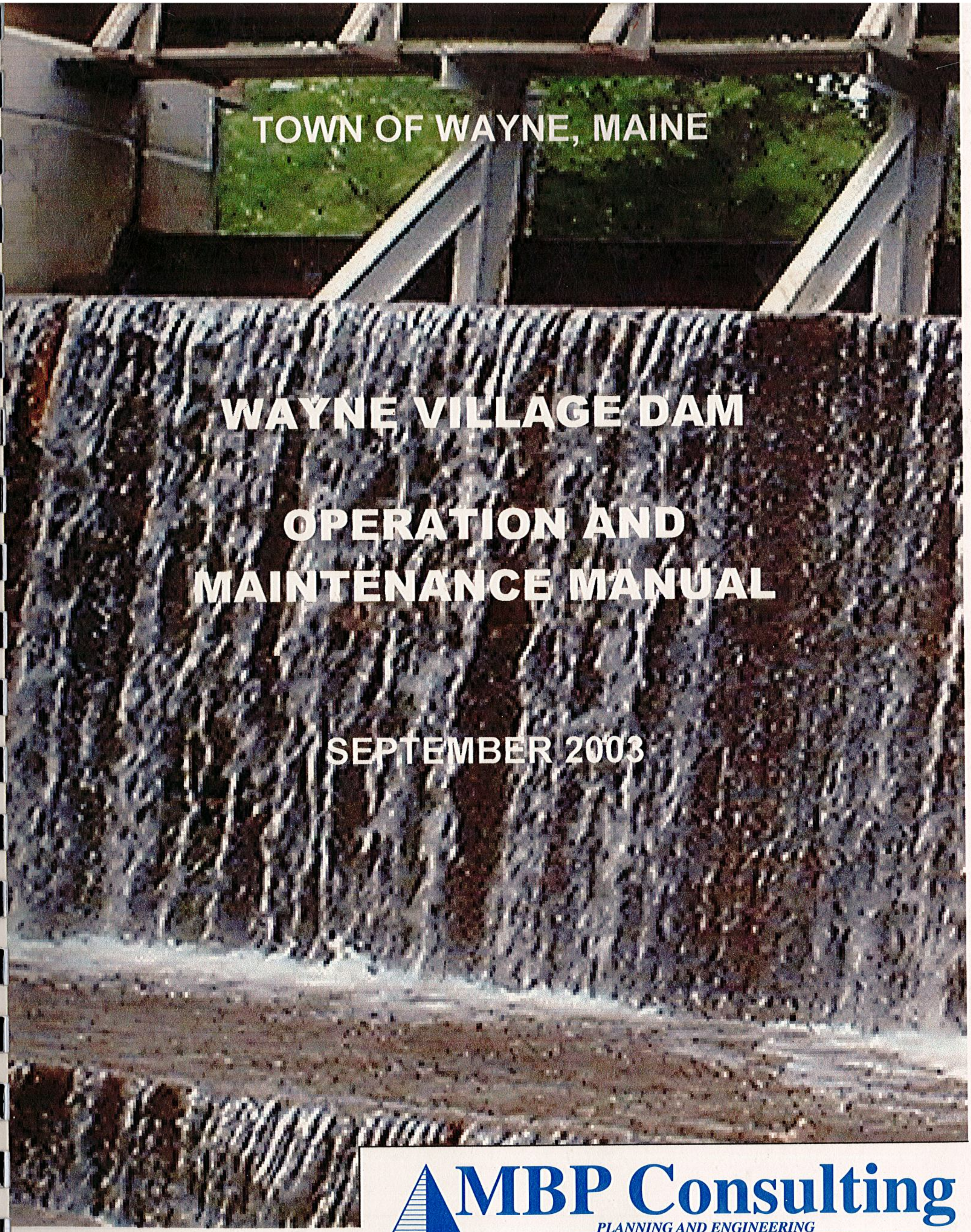

TOWN OF WAYNE, MAINE

WAYNE VILLAGE DAM

OPERATION AND MAINTENANCE MANUAL

SEPTEMBER 2003

MBP Consulting
PLANNING AND ENGINEERING

COPY #5

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OPERATION AND MAINTENANCE MANUAL

SEPTEMBER 2003

Prepared by:

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Planning & Engineering
Portland, Maine

Approved by:

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Revised:

___________________Pages________Date_________

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1.0 INTRODUCTION

This manual provides the necessary information and procedures needed for successful operation and maintenance (O&M) of Wayne Village Dam. Implementation of the O&M plan will address public safety for residents and properties located upstream and downstream of the dam, monitor earlier deterioration and extend the useful life of the dam structures and facilities. The plan also enhances the functioning of Pocasset Lake, the local ecosystem including fisheries, wildlife, and water quality, provides a stable water level, protects the lake waterfront properties, and reduces the risk and liability associated with ownership. The manual includes background information, dam description, hydrology and hydraulics, inspection guidelines, operation and maintenance procedures including lake water level management, and an emergency action plan.

The O&M manual should be reviewed annually for appropriateness and revised as necessary.

2.0 BACKGROUND

Wayne Village Dam (National No. 00370, State No. 00161, MEMA No. 101)[1] is located on Mill Stream, at the outlet of Pocasset Lake, in the Town of Wayne (Town), Kennebec County, Maine (Figure 1). The dam is owned and operated by the Town. The dam impoundment, Pocasset Lake, with a surface area of 587 acres and normal storage of 6,400 acre-ft, is used for recreation, private water supply, and fire control. The lake lies solely within the Town's boundaries.

The dam is a focal point of the Town's historical and cultural heritage and was reportedly built circa 1850 or earlier to provide water power for a variety of industrial enterprises including saw, grist, and woolen mills and a shovel handle factory. The last manufacturing facility at the dam, a crutch factory, ceased operations in 1949 and the old, 1865-mill building was demolished. Significant repairs to the dam were performed in 1974 when the spillway # 1 and the east portion of the dam were resurfaced with concrete. During that time, concrete aprons were added to spillways # 1 and # 2.

In the last two decades, the condition of the dam has been gradually declining. An inspection conducted by the Maine Emergency Management Agency (MEMA) in 1997 found significant deterioration of the dam concrete and stone masonry, cracking, excessive seepage and leakage, sinkholes in the west dike and disintegration of a concrete wall protecting the upstream slope of the dike. The MEMA report recommended that repairs to the dam to be initiated. Following the MEMA inspection, the dam hazard potential was reclassified by the US Army Corps of Engineers from significant to low. Since 1997 the condition of the dam has been progressively worsening (increase in seepage and leakage, development of large sinkholes) raising concerns about the integrity and potential failure of the dam.

A major dam rehabilitation and modification program was undertaken by the Town during the period from September 2002 through May 2003. The repair program included installation of a concrete overlay on the upstream face, placement of a concrete cap on the top, filling an old

[1] Information used in preparation of this manual is contained in Section "References".

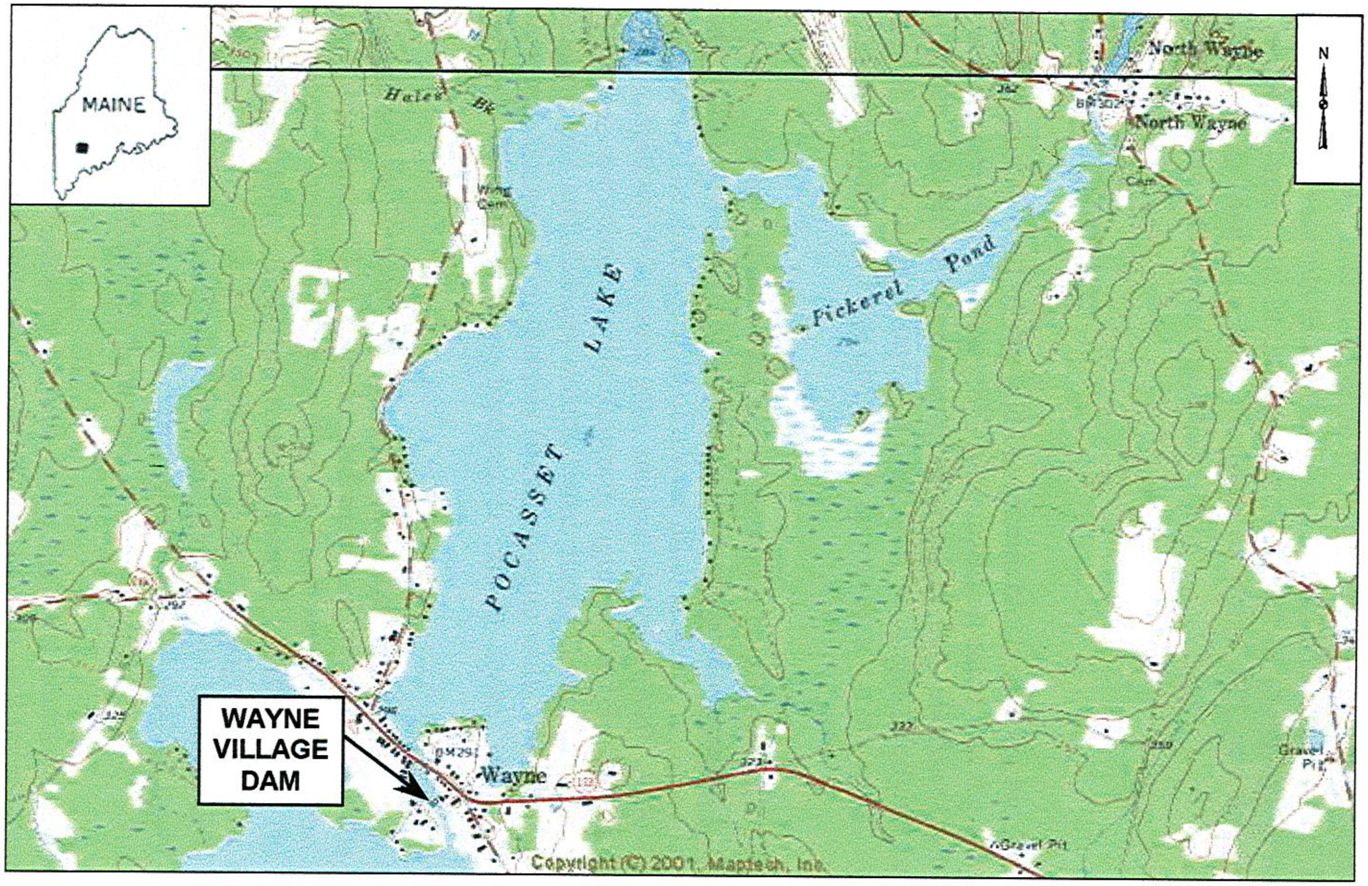

FIGURE 1
WAYNE VILLAGE DAM, WAYNE, MAINE
LOCATION MAP

sluice opening in the west section with concrete, resurfacing of the spillway # 1 sidewalls, replacement of spillway # 2 and resurfacing of the spillway sidewalls and apron, resurfacing of the upstream portion of the east abutment retaining wall, replacement of the west retaining wall, replacement of the west dike with a new concrete cutoff wall and stone riprap on the upstream and downstream slopes, and installation of a new sluice gate and trashracks. Additional repair work included improvements to the flashboard system of the spillway # 1, installation of a staff gage to monitor water level in the pond, replacement of footbridge piers, strengthening of the west stone wall in Memorial Park upstream of Route 133, and extension and deepening of residential water line intakes in Mill Pond.

3.0 DAM DESCRIPTION

The original dam was built of dry-laid cut granite blocks and rubble later cemented to increase stability and watertightness. The 2002-2003 repair revealed that the dam masonry was built on 2½ to 3-ft-high wooden cribs consisting of about 12-inch diameter logs. The cribwork, placed on the top of a 15-inch-thick layer of dark, soft sediment overlying hardpan, appeared to be sound. The cribs exhibited large open voids appearing to be one of the major sources of leakage through the dam.

The renovated Wayne Village Dam has a maximum height of about 18 ft and is approximately 175 ft long including a 124-ft-long concrete/masonry portion spanning between the east and west abutments walls. The dam consists of a west dike, west retaining wall, west section, spillway # 1, east section, spillway # 2, sluice gate, and east abutment wall. A downstream view of the dam and dam sections are schematically shown in Figures 2 and 3. Details of the dam are contained in the design plans and changes orders issued during repair construction. To provide reliable seepage control, the new dam features (west retaining wall, west dike cutoff wall, and upstream face overlays) were founded on hardpan or native, dense, low permeability glacial-marine deposits.

Prior to construction, the dam was surveyed using the USGS benchmark installed on the concrete abutment of the Route 133 bridge located upstream of the dam. The critical dam elevations surveyed included the top of the west dike, east and west sections, crest of the spillways # 1 and # 2, east abutment wall, and the top of the spillway # 1 flashboards. The repair construction was performed to match the original dam elevations and alignment. The only exception was the spillway # 2 where its sidewalls were resurfaced with 10-inch-thick concrete resulting in a shortening of the spillway length. To maintain the original spillway hydraulic capacity, the spillway top was lowered by 2½ inches.

West Dike. The 50-ft-long[2] west dike forms the west abutment of the dam. The dike is an earthen structure with a centrally located concrete cutoff wall for seepage control. The wall is 48 ft long, 30 inches at the base and 18 inches at the top and is tied to the west retaining wall. The top of the cutoff wall is at El. 286.2[3]. The excavation around the wall and top of the dike was filled with compacted screened sand. The top of the dike was loamed and seeded to approximate

[2] All dimensions are approximate and rounded to the nearest foot unless otherwise noted.
[3] All elevations are in feet and references to the National Geodetic Vertical Datum of 1929 (NGVD).

