



# WESTFIELD FLOOD CONTROL COMMISSION

## Arm Brook & Powdermill Brook Flood Control Dams

### Rehabilitation Recommendations

**THE CITY OF WESTFIELD**  
HAMPDEN COUNTY, MASSACHUSETTS

**Submitted to:**

The Honorable Mayor Donald F. Humason and the Westfield City Council

**Passed:**

February 17, 2021

**Prepared by:**

Albert G. Giguere Jr.

Chairman

Westfield Flood Control Commission

59 Court Street

Westfield, MA



### Overview:

“The mission of the Flood Control Commission has been defined as monitoring and reporting on levees and waterways vital to the city’s interest. Construction of Arm Brook and Powdermill Brook Flood Control Dams broadened this mission to include routine maintenance and essential improvements. It is therefore the mission of the Flood Control Commission to perform these duties to the fullest extent possible.”

**The municipal flood control infrastructure is identified as follows:**

- Arm Brook Flood Control Reservoir/Dam Project LCA PL 566-83
- Powdermill Brook Flood Control Reservoir/Dam Project LCA PL 566-83

### Powdermill Brook Flood Control Dam

### Arm Brook Flood Control Dam



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**“Flood Control Infrastructure is an idle giant, often ignored and hidden in plain view, but its importance becomes quite apparent during a flood and it has to work...”**

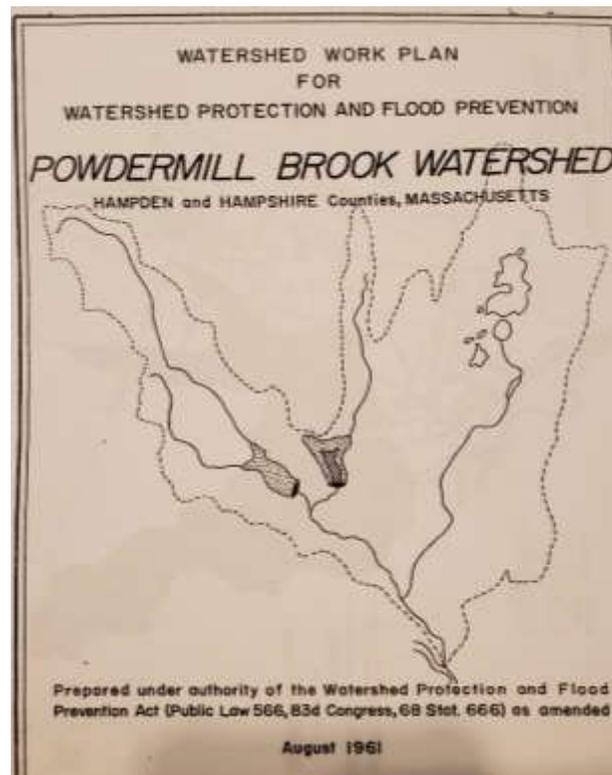
**(Albert G. Giguere Jr., 2015 WFCC-USACE Public Hearing on Little River Levee)**

## GENERAL INFORMATION

**“Arm Brook” and “Powdermill Brook” pose serious risks to residents and businesses in the Lower Notre Dame, North Elm, and Union Street neighborhoods.**

**Critical regional infrastructure at risk from flood damage:**

- US Interstate 90 aka “The Massachusetts Turnpike”.
- US Route 202/MA Route 10
- Pioneer Valley Railroad: freight yard, lines, Holyoke connector.
- Boston-Albany Rail Corridor: CSX and Amtrack (primary East-West rail line in Mass.)



By the 1700's, most of Northern Westfield, Wyben, and Montgomery had been cleared for farming, which resulted in increased runoff and significant levels of erosion in the area. In the aftermath of the 1955 Flood, the Federal Government embarked on a large effort to reduce flooding and erosion damage across the Lower Westfield River Basin. Amongst a number of projects was the “Powdermill Brook Watershed Flood Control Project”. Powdermill Brook and Arm Brook Flood Control Dams were built together, as part of the larger project, designed to minimize erosion issues and to control flood damage, protecting the vital infrastructure in the area. This watershed contains over 5000 acres of ponds, streams, springs, and wetlands. It encompasses much of the area above the Barnes Aquifer and is part of the Westfield River Watershed. The project was begun in 1961 and by 1965, both dams had been completed and turned over to the City of Westfield, with a Local Cooperation Agreement (LCA). This LCA necessitated the need for a body dedicated to the oversight and maintenance of the dams, and thus the City of Westfield created the Westfield Flood Control Commission.

## **GENERAL REPORT**

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**“The Flood Control Commission’s role is a matter of Public Safety, protecting Westfield’s Residents, Their Property, Their Livelihoods, and Infrastructure from Flooding.”**

Arm Brook and Powdermill Brook Flood Control Dams have both exceeded their 50-year design life and require substantial upgrades and repairs to meet Westfield’s future flood control needs. A number of issues tied to deferred maintenance, age, and vandalism compromise the overall reliability of the dams. Additionally, during the engineering studies conducted by the USDA-NRCS, both dams were found to be deficient in their ability to sustain the 100-year flood event, which could result in a failure of each dam.

The USDA-NRCS PL 566-83 Dam Rehabilitation Program offers a 65/35% Cost Share, affording our city a cost share of less than \$6 million. Should the City choose not to pursue this rehabilitation further, the city would incur the full fiscal responsibility for both rehabilitations and could exceed \$20 million.

### **Arm Brook Flood Control Reservoir/Dam Project LCA PL 566-83**

Sponsors: City of Westfield Massachusetts, Hampden Hampshire County Conservation District

USDA-NRCS FY2020 Funded Status: Planning

- The Arm Brook Dam is one of two Class 1 High Hazard PL-566 floodwater retarding dams in the Powdermill Brook Watershed. The planning phase of rehabilitation of the dam was completed in 2020. Rehabilitation of the dam will prevent flood breach damages to 96 residences, 14 non-residential properties, 1 interstate highway, 10 major roads, 2 rail lines, and 8 bridge/culvert crossings. (\*these numbers reflect flooding caused by Arm Brook alone).

