Final Supplemental Watershed Plan No. 2 and Environmental Assessment for the Rehabilitation of Floodwater Retarding Structures Garrett Dam (PA-413), Varcoe Dam (PA-415), Martin Dam (PA-419) and Finkleday Dam (PA-421) of the Lackawaxen Tributaries Watershed
Wayne County, Pennsylvania

PREPARED BY
USDA Natural Resources Conservation Service

IN COOPERATION WITH
Wayne County Board of County Commissioners
Wayne Conservation District

August 2023

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AUTHORITY

The original watershed work plan was prepared, and the works of improvement were installed under the authority of the Watershed Protection and Flood Prevention Act of 1954. The rehabilitation of the Lackawaxen Tributaries Dams (shown below) is authorized by Section 14 of the Watershed Protection and Flood Prevention Act (Public Law 83-566) as enacted by Section 313 of Public Law 106-472, otherwise known as "The Small Watershed Rehabilitation Amendments of 2000."

ABSTRACT

Name/number	DEP ID	NIDID
Garrett Dam / PA-413	D64-194	PA00097
Varcoe Dam / PA-415	D64-172	PA00088
Martin Dam / PA-419	D64-170	PA00086
Finkleday Dam / PA-421	D64-171	PA00087

The dams mentioned above do not presently meet Natural Resources Conservation Service (NRCS) standards for auxiliary spillway (ASW) stability and integrity, which would result in breaching of the auxiliary spillway during the design flood. Furthermore, Garrett Dam, Varcoe Dam, and Martin Dam are overtopped during the design flood. Based on the results of the process-based model, the overtopping of Garrett Dam and Martin Dam would result in failure of the structures.

Each of the rehabilitation projects will include the following:

- Constructing a new impact basin to stabilize the outlet.
- Constructing a filter diaphragm near the downstream slope around the existing principal spillway conduit and installing new plastic toe drainpipes with a multi-stage filter.

The preferred alternative for Garrett Dam involves the following:

- Armoring the 100-foot-wide auxiliary spillway with RCC covered with topsoil.
- Constructing a RCC cutoff wall at the downstream end of the RCC spillway and covering the RCC with sacrificial topsoil.

- Raising the dam crest to EL 1207.9 and flattening the downstream slope to 3H:1V.
- Replacing the non-standard principal spillway riser.
- Repairing the pipe joints in the existing 30-inch diameter reinforced concrete principal spillway conduit.
- Project installation cost is estimated to be $6,252,100 of which $4,627,400 will be paid from the Small Watershed Rehabilitation funds and $1,624,700 from local funds.

The preferred alternative for Varcoe Dam involves the following:

- Armoring the 50-foot-wide auxiliary spillway with articulated concrete blocks (ACBs).
- Constructing a reinforced concrete cantilever cutoff wall at the downstream end of the ACB spillway.
- Grading and raising the dam crest to EL 1277.6 ft and flattening the downstream slope to 3H:1V.
- Modifying the principal spillway low stage orifice to increase the normal pool by 0.14 feet to accommodate the required sediment storage and replacing or repairing the principal spillway riser trash rack and existing gate.
- Project installation cost is estimated to be $4,278,500 of which $3,337,900 will be paid from the Small Watershed Rehabilitation funds and $940,600 from local funds.

The preferred alternative for Martin Dam involves the following:

- Armoring of the 40-foot-wide auxiliary spillway with RCC and constructing a reinforced concrete cutoff wall at the downstream end of the spillway.
- Raising the dam crest to EL 1281.4 ft, flattening the downstream slope to 3H:1V, constructing a 20-ft wide stability berm (3H:1V) on the upstream slope.
- Replacing and moving the existing principal spillway riser to accommodate the stability berm.
- Project installation cost is estimated to be $5,813,600 of which $4,353,200 will be paid from the Small Watershed Rehabilitation funds and $1,460,400 from local funds.

The preferred alternative for Finkleday Dam involves the following:

- Armoring of the 60-foot-wide auxiliary spillway with ACBs and constructing a secant pile cutoff wall at the downstream end of the spillway.
- Leveling the dam crest to EL 1281 ft and flattening the downstream slope to 3H:1V.
- Repairing or replacing the principal spillway riser trash rack and existing gate.
- Project installation cost is estimated to be $4,765,100 of which $3,666,800 will be paid from the Small Watershed Rehabilitation funds and $1,098,300 from local funds.

