gullies in the embankment slope. The erosion will cause loss of material and make maintenance of the embankment difficult. Prompt repair of the erosion is required to prevent more serious damage to the embankment. If erosion gullies are extensive, a registered professional engineer may be required to design a more rigid repair such as riprap or concrete. Minor rills and gullies can be repaired by filling them with compacted cohesive material. Topsoil should be a minimum of 4 inches deep. The area should then be seeded and mulched. Not only should the eroded areas be repaired, but the cause of the erosion should be addressed to prevent a continued maintenance problem.

Footpaths

Paths from animal and pedestrian traffic are problems common to many embankments. If a path has become established, vegetation in this area will not provide adequate protection and a more durable cover will be required unless the traffic is eliminated. Gravel, asphalt, and concrete have been used effectively to cover footpaths. Embedding railroad ties or other treated wood beams into an embankment slope to form steps is one of the most successful and inexpensive methods used to provide a protected pathway.

Vehicle Ruts

Vehicle ruts can also be a problem on the embankment. Vehicular traffic on the dam should be discouraged especially during wet conditions except when necessary. Water collected in ruts may cause localized saturation, thereby weakening the embankment. Vehicles can also severely damage the vegetation on embankments. Worn areas could lead to erosion and more serious problems. Ruts that develop in the crest should be repaired by grading to direct all surface drainage into the impoundment. Bare and eroded areas should be repaired using the methods mentioned in the above sections. Constructed barriers such as fences and gates are effective ways to limit access of vehicles.

Improper Vegetation

Crown vetch, a perennial plant with small pink flowers, has been used on some dams in Ohio but is not recommended (see Figure 1). It hides the embankment surface, preventing early detection of cracks and erosion. It is not effective in preventing erosion.

Continued on back!

Figure 1: Crown Vetch
(Source: http://www.vg.com)

Vines and woody vegetation such as trees and brush also hide the embankment surface preventing early detection of cracks and erosion. Tall vegetation also provides a habitat for burrowing animals. All improper vegetation must be removed from the entire embankment surface. Any residual roots that are larger than 3 inches in diameter must be removed. All roots should be removed down to a depth of at least 6 inches and replaced with a compacted clay material; then 4 inches of topsoil should be placed on the disturbed areas of the slope. Finally, these areas must be seeded and mulched to establish a proper grass cover.

Maintenance

Embankments, areas adjacent to spillway structures, vegetated channels, and other areas associated with a dam require continual maintenance of the vegetal cover. Removal of improper vegetation is necessary for the proper maintenance of a dam, dike or levee. All embankment slopes and vegetated earth spillways should be mowed at least twice a year. Reasons for proper maintenance of the vegetal cover include unobstructed viewing during inspection, maintenance of a non-erodible surface, discouragement of burrowing animal habitation, and aesthetics.

Common methods for control of vegetation include the use of weed trimmers or power brush-cutters and mowers. Chemical spraying to kill small trees and brush is acceptable if precautions are taken to protect the local environment. Some chemical spraying may require proper training prior to application. Additional information can be found on the Trees and Brush Fact Sheet.

Any other questions, comments concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
2045 Morse Road
Columbus, Ohio 43229-6605
Voice: (614) 265-6731 Fax: (614) 447-9503
Website: http://www.dnr.state.oh.us/water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 99–59

Dam Safety: Open Channel Spillways

(Concrete Chutes and Weirs)

Concrete chutes and weirs are used for principal spillways and emergency spillways. The principal spillway is used to pass normal flows, and the emergency spillway provides additional flow capacity during large flood events. If the principal spillway for a dam is a concrete weir and/or chute, the flow capacity may be large enough that an emergency spillway is not needed. Unlike grass-lined channel spillways that should always be located on natural ground, a concrete weir or chute may be located on the dam, but must be properly designed so that the integrity of the dam is not endangered.

The main components of a concrete chute spillway are the inlet structure, control section, discharge channel, and outlet erosion control structure. The inlet structure conveys water to the control section. The control section is the highest point in the channel and regulates the outflow from the reservoir. It is usually located on or near the crest of the dam. The control section may consist of a concrete weir or may simply be the most elevated slab in the floor of the chute. The discharge channel is located downstream of the control section and conveys flow to the outlet erosion control structure. This structure is designed to dissipate most of the erosive energy of the flow before it enters the downstream channel.

Overall Design and Safety Considerations

Alignment

For good hydraulic performance, abrupt changes should be avoided. This applies to sudden changes in vertical elevation of the chute floor, abrupt widening or narrowing of the chute, and sharp turns in the chute. Anything that will abruptly disrupt or change the direction of the flow in the chute will reduce flow capacity and will place more stress on the concrete. The best performance is obtained when the distribution of flow is even across the channel.

Settlement and Movement

Abnormal settlement, heaving, deflections, and lateral movement of the sidewalls or floor slabs of the spillway can occur. Movements are usually caused by a loss of underlying material, excessive settlement of the fill, or the buildup of water pressure behind or under the structure. Any abnormal settlement, heaving, deflections or lateral movement in the concrete spillway should be immediately investigated by a registered professional engineer knowledgeable about dam safety. As necessary, plans and specifications for repair to the spillway should also be promptly developed and implemented by a registered professional engineer.

The concrete sidewalls and floor of the chute must have enough strength to withstand water loads, soil/fill loads, uplift forces, weathering, and abrasion. The forces of weathering, movement of abrasive materials by water flowing in the spillway, or cavitation may cause surface defects or more serious concrete deterioration. The freeze-thaw cycle is the most damaging weathering force acting on exposed concrete. The concrete's durability and resistance to weathering and deterioration will be determined by the concrete mix, age of the concrete, and proper sealing of the joints. Typical problems with concrete structures include scaling, spalling, honeycombing, bugholes, and popouts. Please refer to the "Problems with Concrete Materials" fact sheet for further explanation of these problems and more details about concrete durability and design. Plans and specifications for repair of structural cracks, or other structural problems, should be developed and implemented by a registered professional engineer so that the integrity of the spillway and/or embankment is not jeopardized.

Undermining

Undermining of the chute may occur at any point along its length. The chute may become undermined at the inlet and/or outlet due to an inadequate cutoff wall or erosion protection. Erosion beneath and alongside the spillway may also be caused by seepage and inadequate drainage. Undermining and erosion will lead to settlement of the undermined portions of the chute. If the concrete spillway is located on the embankment, undermining and collapse of portions of the chute will jeopardize the safety of the dam. If the spillway is located in the abutment, erosion and lowering of the lake level may result. A registered professional engineer should be hired to develop plans and specifications to repair undermining of the chute.

Continued on back!

Cutoff Wall and Endwall

A cutoff wall should be placed at the entrance to the concrete chute to prevent the flow approaching and entering the chute from flowing beneath and undermining the floor slabs. Undermining of the chute can cause cracking and collapse of the slabs as the underlying material is eroded away. In addition, a cutoff wall is necessary at the downstream end of the chute in order to prevent undermining by flows exiting the chute and entering the downstream channel. The cutoff wall or endwall should be founded on bedrock or have adequate support to provide stability and prevent undermining of the wall itself.

Outlet Erosion Control Structure

The discharge at the outlet may exit the chute at a high velocity. Based on the anticipated velocity, energy, and volume of flow, a structure may be needed to protect the spillway and/or dam from erosion and undermining. Please refer to the "Outlet Erosion Control Structures" fact sheet for more detailed information.

Seepage

The rate and content of flow from weep holes and relief drains must be monitored and documented regularly. Muddy flow may indicate erosion of fill material along the spillway or piping through the embankment. The presence of soil particles or muddy flow from the drains indicates that the filter or underdrainage is not functioning properly and is allowing the migration of soil particles from the embankment. Sudden increases in flow, or muddy flow from the drains should be immediately investigated by a registered professional engineer in order to determine the cause and severity of the problem. Plans and specifications to properly control the seepage and repair the drain(s) and embankment should also be developed and carried out under the direction of a registered professional engineer.

In addition to monitoring the amount of flow, normal maintenance consists of removing all obstructions from drain holes and pipes to allow free drainage. Typical obstructions include debris, gravel, sediment and rodent nests. Water should not be permitted to submerge the pipe outlets for extended periods of time. This will inhibit inspection and maintenance and may cause the drains to clog. Also see the "Seepage Through Earthen Dams" fact sheet for more information.

Underdrainage and Weep Holes

Weep holes, relief drains and underdrains must be included with the concrete chute to relieve excessive water pressure or infiltration from behind the walls and floor. The drainage system for the chute should consist of correctly placed and sized drainage holes, perforated pipes, and filter and bedding materials, such as sand and gravel. Seepage can occur through the dam, along the contact between the embankment and the concrete chute, or through open joints and cracks. Uncontrolled seepage flow along the structure can erode the underlying fill material (undermining) which may cause cracking or buckling of the slabs. Excessive pressure behind the walls and floor of the chute can cause cracking and heaving of the concrete. The freeze-thaw cycle can increase the amount of stress and strain on the concrete and can also cause heaving, cracking and additional serious damage to the structure. Weep holes, relief drains, and underdrainage for a concrete chute spillway should be designed by a registered professional engineer.

Any other questions, comments concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
2045 Morse Road
Columbus, Ohio 43229-6693
Voice: (614) 265-6731 Fax: (614) 447-9503
Website: http://www.dnr.state.oh.us/water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 99–51

Dam Safety: Outlet Erosion Control Structures
(Stilling Basins)

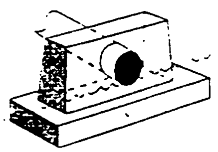
Water moving through the spillway of a dam contains a large amount of energy. This energy can cause erosion at the outlet which can lead to instability of the spillway. Failure to properly design, install, or maintain a stilling basin could lead to problems such as undermining of the spillway and erosion of the outlet channel and/or embankment material. These problems can lead to failure of the spillway and ultimately the dam. A stilling basin provides a means to absorb or dissipate the energy from the spillway discharge and protects the spillway area from erosion and undermining. An outlet erosion control structure such as a headwall/endwall, impact basin. United States Department of the Interior, Bureau of Reclamation Type II or Type III basin, baffled chute, or plunge pool is considered an energy dissipating device. The performance of these structures can be affected by the tailwater elevation. The tailwater elevation is the elevation of the water that is flowing through the natural stream channel downstream during various flow conditions.

A headwall/endwall, impact basin, Type II or Type III basin, and baffled chute are all constructed of concrete. Concrete structures can develop surface defects such as minor cracking, bugholes, honeycombing, and spalling. Concrete structures can have severe structural defects such as exposed rebar, settlement, misalignment and large cracks. Severe defects can indicate structural instability.

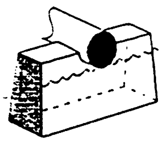
Headwall/Endwall

A headwall/endwall located at or close to the end of the discharge conduit will provide support and reduce the potential for undermining. A headwall/endwall is typically constructed of concrete, and it should be founded on bedrock or have an adequate foundation footing to provide support for stability. A headwall/endwall can become displaced if it is not adequately designed and is subject to undermining. Displacement of the headwall/endwall can lead to separation of the spillway conduit at the joints which could affect the integrity of the spillway conduit. If a concrete structure develops the structural defects mentioned in the opening paragraphs, or if the discharge spillway conduit does not have a headwall/endwall, then a registered professional engineer should be contacted to evaluate the stability of the outlet.