### **Powdermill Brook Flood Control Reservoir/Dam Project LCA PL 566-83**

Sponsors: City of Westfield Massachusetts, Hampden Hampshire County Conservation District

USDA-NRCS FY2020 Funded Status: Planning

- The Powdermill Dam is one of two Class 1 High Hazard PL-566 floodwater retarding dams in the Powdermill Brook Watershed. The planning phase of rehabilitation of the dam nearly complete. Rehabilitation of the dam will prevent flood breach damages to 400 residential and commercial buildings, 1 interstate highway, 25 major roads, 3 rail lines, and 7 bridge/culvert crossings. (\*these numbers reflect flooding caused by Powdermill Brook alone).

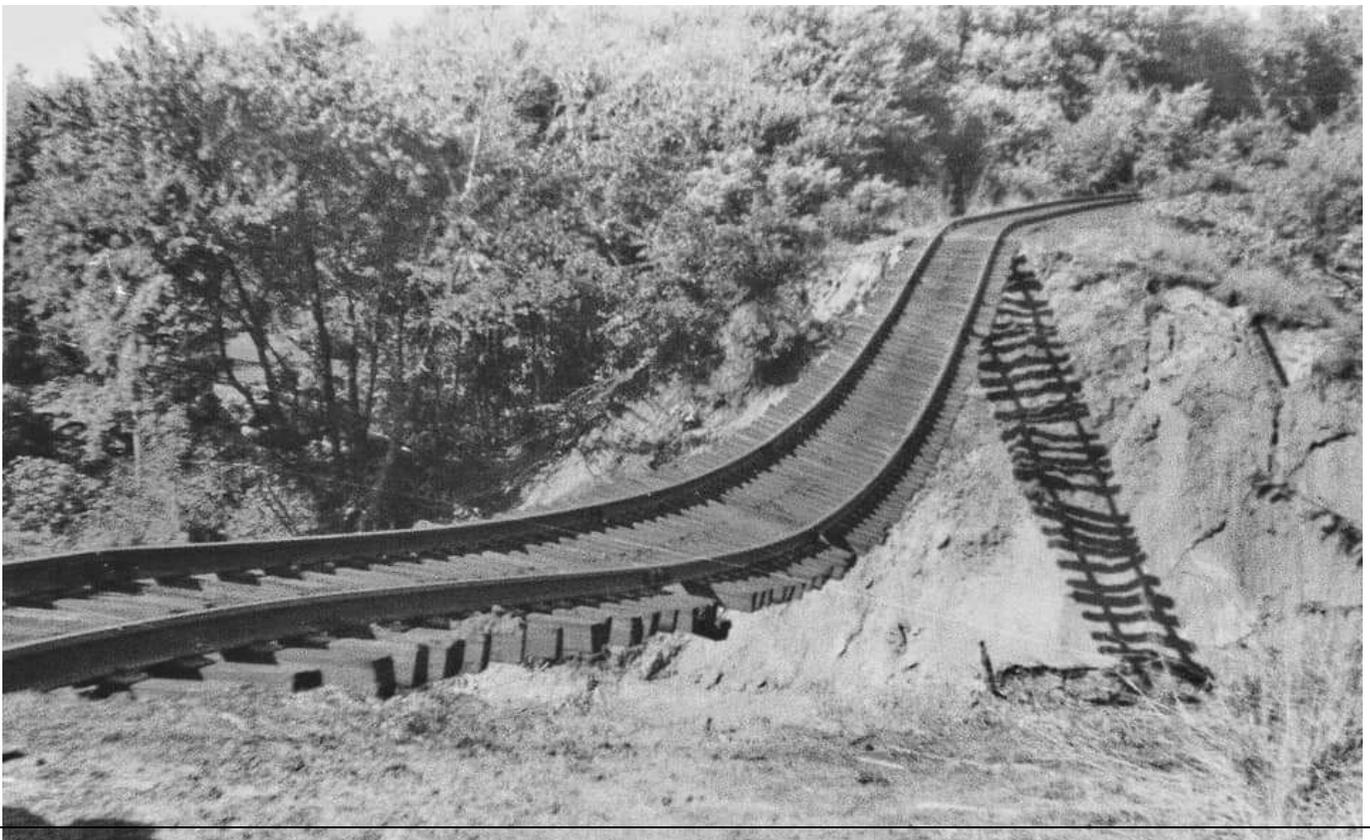
### **WFCC RECOMMENDATIONS to Mayor and City Council:**

The Westfield Flood Control Commission’s “Performance Evaluation of 2015” found that both dams needed “Significant” repairs. Based upon the more recent USDA-NRCS engineering studies, these dams require complete rehabilitation to meet safety standards.

- Pursue Preferred Alternative #2 for Powdermill Brook Flood Control Dam.
- Pursue Preferred Alternative #3 for Arm Brook Flood Control Dam.
- Incur ALL permitting costs, as required.
- Pursue USDA-NRCS land taking to ABOVE Auxiliary Spillway (ASW) Crest Elevation.



Above: "Powdermill Brook Bridge" US 202/ MA10/ North Elm - Notre Dame 1955 Flood  
Below: "NYNH&H Railroad Crossing on Powdermill Brook - (Now Pioneer Valley RR)



## August 1955

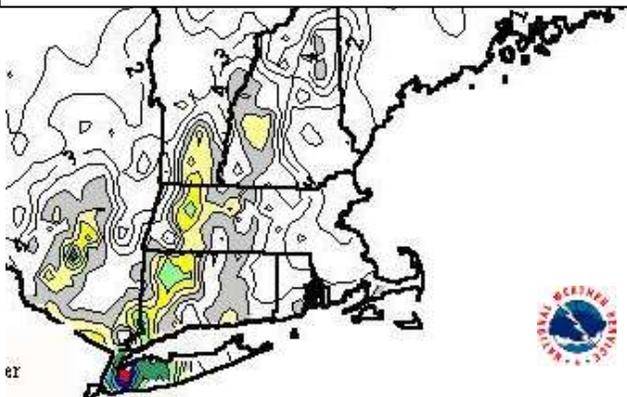
**Westfield River @ City of Westfield**  
**26 inches, Monthly Rainfall Total**  
**70,300 cubic feet per second**  
**141 cubic feet per square mile**  
**34.2 ft Above Flood Stage**