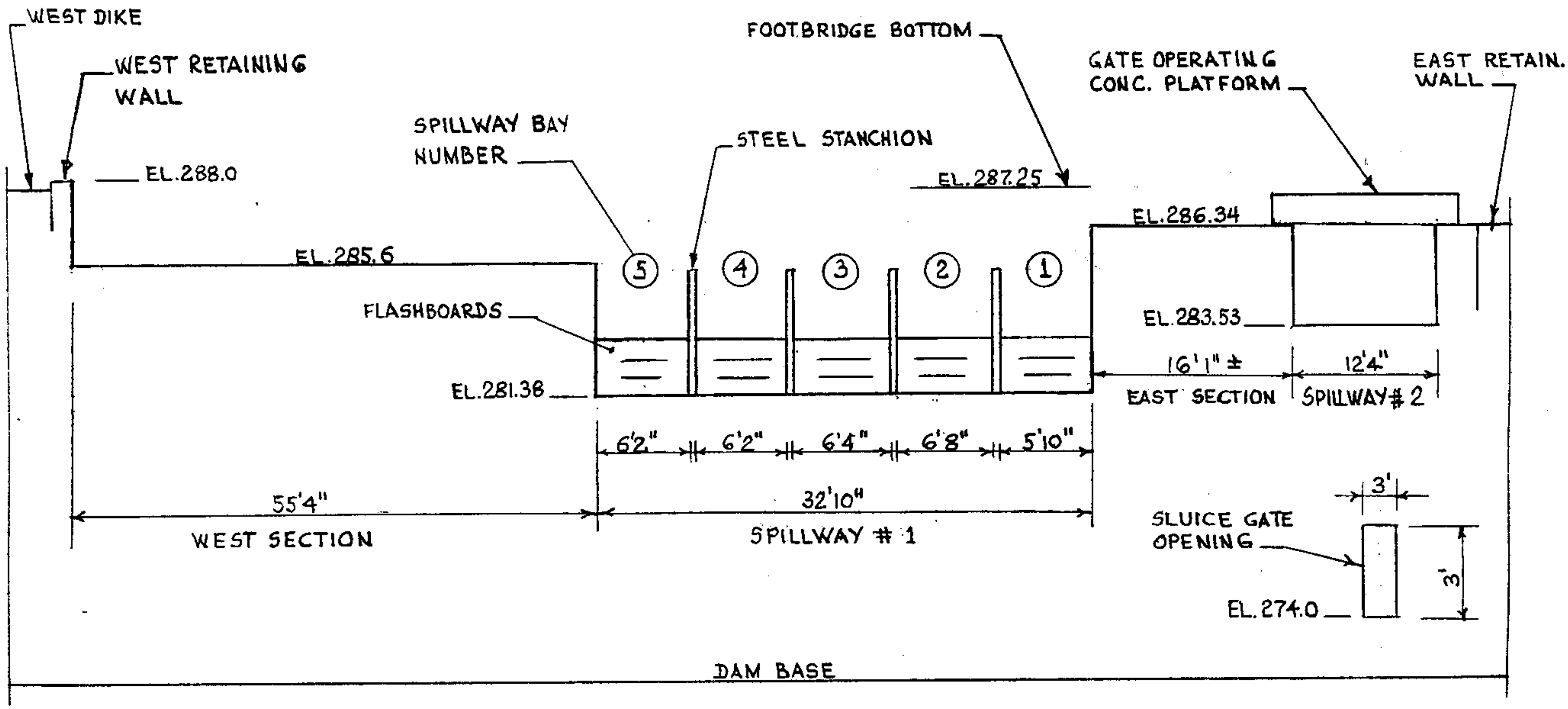

FIGURE 2	WAYNE VILLAGE DAM, WAYNE, MAINE **OPERATION AND MAINTENANCE MANUAL** **DAM DOWNSTREAM ELEVATION** ***MBP CONSULTING, PORTLAND, MAINE***

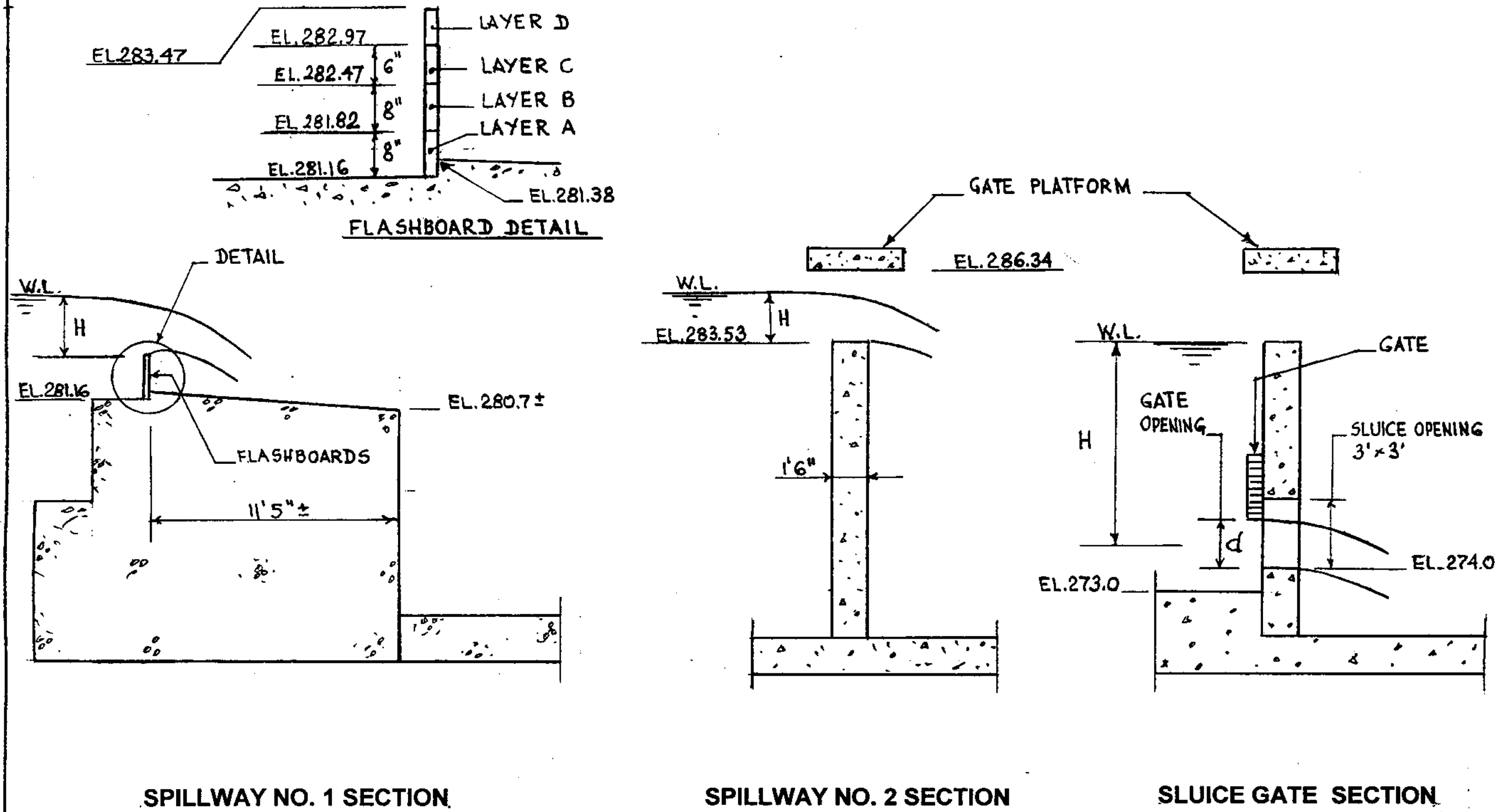

FIGURE 3	WAYNE VILLAGE DAM, WAYNE, MAINE **OPERATION AND MAINTENANCE MANUAL** DAM SECTIONS *MBP CONSULTING, PORTLAND, MAINE*

El. 287.5. The upstream slope of the dike varies from about 3H:1V (horizontal:vertical) to 10H:1V following the original grade. The downstream slope varies between 2H:1V to 3H:1V. Both slopes are protected with heavy, 2 ft to 3 ft-thick riprap placed over a 12-inch crushed-stone filter blanket.

West Retaining Wall. The west concrete retaining wall separates the west dike from a concrete/masonry portion of the dam. A 15-ft-long upstream section of the wall is of a cantilever type and contains 11-ft-wide, 18-inch-thick footing slab and 2-ft-wide stem extending to El. 288.0. The wall contains a recess to support the footbridge beams. A 17-ft-long downstream section of the wall is founded on the original stone masonry embedded into concrete. The wall is 18-inch-thick and flaring west following the alignment of the original stone masonry wall.

West Section. A 55-ft-long section of the dam between the west retaining wall and spillway # 1 supports three piers of the footbridge adjacent to the dam on the upstream side. The top of the structure is at El. 285.6, slopes downstream matching the original pitch, and varies in width from 9 ft to 10 ft. The repairs to the section included installation of a 10-inch upstream face concrete overlay embedded 18 inches into native soil and doweled to the dam; removal of deteriorated masonry and installation of a 10-inch concrete cap on the top; and filling the original sluice opening with concrete covered on the downstream side with granite blocks to match the appearance of the adjacent original masonry.

Spillway # 1. The structure is a broad-crested weir, 33 ft long and 14 ft wide. The top of the spillway is slanted downstream at about ¾ inch per foot. The downstream toe of the structure is protected with a 12-ft-wide, 2-ft-thick concrete apron and a blanket of large to medium size stone further downstream. The spillway crest is at El. 281.38 or about 4 ft-3 inches below the top of the west section.

A flashboard system, installed on the spillway crest to control the water level of Pocasset Lake, consists of removable 2-inch-thick wooden boards, steel stanchions, and operating walkway. Steel stanchions or vertical steel I-beams divide the spillway crest on five bays numbered from east to west. The stanchions houses four layers of boards designated A, B, C, and D from the bottom to the top. Layers A and B contain 8-inch-high boards and layers C and D contain 6-inch-high boards[4]. The flashboards are operated from a walkway at El. 285.9.

The recent repairs to the spillway included placement of a concrete overlay on the upstream face, resurfacing of the east and west sidewalls, installation of new, galvanized steel beams attached to the existing stanchions to facilitate operation of the flashboards, and repainting of the existing stanchions. Two piers installed over the spillway top immediately upstream of the flashboards support the footbridge.

East Section. The east dam section located between spillways # 1 and # 2 is about 16 ft long with a width at the top varying from approximately 11 ft at the spillway # 1 to 6 ft at the spillway

[4] The flashboards surveyed in the fall of 2002 prior to the start of repair construction (the top El. 282.97) reportedly contained only two of three 8-inch board layers. When the three layers of 8-inch boards installed, the top of the boards is at El. 283.38. A 6-inch-high board, a layer D, should be added to bring the top of flashboards to El. 283.47 to match the historic elevation.

2. The upstream and downstream faces are inclined at an estimated slope of 1H:8V. During the last repair, the deteriorated concrete on the top was removed and uneven surface was concreted to approximately El. 286.3. Also, the upstream face received a new, 10-inch concrete overlay.

Spillway # 2. The structure includes a new, 18-inch-thick reinforced concrete wall and concrete apron extending about 11 ft downstream. The spillway is 12 ft-4 inch-long with the top at El. 283.53 or about 2 ft above the spillway # 1 crest with the flashboards removed. The deteriorated spillway sidewalls were resurfaced with 8-inch to 10-inch concrete overlays and the apron was rehabilitated with an 8-inch overlay to El. 271.2.

Sluice Gate. A new sluice gate structure adjacent to the upstream side of the spillway # 2 consists of a 3 ft by 3 ft opening in the spillway wall, a 2.5 ft by 7 ft by 7 ft concrete footing supporting two, 1-ft-thick concrete piers, steel trashracks between the piers, and a stainless 3 ft by 3 ft slide gate with a stem and gate hoist. The gate is operated manually from a concrete platform installed over the spillway. The opening invert is at El. 274.0, one foot above the top of the footing. The top of the piers is at El. 282.0. The piers contain a removable steel grating which serves for trashrack cleaning during low water in the pond. The piers at the upstream end include slots for installation of a bulkhead or stoplogs to dewater the structure when the gate and trashracks are scheduled for repair or replacement. The concrete gate platform supporting the gate hoist is 1 ft by 4 ft by 16 ft and is enclosed with a steel handrail to provide safety for operating personnel and public.

East Retaining Wall. The wall, originally of stone masonry construction, forms the east abutment of the dam and supports the east end of the footbridge beams. The 29-ft-long, 18-ft-high upstream portion of the wall is encased in concrete. The downstream portion of the wall is built of dry-laid cut granite blocks and houses a surface water drainage outlet. The top of the upstream portion varies between El. 286.0 and El. 287.22. The original concrete facing of the upstream wall contained open voids and cracks causing significant leakage of the east abutment. The repairs to the upstream wall consisted of removal of a 3 ft by 3 ft by 20 ft concrete step attached to the wall, excavation and removal of 6 ft to 8 ft of sediment to native hardpan, and resurfacing the wall with a 10-inch concrete overlay.

Table 1 below contains a summary of statistics for each dam structure:

Table 1
Summary of Dam Statistics

Dam Structure	Feature	Elevation	Dimensions	Comments
West Dike	Top	287.5 ±	50' long, 25' wide	
	Conc. core wall, top	286.8	1.5' thick, 48' long	
West Retaining Wall	Top	288.0	2' thick, 15' long	Upstream portion
			1.5' thick, 17' long	Downstream portion
West Section	Top	285.9	55' long, 9'-10' wide	
Spillway # 1	Top	281.38	33' long, 14' wide	
	Flashboards: top	283.47	5 bays, ea. 6'3" long (aver.)	2-8", 2-6" boards
	sill	281.16		
	Apron, top	272.0 ±	33' long, 12' wide	
East Section	Top	286.3 ±	16' long, 6'-11' wide	
Spillway # 2	Top	283.53	12'4" long, 1,5' thick	
Gate Sluice	Opening, invert	274.0	3' x 3' opening	
	Trashrack piers, top	282.0	2-1' thick, 7' long	
	Trashracks: top	282.0	9' high, 5' wide	Removable grating on top of trashracks
	bottom	273.0		
	Gate service platform	287.3 ±	16' long, 4' wide	Top elevation
East Retaining Wall	Upstream portion: top	287.22	29' long, 2'-3' thick	Highest elevation

4.0 HYDROLOGY AND HYDRAULICS

Watershed Hydrology. The peak flows from the dam watershed were estimated for different recurrence intervals using a methodology developed by the US Geological Survey (USGS). The methodology is based on drainage area and basin wetlands (lakes, ponds, reservoirs and rivers). According to the FEMA flood study, the drainage area for Wayne Village Dam is 59 sq. mi. The dam watershed includes a number of impoundments such as Pocasset Lake, Lovejoy Pond, Echo Lake, Hopkins Pond, and Flying Pond. A wetland area of 12 percent was assumed based on the recent hydrologic study for Androscoggin Lake (E·PRO, 2002). The following peak flood flows were calculated for 2, 5, 10, 25, 50, and 100-year recurrence intervals (Table 2):

Table 2
Flood Peak Flows

Recurrence Interval (years)	Peak Flow (cfs)
2	1,290
5	1,920
10	2,370
25	2,970
50	3,430
100	3,910

The calculated 50-year peak flow of 3,430 cfs is in close agreement with the Q_{50} of 3,319 cfs determined by the MDOT for replacement of Mill Stream Bridge located about 700 ft upstream of the dam.