Headwall



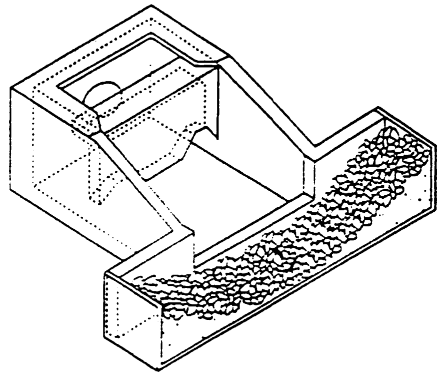
Endwall



Impact Basin

A concrete impact basin is an energy dissipating device located at the outlet of the spillway in which flow from the discharge conduit strikes a vertical hanging baffle. Discharge is directed upstream in vertical eddies by the horizontal portion of the baffle and by the floor before flowing over the endsill. Energy dissipation occurs as the discharge strikes the baffle, thus, performance is not dependent on tailwater. Most impact basins were designed by the United States Department of Agriculture, Natural Resources Conservation Service and the United States Department of Interior, Bureau of Reclamation. If any of the severe defects that are referenced in the opening paragraphs are observed, a registered professional engineer should be contacted to evaluate the stability of the outlet.

Impact Basin

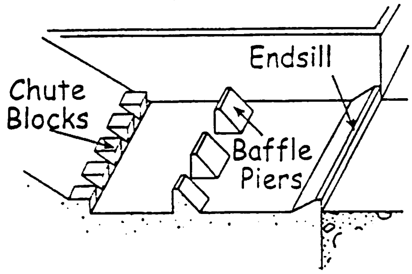


U.S. Department of Interior, Bureau of Reclamation Type II and Type III Basins

Type II and Type III basins reduce the energy of the flow discharging from the outlet of a spillway and allow the water to exit into the outlet channel at a reduced velocity. Type II energy dissipators contain chute blocks at the upstream end of the basin and a dentated (tooth-like) endsill. Baffle piers are not used in a Type II basin because of the high velocity water entering the basin.

Continued on back!

Type III Basin

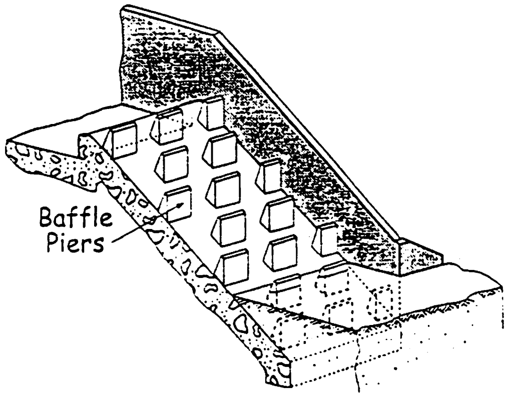


Type III energy dissipators can be used if the entrance velocity of the water is not high. They contain baffle piers which are located on the stilling basin apron downstream of the chute blocks. Located at the end of both the Type II and Type III basins is an endsill. The endsill may be level or sloped, and its purpose is to create the tailwater which reduces the outflow velocity. If any of the severe defects associated with concrete structures are observed, a registered professional engineer should be contacted to evaluate the stability of the basin.

Baffled Chute

Baffled chutes require no initial tailwater to be effective and are located downstream of the control section. Multiple rows of baffle piers on the chute prevent excessive acceleration of the flow and prevent the damage that occurs from a high discharge velocity. A portion of the baffled chute usually extends below the streambed elevation to prevent undermining of the chute. If any of the severe problems associated with concrete that are referenced in the opening paragraphs are observed, a registered professional engineer should be contacted to evaluate the stability of the outlet.

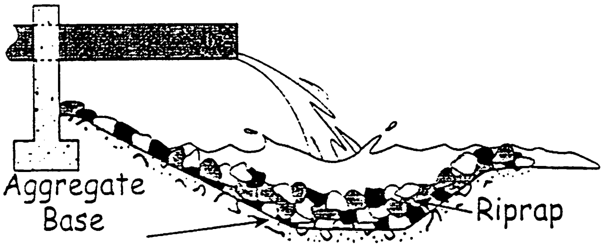
Baffeled Chute Basin



Plunge Pool

A plunge pool is an energy dissipating device located at the outlet of a spillway. Energy is dissipated as the discharge flows into the plunge pool. Plunge pools are commonly lined with rock riprap or other material to prevent excessive erosion of the pool area. Discharge from the plunge pool should be at the natural streambed elevation. Typical problems may include movement of the riprap, loss of fines from the bedding material and scour beyond the riprap and lining. If scour beneath the outlet conduit develops, the conduit will be left unsupported and separation of the conduit joints and undermining may occur. Separation of the conduit joints and undermining may lead to failure of the spillway and ultimately the dam. A registered professional engineer should be contacted to ensure that the plunge pool is designed properly.

Plunge Pool



Additional information about related topics can be found on the following fact sheets: "Inspection of Concrete Structures," "Spillway Conduit System Problems," "Open Channel Spillways (Concrete Chutes and Weirs)," and "Problems with Concrete Materials."

Any questions, comments, concerns, or fact sheet requests should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of WaterDam Safety Engineering Program
1939 Fountain Square Drive, Building E-3
Columbus, OH 43224-1336
(614) 265-6731 (Voice)
(614) 447-9503 (Fax)
http://www.dnr.state.oh.us/water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 94–31

Dam Safety: Seepage Through Earthen Dams

Contrary to popular opinion, wet areas down stream from dams are not usually natural springs, but seepage areas. Even if natural springs exist, they should be treated with suspicion and carefully observed. Flows from ground-water springs in existence prior to the reservoir would probably increase due to the pressure caused by the pool of water behind the dam.

All dams have some seepage as the impounded water seeks paths of least resistance through the dam and its foundation. Seepage must, however, be controlled to prevent erosion of the embankment or foundation or damage to concrete structures.

Detection

Seepage can emerge anywhere on the downstream face, beyond the toe, or on the downstream abutments at elevations below normal pool. Seepage may vary in appearance from a "soft," wet area to a flowing "spring." It may show up first as an area where the vegetation is lush and darker green. Cattails, reeds, mosses, and other marsh vegetation often become established in a seepage area. Another indication of seepage is the presence of rust-colored iron bacteria. Due to their nature, the bacteria are found more often where water is discharging from the ground than in surface water. Seepage can make inspection and maintenance difficult. It can also saturate and weaken portions of the embankment and foundation, making the embankment susceptible to earth slides.

If the seepage forces are large enough, soil will be eroded from the foundation and be deposited in the shape of a cone around the outlet. If these "boils" appear, professional advice should be sought immediately. Seepage flow which is muddy and carrying sediment (soil particles) is evidence of "piping," and will cause failure of the dam. Piping can occur along a spillway and other conduits through the embankment, and these areas should be closely inspected. Sinkholes may develop on the surface of the embankment as internal erosion takes place. A whirlpool in the lake surface may follow and then likely a rapid and complete failure of the dam. Emergency procedures, including downstream evacuation, should be implemented if this condition is noted.

Seepage can also develop behind or beneath concrete structures such as chute spillways or headwalls. If the concrete structure does not have a means such as weep holes or relief drains to relieve the water pressure, the concrete structure may heave, rotate, or crack. The effects of the freezing and thawing can amplify these problems. It should be noted that the water pressure behind or beneath structures may also be due to infiltration of surface water or spillway discharge.

A continuous or sudden drop in the normal lake level is another indication that seepage is occurring. In this case, one or more locations of flowing water are usually noted downstream from the dam. This condition, in itself, may not be a serious problem, but will require frequent and close monitoring and professional assistance.

Control

The need for seepage control will depend on the quantity, content, and location of the seepage. Reducing the quantity of seepage that occurs after construction is difficult and expensive. It is not usually attempted unless the seepage has lowered the pool level or is endangering the embankment or appurtenant structures. Typical methods used to control the quantity of seepage are grouting or installation of an upstream blanket. Of these methods, grouting is probably the least effective and is most applicable to leakage zones in bedrock, abutments, and foundations. These methods must be designed and constructed under the supervision of a professional engineer experienced with dams.

Continued on back!

Controlling the content of the seepage or preventing seepage flow from removing soil particles is extremely important. Modern design practice incorporates this control into the embankment through the use of cutoffs, internal filters, and adequate drainage provisions. Control at points of seepage exit can be accomplished after construction by installation of toe drains, relief wells, or inverted filters.

Weep holes and relief drains can be installed to relieve water pressure or drain seepage from behind or beneath concrete structures. These systems must be designed to prevent migration of soil particles but still allow the seepage to drain freely. The owner must retain a professional engineer to design toe drains, relief wells, inverted filters, weep holes, or reliefholes.

Monitoring

Regular monitoring is essential to detect seepage and prevent dam failure. Knowledge of the dam's history is important to determine whether the seepage condition is in a steady or changing state. It is important to keep written records of points of seepage exit, quantity and content of flow, size of wet area, and type of vegetation for later comparison. Photographs provide invaluable records of seepage.

All records should be kept in the operation, maintenance, and inspection manual for the dam. The inspector should always look for increases in flow and evidence of flow carrying soil particles, which would indicate that a more serious problem is developing. Instrumentation can also be used to monitor seepage. V-notch weirs can be used to measure flow rates, and piezometers may be used to determine the saturation level (phreatic surface) within the embankment.

Regular surveillance and maintenance of internal embankment and foundation drainage outlets is also required. The rate and content of flow from each pipe outlet for toe drains, relief wells, weep holes, and relief drains should be monitored and documented regularly. Normal maintenance consists of removing all obstructions from the pipe to allow for free drainage of water from the pipe. Typical obstructions include debris, gravel, sediment, and rodent nests. Water should not be permitted to submerge the pipe outlets for extended periods of time. This will inhibit inspection and maintenance of the drains and may cause them to clog.

Any other questions, comments concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
1939 Fountain Square, Building E-3
Columbus, Ohio 43224-1336
(614) 265-6731 (Voice) (614) 447-9503 (Fax)
http://www.dnr.state.oh.us/water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 93–26

Dam Safety: Lake Drains

A lake drain is a device to permit draining a reservoir, lake or pond. Division of Water Administrative Rule 1501:21-13-06 requires that all Class I, Class II and Class III dams include a lake drain.

Types of Drains

Common types of drains include the following:

- A valve located in the spillway riser.
- A conduit through the dam with a valve at either the upstream or downstream end of the conduit.
- A siphon system (Often used to retrofit existing dams).
- A gate, valve or stoplogs located in a drain control tower.

Uses of Drains

The following situations make up the primary uses of lake drains:

Emergencies: Should serious problems ever occur to threaten the immediate safety of the dam, drains may be used to lower the lake level to reduce the likelihood of dam failure. Examples of such emergencies are as follows: clogging of the spillway pipe which may lead to high lake levels and eventually dam overtopping, development of slides or cracks in the dam, severe seepage through the dam which may lead to a piping failure of the dam, and partial or total collapse of the spillway system.

Maintenance: Some repair items around the lake and dam can only be completed or are much easier to perform with a lower than normal lake level. Some examples are: slope protection repair, spillway repairs, repair and/or installation of docks and other structures along the shoreline, and dredging the lake.