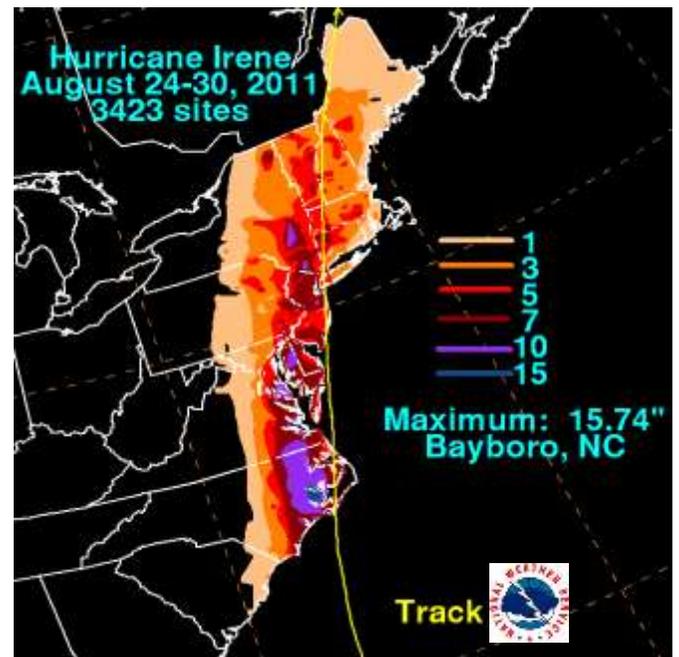
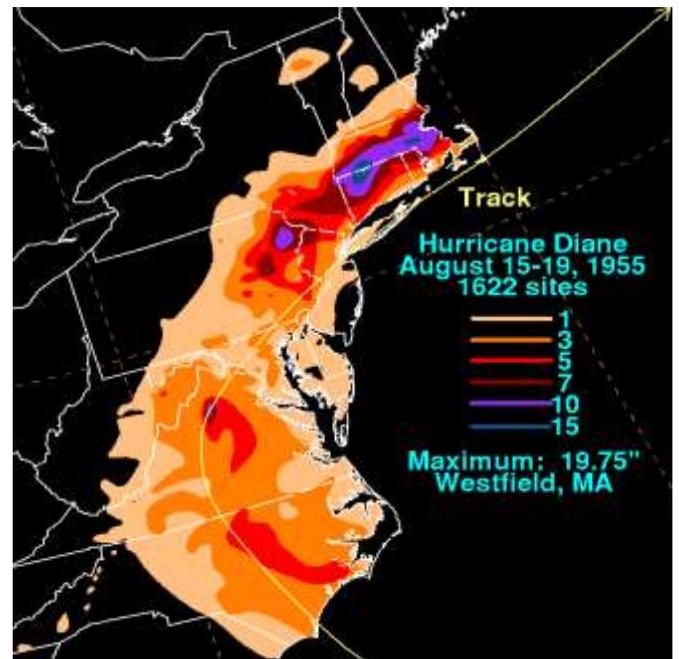
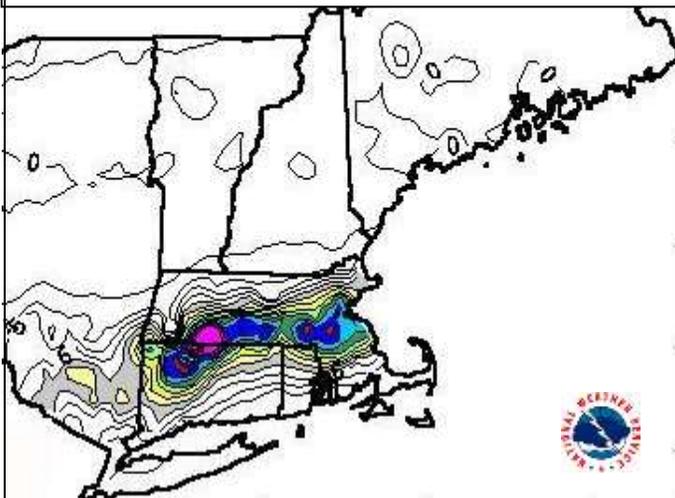
Information NOAA - NWS



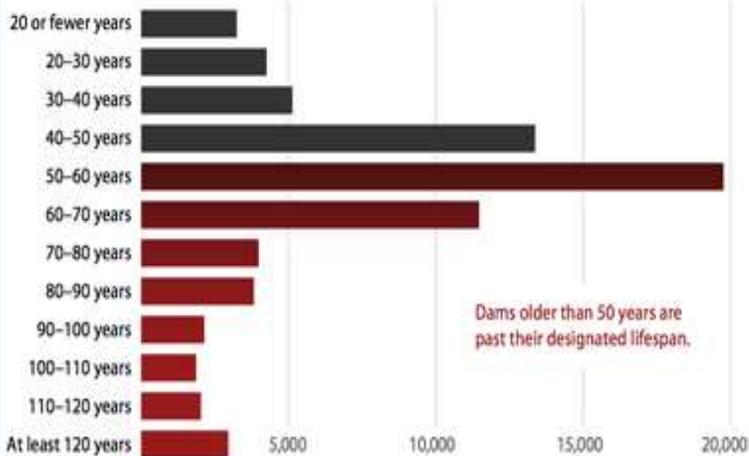
### Hurricane Connie Rainfall August 11-14, 1955



### Hurricane Diane Rainfall August 17-20, 1955



**FIGURE 1**  
**Number of dams per age range, by 2020**



Source: United States Army Corps of Engineers, "CorpsMap: The National Inventory of Dams," available at [http://mid.usace.army.mil/cm\\_apex/?p=838:12](http://mid.usace.army.mil/cm_apex/?p=838:12) (last accessed September 2016).