Dam Hydraulics. The hydraulic capacity of the dam was determined by summing the discharges calculated for each water conveying structure at different pond water levels up to El. 287.5. The hydraulic structures included spillways # 1 and # 2, sluice gate, and east and west sections. The spillway # 1 flow was determined for each bay with flashboards removed and in place. In the last case, the flow over different layers of boards was calculated. The broad-crested weir flow was used to determine the capacity of the spillway # 1 (without flashboards), spillway # 2, and the east and west sections. A sharp-crested weir was assumed for the spillway # 1 with flashboards. Orifice flow was assumed for the sluice with the gate openings varying from 1 inch to 3 ft.

The results of the hydraulic analysis for each structure and dam were tabulated, plotted and presented in Tables A1-A4 and Figures A1-A9 of Appendix A "Dam Hydraulics". Table 3 below shows the total hydraulic capacity of the dam for three critical pond water elevations: 285.9 (the top of the west section), 286.3 (the top of the east section), and 287.5 (the top of the west dike):

Table 3
Dam Hydraulic Capacity

Pond Elevation (ft)	Dam Discharge (cfs)
285.9	959
286.3	1,307
287.5	2,207

As shown in Table 3, the dam has a relatively small hydraulic capacity and can only safely pass floods up to the 10-yr recurrence interval. When the pond level reaches El. 287.5 (the top of the west dike), the east dam abutment and pond bank would be overtopped requiring sandbagging to keep the pond within its banks. However, with flood exceeding the 25-yr recurrence interval the water level in the Androscoggin Lake, located immediately downstream of the dam, begins rising due to a combination of the backflow from the Androscoggin River and the inflow from the upstream 83-sq. mi watershed. During the 100-yr flood event, the Androscoggin Lake water level would be at El. 286.4 (FEMA) and up to El. 288.0 (E·PRO) with the Pocasset Lake level at El. 289.2 (FEMA). As a result, the dam would be partially or completely submerged. Submergence of the dam was documented during the 1936, 1951, 1953, 1973, and 1987 floods.

Minimum Flow. There was no specific minimum flow or aquatic base flow requirements stipulated by DEP in the dam repair construction permit issued in August 2002. A minimum flow of 17.7 cfs was determined assuming the unit flow of 0.3 cfs per square mile of the watershed area based on the IF&W criteria. During the dry season, the watershed flow is controlled by the upstream dams and Pocasset Lake receives inflow from the adjacent drainage area of 9 sq. mi (E·PRO), the area between Wayne Village Dam and Lovejoy Pond Dam. The minimum flow from the adjacent lake watershed was determined as 2.7 cfs, which should be provided downstream during dry season with no contributing inflow from the upstream dams.

Lake Drawdown. Uncontrolled outflow through the dam (spillway flashboard leakage or sluice gate opening) may have a significant effect on the lake water level particularly during dry season with no appreciable inflow into the lake. The lake drawdown due to the dam outflow was calculated assuming no change in the lake surface area for the duration of flow and no inflow into the lake. The details of the lake drawdown are included in the tabulated (Table A5) and graphic (Figure A10) form in Appendix A. A summary of the lake drawdown due to the dam outflow and flow duration is presented in Table 4 below:

Table 4
Pocasset Lake Level Drawdown Due to Outflow at Dam

Outflow (cfs)	Duration (days)			
	5	10	20	30
3	0.6"	1.2"	2.4"	3.7"
5	1.0"	2.0"	4.1"	6.1"
10	2.0"	4.1"	8.1"	12.2"
15	3.0"	6.1"	12.2"	18.3"
30	4.1"	8.1"	16.2"	24.3"

The results show that a continuous outflow of 5 cfs to 10 cfs at the dam, a normal estimated spillway flashboard leakage, can lower the lake water level by 4 to 8 inches during a 20-day period without inflow into the lake.

5.0 MAINTENANCE

Maintenance is necessary to retain the dam in safe and functioning condition, repair or replace failed components, prevent or treat deterioration, and repair damages caused by natural events (flooding, ice movement, drought, earthquakes), weathering, or vandalism.

Proper maintenance of the dam will extend the service life of the structures and significantly reduce risk, liability, and future cost of dam repairs.

A dam maintenance plan should be based primarily on systematic, frequent, and regular inspections. The inspections should assess performance of the dam, determine compliance with the O&M manual, assess the adequacy of previous O&M activities, identify O&M needs, identify conditions that may threaten life and property, and develop a schedule to address O&M needs.

5.1 Inspections

Four types of inspections may be required over the life of the dam: monitoring, emergency, annual, and comprehensive.

Monitoring of the dam should be routinely conducted at least weekly to observe operation and assess performance. On-site monitoring may be accomplished by anyone, including dam keepers or operators, landowners, or Town's representatives. Any change in the dam condition and operation observed, irregularities, or abnormal developments between scheduled inspections should be identified and reported to the O&M personnel.

Monitoring of the dam should include recording the pond water level using a staff gage installed on the upstream face of the west retaining wall. The pond level should be recorded weekly. During significant meteorological events such as heavy rainfall, flooding, or extreme drought, the pond water level should be recorded more frequently up to daily and hourly. The pond levels measured should be entered into the form included in Appendix B.

Emergency inspections are conducted if a major event, such as a significant flood due to extreme rainfall or snowmelt, ice jamming, earthquake, failure of the upstream dams, sluice gate malfunctioning, excessive seepage, pond dewatering, vandalism, and loss of life or severe personal injury has occurred at the dam site. The inspection of the dam structures is performed before, during or immediately after the site event to evaluate damage and record all condition changes.

Annual inspections should be performed to determine if the dam and its structures are functioning as intended. A detailed description of items to observe during annual inspection is included in Subsection 5.2. During each inspection, a checklist for the safety and maintenance items should be used (Appendix C). Photographs should be taken to document deficiencies or the change in conditions that may have an adverse impact on the performance of the dam. The record of the annual inspection should contain the following:

- Inspection date
- Names of inspectors and participants
- Structures inspected
- Description of conditions observed including photographic documentation
- Complete inspection checklist
- A form with recorded pond water levels
- Maintenance work required
- A schedule to address O&M needs

Comprehensive inspections are performed to determine the structural integrity of the dam and determine whether the dam meets current engineering practice and applicable regulatory criteria. The comprehensive inspection is conducted once every three years by a professional, licensed engineer experienced in dam design, construction, and performance evaluation. The results of the inspection should be included in a report. The inspection report should review all data related to the dam, the O&M plan, and all previous inspection reports, describe the condition of each structure, abutments, Mill Pond area, downstream discharge channel, and footbridge, and contain recommendations to improve operation, maintenance, and safety of the dam.

5.2 Observation Items

During the dam inspections, specific attention should be given to the following items:

- Concrete Structures. The concrete retaining walls, upstream face and downstream face overlays, top caps, spillway crests, sidewalls and aprons, and sluice gate platform should be visually observed for signs of movement, weathering, erosion, cracking, spalling, efflorescence, seepage, rebar corrosion, and vegetation growth. The spillway crest should be checked for erosion, obstructions to flow, and debris accumulation. Vertical and horizontal construction joints should be observed for evidence of leakage, openings, offsets, differential movement, and condition of the joint sealant. Stone blankets downstream of the spillway aprons should be observed for missing rocks, bare areas, scour, and toe undermining.

- Earthen Structures. The west dike and east abutment should be observed for indication of settlement, movement, sloughing, bulging, subsidence, sinkholes, cracking, seepage, piping, animal burrows, and vegetation growth. Special attention should be paid to interaction of soil material with the east and west retaining walls. The top of the dike should be observed for open bare spots, erosion, tree, brush, and woody growth, and signs of foot and vehicular traffic. Rock riprap on the upstream and downstream slopes should be observed for evidence of instability, damage, displacement, missing stone, vandalism, and vegetation growth.

- Spillway Flashboards. The wooden boards should be observed for evidence of deterioration, rot, splitting, excessive leakage, missing boards, debris accumulation, and acts of vandalism. The steel locking devices should be observed for corrosion, proper functioning, and signs of tampering. The steel stanchions housing the boards should be observed for signs of movement, bending, rust, corrosion, heavy oxidation, and paint peeling. The wooden operating walkway should be observed for indication of movement, sagging, cracking, splitting, rot, missing boards, and acts of vandalism.

- Sluice Gate and Trashracks. The sluice gate should be observed for signs of leakage around its perimeter, rust and corrosion of steel frames, guides, and hoisting operator, stem bending, and acts of vandalism. The trashrack structure should be observed for signs of steel bar corrosion and bending, clogging, debris, and condition of steel grating.

- Abutments. The dam abutments should be observed for signs of erosion, seepage, sinkholes, instability, and vegetation overgrowth. In addition, the east abutment stone masonry wall should be observed for indication of movement, displacement, loose and dislodging stone blocks, and impact of the surface water drainage pipe outlet on the condition of the wall and adjacent dam concrete.

- Pond. The Mill Pond area upstream of the dam should be observed for evidence of siltation and presence of eddies and whirlpools. Pond banks should be observed for signs of slope instability, erosion, benching, undercutting, debris accumulation, and burrowing by animals.

- Downstream Channel. The downstream discharge channel between the dam and Androscoggin Lake should be observed for obstructions, encroachments, sediment deposition, streambed scour, slope erosion and stability, rock condition on the stream floor, debris accumulation, overhanging trees, and new residential structures.

5.3 Preventive Maintenance

A preventive maintenance plan should be developed and based on the results of the dam inspections. All maintenance actions performed should be recorded and included into the dam maintenance log (Appendix D). The following items should be included into the regular maintenance plan to assure safe and proper functioning of the dam:

- Concrete Structures. Deteriorated, spalled, cracked, and eroded concrete should be repaired. Spalls 1 to 4 inches deep and cracks less than ¼ inch should be repaired with cement mortar and sealing compound, respectively. The concrete used for repairs should match or exceed the quality of the original concrete. Construction joints with the sealant compound missing should be repaired with materials similar to that used in the original construction.

- Masonry Structures. Loose, unstable, cracked, dislodged or missing large stone, rubble, and cut granite blocks from the downstream face of the west section and the downstream portion of the east abutment retaining wall should be replaced or strengthened in the original position. If cementitious or polymer grout is used, weep holes should be provided for free drainage of the masonry. The repair should preserve the aesthetics and natural appearance of the old stonework.

- Earth Structures. All soil removed from the west dike and east abutment by erosion, vehicles, rodents, vandalism, or other causes should be replaced to the original slopes and grades. All replacement soil should be compacted and graded to prevent ponding or concentrated drainage. The materials applied for repairs should match the type and gradation of soils used for construction of the structures.

- Rock Riprap. Rock riprap on the upstream and downstream slopes of the west dike that is dislodged or missing should be replaced or moved back into the original position. Protective stone washed out from the toe of the spillway # 1 and # 2 concrete aprons should be replaced with heavy rock riprap similar in gradation to that used on the slopes of the west dike.

- Vegetation. A native grass cover should be established on the top of the west dike. All bare areas or areas in poor condition damaged by erosion, freezing, drought, or traffic should be fertilized, watered, and reseeded. Mow grass regularly to maintain vigorous turf.

- Trees, Brush, Woody Growth. Control weeds, brush, woody vegetation, and trees on the dam structures and within 20 ft upstream and downstream of the dam by spraying or removal. This vegetation should be controlled before it reaches 1 ft in height or 1 inch in diameter. All pesticide application shall be done in accordance with applicable laws and regulations.

- Debris. The crest and apron of the spillways # 1 and # 2, upstream face and downstream toe of the dam, upstream and downstream slopes of the west dike, sluice gate trashracks, and water surface and banks of Mill Pond should be kept clear of trees, logs, debris, trash, and other obstacles which will interfere with proper functioning of the dam structures and impede condition monitoring. All debris should be collected and disposed of at least annually and immediately after major floods.

- Spillway Flashboards. Missing, deteriorated, or vandalized boards should be replaced immediately. The board locking device should be checked for proper performance. Any steel stanchions that show signs of rust, heavy oxidation, and peeling should be cleaned and coated with a paint and primer as used during construction or equal. A sagging and structurally unsafe operating walkway should be repaired immediately.

  With the sluice gate closed, total flashboard leakage should not exceed 3 cfs or 0.6 cfs per bay which corresponds to the minimum flow of 2.7 cfs. The leakage reduction may be achieved by installation of a PVC liner on the upstream face of the boards and/or fastening a ¼ to ½-inch flat rubber seal to the bottom and sides of the boards.

- Sluice Gate. The sluice slide gate and hoisting operator should be kept in good working order. The gate operator should be lubricated in accordance with manufacturer's specifications (Whipps Inc., Athol, MA, tel. 978-249-7924). As a minimum, the gate should be operated and tested at each annual inspection. The gate test consists of lifting the gate to specified position (1 ft to 2 ft) and lowering the gate to fully closed position. During the testing, the gate should be checked for smooth operation, binding, improper resistance, stem alignment, rough and noisy movement, seal wear, and leakage. Excessive force should not be used when operating the gate. Repair or replace all nonfunctional hardware such as a stem, stem guide, seals, and anchor bolts. If necessary, dewater the gate by installation of bulkhead or stoplogs, inspect, and repair or replace damaged parts. During dewatering, the trashracks should be inspected and bent, corroded, loose, or missing bars, supports, and anchor bolts should be repaired or replaced.