Winter Drawdown: Some dam owners prefer to lower the lake level during the winter months to reduce ice damage to structures along the shoreline and to provide additional flood storage for upcoming spring rains. Several repair items are often performed during this winter drawdown period. Periodic fluctuations in the lake level also discourage muskrat and beaver habitation along the shoreline. Muskrat burrows in earthen dams can lead to costly repairs.

Common Maintenance Problems

Common problems often associated with the maintenance and operation of lake drains include the following:

- Deteriorated and bent control stems and stem guides.
- Deteriorated and separated conduit joints.
- Leaky and rusted control valves and sluice gates.
- Deteriorated ladders in control towers.
- Deteriorated control towers.
- Clogging of the drain conduit inlet with sediment and debris.
- Inaccessibility of the control mechanism to operate the drain.
- Seepage along the drain conduit.
- Erosion and undermining of the conduit discharge area because the conduit outlets significantly above the elevation of the streambed.
- Vandalism.
- Development of slides along the upstream slope of the dam and the shoreline caused by lowering the lake level too quickly.

Operation and Maintenance Tips

A. All gates, valves, stems and other mechanisms should be lubricated according to the manufacturer's specifications. If you do not have a copy of the specifications and the manufacturing company can not be determined, then a local valve distributor may be able to provide assistance.

B. The lake drain should be operated at least twice a year to prevent the inlet from clogging with sediment and debris, and to keep all movable parts working easily. Most manufacturers recommend that gates and valves be operated at least four times per year. Frequent operation will help to ensure that the drain will be operable when it is needed. All valves and gates should be fully opened and closed at least twice to help flush out debris and to obtain a proper seal. If the gate gets stuck in a partially opened position, gradually work the

Continued on back!

gate in each direction until it becomes fully operational. Do not apply excessive torque as this could bend or break the control stem, or damage the valve or gate seat. With the drain fully open, inspect the outlet area for flow amounts, leaks, erosion and anything unusual.

C. All visible portions of the lake drain system should be inspected at least annually, preferably during the periodic operation of the drain. Look for and make note of any cracks, rusted and deteriorated parts, leaks, bent control stems, separated conduit joints or unusual observations.

D. A properly designed lake drain should include a headwall near the outlet of the drain conduit to prevent undermining of the conduit during periods of flow. A headwall can be easily retro-fitted to an existing conduit if undermining is a problem at an existing dam. A properly designed layer of rock riprap or other slope protection will help reduce erosion in the lake drain outlet area.

E. Drain control valves and gates should always be placed upstream of the centerline of the dam. This allows the drain conduit to remain depressurized except during use, therefore reducing the likelihood of seepage through the conduit joints and saturation of the surrounding earth fill.

F. For accessibility ease, the drain control platform should be located on shore or be provided with a bridge or other structure. This becomes very important during emergency situations if high pool levels exist.

G. Vandalism can be a problem at any dam. If a lake drain is operated by a crank, wheel or other similar mechanism, locking with a chain or other device, or off-site storage may be beneficial. Fences or other such installations may also help to ward off vandals.

H. The recommended rate of lake drawdown is one foot or less per week, except in emergencies. Fast drawdown causes a build-up of hydrostatic pressures in the upstream slope of the dam which can lead to slope failure. Lowering the water level slowly allows these pressures to dissipate.

Monitoring

Monitoring of the lake drain system is necessary to detect problems and should be performed at least twice a year or more frequently if problems develop. Proper ventilation and confined space precautions must be considered when entering a lake drain vault or outlet pipe. Items to be considered when monitoring a lake drain system include the stem, valve, outlet pipe and related appurtenances. Monitoring for surface deterioration (rust), ease of operation, and leakage is important to maintain a working lake drain system. If the stem or valve appears to be inoperable because of deterioration or if the operability of the lake drain system is in question, because the valve does not completely close (seal) and allows an excessive amount of leakage, then a registered professional engineer or manufacturer's representative should be contacted. Photographs along with written records of the monitoring items performed provide invaluable information. For further information on evaluating the condition of the lake drain system see the "Spillway Conduit System Problems", "Problems with Metal Materials", "Problems with Plastic (Polymer) Materials", and "Problems with Concrete Materials" fact sheets.

Conclusion

An operable lake drain accomplishes the following:

1. Makes for a safer dam by providing a method to lower the lake level in an emergency situation.
2. Allows the dam owner to have greater control of the lake level for maintenance, winter drawdown and emergency situations.
3. Meets the requirements of the Ohio Dam Safety Laws.

Any other questions, comments concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
1939 Fountain Square, Building E-3
Columbus, Ohio 43224-1336
(614) 265-6731 (Voice) (614) 447-9503 (Fax)
http://www.dnr.state.oh.us/water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 94-28

Dam Safety: Trees and Brush

The establishment and control of proper vegetation is an important part of dam maintenance. Properly maintained vegetation can help prevent erosion of embankment and earth channel surfaces, and aid in the control of groundhogs and muskrats. The uncontrolled growth of vegetation can damage embankments and concrete structures and make close inspection difficult.

Trees and Brush

Trees and brush should not be permitted on embankment surfaces or in vegetated earth spillways. Extensive root systems can provide seepage paths for water. Trees that blow down or fall over can leave large holes in the embankment surface that will weaken the embankment and can lead to increased erosion. Brush obscures the surface limiting visual inspection, provides a haven for burrowing animals, and retards growth of grass vegetation. Tree and brush growth adjacent to concrete walls and structures may eventually cause damage to the concrete and should be removed.

Stump Removal & Sprout Prevention

Stumps of cut trees should be removed so vegetation can be established and the surface mowed. Stumps can be removed either by pulling or with machines that grind them down. All woody material should be removed to about 6 inches below the ground surface. The cavity should be filled with well-compacted soil and grass vegetation established.

Stumps of trees in riprap cannot usually be pulled or ground down, but can be chemically treated so they will not continually form new sprouts. Certain herbicides are effective for this purpose and can even be used at water supply reservoirs if applied by licensed personnel. For product information and information on how to obtain a license, contact the Ohio Department of Agriculture at the following address:

Ohio Department of Agriculture
Pesticide Regulation
8995 E. Main Street
Reynoldsburg, Ohio 43068
Telephone Number (614) 728-6987

These products should be painted, not sprayed, on the stumps. Other instructions found on the label should be strictly followed when handling and applying these materials. Only a few commercially available chemicals can be used along shorelines or near water.

Embankment Maintenance

Embankments, areas adjacent to spillway structures, vegetated channels, and other areas associated with a dam require continual maintenance of the vegetal cover. Grass mowing, brush cutting, and removal of woody vegetation (including trees) are necessary for the proper maintenance of a dam, dike, or levee. All embankment slopes and vegetated earth spillways should be mowed at least twice per year. Aesthetics, unobstructed viewing during inspections, maintenance of a non-erodible surface, and discouragement of groundhog habitation are reasons for proper maintenance of the vegetal cover.

Methods used in the past for control of vegetation, but are now considered unacceptable, include chemical spraying, and burning. More acceptable methods include the use of weed whips or power brush-cutters and mowers. Chemical spraying to first kill small trees and brush is acceptable if precautions are taken to protect the local environment.

It is important to remember not to mow when the embankment is wet. It is also important to use proper equipment for the slope and type of vegetation to be cut. Also, always follow the manufacturer's recommended safe operation procedures.

Any other questions, comments, concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
2045 Morse Road
Columbus, Ohio 43229-6693
Voice: (614) 265-6731 Fax: (614) 447-9503
Website: http://www.dnr.state.oh.us/water

Ohio Department of Natural Resources
Division of Water Fact Sheet

Fact Sheet 94-30

Dam Safety: Earth Dam Failures

Owners of dams and operating and maintenance personnel must be knowledgeable of the potential problems which can lead to failure of a dam. These people regularly view the structure and, therefore, need to be able to recognize potential problems so that failure can be avoided. If a problem is noted early enough, an engineer experienced in dam design, construction, and inspection can be contacted to recommend corrective measures, and such measures can be implemented.

IF THERE IS ANY QUESTION AS TO THE SERIOUSNESS OF AN OBSERVATION, AN ENGINEER EXPERIENCED WITH DAMS SHOULD BE CONTACTED.

Acting promptly may avoid possible dam failure and the resulting catastrophic effect on downstream areas. Engineers from the Division of Water, Engineering Group of the Department of Natural Resources are available at any time to inspect a dam if a serious problem is detected or if failure may be imminent. Contact the division at the following address and telephone number:

Ohio Department of Natural Resources
Division of Water, Engineering Group
1939 Fountain Square, Building E-3
Columbus, Ohio 43224

In an emergency, call 614/265-6731 or 614/265-7006.

Since only superficial inspections of a dam can usually be made, it is imperative that owners and maintenance personnel be aware of the prominent types of failure and their telltale signs. Earth dam failures can be grouped into three general categories: overtopping failures, seepage failures, and structural failures. A brief discussion of each type follows.

Overtopping Failures

Overtopping failures result from the erosive action of water on the embankment. Erosion is due to uncontrolled flow of water over, around, and adjacent to the dam. Earth embankments are not designed to be overtopped and therefore are particularly susceptible to erosion. Once erosion has begun during overtopping, it is almost impossible to stop. A well vegetated earth embankment may withstand limited overtopping if its top is level and water flows over the top and down the face as an evenly distributed sheet without becoming concentrated. The owner should closely monitor the reservoir pool level during severe storms.

Seepage Failures

All earth dams have seepage resulting from water percolating slowly through the dam and its foundation. Seepage must, however, be controlled in both velocity and quantity. If uncontrolled, it can progressively erode soil from the embankment or its foundation, resulting in rapid failure of the dam. Erosion of the soil begins at the downstream side of the embankment, either in the dam proper or the foundation, progressively works toward the reservoir, and eventually develops a "pipe" or direct conduit to the reservoir. This phenomenon is known as "piping." Piping action can be recognized by an increased seepage flow rate, the discharge of muddy or discolored water, sinkholes on or near the embankment, and a whirlpool in the reservoir. Once a whirlpool (eddy) is observed on the reservoir surface, complete failure of the dam will probably follow in a matter of minutes. As with overtopping, fully developed piping is virtually impossible to control and will likely cause failure.

Seepage can cause slope failure by creating high pressures in the soil pores or by saturating the slope. The pressure of seepage within an embankment is difficult to determine without proper instrumentation. A slope which becomes saturated and develops slides may be showing signs of excessive seepage pressure.

Structural Failures

Structural failures can occur in either the embankment or the appurtenances. Structural failure of a

Continued on back!

spillway, lake drain, or other appurtenance may lead to failure of the embankment. Cracking, settlement, and slides are the more common signs of structural failure of embankments. Large cracks in either an appurtenance or the embankment, major settlement, and major slides will require emergency measures to ensure safety, especially if these problems occur suddenly. If this type of situation occurs, the lake level should be lowered, the appropriate state and local authorities notified, and professional advice sought. If the observer is uncertain as to the seriousness of the problem, the Division of Water should be contacted immediately.