## Powdermill Brook Flood Control Reservoir/Dam

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This Flood Control Project abuts the Twiss Street Sanitation Transfer Station/ Former Dump and Pioneer Valley Railroad spur. It was built as part of a larger Federal Flood Control Project; “Powdermill Brook Flood Control Project”, started in 1961 and completed in 1964. It was designed to handle a 100 Year Flood level storm and controls 2,894 acres of runoff. The Dam contains over 100,000 cubic yards of earthen fill, and is 47ft high above the Powdermill Brook basin, utilizes a drop inlet drain to control normal flow, and has an earthen spillway to control extreme overflow. The United States Department of Agriculture -Natural Resources Conservation Service (USDA-NRCS) and the Massachusetts Department of Conservation and Recreation -Office of Dam Safety (DCR-ODS) oversee and periodically conduct safety standard inspections of the dam, per Local Cooperation Agreement (LCA) and Massachusetts Dam Safety Law. Under state law, the Flood Control Commission must contract with a certified engineer every two years, conduct a Phase 1 Safety Inspection of the dam, and submit it to the DCR-ODS, with copy provided to the USDA-NRCS. Due to its size and risk presented, it is regulated as being a High Hazard Dam. Federal, State, & Municipal funds were involved, and the original construction was authorized, conditionally, by an Act of Congress.

*“Watershed Work Plan for Watershed Protection and Flood Prevention, which was prepared under the Authority of the United States Watershed Protection and Flood Prevention Act, Public Law 566, 83rd Congress, 68 Stat. 666, as amended.”*

### Status:

The Powdermill Brook Flood Control Reservoir/Dam Project is in the worst overall condition versus Arm Brook Flood Control Reservoir/Dam. Having served the city for a little more than 50 years, it now requires a “Complete Rehabilitation to New Federal Standards”, per the USDA-NRCS and concurred by the DCR-ODS. The City is now near the point at which it must commit to the USDA-NRCS Rehabilitation.

### Conclusion:

This Flood Control Project is in “**FAIR**” Condition, based upon the DCR-Office of Dam Safety’s rating guidelines, and requires a “Complete Rehabilitation”. It has a number of Deficiencies and some required immediate remediation to prevent further deterioration that could become costly to repair.

**It is the Recommendation of the Westfield Flood Control Commission that the City of Westfield should pursue USDA-NRCS Preferred Alternative #2, incurring all of the permitting costs and all USDA-NRCS land taking recommendations to the ABOVE ASW Crest Elevation to help prevent possible flooding of private property and help curb incursions onto the flood control site, such as illegal dumping of yard waste, illegal ATV traffic, and other issues currently identified at Powdermill Brook Flood Control Dam. The Phase 1 Safety Inspection was recently completed and submitted and should be considered supplemental to this report.**

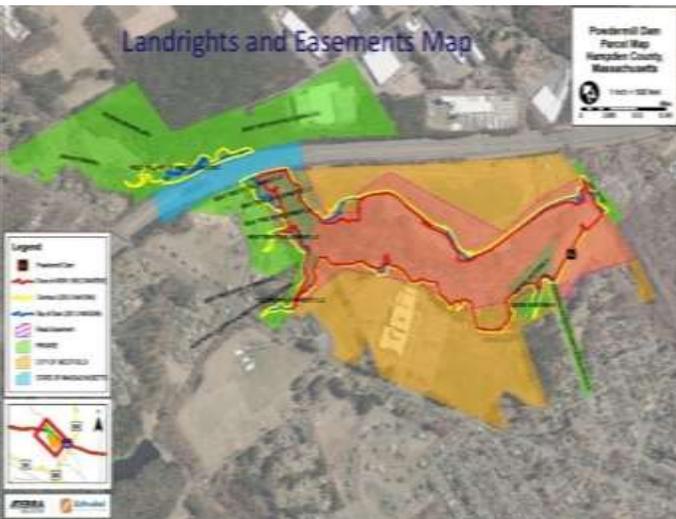
# Powdermill Brook Flood Control Reservoir/Dam



- Note "Pathways", illegal ATV activity causing significant surface damage to Dam.



**Top Left:** Damage caused by illegal ATV activity & damaged plaque @ Park & Rec.  
**Middle Left:** Reservoir Pool choked by weeds and siltation.  
**Bottom Left:** Henry Warchol, Longtime Commissioner examining damage to crest.  
**Top Right:** Dam Crest heavily eroded and damaged by decades of ATV illegal traffic.  
**Middle Right:** ATV activity essentially has turned the dam into an illegal autocross.  
**Bottom Right:** Riser Structure, gate valve, and weed choked reservoir pool.  
 (Photo Credits: Albert G. Giguere Jr.)



## Preferred Alternative



NRCS planning policy (Principles, Requirements & Guidelines) state that Federal investments in water resources, as a whole, should strive to maximize public benefits, with appropriate consideration of costs. Public benefits encompass environmental, economic, and social goals; include monetary and non-monetary effects; and allow for the consideration of both quantified and unquantified measures.

Alternative 2 maximizes public benefits with consideration of costs

Raise the top of dam 2 feet and construct 106-foot-wide labyrinth weir along with RCC ASW at a total project cost of \$7,715,500.

- Federal Cost = \$5,587,300
- Nonfederal Costs = \$2,128,200

## Description of Alternative 2

Raise the top of dam elevation by 2 feet to EL 205 and construct a 106-foot-wide, 4-cycle labyrinth weir at the existing ASW crest elevation. The chute of the labyrinth weir will be constructed of RCC with reinforced concrete sidewalls. An RCC stilling basin with riprap outlet protection will also be constructed at the toe of the chute.

## Economic Impacts / Damages

### Without Dam

- Residential Bldgs. = \$71,700
- Commercial Bldgs. = \$73,600
- Public Bldgs. = \$5,200
- Crossings/Roadways = \$85,600
- **Total Damages = \$236,100**

### With Dam in Place

- Residential Bldgs. = \$4,900
- Commercial Bldgs. = \$11,600
- Public Bldgs. = \$200
- Crossings/Roadways = \$25,300
- **Total Damages = \$42,000**

From: "Lyons, Jim - NRCS, Holden, MA (jim.lyons@usda.gov)" <jim.lyons@usda.gov>  
To: Albert Giguere <albert.giguere@cityofwestfield.org>, Brother Al me  
<brotheral01@hotmail.com>  
Cc: "Davis, Deron - NRCS, Amherst, MA" <deron.davis@usda.gov>  
Date: 02/26/2020 11:53 AM  
Subject: Pond drains for Powdermill and Arm Brook dam

Al,

In follow-up to our discussion last week.