- Handrail. The steel handrail installed on a concrete operating deck of the sluice gate should be repaired as needed. Rusted posts and rails should be cleaned and coated with cold galvanized paint. Loose or missing anchor bolts should be tightened or replaced immediately.

When there are signs of extensive seepage, piping, subsidence, structural movement, stability concerns, or progressive concrete deterioration, a registered dam engineer should be retained to develop a plan with appropriate corrective measures.

6.0 OPERATION

Operation of the dam should provide safe functioning of the facility as intended, maintain the lake water level to satisfy seasonal recreational and water supply requirements, provide fire control, preserve lake water quality, and allow downstream minimum flow releases.

The operating requirements include a schedule of inspections, maintenance and repairs, spillway # 1 flashboard and sluice gate operation, and lake water management procedures.

6.1 Inspection Schedule

A description of monitoring, emergency, annual, and comprehensive inspections is included in Section 5.0 of this manual. The Town will develop and publish an inspection schedule for each type of inspection. A general schedule for inspection of the dam facilities is provided below (Table 5):

Table 5
Dam Inspection Schedule

Inspection Type	Inspection Frequency	Inspecting personnel
Monitoring	Irregular	Dam operator, town citizens
Emergency	Daily during major event [a]	Dam Operator/Professional Engineer
Annual	Once a year	Dam Operator/Engineer
Comprehensive	Once every 3 years	Professional Engineer

a. Significant flood, ice jamming, earthquake, upstream dam failure, sluice gate malfunctioning, excessive seepage, pond dewatering, vandalism, loss of life or severe personal injury at the dam site.

6.2 Maintenance Schedule

Routine maintenance procedures are described in Section 5 of this manual. The following maintenance schedule for the dam structures should be based on the results of regular inspections (Table 6):

Table 6
Maintenance Schedule

Maintenance Type	Frequency	Comments
Concrete repair	Within 3 months	
Earthwork repair	Within 3 months	West dike and dam abutments
Stone masonry repair	Within 3 months	West section, east abutment wall
Rock riprap repair	Within 3 months	West dike, toe of spillway aprons
Spillway # 1 flashboard repair	Within 1 week	Boards, stanchions, walkway
Sluice gate repair	Within 1 month	
Handrail repair	Within 1 week	
Weed, brush, tree control	Annually	Dam, west dike, abutments
Grass mowing	Monthly	West dike, abutments
Debris control:		Remove debris of dam site
Spillways	Monthly	Flashboards, crests, aprons
Sluice trashracks	Twice a year	Pond level below El. 282.5
Dam toe, west dike, pond	Annually	Immediately after major floods

6.3 Sluice Gate Operation

The sluice gate is operated to provide minimum flow releases downstream of the dam, lower the pond to conduct repair work and inspect submerged portions of the dam, draw the lake down to provide additional storage in anticipation of a major flood, and during an emergency.

The sluice gate is opened when the minimum flow releases are required. This condition can occur when leakage through the spillway # 1 flashboards is less than 3 cfs or the pond level drops below the spillway crest, El. 281.4. The minimum flow can be provided by opening the gate by 1 to 2 inches (Appendix A, Table A3, Figure A8).

During the dry season with a low water level in the lake, the flow through the dam can be restricted by sealing the leaking spillway flashboards and providing controlled downstream releases by opening the sluice gate. A prolong operation of the gate during the winter should be minimized to avoid freezing of the gate in the lifted position leading to uncontrolled flow releases.

6.4 Water Management

Pocasset Lake is a major natural resource providing fishing, boating, swimming, water supply, and fire control, accommodating wetlands and wildlife, and providing an aesthetic setting for numerous residential developments.

The lake is a relatively shallow impoundment with a surface area of 587 acres and a maximum and average depth of 20 ft and 16 ft, respectively. The water quality is monitored annually for clarity, phosphorous, and dissolved oxygen by the DEP since 1976. The physical and chemical parameters measured during the last 25 years appear stable and show no signs of deterioration of the water quality.

The Pocasset Lake waters level is influenced by the inflow from the 59-sq. mi watershed area, rate of evaporation, and outflow at the dam. The dam discharge prior to the 2002-2003 repair was controlled by the height of the spillway # 1 flashboards, flow over the spillway # 2, sluice intake, the notch in the top of the west section the dam (the area of the original sluice), and extensive leakage through spillway flashboards, west dike, and other portions of the dam. The dam repair resulted in sealing of the original sluice and notch in west section and elimination of excessive dam and west dike leakage. Installation of the sluice gate also enhanced the lake level management efficiency.

The historic lake levels at the dam vary about 2.5 ft to 3 ft: from the high level in the spring, El. 285.0 or 7 inches below the top of the west section, to the low level during the fall and winter, El. 282.0-282.5 or the top of the original bottom board layer. The summer level fluctuates near the top of fully installed flashboards, El. 283.5.

Traditionally, the lake water level has been controlled by removal of one board in the fall (two boards in place), removal of two boards on April 1 (one board in place), and reinstallation of all three boards on June 1 prior to the start of the summer, recreational season.

To maintain the lake as close as possible to the historic levels, provide the minimum downstream flow releases, and pass the major flood flows safely, the following operation schedule of the spillway flashboards and sluice gate is recommended:

- <u>Late Fall-Winter Period: Lake Drawdown</u>. Beginning October 1, two layers of 8-inch boards are installed on the spillway crest # 1, the sluice gate is closed, and the lake is gradually lowered. By November 1, before formation of an ice cover, the lake is drawn down to El. 282.5, the top of the flashboards. The boards remains in place with the gate closed until March 31. The leakage through the boards during this period is not critical and allows a minimum flow. Private water lines, susceptible to freezing in the winter, should be lowered to a minimum El. 279.0 or 3.5 ft below the target water level.

- <u>Spring Period: Lake Refilling</u>. Between April 1 and May 30, one layer of the 8-inch boards on the spillway # 1 crest is in place and the sluice gate is closed. During this period, the lake is refilled and maintained at a level not to exceed El. 285.0, the maximum water level, which is 7 inches below the top of the west section. If the lake water level continues rising and threatens overtopping the west section, the spillway crest is cleared of all boards and the sluice gate is opened to provide additional hydraulic capacity.

- <u>Summer-Early Fall: Lake Recreational Period.</u> Between June 1 and September 30, the flashboards are reinstalled to the maximum height with two layers of 8-inch boards and two layers of 6-inch boards in place. The lake level is maintained at El. 283.5, the top of the flashboards, and the sluice gate is closed. When the lake level drops below El. 283.5, the flashboards are sealed to reduce leakage to 2 cfs or less. With the flashboards sealed, the sluice gate is open (1 to 2 inches) to supplement the flashboard leakage for minimum flow releases.

Any significant drop in the target summer water level should be avoided due to the impact on boat access from private docks and moorings and potential increase in water turbidity and concentration of nutrients.

- Major Flooding. When a major flood, in excess of the 2-year to 10-year recurrence period, is anticipated and threatens overtopping the dam and east abutment, all flashboards of the spillway # 1 should be removed and the sluice gate fully open to lower the lake and provide additional storage. The owners of the upstream dams should be contacted and requested to hold the water to reduce downstream releases.

The following is the summary of operating schedule for management of the Pocasset Lake water level (Table 7):

Table 7
Pocasset Lake Water Level Management Schedule

Water Control Structure	Operating Period	Operating Procedure	Lake Water Level	Comments
Spillway # 1 flashboards	October 1-March 31	Two 8" boards in place	El. 282.5	
	April 1-May 30	One 8" board in place	El. 285.0	Remove all boards when water rising to El. 285.0
	June 1-September 30	All four boards in place	El. 283.5	When pond below El. 283.5 seal flashboards to minimize leakage
	Unspecified	All boards removed	Lake level rising rapidly	Major flooding
Sluice gate	October 1-March 31	Gate closed	El. 282.5	
	April 1-May 30	Usually closed	El. 285.0	Gate open when spillway boards removed and lake approaching El. 285.0
	June 1-September 30	Gate open 1" to 2"	El. 283.5	Gate open when flashboard leakage less than 2 cfs
	Unspecified	Gate fully open	Lake level rising rapidly	Major flooding

One year after implementation of the O&M manual, the results should be evaluated and the height of the spillway # 1 flashboards and the sluice gate operation for each operating season should be readjusted and modified if necessary.

7.0 EMERGENCY ACTION PLAN

The low hazard potential classification assigned to Wayne Village Dam is based on consideration of the effects of a failure but not on the actual condition of the dam. According to FEMA, a low hazard potential dam is a structure where failure or misoperation results in no probable loss of human life and economic or environmental losses downstream of the dam. However, failure or misoperation of Wayne Village Dam may result in significant economic and environmental damage to the Town due to negative effects on Pocasset Lake and Mill Pond upstream of the dam including interruption of water supply and fire control, loss of environmental benefits, damage to wildlife habitat, fishery, and water quality, potential for ice jamming, and reduction in shoreline property values.

In general, an emergency action plan (EAP) should be prepared and activated in the case of an emergency. An emergency in terms of dam operation is defined as an impending or actual sudden release of water caused by an accident, misoperation, sabotage, or failure of a dam. An EAP identifies potential emergency conditions at the dam and specifies preplanned actions to be followed to minimize damage to the upstream and downstream properties.

7.1 Potential Emergency Problems and Immediate Response Actions

Emergency conditions threatening safety of the dam should be recognized and identified by a dam operator and/or shoreline owners close to the dam and an immediate response should be initiated. The following potential problem indicators and possible immediate response actions were identified to provide safe operation of Wayne Village Dam (Table 8):

Table 8
Potential Emergency Problems and Immediate response Actions

Potential Emergency Problems	Immediate Response Actions
Downward movement of concrete/masonry structures with excessive leakage observed	Remove spillway # 1 flashboards, open sluice gate and lower the pond to a safe level; stabilize affected structures
Slides on upstream or downstream slope of west dike with loss of freeboard [5]	Remove spillway # 1 flashboards, open sluice gate and lower the pond to a safe level; stabilize slopes; restore freeboard

(over)

[5] Freeboard for the west dike is 2.5 ft: the difference in elevations between the top of the structure (El. 287.5) and maximum pond water level established at El. 285.0.

Table 8 (cont'd)

Potential Emergency Problems	Immediate Response Actions
Erosional seepage flow (piping) through west dike, east abutment, or dam foundation with water cloudy at exit areas	Remove spillway # 1 flashboards, open sluice gate and lower the pond level until non-erosive velocity reached or seepage stops; place impermeable material at seepage entrance and drainage blanket at seepage exits
Excessive settlement of west dike, east abutment, or dam structures	Remove spillway # 1 flashboards, open sluice gate and lower the pond to a safe level; place sandbags or sand/gravel material to restore freeboard; maintain low level in pond until permanent repairs can be made
Significant flood threatening overtopping east bank of Mill Pond and erosion of east dam abutment is anticipated	Remove spillway # 1 flashboards, open sluice gate and lower the pond to provide additional storage; place sandbags or sand/gravel berm along the east bank to keep flood waters within banks
Binding or jamming of sluice gate resulting in excessive uncontrolled release of water downstream	Install bulkhead or stoplogs into pier slots upstream of gate; dewater the gate; repair or replace the gate

7.2 Emergency Notification

The dam operator who is responsible for operation and maintenance of the dam and who visits the site frequently will likely be the first person to identify a potential emergency problem with the dam and initiate the emergency response. The following is a simplified, arranged in a prioritized order, notification list of Town personnel, agencies, and organizations responsible for implementing immediate emergency actions (Table 9):

Table 9
Emergency Notification List

Organization	Personnel	Telephone
Town of Wayne: Dam Operator	George Richardson	685-4359 (H)
Dam Operator	Wayne Bryant	685-9525 (H)
Fire Department	John Christopher	911
Town Manager	Greg Davis	685-4983(O)
Board of Selectmen	Ken Bate	685-9857 (H)
Kennebec County Emergency Management Agency	Vincent Cerasuolo	623-8407 (O)
Maine Emergency Management Agency	Arthur Cleaves	1-800-452-8735
Town of Fayette, Town Manager	Jim Collins	685-4373
Contractor: Reed & Reed	Charlie Guerette	443-9747 (O),377-2514 (H)
Engineer: MBP Consulting	Myron Petrovsky	773-5425

Upon observing a potential emergency problem(s) with the dam, the dam operator should immediately notify the Town's Fire Department and continue monitoring the situation. The Fire Department will notify the Town Manager and Board of Selectmen and arrive to the dam site to evaluate the situation. Following the assessment of severity of the problem(s), the Town Manager will notify the Kennebec County Emergency Agency, MEMA, and Town of Fayette. If immediate remedial actions are required, the Town Manager will notify the Contractor and Engineer to assess the dam conditions and develop emergency repairs.

The Town is responsible for assigning qualified personnel for operation of the dam. The personnel should be properly trained in conducting routine inspections and performing the functions necessary during an emergency. The emergency notification list should be displayed at conspicuous locations in the Fire Department and Town Office and carried by a dam operator at all times. The emergency notification list should be updated annually.

8.0 REFERENCES

1. "Flood Insurance Study. Town of Wayne, Maine, Kennebec County". Federal Emergency Management Agency (FEMA), April 3, 1989.
2. Wayne Village Dam. Hazard Potential Classification. US Army Corps of Engineers, Letter to Maine Emergency Management Agency (MEMA), January 14, 1998.
3. "Surficial Geology of the Wayne Quadrangle, Maine" by Woodrow B. Thompson and Geoffrey W. Smith. Maine Geological Survey, 1977.
4. "Inspection of Wayne Village Dam". MEMA, August 1997.
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7. "Wayne Village Dam Repair, Wayne, Maine". Application for Natural Resources Protection Act Permit. Prepared by Town of Wayne and MBP Consulting. June 2002.
8. "Contract Documents for Wayne Village Dam Repair". Town of Wayne, Maine. September 2002.
9. Wayne Village Dam Repair Construction. Change Orders. MBP Consulting. October 2002-January 2003.
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11. "Dead River Dam. Study to Minimize Flood Flows from the Androscoggin River into the Androscoggin Lake". E·PRO, April 2002.
12. MDOT Intercorrespondence: A. Mann to G. Scofield, Hydrologic Studies for Bridges in Upton, Wayne, and Newcastle. November 8, 2001.
13. Correspondence with Walter A. Reiner, Jr., MD. Wayne, ME: Pocasset Lake Water Quality Measurements, 1976-2002. DEP, Bureau of Land and Water Quality.
14. "Regulation of Water Levels and Minimum Flows". MDEP, Bureau of Land and Water Quality, March 2003.
15. "Hazard Potential Classification Systems for Dams". FEMA, October 1998.
16. "Emergency Action Planning for Dam Owners". FEMA, October 1998.