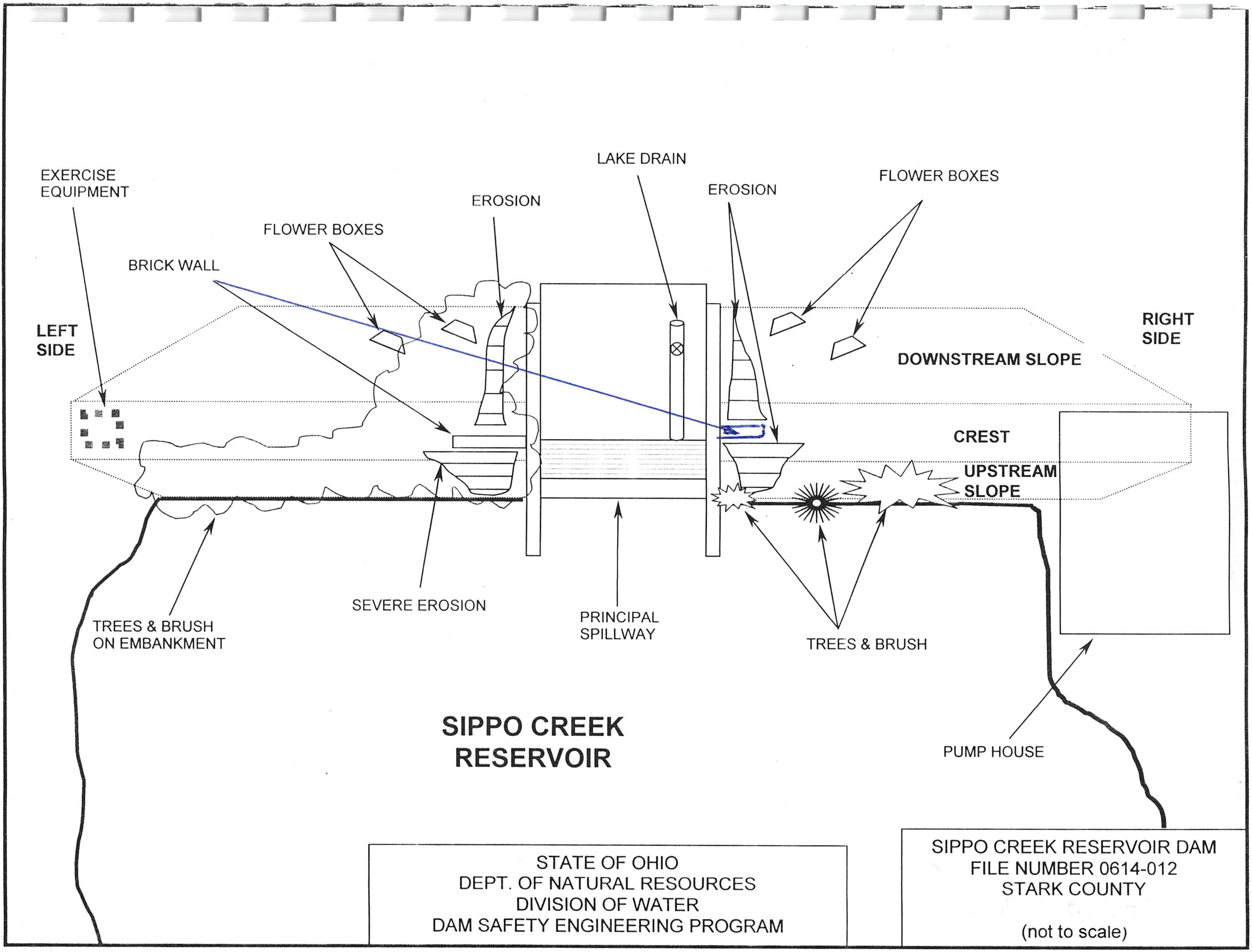
The three types of failure previously described are often interrelated in a complex manner. For example, uncontrolled seepage may weaken the soil and lead to a structural failure. A structural failure may shorten the seepage path and lead to a piping failure. Surface erosion may result in structural failure.

Minor defects such as cracks in the embankment may be the first visual sign of a major problem which could lead to failure of the structure. The seriousness of all deficiencies should be evaluated by someone experienced in dam design and construction. A qualified professional engineer can recommend appropriate permanent remedial measures.

Any other questions, comments concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
1939 Fountain Square, Building E-3
Columbus, Ohio 43224-1336
(614) 265-6731 (Voice) (614) 447-9503 (Fax)
http://www.dnr.state.oh.us/odnr/water/

Section 2



STATE OF OHIO
DEPT. OF NATURAL RESOURCES
DIVISION OF WATER
DAM SAFETY ENGINEERING PROGRAM

SIPPO CREEK RESERVOIR DAM
FILE NUMBER 0614-012
STARK COUNTY

(not to scale)

SIPPO CREEK RESERVOIR DAM
FEBRUARY 21, 2006
FILE NUMBER: 0614-012

Overview of the upstream slope. Note the trees and brush.

View of the right crest.

View of the right upstream slope and crest near the principal spillway inlet. Note the erosion and lack of vegetal ground cover.

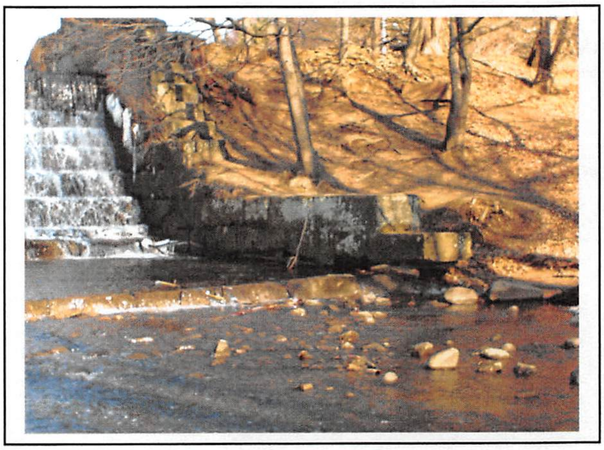
View of the left crest. Note the lack of vegetal cover and the exposed tree roots from erosion.

SIPPO CREEK RESERVOIR DAM
FEBRUARY 21, 2006
FILE NUMBER: 0614-012

View of the brick cut-off wall across the right half of crest and the downstream slope.

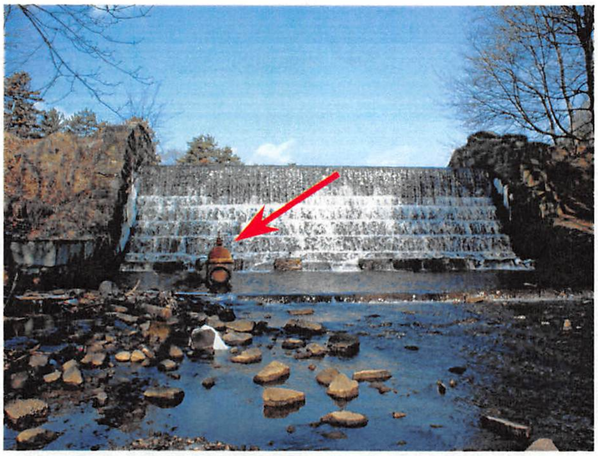
View of the brick cut-off wall across the left half of crest. The blue arrow indicates where bricks have become displaced from the wall.

View of the right downstream slope. The red circles indicate the locations of planter boxes on the slope, and the blue lines indicate the location of erosion gullies on the slope.



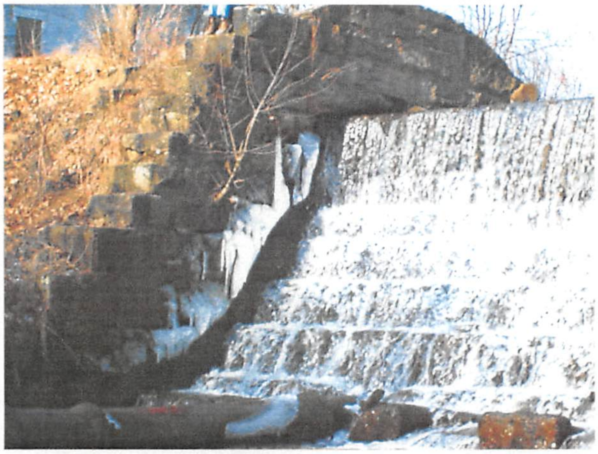
View of the left downstream slope. Note the lack of vegetal ground cover and the trees on the dam.

SIPPO CREEK RESERVOIR DAM
FEBRUARY 21, 2006
FILE NUMBER: 0614-012

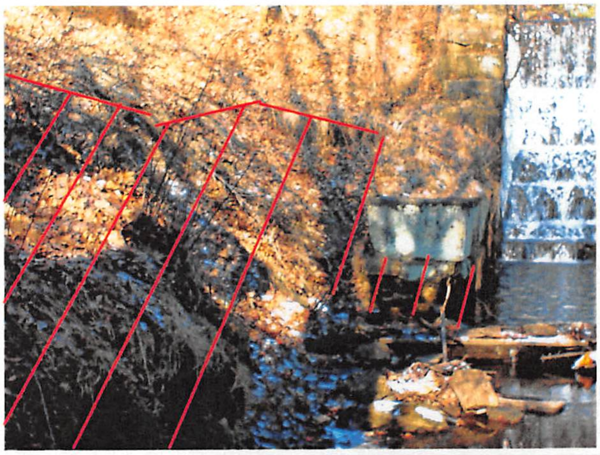


View of the hand placed masonry block principal spillway. The red arrow points to the lake drain pipe and valve.

View of the principal spillway outlet channel.

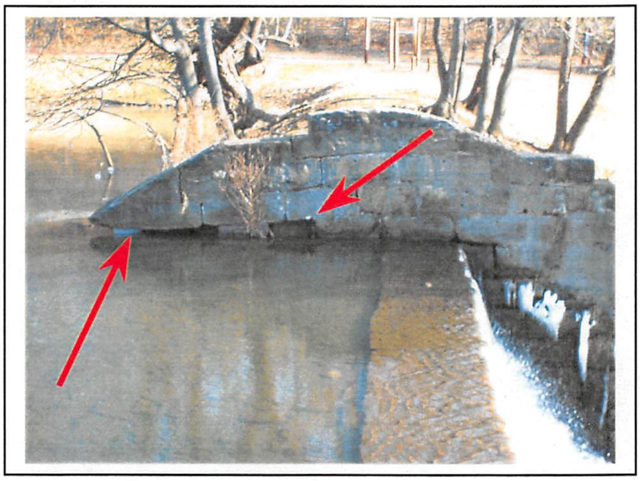


View of the interior right principal spillway side wall. Note the ice from seepage through the joints in the wall. Also note the sapling growing from out of the wall.

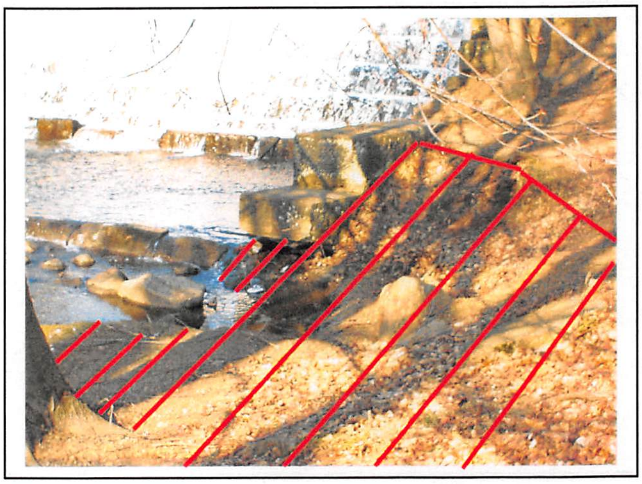


View of the downstream end of the right side wall. The red hatched area indicates erosion. Note that it is eroded behind and under the end of the wall.