As you are aware, the pond drains for both the Powdermill and Arm Brook dams have not been operated for many years (it is not known when they were last operated). Since the pond drain has not been used for a long time, it is likely that sediment and debris has accumulated in front of the pond drain valve for each of the dams. Operating the ponds drains at this time without inspection runs the risk of possibly damaging the valve stem, guides or causing the valve to be stuck open due to sediment and debris. The pond drain valve and stems should be inspected and any significant sediment/ debris be removed prior to attempting to open the valve. Significant accumulations of sediment/debris should be removed prior to opening the valve and the guides and stem should be repaired if needed. Care should be taken during opening and closing of the valves to prevent damage to the valve stem and guides. To ensure that the valves are functional, the valves should be opened and closed on yearly basis.

Functional ponds drains for both the Powdermill and Arm Brook dams are an important component of the flood water retarding dams. The purpose of the pond drains are to allow for the impoundment level to be lowered for inspection, maintenance and rehabilitation of the dam. As part of the current dam rehabilitation planning contracts the inspection of the principal spillway pipe and riser structure is being delayed due to the inability to lower the impoundment level at both of the dams to allow for video inspection of the principal spillway and riser.

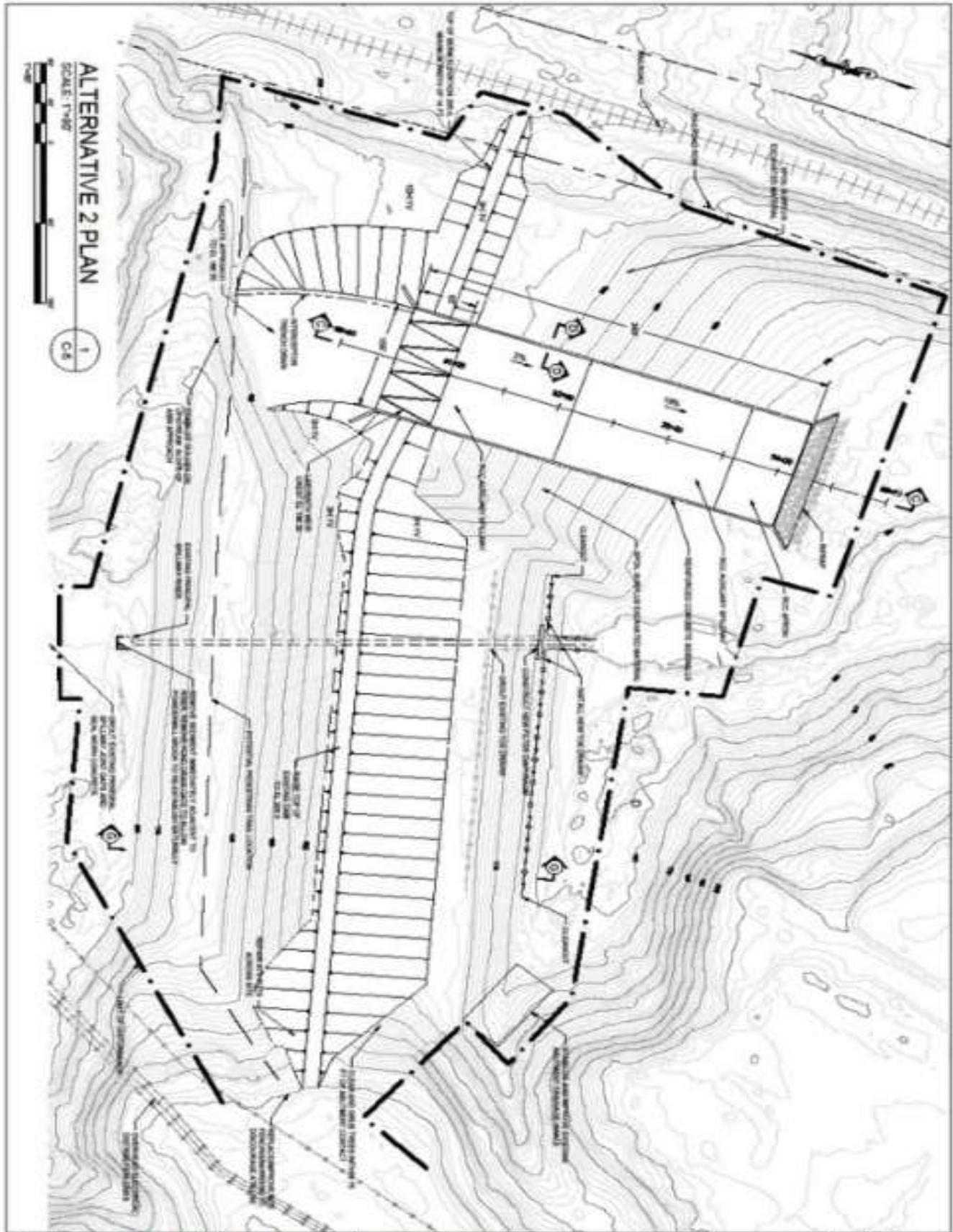
Jim

James Lyons  
Civil Engineer



U.S. Department of Agriculture  
Natural Resources Conservation Service  
52 Boyden Rd, Suite 100  
Holden, MA 01520

Phone 774-345-7027  
Email: [jim.lyons@ma.usda.gov](mailto:jim.lyons@ma.usda.gov)



 330 Shoemaker Avenue Building 15, Suite 100 Ambler, Pennsylvania 19002	 United States Department of Agriculture Safety, Security, Innovation & Service	<b>POWDERMILL DAM WESTFIELD, MASSACHUSETTS</b>		No. of Acres Total Projected 750
		ALTERNATIVE 2 PLAN		