APPENDIX A

DAM HYDRAULICS

A1. SPILLWAY # 1 DISCHARGE

TABLE A1
SPILLWAY # 1 DISCHARGE (cfs)

Pond Elev. (ft)	Bay 1	Bay 2	Bay 3	Bay 4	Bay 5	Total
	Flashboards Removed					
281.4	0	0	0	0	0	0
281.8	3.9	4.4	4.2	4.1	4.1	21
282.5	18	20	19	19	19	95
283.0	31	36	34	33	33	166
283.5	47	53	51	49	49	249
284.0	64	74	70	68	68	344
284.5	84	96	91	89	89	447
285.0	105	120	114	111	111	560
285.6	132	151	143	140	140	706
286.3	166	190	181	176	176	889
	Flashboard layer A in Place					
281.8	0	0	0	0	0	0
282.5	12	13	12	12	12	60
283.0	25	29	27	27	27	135
283.5	43	49	46	45	45	228
284.0	63	72	68	66	66	336
284.5	85	98	93	90	90	456
285.0	110	126	120	117	117	589
285.6	143	163	155	150	150	762
286.3	183	210	199	194	194	982
	Flashboard layers A and B in Place					
282.5	0	0	0	0	0	0
283.0	6.8	7.8	7.4	7.2	7.2	36
283.5	19	22	21	20	20	103
284.0	35	40	38	37	37	189
284.5	54	62	59	58	58	291
285.0	76	87	83	80	80	407
285.6	105	120	114	111	111	561
286.3	143	163	155	151	151	762
	Flashboard layers A, B, and C in Place					
283.0	0	0	0	0	0	0
283.5	6.8	7.8	7.4	7.2	7.2	36
284.0	19	22	21	20	20	103
284.5	35	40	38	37	37	189
285.0	54	62	59	58	58	291
285.6	81	92	88	85	85	431
286.3	115	132	125	122	122	617
	Flashboard layers A, B, C and D in Place					
283.5	0	0	0	0	0	0
284.0	6.8	7.8	7.4	7.2	7.2	36
284.5	19	22	21	20	20	103
285.0	35	40	38	37	37	189
285.6	59	67	64	62	62	313
286.3	90	103	98	95	95	482

(over)

TABLE A1 (cont'd)

A discharge capacity of the spillway # 1 was calculated using the weir equation

$$Q=CLH^{1.5},$$

where:

Q – discharge over spillway in cubic feet per second (cfs)

C – discharge coefficient:

C=2.63 for a broad-crested weir with flashboards removed;
C=3.3 for sharp-crested weir with flashboards in place

L – spillway bay length in feet:

Bay 1 = 5'10"; Bay 2 = 6'8"; Bay 3 = 6'4"; Bay 4 = 6'2"; Bay 5=6'2"

H – hydraulic head = a difference in elevations between pond water level and spillway crest. The following spillway crest and flashboard elevations were assumed:

El. 281.38	spillway crest, all flashboards removed
El. 281.82	8"-flashboard layer A in place
El. 282.47	8"-flashboard layer B in place
El. 282.97	6"-flashboard layer C in place
El. 283.47	6" –flashboard layer D in place

Notes:

1) No flow adjustments were made for leakage through and around flashboards;

2) No corrections were made to the flow in spillway bays 1 and 3 where footbridge steel piers located.