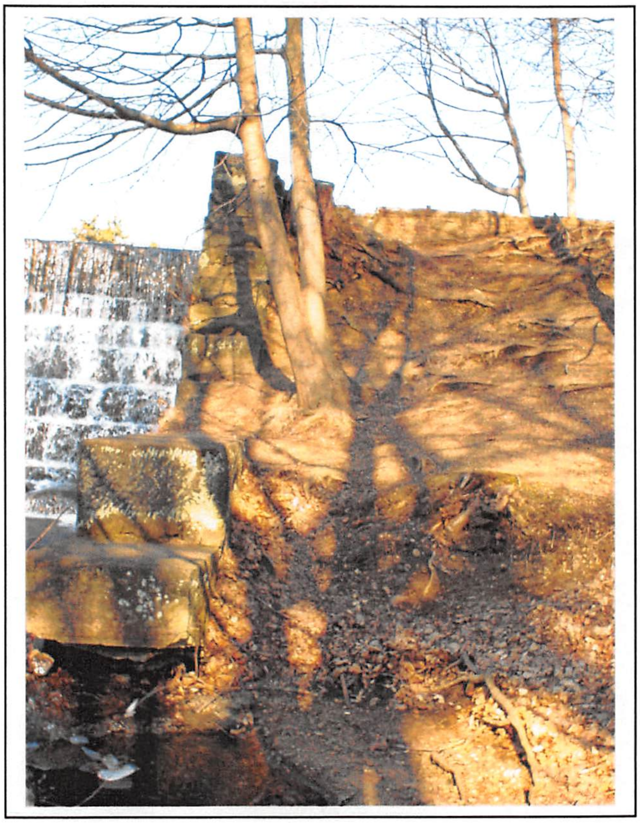
SIPPO CREEK RESERVOIR DAM
FEBRUARY 21, 2006
FILE NUMBER: 0614-012

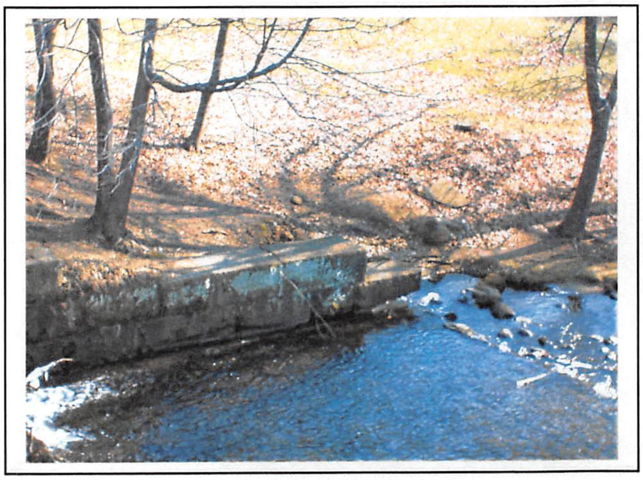


Interior view of the left upstream end of the principal spillway sidewall. The arrows indicate undermining of the wall and missing stones. Also note the seepage emerging from the side wall through unsealed joints.



View of the downstream side of the left side wall. The hatched lines indicate erosion under and behind the side wall.





Other views of the undermining and erosion at the downstream end of the left side wall.

Dam Classification Checklist

Name of Dam: Sippo Creek Reservoir Dam

File Number: 0614-012

County: Stark

Date: February 21, 2006

Engineer: TML

The classification of a dam is based on three factors: the dam's height, storage capacity, and potential downstream hazard. The height of the dam is the vertical distance from the crest to the downstream toe. The storage capacity is the volume of water that the dam can impound at the top of dam (crest) elevation. The downstream hazard consists of roads, buildings, homes, and other structures that would be damaged in the event of a dam failure. Potential for loss of life is also evaluated. Various dam failure scenarios must be considered, and they include failures when the dam is at normal pool level and failures during significant flood events. Each of the three factors is evaluated, and the final classification of the dam is based on the highest individual factor. Class I is the highest and Class IV is the lowest. The classification of a dam can change based on future development along the downstream channel.

This checklist is intended to establish or verify the appropriate classification in accordance with the Ohio Administrative Code – it does not necessarily show all potential hazards or the full extent of inundation. In addition, elevations are estimated.

HEIGHT CLASSIFICATION

Dam Height = 18.9 feet

___ > 60' - Class I
___ > 40' - Class II
___ > 25' - Class III
X ≤ 25' - Class IV

STORAGE CLASSIFICATION

Stor. Capacity (top of dam)= 82.5 acre-feet

___ > 5000 acre-feet - Class I
___ > 500 acre-feet - Class II
X > 50 acre-feet - Class III
___ ≤ 50 acre-feet - Class IV

EXEMPT~NON-REGULATED

___ Height ≤ 6 feet
___ Storage ≤ 15 acre-feet
___ 6 ft. < Height < 10 ft. & Stor. ≤ 50 ac-ft

Height Class: IV

Storage Class: III

Hazard Class **(see next page):** I **Estimated Population at Risk:** 16+

Final Class: I

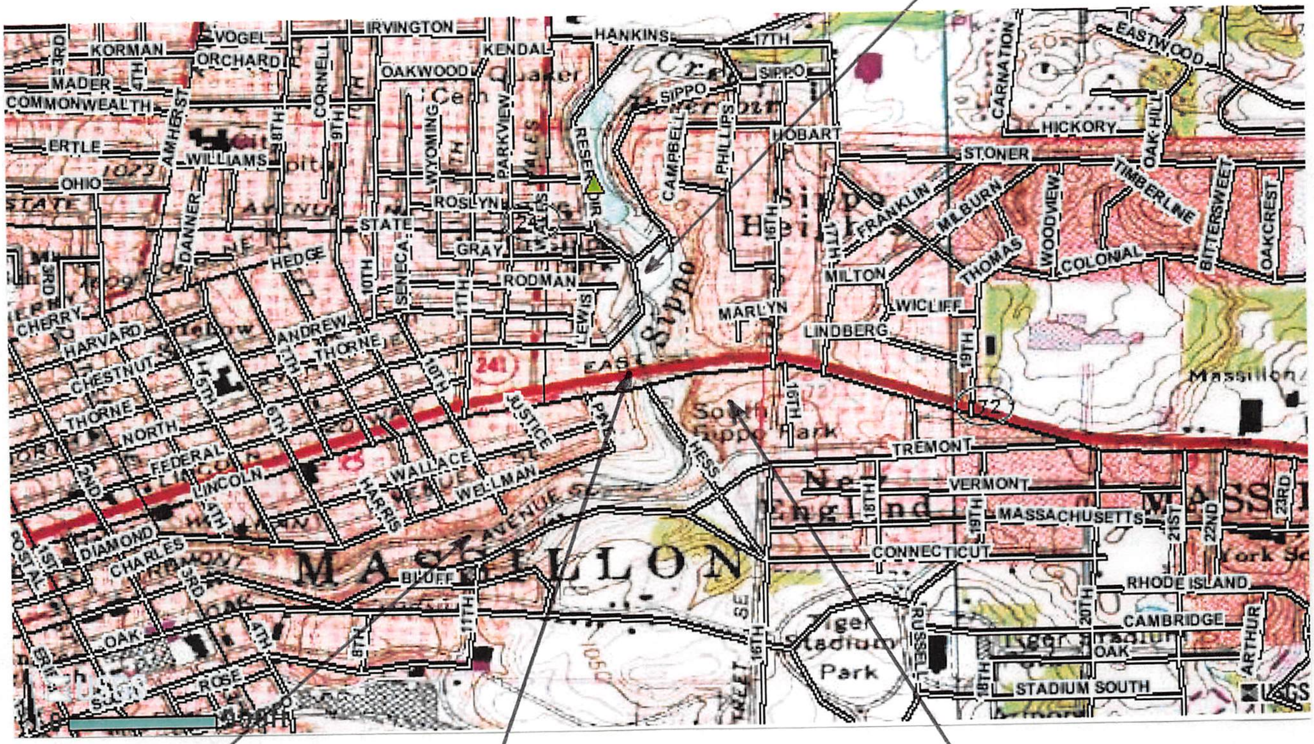
Class Changed (Yes, [✓ No])

POTENTIAL DOWNSTREAM HAZARD

I	II					III		IV	-	-			
Probable loss of human life	Loss of public water supply or wastewater treatment facility, release of health hazardous waste	Flooding of structure or high-value property	Damage to high-value or Class I, II, III dam or levee	Damage to major road (US or state route), disruption of only access to residential or critical facility area	Damage to railroad or public utility	Damage to rural building, not otherwise high-valued property, or Class IV dam or levee	Damage to local road (county and township)	Loss restricted mainly to the dam or agricultural /rural land	No hazard to structure noted	*No hazard assessment; further investigation needed*	Distance downstream of dam to affected structure (feet)	Vertical distance from streambed to base of affected structure (feet)	Horizontal distance from stream to affected structure (feet)
						A					200	3	0
						B					2000	3	0
				C							1500	30	0
D											5300	4	30

This checklist is intended to establish or verify the appropriate classification in accordance with the OAC – it does not necessarily show all potential hazards or the full extent of inundation.

Sketch of Developments Downstream of Dam



A- NORTH SIPPO PARK

D- RESIDENTIAL AREA
ALONG TREMONT AVENUE

C - STATE ROUTE 241
(15' DIAMETER CULVERT)

B - SOUTH SIPPO PARK

Flood Routing Summary

A dam must be able to safely pass severe flood events. A dam uses a combination of reservoir storage capacity and spillway discharge to prevent floodwater from overtopping the embankment crest. As part of this inspection, the Division of Water did not thoroughly investigate the ability of this dam to safely pass the required design flood. In 2001 the Division of Water performed hydrologic and hydraulic calculations to estimate the size of the design flood and the total spillway discharge capacity of the dam. These calculations combined with the reservoir storage capacity were used in the flood routings to determine the maximum water surface elevation in the reservoir for various flood events (see Table I).

Sippo Creek Reservoir Dam is a Class I dam; therefore, in accordance with OAC Rule 1501:21-13-02, the required design flood is 100% of the Probable Maximum Flood (PMF) or the critical flood. This dam and its spillway system must safely pass the design flood without overtopping the embankment crest. Flood routing calculations indicate that the dam can pass 3% of the PMF; Sippo Creek Reservoir Dam does not appear to be able to safely pass the design flood.

Table I - Flood Routing Summary

Flood Event			**Overtopping**	
	Maximum Inflow (cubic feet per second)	**Maximum WSEL*** (feet)	**Depth** (feet)	**Duration** (hours)
PMF	20180	1013.9	13.3	23.7
75% PMF	15135	1010	9.4	22.2
50% PMF	10090	1008.2	7.6	21
25% PMF	5045	1004.6	4	17.3
12% PMF**	2421	1003.2	2.6	13

* WSEL – water surface elevation, in feet above the mean sea level

** 12% PMF is similar to the 100-year flood. The 100-year flood event has a 1% chance of occurring in any given year. This is only an approximation.