**C-5**  
Sheet C-5 of 15



**ALTERNATIVE 2 PROFILE C-C**  
 SCALE 1"=8'  
 VERTICAL SCALE 1"=18'  
 1  
 C-C

<b>C-6</b> <small>Sheet 7 of 13</small>	<b>ATERRA</b> <small>300 Brookside Avenue                  Building 18, Suite 140                  Avonlea, Pennsylvania 19002</small>		<small>United States                  Department of                  Agriculture</small> <small>Nutrition Assistance Administration</small>	<b>POWERMILL DAM                  WESTFIELD, MASSACHUSETTS</b>  ALTERNATIVE 2 PROFILE	Original: JFB
					Checked: ASB
Date: 10/22/2013					
Scale: 1"=8'					
Project:					
Date:					

## Arm Brook Flood Control Reservoir/Dam

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This is the “Jewel” of the Westfield Flood Control System. It was built as part of a larger Federal Flood Control Project; “Powdermill Brook Flood Control Project”, started in 1961 and completed in 1964. It was designed to handle a 100 Year Flood level storm and controls 2,164 acres of runoff. The dam contains 77,200 cubic yards of earthen fill, is 56ft high above the Arm Brook basin, utilizes a drop inlet drain to control normal flow, and has an earthen spillway to control extreme overflow. Arm Brook Reservoir covers approx. 13 acres, with 150 acre-feet-of-water, (48,877,715 Gallons) in Non-Flood Conditions. The United States Department of Agriculture -Natural Resources Conservation Service (USDA-NRCS) and the Massachusetts Department of Conservation and Recreation -Office of Dam Safety (DCR-ODS) oversee and periodically conduct safety standard inspections of the dam, per Local Cooperation Agreement (LCA) and Massachusetts Dam Safety Law. Under state law, the Flood Control Commission must contract with a certified engineer every two years, conduct a Phase 1 Safety Inspection of the dam, and submit it to the DCR-ODS, with copy provided to the USDA-NRCS. Due to its size and risk presented, it is regulated as being a High Hazard Dam. Federal, State, & Municipal funds were involved, and the original construction was authorized, conditionally, by an Act of Congress. This including a required Forested Recreation & Wildlife Conservation purpose, titled as:

*“Watershed Work Plan for Watershed Protection and Flood Prevention, which was prepared under the Authority of the United States Watershed Protection and Flood Prevention Act, Public Law 566, 83rd Congress, 68 Stat. 666, as amended.”, and  
the “United States Fish and Wildlife Coordination Act, as amended.”*

### **Status:**

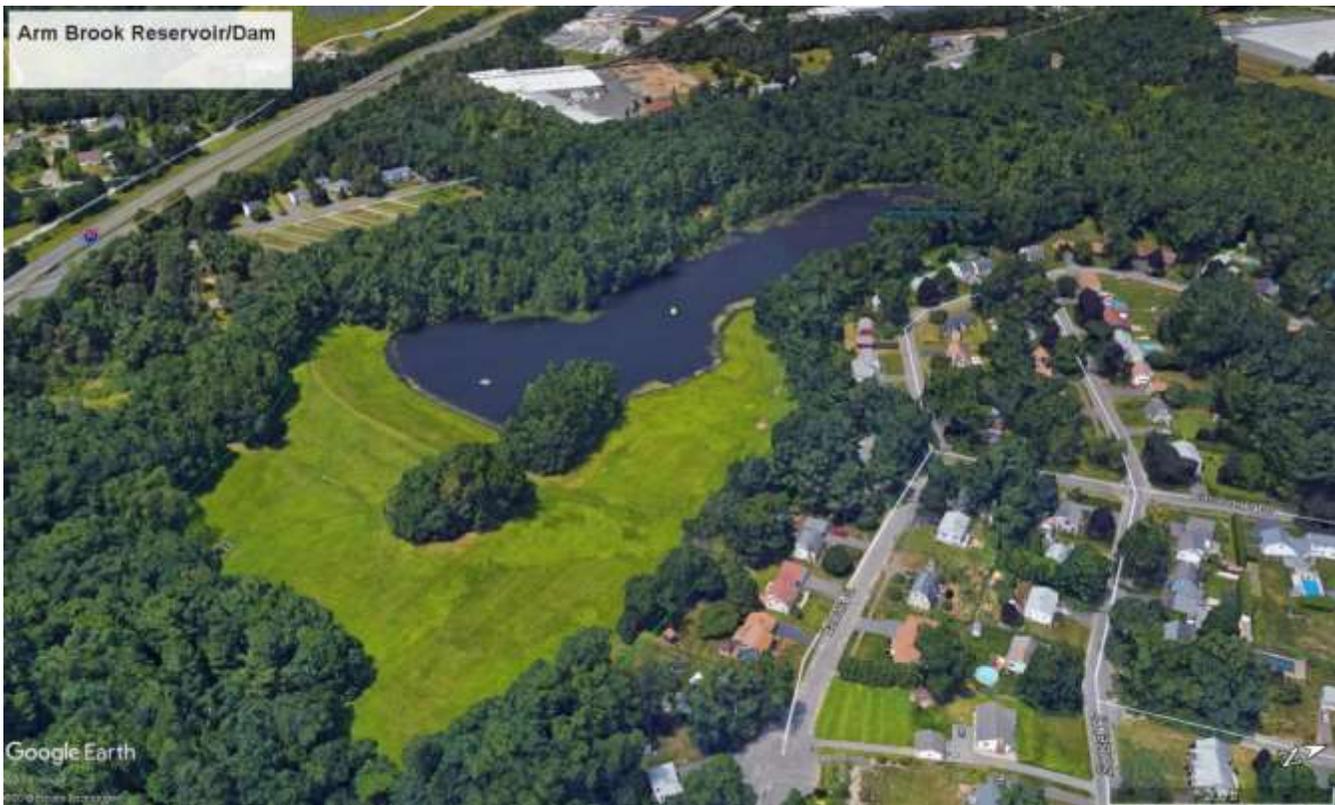
The Arm Brook Flood Control Reservoir/Dam Project is in the best overall condition versus Powdermill Flood Control Reservoir/Dam. Having served the city for a little more than 50 years, it now requires a “Complete Rehabilitation to New Federal Standards”, per the USDA-NRCS and concurred by the DCR-ODS. The City is now near the point at which it must commit to the USDA-NRCS Rehabilitation.