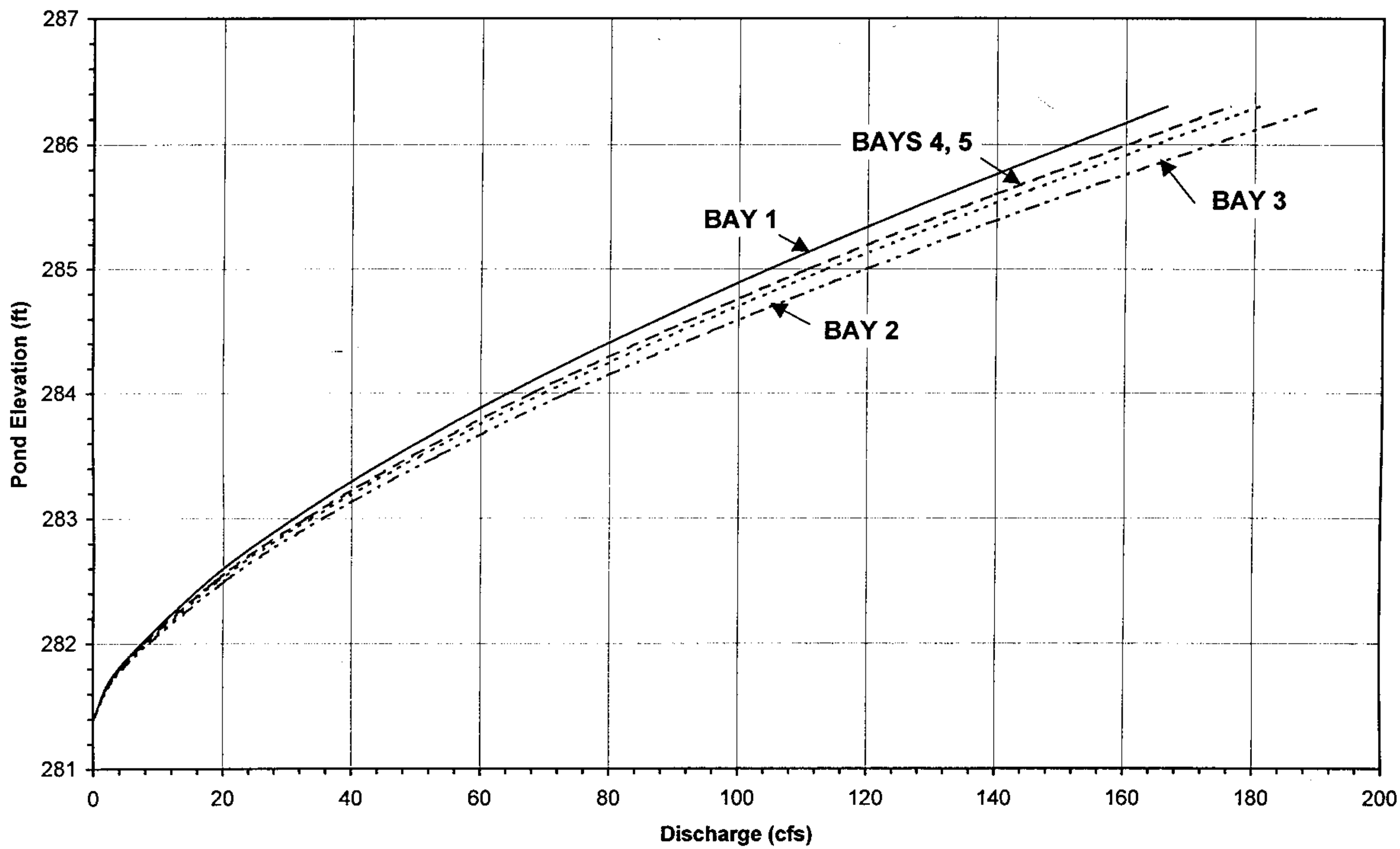

FIGURE A1. DISCHARGE OF SPILLWAY # 1 BAYS: FLASHBOARDS REMOVED

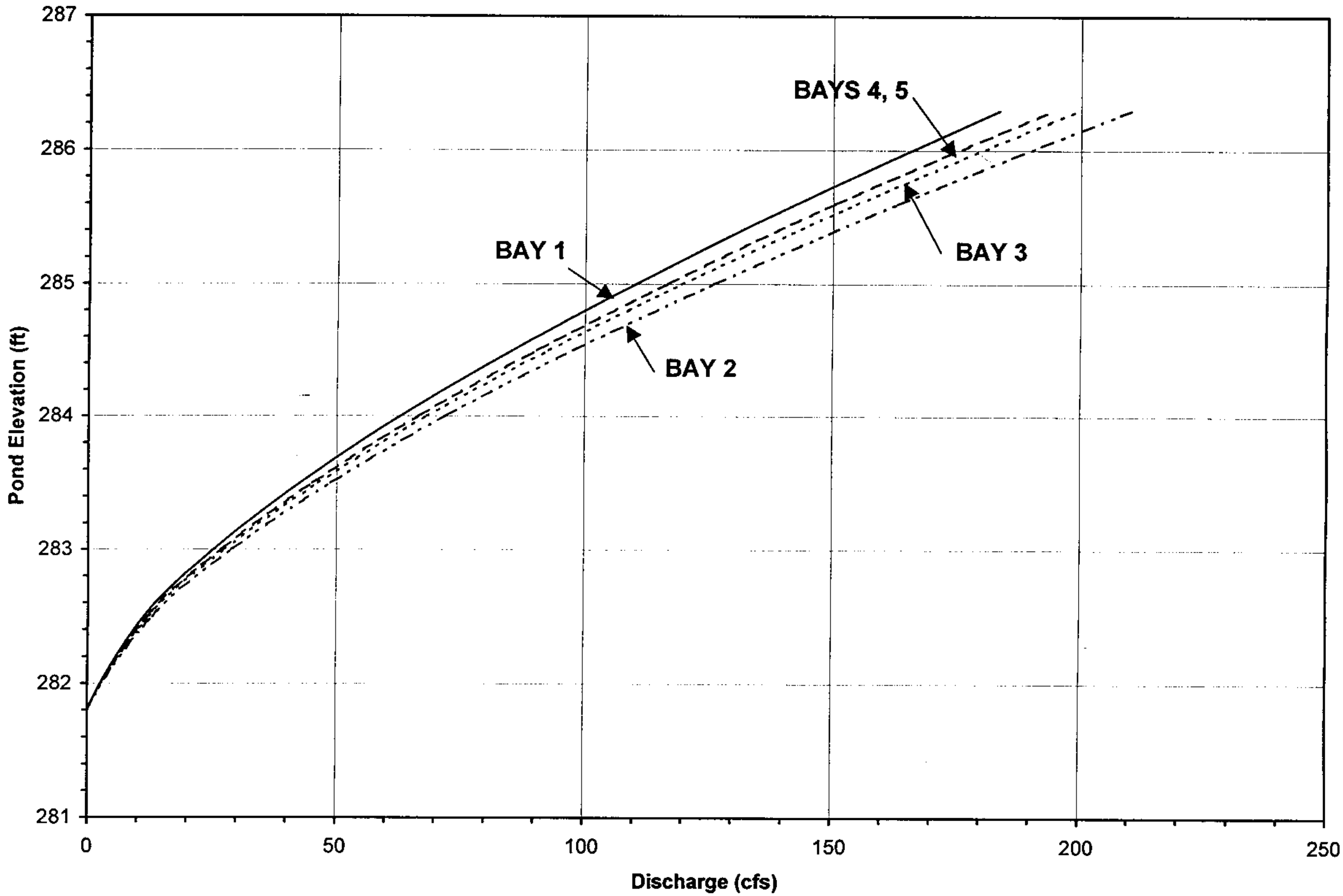

FIGURE A2. DISCHARGE OF SPILLWAY # 1 BAYS: BOARD LAYER "A" IN PLACE

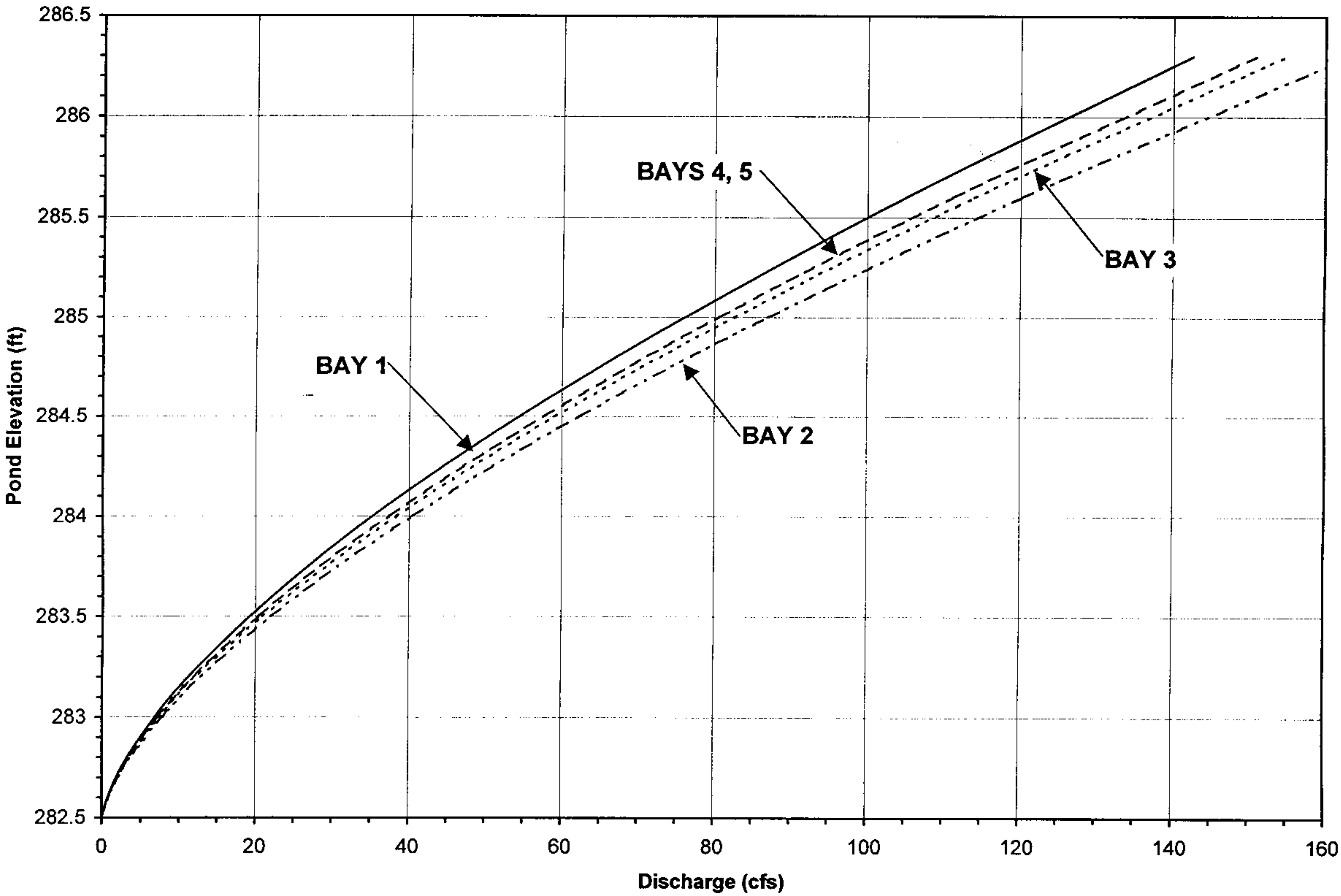

FIGURE A3. DISCHARGE OF SPILLWAY # 1 BAYS: BOARD LAYERS "A" AND "B" IN PLACE

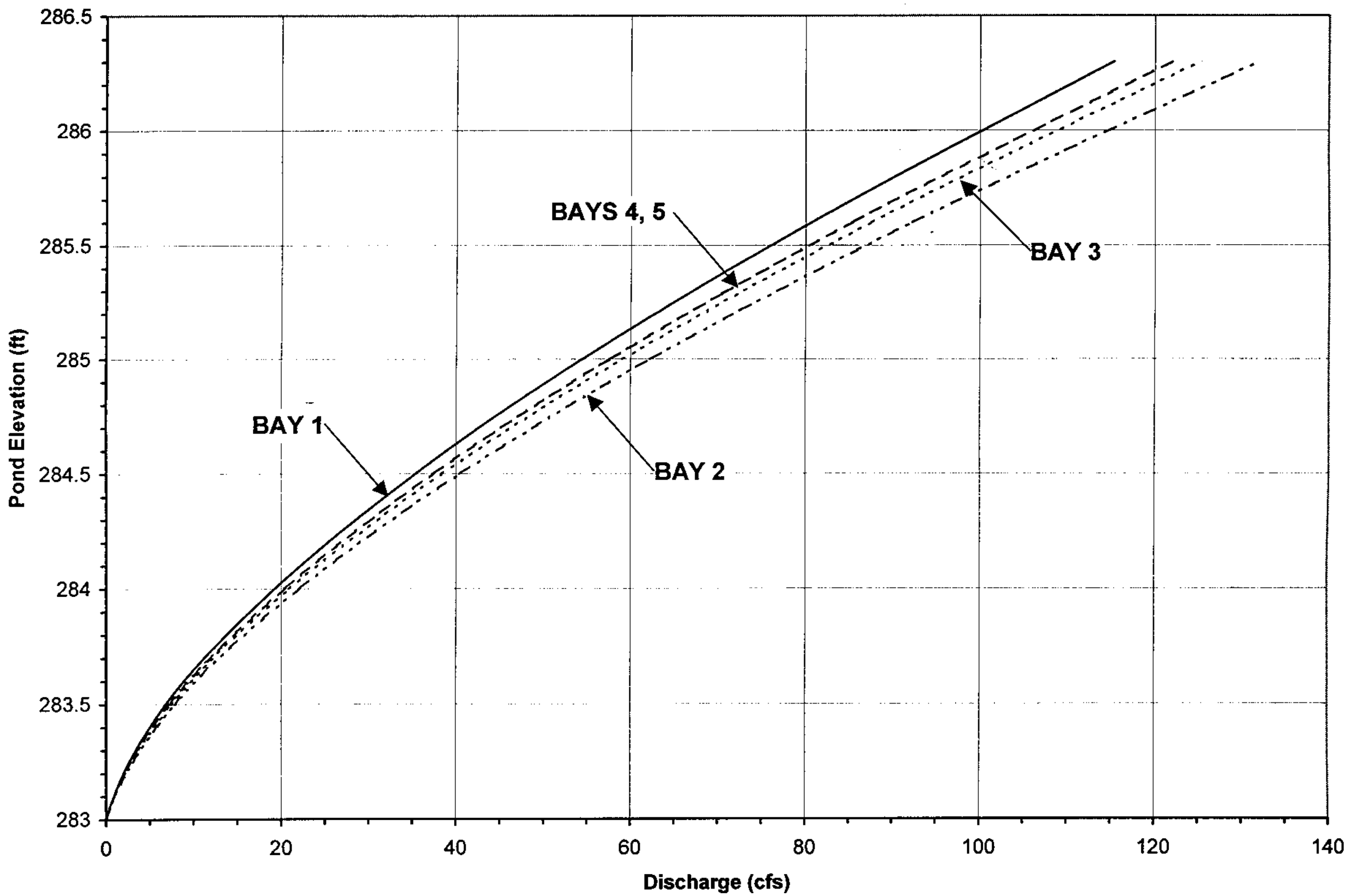

FIGURE A4. DISCHARGE OF SPILLWAY # 1 BAYS: BOARD LAYERS "A" , "B" , AND "C" IN PLACE

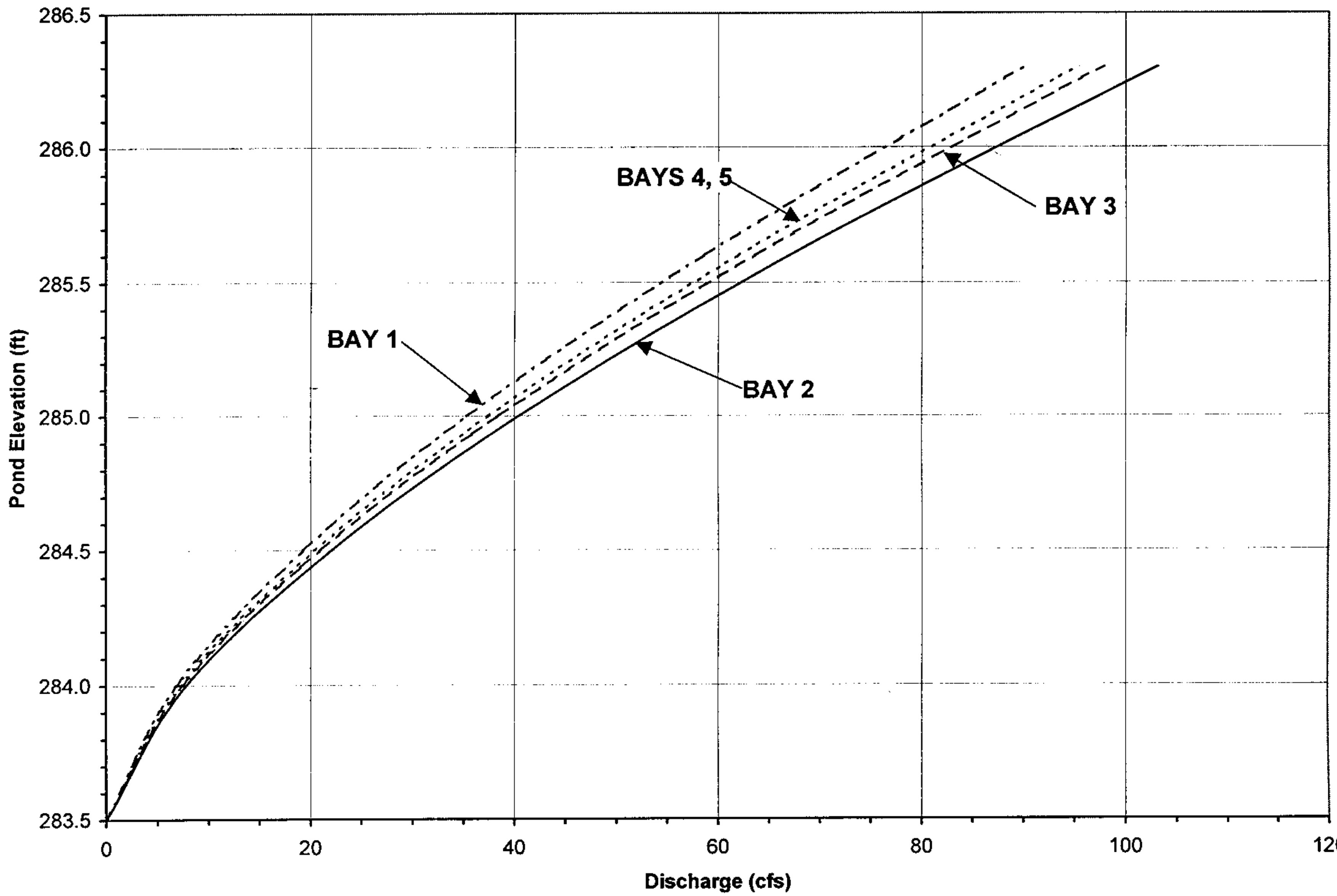

FIGURE A5. DISCHARGE OF SPILLWAY # 1 BAYS: BOARD LAYERS "A", "B", "C", AND "D" IN PLACE

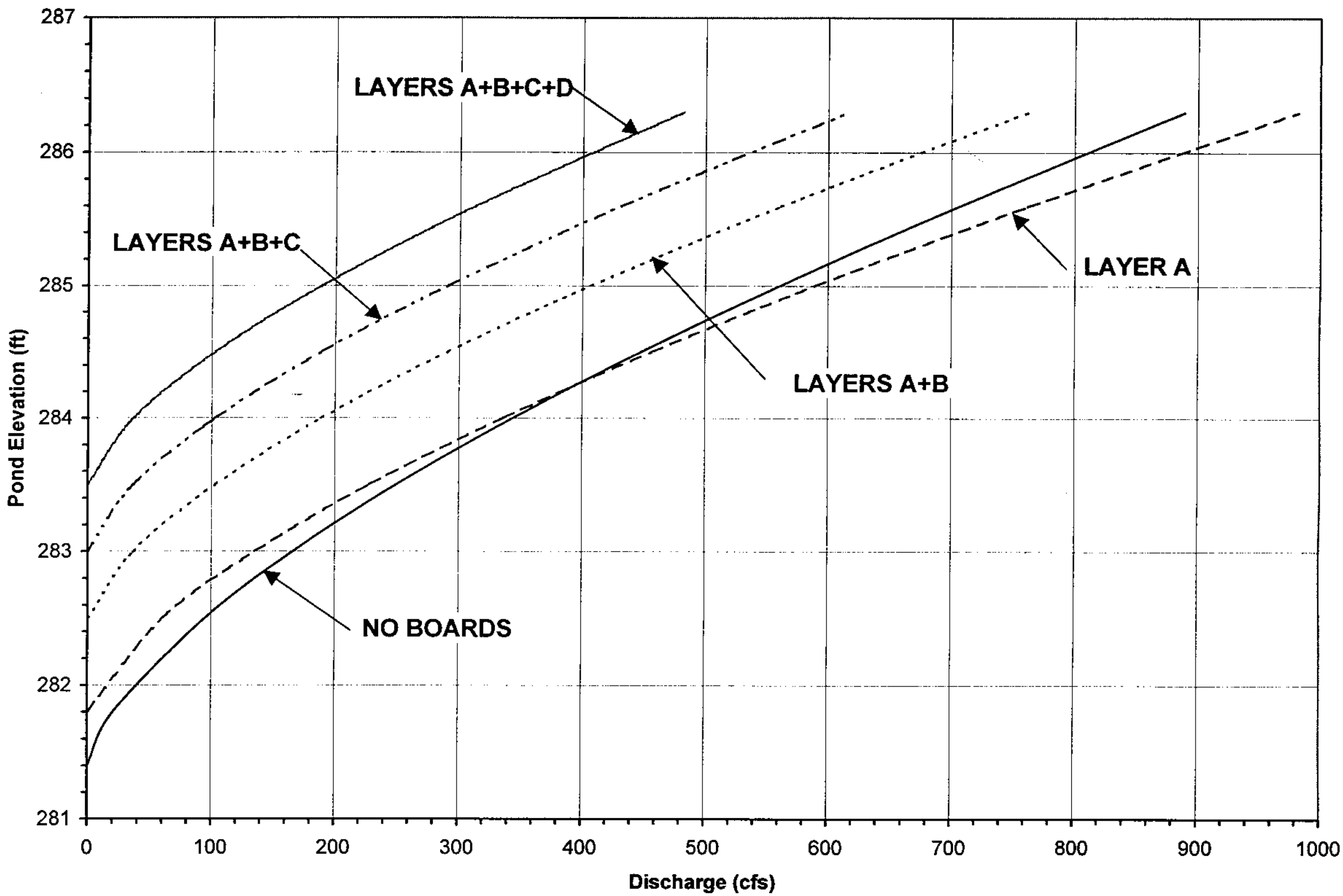

FIGURE A6. SPILLWAY # 1 TOTAL DISCHARGE WITH AND WITHOUT FLASHBOARDS

A2. SPILLWAY # 2 DISCHARGE

Table A2. Discharge vs. Pond Water Level
Figure A7. Spillway Rating Curve

TABLE A2
SPILLWAY # 2 DISCHARGE

Pond Elevation (ft)	Hydraulic Head, *H* (ft)	Discharge Coefficient *C*	Discharge, *Q* (cfs)
283.5	0	0	0
284.0	0.5	2.64	11.5
284.5	1.0	2.75	34.9
285.0	1.5	3.0	68.0
285.6	2.1	3.08	115.6
286.3	2.8	3.3	190.6

The spillway flow was calculated as a broad-crested weir using the following equation:

$$Q = CLH^{1.5}$$

Where:

Q – discharge over spillway crest in feet per second (cfs)

C – discharge coefficient for a broad-crested weir with a weir thickness b = 1'-6'' (Brater and King, "Handbook of Hydraulics", Table 5-3)

L – spillway length in feet = 12'-4''

H – hydraulic head over spillway crest: a difference in elevations between the pond water level and spillway crest (el. 283.53)