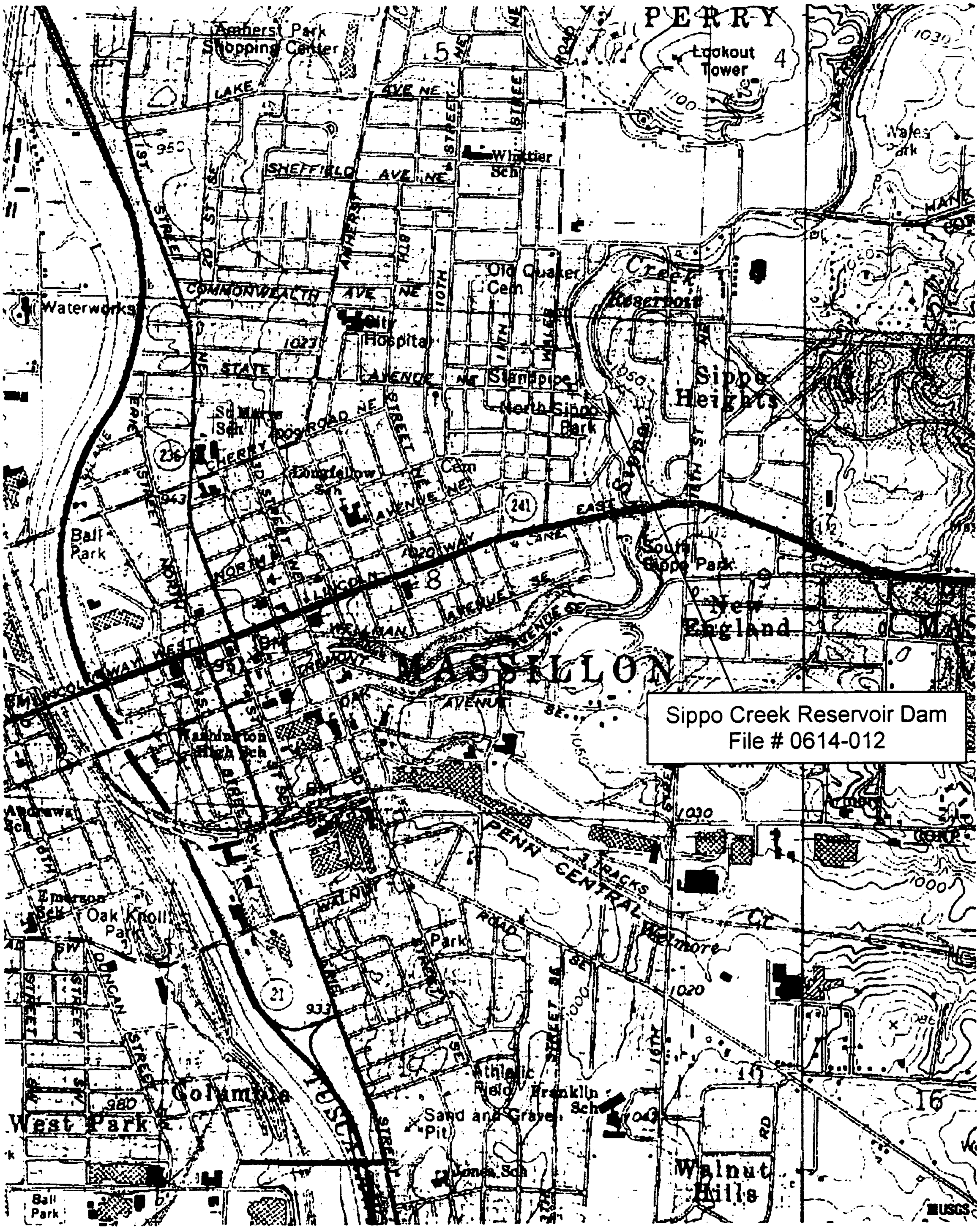
Top of Dam Elevation:	1000.60 feet above msl
Normal Pool Elevation:	997.00 feet above msl

History of Sippo Creek Reservoir Dam

Date	Event
Unknown	Dam constructed
1991	Dam safety inspection by the Division of Water
2000	Repair plans and H&H study submitted, comments provided, no resubmittal
2001	Dam safety inspection by the Division of Water
February 21, 2006	Dam safety inspection by the Division of Water.

Section 3

Location Map



Sippo Creek Reservoir Dam
File # 0614-012

Dam Inventory Sheet

NAME: SIPPO CREEK RESERVOIR DAM
FILE NO: 0614-012
NATIONAL #: OH02825
RESERVOIR:
PERMIT NO: EXEMPT
CLASSIFICATION: I

OWNER INFORMATION

OWNER: City of Massillon
OWNER TYPE: PUBLIC, LOCAL
ADDRESS1: Parks & Recreation
PARCEL NO:
ADDRESS2: 505 Erie St. North
ADDRESS3:
CITY: Massillon **STATE:** OH **ZIP+4:** 44646
CONTACT PERSON: Kenneth Kaminski, Director
TELEPHONE: 330/832-1621

LOCATION INFORMATION

COUNTY: STARK
LATITUDE DEG: 40 **MIN:** 48 **SEC:** 18
TOWNSHIP: PERRY
LONGITUDE DEG: 81 **MIN:** 30 **SEC:** 30
STREAM: SIPPO CREEK
NEAREST AFFECTED COMMUNITY: MASSILON
COMMUNITY'S DISTANCE FROM DAM (miles): 0
USGS QUAD: MASSILLON
USGS BASIN NO: 05040001

DESIGN/CONSTRUCTION INFORMATION

DESIGNED BY: UNKNOWN
CONSTRUCTED BY: UNKNOWN
COMPLETED: **PLANS AVAILABLE:** NO **AT:**
FAILURE/INCIDENT/BREACH:

STRUCTURE INFORMATION

PURPOSE OF DAM: RECREATION, PUBLIC
TYPE OF IMPOUNDMENT: DAM AND SPILLWAY
TYPE OF STRUCTURE: EARTHFILL
DRAINAGE AREA (sq.miles): 14.9 **or (acres):** 9566

EMBANKMENT DATA

LENGTH (ft): 265.0
UPSTREAM SLOPE: 2H:1V
MAX. HEIGHT (ft): 18.9
DOWNSTREAM SLOPE: 2H:1V
TOP WIDTH (ft): 6.0
VOLUME OF FILL (cu.yds.):

SPILLWAY OUTLET WORKS DATA

LAKE DRAIN 24-INCH-DIAMETER GATE VALVE
PRINCIPAL: 36-FT-WIDE WEIR
EMERGENCY: NONE
MAXIMUM TOTAL SPILLWAY DISCHARGE (cfs): 753
DESIGN FLOOD: 1.0 **FLOOD CAPACITY:** 0.03

DAM RESERVOIR DATA

	ELEVATION (ft-MSL)*	AREA (acres)	STORAGE (acre-feet)
FOUNDATION (CUTOFF):			
STREAMBED:	981.7		
PRINCIPAL SPILLWAY:	997.0	4.4	21.7
EMERGENCY SPILLWAY:			
TOP OF DAM:	1000.6	34.0	82.5

** Survey data is best available and not necessarily based on USGS benchmark*

INSPECTION INFORMATION

LAST INSPECTION (m/d/y): 2/21/2006
INSPECTOR: TML
PHASE I:
PRIOR INSPECTIONS: 4/26/2001 WDE 12/19/1991

OTHER SITE VISITS:

OPERATION INFORMATION/REMARKS

RECEIVED REPAIR PLANS 2000, COMMENTS PROVIDED, NO PROGRESS MADE.

EMERGENCY ACTION PLAN: NO **FORMAT:**
ANNUAL FEE: $219.00
LAST DATA ENTRY: 4/7/2006

Dam Safety Inspection Checklist

Complete All Portions of This Section (Pre-inspection)

Name of Dam: SIPPO CREEK RESERVOIR DAM

Class: I

File Number: 0614-012

Date of Inspection: 2/21/06

Design Flood: 1.0

	Required Action Eng.	Maint.	Mon.	None
EAP: (yes [✓ no])	☑	☐	☐	☐
OM&I: (yes [✓ no])	☐	☑	☐	☐
Flood Capacity: 0.03	☑	☐	☐	☐

Ask Owner for Missing Information (at the site)

Owner=s

Name(s):

Address:

City: State: Zip (+4):

Contact Person: Telephone:

Designed By: Constructed By:

Year Completed: Plans (y/n, location):

Purpose of dam:

Remarks:

Home Telephone (optional): Work Telephone (optional):

Interview with Owner (at the site):

Owner/Representative present: (Yes, [✓ No]) Name(s): A SCHEDULE LETTER WAS SENT, BUT NO REPRESENTATIVE SHOWED UP AT THE INSPECTION.

Double check address, telephone #, purpose (check ->) ☐

How long have you owned dam - previous name/owner?

EAP/OM&I: up-dated-(yes, no) & location:

Operate lake drain (times per year, accessibility):

Mowing (times per year):

Prior problems (wet areas, erosion, slides):

Repair or modification (what & when):

Failure/Incident/Breach (max. pool):

Downstream hazard status (recent changes):

Field Information (at the site)

Pool Elevation (during inspection): NORMAL POOL Time: 10:00 [✓ a.m.] p.m.)

Site Conditions(temp., weather, ground moisture): 40°, PARTLY SUNNY, DAMP

Inspection Party: TINA LOMBARDI + DENA BARNHOUSE

Maximum Height: 18.9 Feet (measured or [✓ inventory appears correct])

Normal Pool Surface Area: 4.4 Acres (measured or [✓ inventory appears correct])

Required Action

None / Monitor / Maintenance / Engineer

UPSTREAM SLOPE

Gradient: Horizontal: 2 Vertical: 1 ([✓ est], meas.)

☒ *VEGETATION* [no problem]

☒ Trees: Quantity: ([✓ <5], sparse, dense) ☐ ☐ ☒ ☐

Diameter: (<6", [✓ 6-12"], >12")

Location: (adj. to structure, [✓ entire slope], lt end, rt end, middle, see dwg)

Notes:

☒ Brush: Quantity: (sparse, [✓ dense]) ☐ ☐ ☒ ☐

Location: (adj. to structure, entire slope, lt end, [✓ rt end], middle, see dwg) AND @ R+L SIDES OF P.S.

Notes:

☒ Ground Cover: Type: ([✓ grass], crown vetch) Other: ☐ ☐ ☒ ☐

Quantity: ([✓ bare], [✓ sparse], adequate, dense) SOME GRASS, BUT MOSTLY BARE

Appearance: (too tall, too short, good)

Notes:

☒ *SLOPE PROTECTION* [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☐ None ☐ ☐ ☐ ☐

☒ Riprap: Average Diameter: 8" TO 10" ☐ ☐ ☐ ☒

(adequate, sparse, [✓ displaced], weathered, vegetation) (bedding/fabric noted - yes, no)

Notes: ROCK HAS SLID INTO RESERVOIR

☐ Wave Berm: ☐ ☐ ☐ ☐

Vegetation: (adequate, bare, sparse, improper vegetation)

Notes:

☐ Concrete Slabs: (cracked, settlement, undermined, voids, deteriorated, vegetation) ☐ ☐ ☐ ☐

Notes:

☐ Other: ☐ ☐ ☐ ☐

Notes:

☒ *EROSION* [no problem, could not inspect thoroughly]

☒ Wave Erosion (Beaching): Scarp: Length: Height: VARIES ☐ ☐ ☐ ☒

Location: (adj. to structure, [✓ entire slope], lt end, rt end, middle, see dwg)

Notes: WORST EROSION @ Ⓡ SIDE OF P.S. HAS ERODED INTO CREST.