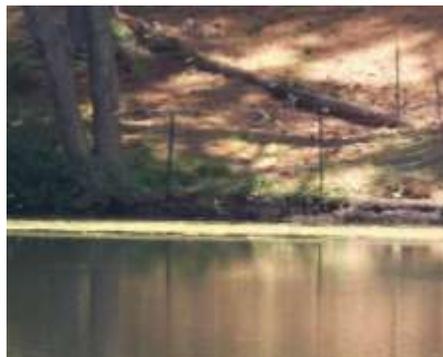
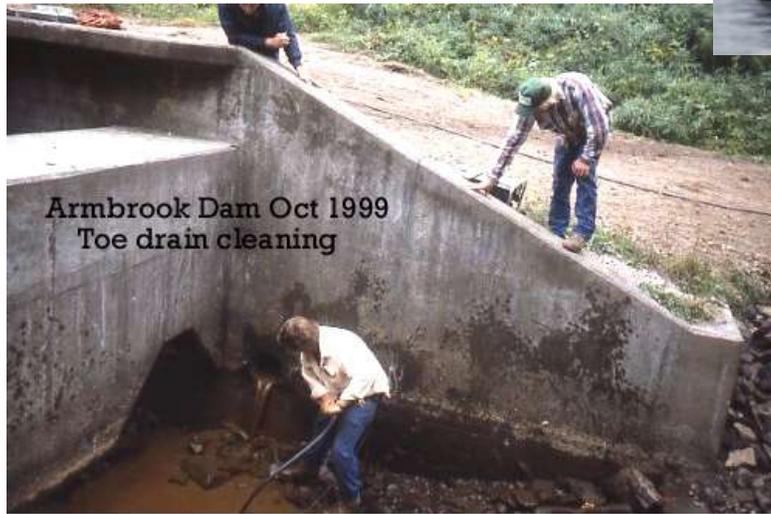
### **Conclusion:**

This Flood Control Project is in “**SATISFACTORY**” Condition, based upon the DCR-Office of Dam Safety’s rating guidelines, and requires a “Complete Rehabilitation”.

**It is the Recommendation of the Westfield Flood Control Commission that the City of Westfield should pursue USDA-NRCS Preferred Alternative #3, incurring all of the permitting costs and all USDA-NRCS land taking recommendations to the ABOVE ASW Crest Elevation to help prevent possible flooding of private property and help curb incursions onto the flood control site, such as illegal dumping of yard waste, illegally placed fencing, and other issues currently identified at Arm Brook Flood Control Dam. The Phase 1 Safety Inspection was recently completed and submitted and should be considered supplemental to this report.**

# Arm Brook Flood Control Reservoir/Dam





**Top Left:** View from West End of Dam.  
**Upper Middle Left:** Henry Warchol, Longtime Commissioner @ Dam Face.  
**Lower Middle Left:** Work in Oct 1999 (photo credit Unknown).  
**Bottom Left:** Illegal residential fencing at reservoir edge.  
**Top Right:** Dam Crest Looking North.  
**Middle Right:** Drainage Riser and Gate Valve Stem.  
**Bottom Left:** Dam Outfall and Toe Drain 2020.  
(photo credits: Albert G. Giguere Jr., except where noted)

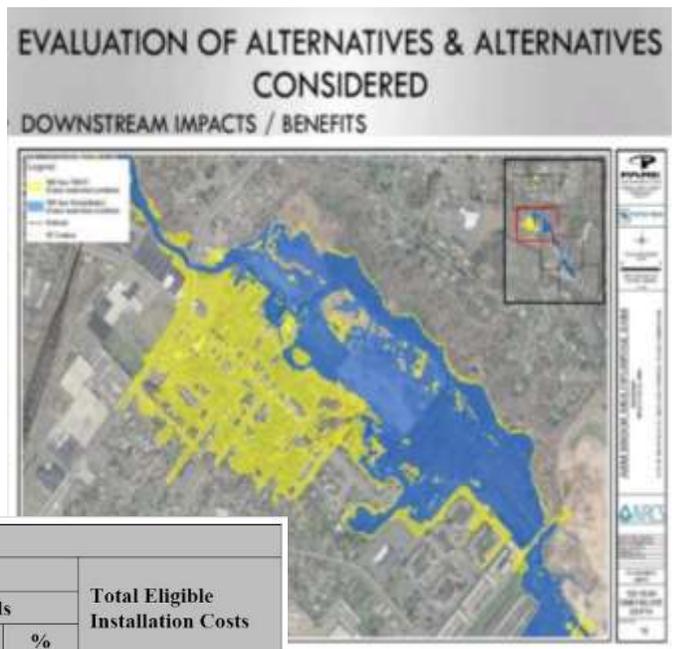


Table S-5: Estimated Project Costs

Rehabilitation Alternative #3	Source				Total Eligible Installation Costs
	PL 83-566 Funds		Other Funds		
	\$	%	\$	%	
Construction	\$ 3,456,228.10	65%	\$ 1,861,045.90	35%	\$ 5,317,274.00
Engineering	\$ 1,042,000.00	100%	\$ -	0%	\$ 1,042,000.00
Relocation	\$ -	0%	\$ -	0%	\$ -
Real Property Rights	\$ -	0%	\$ 140,000.00	100%	\$ 140,000.00
Natural Resources Rights	\$ -	0%	\$ -	0%	\$ -
Project Administration	\$ 250,000.00	100%	\$ -	0%	\$ 250,000.00
Permits	\$ -	0%	\$ 50,000.00	100%	\$ 50,000.00
<b>Total Costs</b>	<b>\$ 4,748,228.10</b>	<b>70%</b>	<b>\$ 2,051,045.90</b>	<b>30%</b>	<b>\$ 6,799,274.00</b>
Annual O&M Costs	\$ -	0%	\$ 13,750.00	100%	\$ 13,750.00