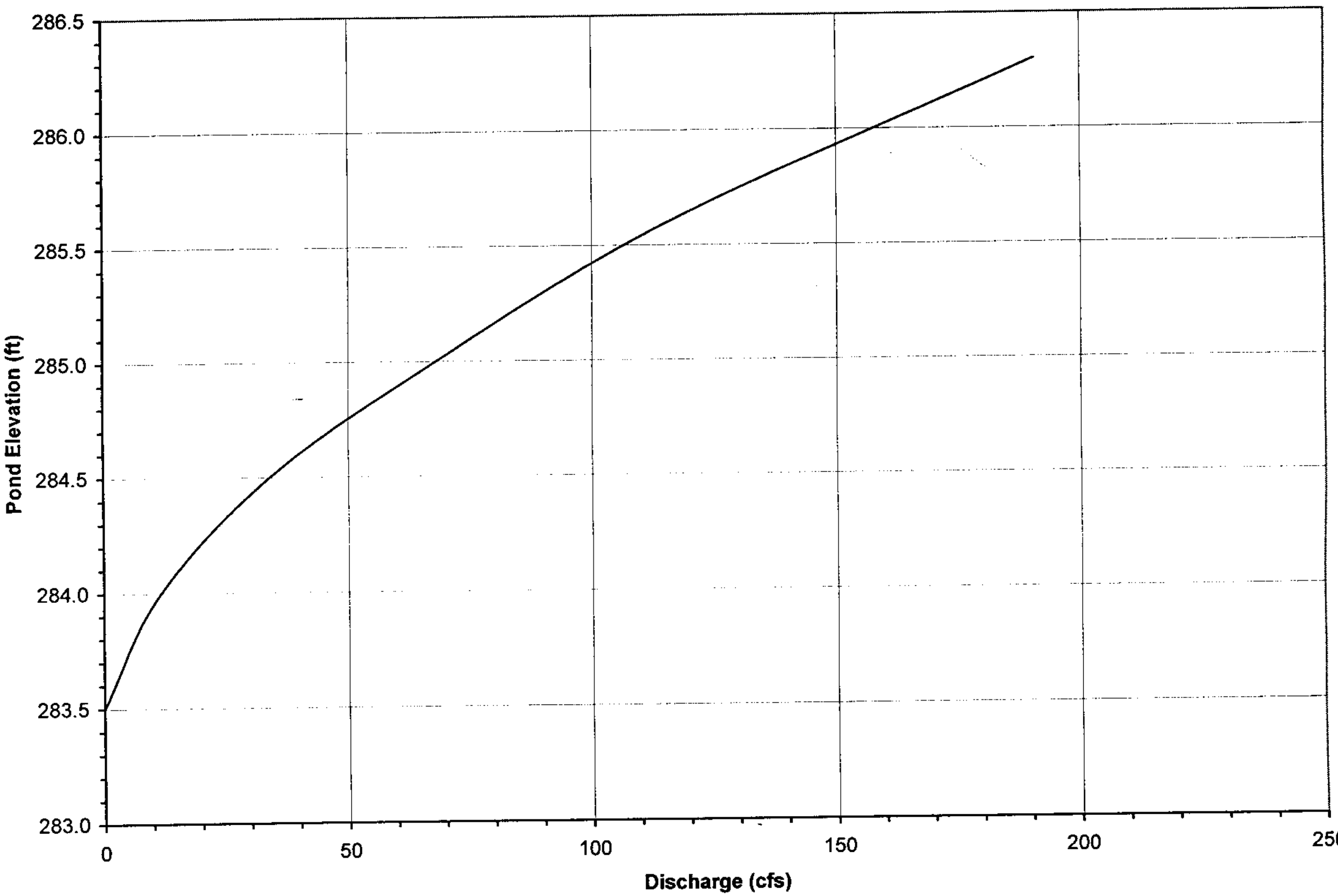

FIGURE A7. SPILLWAY # 2 DISCHARGE RATING CURVE

A3. SLUICE GATE DISCHARGE

Table A3. Discharge vs. Pond Water Level and Gate Openings
Figure A8. Sluice Gate Rating Curves for Different Gate Openings

TABLE A3
SLUICE GATE DISCHARGE

Pond Elevation	Gate Opening	Discharge (cfs)	Pond Elevation	Gate Opening	Discharge (cfs)	Pond Elevation	Gate Opening	Discharge (cfs)
280.0	1”	2.9	**282.5**	1”	3.5	**284.5**	1”	3.9
	2”	5.3		2”	6.7		2”	7.8
	3”	8.8		3”	10		3”	12
	4”	12		4”	14		4”	15
	5”	14		5”	17		5”	19
	6”	17		6”	21		6”	23
	9”	26		9”	31		9”	34
	1’-0”	34		1’-0”	41		1’-0”	46
	1’-6”	50		1’-6”	60		1’-6”	68
	2’-0”	65		2’-0”	79		2’-0”	89
	3’-0”	92		3’-0”	115		3’-0”	130
281.0	1”	3.2	**283.0**	1”	3.6	**285.0**	1”	4.0
	2”	6.3		2”	7.2		2”	8.0
	3”	9.5		3”	11		3”	12
	4”	13		4”	14		4”	16
	5”	16		5”	18		5”	20
	6”	19		6”	21		6”	24
	9”	28		9”	32		9”	35
	1’-0”	37		1’-0”	42		1’-0”	47
	1’-6”	54		1’-6”	62		1’-6”	69
	2’-0”	71		2’-0”	82		2’-0”	91
	3’-0”	102		3’-0”	119		3’-0”	134
281.4	1”	3.3	**283.5**	1”	3.7	**285.6**	1”	4.1
	2”	6.5		2”	7.4		2”	8.2
	3”	9.7		3”	11		3”	12
	4”	13		4”	15		4”	16
	5”	16		5”	18		5”	20
	6”	19		6”	22		6”	24
	9”	29		9”	33		9”	36
	1’-0”	38		1’-0”	43		1’-0”	48
	1’-6”	56		1’-6”	64		1’-6”	71
	2’-0”	73		2’-0”	84		2’-0”	94
	3’-0”	105		3’-0”	123		3’-0”	138
281.8	1”	3.4	**284.0**	1”	3.8	**286.3**	1”	4.2
	2”	6.7		2”	7.6		2”	8.4
	3”	10		3”	11		3”	13
	4”	13		4”	15		4”	17
	5”	17		5”	19		5”	21
	6”	20		6”	23		6”	25
	9”	30		9”	34		9”	37
	1’-0”	39		1’-0”	45		1’-0”	50
	1’-6”	58		1’-6”	66		1’-6”	74
	2’-0”	75		2’-0”	87		2’-0”	97
	3’-0”	109		3’-0”	126		3’-0”	142

The sluice gate discharge was calculated using the following orifice flow equation:

$$Q = CLd(2gH)^{1.5},$$

where:
Q – discharge through a gate opening in cubic feet per second (cfs); C= 0.6, discharge coefficient; L = 3’, a width of the opening; d – height of the gate opening (ft); g = 32.2 ft/sec, acceleration of gravity; H – hydraulic head at center of gate opening (ft)

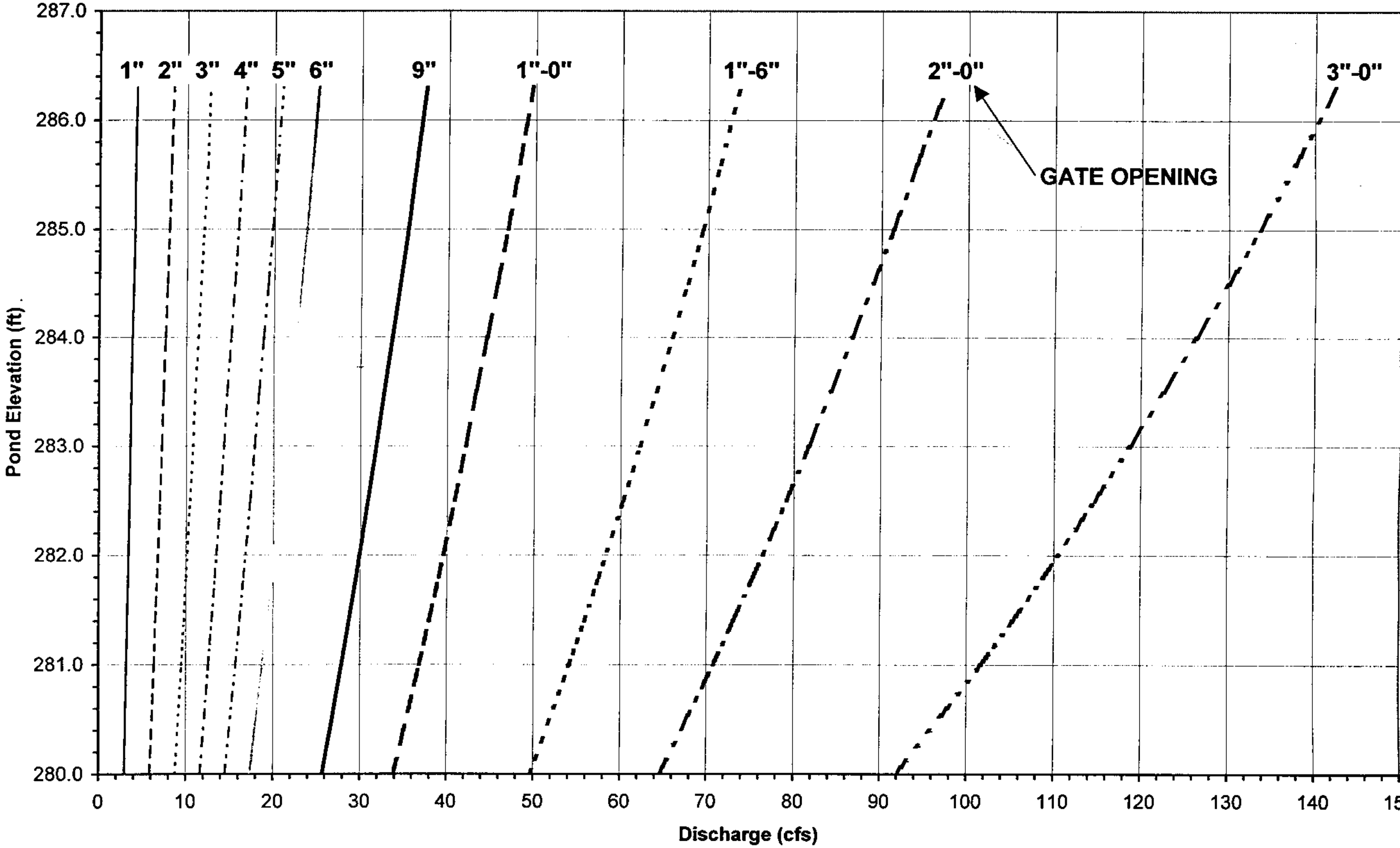

FIGURE A8. SLUICE GATE DISCHARGE RATING CURVES

A4. DAM DISCHARGE CAPACITY SUMMARY

TABLE A4
DAM DISCHARGE CAPACITY SUMMARY

Pond Elevation (ft)	Spillway # 1 (cfs)	Spillway # 2 (cfs)	West Section (cfs)	East Section (cfs)	Sluice Gate (cfs)	Dam Total (cfs)
280.0	0	0	0	0	92	92
281.0	0	0	0	0	102	102
281.4	0	0	0	0	105	105
281.8	21	0	0	0	109	130
282.5	95	0	0	0	115	210
283.0	166	0	0	0	119	285
283.5	249	0	0	0	123	372
284.0	344	12	0	0	126	482
284.5	447	34	0	0	130	611
285.0	560	68	0	0	134	762
285.6	706	116	0	0	138	960
286.3	889	191	85	0	142	1307
287.5	1235	431	342	49	150	2207

Notes:

1. Spillway # 1 discharge includes the condition with the flashboards removed.
2. East and West Sections were assumed as broad-crested weirs with a discharge coefficient $c = 2.63$.
3. Sluice Gate discharge was assumed for an opening of 3' (full gate).

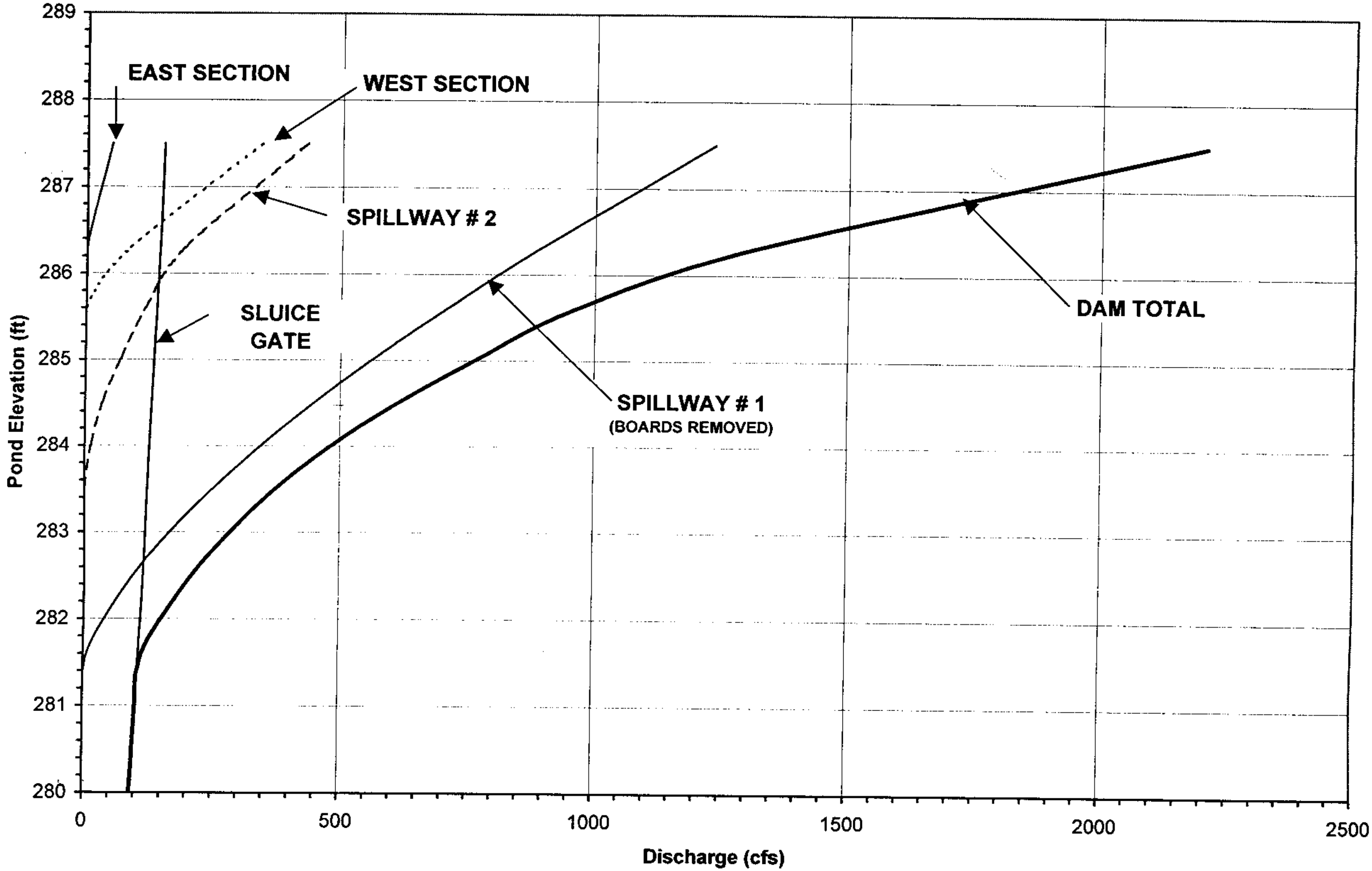

FIGURE A9. DISCHARGE RATING CURVES FOR DAM AND WATER CONVEYING STRUCTURES

A5. EFFECT OF DAM OUTFLOW ON POCASSET LAKE DRAWDOWN (DRY SEASON)