☐ Runoff Erosion (Gullies): Quantity: ☐ ☐ ☐ ☐

Depth: Width: Length:

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes/Causes:

☒ *INSTABILITIES* [[✓ no problem], could not inspect thoroughly]

☐ Slides: Transverse Length: Longitudinal Length: ☐ ☐ ☐ ☐

Scarp: Width: Length:

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Crack: Width: Depth:

Notes/Causes:

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐

Quantity: Length: Width: Depth:

Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)

Notes/Causes:

None / Monitor / Maintenance / Engineer

Required Action

Required Action

None Monitor Maintenance Engineer

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☑ **OTHER** [✓ no problem], could not inspect thoroughly]
☐ Rodent Burrows: (few, numerous) ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes:

☐ Ruts: ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Depth: Width Length:
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☐ Other: ☐ ☐ ☐ ☐
Notes:

CREST Length: 265.0 Width: 6' ([✓ est], meas.)

☑ **VEGETATION** [no problem]
☑ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☑ ☐
Diameter: (<6", [✓ 6-12"], >12")
Location: (adj. to structure, entire crest, [✓ lt end], rt end, middle, see dwg) AT U/S + D/S / CREST INTERFACE !
Notes:
ROOTS FROM THE TREES ARE EXPOSED ON THE CREST.

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐
Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)
Notes:

☑ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☑ ☐
Quantity: ([✓ bare], sparse, adequate, dense)
Appearance: (too tall, too short, good)
Notes:

☑ **EROSION** [no problem, could not inspect thoroughly]
☐ Runoff Erosion (Gullies): Quantity: Depth: Width: Length: ☐ ☐ ☐ ☑
Location: (adj. to structure, entire crest, lt end, [✓ rt end], middle, see dwg)
Notes/Causes: U/S EROSION HAS EATEN INTO CREST.
WORST AREA IS ADJACENT TO RIGHT SIDEWALL OF PRINCIPAL SPILLWAY.
SEE PHOTOS

None Monitor Maintenance Engineer

Required Action

Required Action

None Monitor Maintenance Engineer

☑ ***ALIGNMENT*** [no problem, could not inspect thoroughly]

☑ Vertical: ☐ Low Area: ☐ ☐ ☐ ☑

Location: (adj. to structure, [✓ entire crest], lt end, rt end, middle, see dwg)

Elevation Difference: ≈ 3' Length:

Notes/Causes: VERTICAL ALIGNMENT IS VARIABLE. WORST AREAS ARE ADJACENT TO SPILLWAY.

☐ ☐ ☐ ☐

☐ Horizontal:

Notes/Causes:

☑ ***WIDTH*** [✓ no problem]

☐ Too Narrow

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg) ☐ ☐ ☐ ☐

Notes/Causes:

☑ ***INSTABILITIES*** [no problem, could not inspect thoroughly]

☐ Cracks: ☐ Transverse ☐ Longitudinal ☑ Other ☐ ☐ ☐ ☑

Quantity: Length: Width: Depth:

Location: (adj. to structure, [✓ entire crest], lt end, rt end, middle, see dwg)

Notes/Causes: A BRICK CUTOFF WALL EXTENDS ALONG THE CREST ON BOTH SIDES OF THE SPILLWAY. IT APPEARED THAT THE TOP OF WALL WAS INTENDED TO BE

☐ ~~Cracks: ☐ Transverse ☐ Longitudinal ☐ Other~~ TOP OF DAM. WALL IS EXPOSED ☐ ☐ ☐ ☐

~~Quantity: Length: Width: Depth~~: ON BOTH SIDES.

~~Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)~~ WALL ON Ⓛ SIDE IS EXPOSED

~~Notes/Causes~~: ≈ 3'. THE BRICKS ON Ⓛ WALL ARE BECOMING DISPLACED.

☐ Bulges ☐ Depressions ☑ Hummocky ☐ ☐ ☐ ☑

Size: Height: Depth:

Location: (adj. to structure, [✓ entire crest], lt end, rt end, middle, see dwg) CREST IS VERY HUMMOCKY

Notes/Causes: BECAUSE SEVERAL TREE ROOTS ARE EXPOSED. THIS WILL LIKELY INCREASE EROSION IF THE DAM WERE TO OVERTOP.

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐

Size: Height: Depth:

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Notes/Causes:

☑ ***OTHER*** [✓ no problem], could not inspect thoroughly]

☐ Rodent Burrows: (few, numerous) ☐ ☐ ☐ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Notes:

☐ Ruts: ☐ ☐ ☐ ☐

Location: (adj. to structure, entire crest, lt end, rt end, middle, see dwg)

Depth: Width: Length:

Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian):

☑ Other: THE EXERCISE EQUIPMENT APPEARS TO BE ON THE ☑ ☐ ☐ ☐

Notes LEFT ABUTMENT AS OPPOSED TO ON THE CREST AS NOTED AT THE LAST INSPECTION.

None Monitor Maintenance Engineer

Required Action

{Upstream Slope, **Crest**, Downstream Slope, Seepage, Principal Spillway, Emergency Spillway, Lake Drain}

Required Action

None Monitor Maintenance Engineer

DOWNSTREAM SLOPE Gradient: Horizontal: 2 Vertical: 1 ([✓ est], meas.)

☑ ***VEGETATION*** [no problem]

☑ Trees: Quantity: (<5, sparse, dense) MODERATE ☐ ☐ ☑ ☐
Diameter: (<6", [✓ 6-12"], >12")
Location: (adj. to structure, entire slope, [✓ lt end], rt end, middle, see dwg)
Notes:

☑ Brush: Quantity: ([✓ sparse], dense) ☐ ☐ ☑ ☐
Location: (adj. to structure, entire slop nd, middle, see dwg)
Notes: ADJACENT TO RIGHT END OF SPILLWAY

☑ Ground Cover: Type: ([✓ grass], crown vetch) Other: ☐ ☐ ☑ ☐
Quantity: ([✓ bare], [✓ sparse], adequate, dense) SPARSE AND TOO SHORT ON Ⓡ HALF. MOSTLY
Appearance: (too tall, [✓ too short], good) BARE OF VEGETATION ON Ⓛ HALF.
Notes:

☑ ***EROSION*** [no problem, could not inspect thoroughly]

☑ Runoff Erosion (Gullies): Quantity: 2 Depth: 2' Width: 4' Length: 25' ☐ ☐ ☑ ☐
Location: (adj. to structure, entire slope, lt end, [✓ rt end], middle, see dwg)
Notes/Causes: ADJACENT TO Ⓡ SIDE OF PRINCIPAL SPILLWAY.

☑ ***INSTABILITIES*** ([✓ no problem], could not inspect thoroughly]

☐ Slides: Transverse Length: Longitudinal Length: ☐ ☐ ☐ ☐
Scarp: Width: Length:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Crack: Width: Depth:
Notes/Causes:

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Cracks: ☐ Transverse ☐ Longitudinal ☐ Other ☐ ☐ ☐ ☐
Quantity: Length: Width: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

☐ Bulges ☐ Depressions ☐ Hummocky ☐ ☐ ☐ ☐
Size: Height: Depth:
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes/Causes:

None Monitor Maintenance Engineer

Required Action

Required Action
None Monitor Maintenance Engineer

☑ **OTHER** [no problem, could not inspect thoroughly]

☐ Rodent Burrows: (few, numerous) ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Notes:

☐ Ruts: ☐ ☐ ☐ ☐
Location: (adj. to structure, entire slope, lt end, rt end, middle, see dwg)
Depth: Width: Length:
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian)

☑ Other: FLOWER BOXES ARE LOCATED ON Ⓡ+Ⓛ SLOPES. ☐ ☐ ☑ ☐
Notes: THESE MUST BE REMOVED.

☑ **SEEPAGE** [[✓ no problem], could not inspect thoroughly]

☐ Wet Area ☐ Flow ☐ Boil ☐ Sinkhole ☐ ☐ ☐ ☐
Flow Rate Size:
Location:
☐ Aquatic Vegetation ☐ None
☐ Rust Colored Deposits ☐ None
☐ Sediment in Flow ☐ None
☐ Other:
Notes/Causes:

☐ Wet Area ☐ Flow ☐ Boil ☐ Sinkhole ☐ ☐ ☐ ☐
Flow Rate Size:
Location:
☐ Aquatic Vegetation ☐ None
☐ Rust Colored Deposits ☐ None
☐ Sediment in Flow ☐ None
☐ Other:
Notes/Causes:

☑ **EMBANKMENT DRAINS** [none, [✓ none found], no problem, could not inspect thoroughly]

Type: ☐ Toe Drain ☐ Relief Wells ☐ Other: ☐ ☐ ☐ ☐
Flow Rate: Size: Number:
Location:
Notes:

☑ **MONITORING INSTRUMENTATION** [none, [✓ none found], no problem, could not inspect thoroughly]

☐ None Found ☐ Piezometers ☐ Weirs/Flumes ☐ Other ☐ ☐ ☐ ☐
☐ Periodic Inspections by:
Notes:

None Monitor Maintenance Engineer
Required Action

Required Action
None Monitor Maintenance Engineer

PRINCIPAL SPILLWAY

☑ ***GENERAL INLET*** [[✓ no problem], could not inspect thoroughly]

☑ Anti-Vortex Plate [✓ None] Dimensions: (adequate, too small,) ☑ ☐ ☐ ☐
Type: (steel, concrete, aluminum, stainless steel, corrugated metal, wood, other):
Deterioration: (missing sections, rusted, collapsed)
Notes:

☑ Flash Boards [✓ None] ☑ ☐ ☐ ☐
Type: (metal, wood):
Deterioration:
Notes:

☑ Trashrack [✓ None] Opening Size: (adequate, too small, too large) ☑ ☐ ☐ ☐
Type: (metal bars, fence, screen, concrete, baffle, other):
Deterioration: (broken bars, missing sections, rusted, collapsed)
Notes:

☑ ***INLET OBSTRUCTION*** [[✓ no problem], could not inspect thoroughly]

☐ Debris: (leaves, trash, logs, branches, ice) ☐ ☐ ☐ ☐
☐ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☐ ☐
Diameter: (<6", 6-12", >12")
Location: (entire inlet, lt side, rt side, middle, see dwg)
Notes:

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐
Location: (entire inlet, lt side, rt side, middle, see dwg)
Notes:

☐ Other:(beaver activity, trashrack opening too small, partially/completely blocked, i.e.) ☐ ☐ ☐ ☐

Notes:

☑ ***INLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal
(loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) ☐ ☐ ☐ ☐

Dimensions:
Location:
Notes/Causes:

☐ Concrete
(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐
(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐
(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐
Dimensions/Location:
Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐
(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐
(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐
Dimensions/Location:
Notes/Causes:

☐ Plastic ☐ ☐ ☐ ☐
(deterioration, cracking, deformation)
Dimensions:
Location:
Notes/Causes:

None Monitor Maintenance Engineer
Required Action

Required Action
None Monitor Maintenance Engineer

☐ Earthen

☐ Ground Cover: Type: (grass, crown vetch) Other:
Quantity: (bare, sparse, adequate, dense) ☐ ☐ ☐ ☐
Appearance: (too tall, too short, good)
Notes:

☐ Erosion: (wave, surface runoff) ☐ ☐ ☐ ☐
Description (height/depth/length/etc):
Notes:

☐ Ruts: ☐ ☐ ☐ ☐
Location: (entire inlet, lt side, rt side, middle, see dwg)
Depth: Width: Length:
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian):

☐ Riprap: Average Diameter:
(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no) ☐ ☐ ☐ ☐
Notes:

☐ Rock-Cut (weathered, erosion)
Description: ☐ ☐ ☐ ☐
Notes:

☑ Other: STONE - SEVERAL OF THE STONES AREMISSING AND THE MORTAR BETWEEN SEVAERAL STONE HAS WORN AWAY. ☐ ☐ ☐ ☑

☑ **OTHER INLET PROBLEMS** problem, could not inspect thoroughly]

☐ Mis-Alignment:(pipe, chute, sidewall, headwall) ☐ Pipe Deformation ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☑ Undermining:
Location/Description: UNDER BOTH INLET SIDEWALLS ☐ ☐ ☐ ☑
Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

☑ **OPEN CHANNEL CONTROL SECTION** [no problem, could not inspect] **Width** 36' ([✓ est.] ms.) **Brdth** 3' ([✓ est.] ms.)
Notes: ☑ ☐ ☐ ☐

☑ **OUTLET OBSTRUCTION** [[✓ no problem], could not inspect thoroughly]

☐ Debris: (leaves, trash, logs, branches, ice) ☐ ☐ ☐ ☐
☐ Trees: Quantity: (<5, sparse, dense) ☐ ☐ ☐ ☐
Diameter: (<6", 6-12", >12")
Location: (entire outlet, lt side, rt side, middle, see dwg)
Notes:

☐ Brush: Quantity: (sparse, dense) ☐ ☐ ☐ ☐
Location:(entire outlet, lt side, rt side, middle, see dwg)
Notes:

Required Action

☐ Other:(beaver activity, partially/completely blocked, i.e.) ☐ ☐ ☐ ☐

Notes:

None Monitor Maintenance Engineer

{Upstream Slope, Crest, Downstream Slope, Seepage, **Principal Spillway-Inlet/Outlet**, Emergency Spillway, Lake Drain}

Required
Action

None Monitor Maintenance Engineer

☐ ***OUTLET MATERIALS*** [no problem, could not inspect thoroughly]

☐ Metal (loss of coating/paint, surface rust, corrosion (pitting, scaling), rusted out, pipe deformation) ☐ ☐ ☐ ☐
Dimensions:
Location:
Notes/Causes:

☐ Concrete
(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐
(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐
(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐
Dimensions/Location:
Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐
(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐
(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐
Dimensions/Location:
Notes/Causes:

☐ Plastic (deterioration, cracking, deformation) ☐ ☐ ☐ ☐
Dimensions:
Location:
Notes/Causes:

☐ Earthen
☐ Ground Cover: Type: (grass, crown vetch) Other: ☐ ☐ ☐ ☐
Quantity: (bare, sparse, adequate, dense)
Appearance: (too tall, too short, good)
Notes:

☐ Erosion: (other, surface runoff) ☐ ☐ ☐ ☐
Description (width/depth/length/etc):
Notes:

☐ Ruts: ☐ ☐ ☐ ☐
Location: (entire inlet, lt side, rt side, middle, see dwg)
Depth: Width: Length:
Notes/Causes: (truck/auto, motorcycle, ATV, animals, pedestrian):

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐
(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no)
Notes:

☐ Rock-Cut (weathered, erosion)
Description/Notes: ☐ ☐ ☐ ☐

☑ Other: STONE: SEVERAL ARE MISSING AND SEVERAL HAVE MORTAR MISSING. THE APRON WAS IN VERY GOOD CONDITION ☐ ☐ ☐ ☑

☑ ***OTHER OUTLET PROBLEMS*** [no problem, could not inspect thoroughly]
☐ Mis-Alignment: (pipe, chute, sidewall, headwall) ☐ Pipe Deformation ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

None Monitor Maintenance Engineer

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☑ Undermining: AT BOTH SIDES OF THE SIDEWALLS ☐ ☐ ☐ ☑
Location/Description:
Notes/Causes:

☐ Other: ☐ ☐ ☐ ☐

{Upstream Slope, Crest, Downstream Slope, Seepage, **Principal Spillway-Outlet**, Emergency Spillway, Lake Drain}

Required
Action

Required Action

None Monitor Maintenance Engineer

OUTLETEROSION CONTROL STRUCTURE (Stilling Basins)

☐ None

☑ (endwall/headwall, plunge pool, impact basin, flip bucket, USBR, baffled chute, rock lined channel) ☐ ☐ ☐ ☐

Notes: STEPPED SPILLWAY W/ROCK-LINED CHANNEL. ☐ ☐ ☐ ☑

Components (baffle blocks, chute blocks, endsill) STONE APRON ≈ 25' LONG AT BOTTOM OF STEPPED SPILLWAY.

☑ **MATERIAL** [no problem, could not inspect thoroughly]

☑ Riprap: Average Diameter:

(adequate, [✓ sparse], [✓ displaced], weathered, vegetation) (bedding/fabric noted - yes, no) ☐ ☐ ☑ ☑

Notes: IT APPEARED THAT THE MAJORITY OF STONE PROTECTION HAD WASHED DOWNSTREAM.

☐ Concrete

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

(bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐

(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐

(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐

Dimensions/Location:

Notes/Causes:

☑ **OTHER** [no problem, could not inspect thoroughly] ☐ ☐ ☐ ☐

☐ Mis-Alignment:(sidewall, headwall, entire struct.)

Location:

Description:

Notes/Causes:

☑ SEEPAGE ~~Separated Joint~~ ☑ Loss of Joint Material ☐ ☐ ☑ ☑

Location: BOTH INTERIOR SIDE WALLS

Description: FROZEN WATER IN SEVERAL AREAS.

Notes/Causes: LOSS OF MORTAR BETWEEN STONES.

☑ Undermining: + EROSION ☐ ☐ ☐ ☑

Location: IMMEDIATELY D/S OF STONE APRON / AROUND AND

Description: UNDER ENDS OF SIDEWALLS.

Notes/Causes: LACK OF ENERGY DISIPATION. WORSE AREA ON Ⓛ SIDE BELOW SPILLWAY. 4" HIGH EROSION SCARP FOR ≈ 20'.

☐ Other: ☐ ☐ ☐ ☐

☑ **DRAINS** [none, [✓ none found], no problem, could not inspect thoroughly] (See **SEEPAGE** Section for Toe Drains & Relief Wells)

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other: ☐ ☐ ☐ ☐

Flow Rate: Size: Number:

Location:

Notes:

Type: ☐ Weep Holes ☐ Relief Drains ☐ Other: ☐ ☐ ☐ ☐

Flow Rate: Size: Number:

Location:

Notes:

None Monitor Maintenance Engineer

Required Action

Required Action
None Monitor Maint. Engineer

LAKE DRAIN

☑ GENERAL

☐ None Found ☐ Does not have one ☐ ☐ ☐ ☐

☑ Type of Lake Drain (isolated control/intake tower, [✓ valve] vault w/ [✓ outlet conduit], valve in riser/drop inlet, siphon) ☐ ☐ ☐ ☐

Notes: LOCATED THROUGH RIGHT SIDE OF PRINCIPAL SPILLWAY.

☑ Operated During Inspection (yes [✓ no])

Notes: UNSURE OF ITS OPERABILITY ☐ ☐ ☐ ☑

☑ ACCESS TO VALVE/SLUICE GATE [no problem, could not inspect thoroughly]

☑ Type (not accessible, from shore, boat, walkway, other) ☑ ☐ ☐ ☐

Notes: ACCESS VALVE BY WALKING INTO D/S CHANNEL.

☐ Walkway/Platform:

☐ Concrete Deterioration ☐ Cracks (platform, piers, end supports, railing) ☐ ☐ ☐ ☐

Location:

Notes:

☐ Wood Deterioration ☐ ☐ ☐ ☐

Notes:

☐ Metal Deterioration ☐ ☐ ☐ ☐

(minor, moderate, extensive, other)

Notes:

☑ LAKE DRAIN COMPONENTS [no problem, could not inspect thoroughly]

☐ Concrete Structure ☐ ☐ ☐ ☐

Location:

Description: (deterioration, misalignment, cracks):

Notes/Causes:

☑ Valve Control (Operating Device)

☑ No Operating Device ☐ No Stem ☐ Bent/Broken Stem ☐ Other ☐ ☐ ☐ ☑

Notes/Operability:

☑ Valve / Sluice Gate

☑ Metal Deterioration: (surface rust, [✓ minor], moderate, extensive, other) ☐ ☐ ☐ ☐

Location:

Flow Rate:

Notes/Causes:

☐ Misalignment ☐ ☐ ☐ ☐

Notes/Causes:

☐ Leakage - Flow Rate: ☐ ☐ ☐ ☐

Notes/Causes:

☐ Valve / Sluice Gate

☐ Metal Deterioration: (surface rust, minor, moderate, extensive, other) ☐ ☐ ☐ ☐

Location:

Flow Rate:

Notes/Causes:

☐ Misalignment - Notes/Causes: ☐ ☐ ☐ ☐

☐ Leakage - Flow Rate: ☐ ☐ ☐ ☐

Notes/Causes:

Required Action
None Monitor Maintenance Engineer

A.

Required Action: None / Monitor / Maintenance / Engineer

☑ Outlet Conduit

☐ Metal: (loss of coating/paint, [✓ surface rust], corrosion (pitting, scaling), rusted out) ☐ ☐ ☐ ☐
Location:
Notes/Causes:

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐
(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐
(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐
Dimensions/Location:
Notes/Causes:

☐ Plastic: (deterioration, cracking) ☐ ☐ ☐ ☐
Location:
Notes/Causes:

☐ Conduit Deformation ☐ Mis-Alignment: ☐ ☐ ☐ ☐
Location:
Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Vegetation (trees, brush) ☐ ☐ ☐ ☐
Notes:

☑ Other: 8" PIPE COMES OFF A LAKE DRAIN BEFORE VALVE ☑ ☐ ☐ ☐
Notes: AND GOES UNDER GROUND. (APPEARS THAT 8" PIPE IS UNDER PRESSURE.)

☑ Energy Dissipator

☑ Type (endwall, plunge pool, impact basin, stilling basin, [✓ rock-lined channel], none) ☐ ☐ ☐ ☑
Notes: SEE "MATERIAL" SECTION UNDER PRINCIPAL SPILLWAY OUTLET EROSION CONTROL STRUCTURE.

☐ Riprap: Average Diameter: ☐ ☐ ☐ ☐
(adequate, sparse, displaced, weathered, vegetation) (bedding/fabric noted - yes, no))
Notes:

☐ Concrete (bug holes, hairline crack, efflorescence) ☐ ☐ ☐ ☐
(spalling, popouts, honeycombing, scaling, craze/map cracks) ☐ ☐ ☐ ☐
(isolated crack, exposed rebar, disintegration, other) ☐ ☐ ☐ ☐
Dimensions/Location:
Notes/Causes:

☐ Mis-Alignment: ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Separated Joint ☐ Loss of Joint Material ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

☐ Undermining: ☐ ☐ ☐ ☐
Location/Description:
Notes/Causes:

Required Action

☐ Other: ☐ ☐ ☐ ☐
Notes:

None / Monitor / Maintenance / Engineer