	Alternative	
	No Action Future Without Federal Investment Project (Rehabilitate to State Standards) <sup>1/</sup>	Rehabilitate to NRCS High Hazard Potential Dam
<b>Project Investment (rounded)</b>	<b>\$3,880,900</b>	<b>\$6,804,300</b>
<b>NED Account</b>		
Adverse, Rehabilitation Cost, Average Annual		\$214,300
<b>Total Adverse, Average Annual</b>	<b>\$0</b>	<b>\$214,300</b>
Beneficial, Damage Reduction, Average Annual		\$84,100
Beneficial, FWOPI Costs Avoided, Average Annual		\$127,900
<b>Total Beneficial, Average Annual</b>	<b>\$0</b>	<b>\$212,000</b>
<b>Net Benefit</b>		<b>(\$2,300)</b>



(Photo & Info Credit USDA-NRCS, PARE Group, & Tetra Tech)

<sup>1/</sup> The FWOPI Alternative has \$3,880,900 in construction costs associated with rehabilitation to Mass DCR standards. In the NED Account display, this Adverse Annual Cost of \$127,900 is tracked as a Beneficial Annual value for the Rehabilitation Alternative rather than an Adverse Annual Cost in the FWOPI Alternative.





## Glossary

- Dam Face** - The external upstream and downstream surfaces of a dam structure.
- Dike** - a relatively short length, concrete or earthen-fill barrier that confines or diverts floodwater of a river channel, thus protecting flood prone areas. Sometimes used slangily to refer to a levee.
- Drainage Area** - the total land area where surface water runs off and collects in a stream, or series of streams that make up a single watershed.
- Drop Inlet Drain** - a device, in a stream or water impoundment/dam, preventing water from rising above a certain elevation. Once water reaches a certain level, excess water passes into the structure and is diverted to via a conduit to the opposite side of the impoundment.
- Earthen Dam** - an engineered impediment of well-compacted, layered earthen fill, used to control or restrict the flow of a stream or river, which employs drain zones to collect & remove seep water, thus preserving its integrity.
- Earthen Fill** - a well-graded and/or engineered mixture of soil containing principally gravel, sand, silt, and clay, which is used with other materials to construct dams, levees, dikes, and hurricane protection barriers.
- Erosion** - is the process by which soil and rock are removed by natural processes such as wind or water flow and transported and deposited in other locations. While erosion is a natural process, human activities have increased it 10-40 times the natural rate. Excessive erosion causes problems such as land degradation, sedimentation of waterways, and ecological collapse due to loss of the nutrient rich upper soil layers.
- Flash Floods** - usually result from intense rainfall over a relatively small area, or areas heavily saturated from previous precipitation. The National Weather Service is responsible for issuance of Flash Flood Warnings.
- Floods** - are caused by many factors: heavy rainfall, highly accelerated snowmelt, severe winds over water, unusual high tides, or failure of dams, levees, retention ponds, or other structures that retained the water, and can be exacerbated by increased amounts of impervious surface which reduces vegetation that can absorb rainfall.
- Flood Stage** - The stages established by the National Weather Service, in which a river overflows its channel banks.
- FEMA** - Federal Emergency Management Agency (FEMA)
- Federal Project** - A flood control work authorized by Congress or by a Federal agency and conditionally turned over to a local city, town, county, or state agency for operation and maintenance.
- Flood Control Act of 1936** - The Flood Control Act of 1936, PL. 74-738, (FCA 1936) was an Act of the United States Congress signed into law by President Franklin Delano Roosevelt on 22 June 1936. It authorized civil engineering projects such as dams, levees, dikes, and other flood control measures through the United States Army Corps of Engineers and other Federal agencies. It further put watersheds, water flow retardation, and soil erosion prevention under the Department of Agriculture via Soil Conservation Service.
- Flood Control Project/Works** - Structures designed and constructed to prevent damage by irregular and unusual rises in water level and include levees, dikes, channels, dams, and pumping stations
- Floodplain** - the land adjoining a river, stream, ocean, or lake that is likely to be flooded during periods of excess precipitation or abnormal high tide. Under FEMA and USACE specifications, areas designated to flood.
- Floodway** (Regulatory USACE/FEMA) – a river channel and adjacent land areas that must be reserved in order to discharge floodwaters, without cumulatively increasing water surface elevation above a designated height.
- Floodwalls** - reinforced concrete walls that act as barriers against floodwaters and confine them to the river channel, protecting flood prone areas. Floodwalls are usually built-in areas with a limited amount of space.
- Gabion Wall** - a retaining wall constructed of trap rock filled wire mesh baskets.
- NRCS** - United States Department of Agriculture's Natural Resources Conservation Service.
- Levee** - an elongated naturally occurring ridge or artificially constructed earthen wall, often parallel to the course of a river in its floodplain or along low-lying coastlines.
- Outlet Drain**- gated conduits, usually located at the base of a dam or the exit point for a stormwater drainage system.
- Pumping Station** - a structure containing pumps that discharges floodwaters from a protected area over or through a levee or floodwall into a river or ocean.
- Spillway** - a channel-shaped structure, which allows water exceeding the storage capacity of a reservoir to pass through or around a dam instead of overtopping it.
- Stone Slope Protection** - a layer of large pieces of trap rock or other stone, underlain by a layer of gravel bedding, designed to prevent erosion from stream flow, wave attack, and runoff.
- Riparian Area** - is the interface between land and a river or stream, significant in ecology, environmental management, and civil engineering because of their role in soil conservation and habitat biodiversity.
- Stormwater** - is water that originates as rain, snow, or snowmelt that cannot be absorbed into the soil due to impervious surfaces such as asphalt, concrete, compacted soils, or structures, & flows into storm drains.
- Storm Water Drainage System** - designed to drain excess rain and ground water from paved streets, parking lots, sidewalks, and roofs into a network of piping that eventually leads to a nearby body of water.
- Training Dike** - a structure extending from the shore into the water that redirects the current, preventing sediment from settling and ensuring that adequate depths are maintained.
- Training Wall** - a structure built along channel banks to narrow the channel area, thereby controlling the velocity of the flow of water and preventing the buildup of sediment. Training walls and training dikes have the same purpose: to ensure adequate depths are maintained.
- USACE** - US Army Corps of Engineers (USACE)
- Weir** - a concrete structure designed as part of the spillway that allows water to exit a reservoir and over the spillway.