TABLE A5
POCASSET LAKE DRAWDOWN DUE TO DAM OUTFLOW AND FLOW DURATION (dry season)

Dam Outflow (cfs)	Flow Duration (days)									
	1	2	3	4	5	10	15	20	25	30
	Lake Drawdown (inches)									
1	0.04	0.08	0.12	0.16	0.2	0.41	0.61	0.81	1.01	1.22
2	0.08	0.16	0.24	0.32	0.41	0.81	1.22	1.62	2.03	2.43
3	0.12	0.24	0.36	0.49	0.61	1.22	1.82	2.43	3.04	3.65
4	0.16	0.32	0.49	0.65	0.81	1.62	2.43	3.24	4.05	4.87
5	0.2	0.41	0.61	0.81	1.01	2.03	3.04	4.05	5.07	6.08
10	0.41	0.81	1.22	1.62	2.03	4.05	6.08	8.11	10.14	12.16
15	0.61	1.22	1.82	2.43	3.04	6.08	9.12	12.16	15.21	18.25
20	0.81	1.62	2.43	3.24	4.05	8.11	12.16	16.22	20.27	24.33
30	1.22	2.43	3.65	4.87	6.08	12.16	18.25	24.33	30.41	
40	1.62	3.24	4.87	6.49	8.11	16.22	24.33			
50	2.03	4.05	6.08	8.11	10.14	20.27				

The Pocasset Lake drawdown due to dam outflow and flow duration during dry season was estimated using the following formula:

$$D = 23.80 \frac{Q*T}{A},$$

Where:

D – Lake water level drawdown in inches
Q – Total flow through dam including leakage in cubic feet per second (cfs)
T – Flow duration in days
A – Lake surface area = 587 acres
23.80- Conversion factor

Notes

For each flow duration period the following assumptions were made in lake drawdown calculations:

- The lake area remains unchanged and equal 587 acres
- The lake receives no rainfall or runoff from the watershed
- The change in the lake level occurs only as a result of water withdrawal from the lake

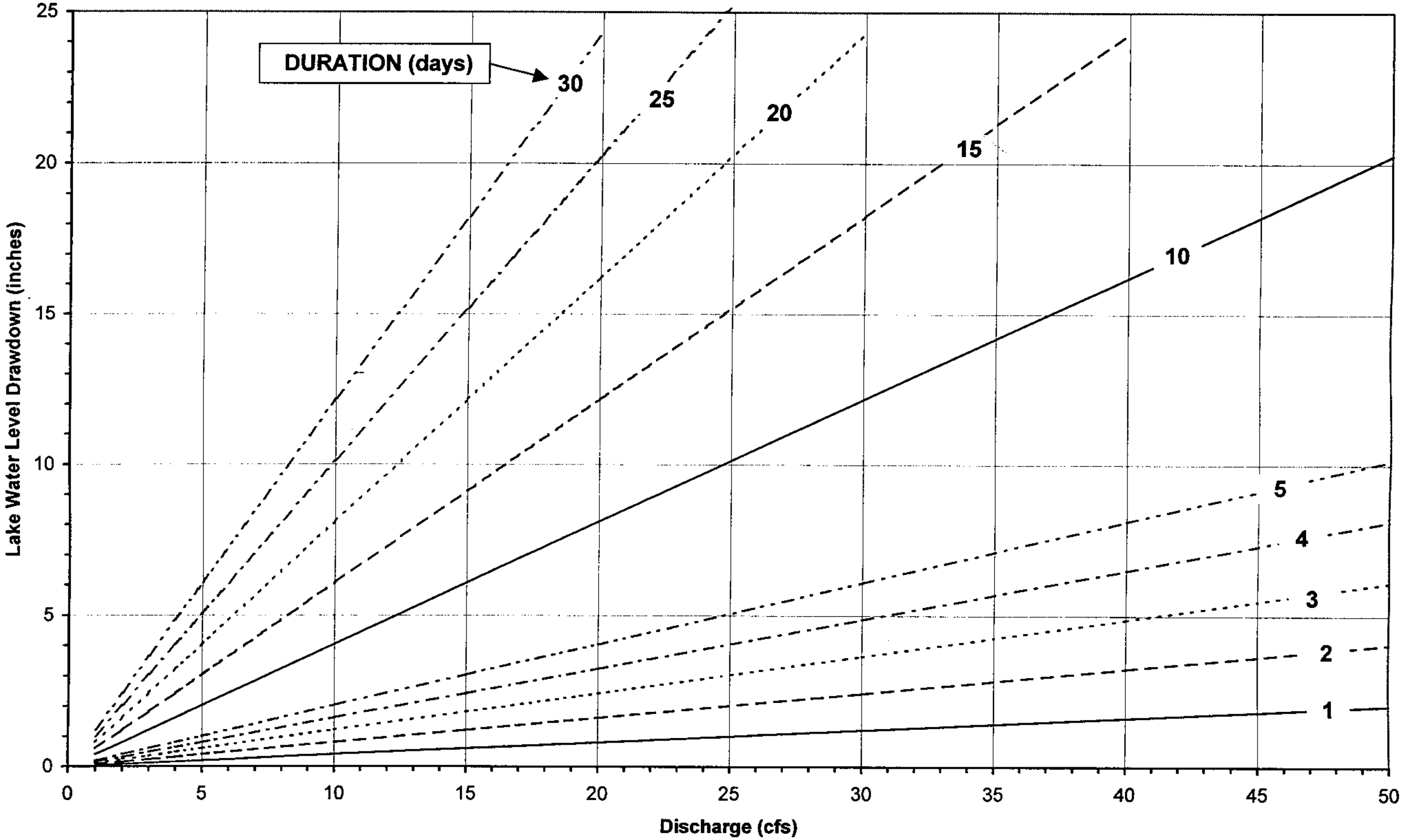

FIGURE A10. POCASSET LAKE DRAWDOWN AS A FUNCTION OF DAM OUTFLOW AND FLOW DURATION
(DRY SEASON)

APPENDIX B

LOG FOR RECORDING POND WATER LEVELS

LOG FOR RECORDING POND WATER LEVELS

Date	Pond El.	Spillway # 1 Flashboard Layers[1] in Place					Sluice Gate Opening (inches)	Weather (temp, sun, rain, snow, ice cover)	Name of Observer
		Bay 1[2]	Bay 2	Bay 3	Bay 4	Bay 5			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			
		A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D	A, B, C, D			

Comments:

[1] Circle the board layer in place. Board layers are lettered A, B, C, D from the bottom to the top. Boards A, B are 8" high; boards C, D are 6" high.
[2] Spillway bays are numbered from east to west.

APPENDIX C

INSPECTION CHECKLIST

DAM INSPECTION CHECKLIST

General		
Pond El.	Weather: dry, sunny, cloudy, fog, rain, drizzle, snow	Air temperature
Spillway # 1:	Flashboard layers A, B, C, D in place	Flashboard leakage:
Spillway # 2:	Dry Flowing	
Sluice Gate:	Open Closed	
Remarks:		
Inspector/Observer:		Date:

INSPECTED AREA	CONDITION	OBSERVATION	check (x) monitor	evaluate	repair
West Dike					
Top	cracking, erosion, sinkholes, settlement				
	grass bare areas, animal burrows				
Upstream Slope	cracking, sloughing, erosion, sinkholes				
	missing/displaced riprap, animal burrows				
	vegetation grass,brush, trees)				
Downstream Slope	cracking, sloughing, erosion, sinkholes				
	missing/displaced stone, animal burrows				
	wet/seepage areas, grass/trees/brush				
	toe undercutting				
West Retaining Wall					
Top	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion				
Waterside Face	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion, efflorescence				
	wet areas, seepage				
Landside Face	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion, efflorescence				
West Section (between west retaining wall and spillway # 1)					
Top	concrete cracking, spalling, erosion				
	joint offsets, rebar corrosion, vegetation				
Upstream Face	concrete cracking, spalling, erosion				
	joint offsets/sealant loss, rebar corrosion				
Downstream Face (concrete)	concrete cracking, spalling, erosion				
	joint offsets, rebar corrosion				
Downstream Face (stone)	cracking, wet areas, seepage, loose stone				
	displaced/missing stone, vegetation				
	base undercutting				

Comments:

DAM INSPECTION CHECKLIST

INSPECTED AREA	CONDITION	OBSERVATION	check (x) monitor	evaluate	repair
	Spillway # 1				
Top	cracking, spalling, erosion, movement				
	joint offsets, rebar corrosion, debris				
Upstream Face	cracking, spalling, erosion, joint offsets/				
	sealant loss, rebar corrosion, vegetation				
Downstream Face	cracking, spalling, erosion, joint offsets				
	rebar corrosion, efflorescence, wet areas				
	seepage, vegetation				
Apron	cracking, erosion, rebar corrosion, wet				
	areas, seepage, debris, vegetation, base				
	undercutting, missing protective stone				
East Wall	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion, vegetation				
	efflorescence, wet areas, seepage				
West Wall	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion, vegetation				
	efflorescence, wet areas, seepage				
	Spillway # 1 Flashboards				
Bay 1 Boards	cracking, rotting, splitting, missing boards				
	debris, leakage				
Bay 2 Boards	cracking, rotting, splitting, missing boards				
	debris, leakage				
Bay 3 Boards	cracking, rotting, splitting, missing boards				
	debris, leakage				
Bay 4 Boards	cracking, rotting, splitting, missing boards				
	debris, leakage				
Bay 5 Boards	cracking, rotting, splitting, missing boards				
	debris, leakage				
Stanchions	paint peeling, steel corrosion, cracking				
Operating Deck	board cracking, splitting, rotting				
	steel supports: corrosion, paint damage				
	East Section (between spillways # 1 and # 2)				
Top	concrete cracking, spalling, erosion				
	joint offsets, rebar corrosion, vegetation				
Upstream Face	concrete cracking, spalling, erosion				
	joint offsets, sealant loss, rebar corrosion				
Downstream Face	concrete cracking, spalling, erosion				
	joint offsets, rebar corrosion, vegetation				
	wet areas, seepage, base undercutting				

Comments:

DAM INSPECTION CHECKLIST

INSPECTED AREA	CONDITION	OBSERVATION	check (x) monitor	evaluate	repair
Spillway # 2					
Top	cracking, spalling, erosion, movement				
	rebar corrosion, debris				
Upstream Face	cracking, spalling, erosion, joint offsets				
	sealant loss, rebar corrosion, vegetation				
Downstream Face	cracking, spalling, erosion, joint offsets				
	rebar corrosion, efflorescence, wet areas				
	seepage, debris, vegetation				
Apron	cracking, spalling, erosion, rebar corrosion				
	debris, vegetation, toe undercutting				
	missing protective stone at toe				
East Wall	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion, vegetation				
	efflorescence, wet areas, seepage				
West Wall	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion, vegetation				
	efflorescence, wet areas, seepage				
Sluice Gate					
Concrete Deck	cracking, spalling, erosion, efflorescence				
	rebar corrosion, movement				
Handrail	corrosion, bending, damage, movement				
	missing parts				
Gate/Hoist	corrosion, paint damage, gate jamming				
	stem bending, leakage, hoist problems				
Trashracks	steel bar corrosion/bending, clogging				
	debris, steel grating damage				
East Abutment Wall					
Top (concrete)	cracking, spalling, erosion, movement				
	rebar corrosion, vegetation				
Waterside Face (concrete)	cracking, spalling, erosion, joint offsets				
	movement, rebar corrosion, efflorescence				
	wet areas, seepage, vegetation				
Downstream Section (stone)	erosion, movement, seepage, leakage				
	displaced/missing stone, vegetation				
	base undercutting				
Wooden Footbridge					
Deck and Rails	cracking, rotting, missing boards, loose				
	connectins, sagging				
Beams	cracking, rotting, steel corrosion, sagging				
	loose connections, movement				
Piers	paint loss, corrosion, rotting, movement				
	alignment, loose connections				

APPENDIX D

DAM MAINTENANCE LOG

DAM MAINTENANCE LOG

Date	Structure[1]	Feature[2]	Type[3] of Repair/ Maintenance	Repair/ Maintenance Conducted by:	Repair/ Maintenance Cost	Comments

Notes:

[1] West dike, east/west retaining wall, east/west section, spillways # 1 and # 2, sluice gate

[2] Top, upstream/downstream slope or face, apron, trashracks, handrail

[3] Concrete, earthwork, stone masonry, rock riprap, grass mowing, vegetation control, debris removal, etc.