Total project cost for all four dams is $21,109,300 of which $15,985,300 will be paid from the Small Watershed Rehabilitation funds and $5,124,000 from local funds.

COMMENTS AND INQUIRIES

For further information, please contact Denise Coleman, State Conservationist, USDA – Natural Resources Conservation Service, 359 East Park Drive, Suite 2, Harrisburg, PA 17111-2747, **Phone:** 717-237-2100 or **Toll Free:** 1-888-300-8379

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Summary Supplemental Watershed Plans & Environmental Assessment Documents
for
Lackawaxen Watershed Dams – Garrett Dam (PA-413), Varcoe Dam (PA-415),
Martin Dam (PA-419) and Finkleday Dam (PA-421)
Wayne County and Pennsylvania
8th Congressional District

Authorization:
The rehabilitation of Garrett Dam, Varcoe Dam, Martin Dam and Finkleday Dam is authorized under Public Law 83-566 (as amended), and as further amended by Section 313 of Public Law 106-472.

Sponsors:
Wayne County Soil Conservation District and Wayne County Commissioners

Proposed Action:
Rehabilitate Garrett Dam, Varcoe Dam, Martin Dam and Finkleday Dam to meet current NRCS and Pennsylvania safety and performance standards.

Federal Objective:
Investments in this proposed action reflect national priorities, encourage economic development, and protect the environment by:
(1) seeking to maximize sustainable economic development;
(2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and
(3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

Purpose and Need for Action:
The "Purpose" is to sustain continuity of **Flood Prevention (Flood Damage Reduction)** for Garret, Varco, Martin, and Finkleday watersheds in a safe manner while minimizing environmental, economic, and social impacts.

The present dams do not meet current safety and performance standards of the NRCS as well as the Pennsylvania Department of Environmental Protection (PADEP); therefore, action is necessary. The risk of a catastrophic breach resulting in the failure of these structures is heightened due to their current condition. The effects of such a breach are loss of life, and flood damages to homes, commercial and public facilities, and infrastructure. Garrett and Varcoe Dams have a common downstream floodplain. The same exists for Martin and Finkleday Dams. Because the dams have common downstream floodplains, flood damage reduction analysis results for Garrett and Varcoe are similar as are results for Martin and Finkleday.

Dam Site	Dam Overtopped During FBH	Dam Breaches During FBH	Spillway Breaches During FBH
Garrett Dam	*Yes*	*Yes*	*Yes*
Varcoe Dam	*Yes*	*No*	*Yes*
Martin Dam	*Yes*	*Yes*	*Yes*
Finkleday Dam	*No*	*No*	*Yes*

Dam Site	Compliance with NRCS and PADEP Upstream Embankment Slope Stability Factor of Safety Criteria		
	Normal Pool Steady State Seepage	Flood Surcharge FBH Event	Normal Pool Rapid Drawdown
Garrett Dam	*Yes*	*Yes*	*Yes*
Varcoe Dam	*Yes*	*Yes*	*Yes*
Martin Dam	*Yes*	*Yes*	*No*
Finkleday Dam	*Yes*	*Yes*	*Yes*

Dam Site	Compliance with NRCS and PADEP Downstream Embankment Slope Stability Factor of Safety Criteria	
	Normal Pool Steady Seepage	Flood Surcharge FBH Event
Garrett Dam	*Yes*	*Yes*
Varcoe Dam	*No*	*No*
Martin Dam	*No*	*No*
Finkleday Dam	*Yes*	*Yes*

Hydrologic Breach Buildings & Roads PAR	Static Breach Buildings & Roads PAR
Garrett Dan – 152	Garrett Dam – 53
Varcoe Dam – 33	Varcoe Dam – 40
Martin Dam – 85	Martin Dam – 68
Finkleday Dam – 58	Finkleday Dam – 41

Preferred Alternative:
Based on the supporting analyses performed for this project and consultations with the NRCS and the Sponsors, the Agency Preferred, the National Economic Efficiency (NEE), and the Locally Preferred (PR&G) alternatives are identical.

Garrett Dam
The Preferred Alternative includes:

- Armoring the 100-foot-wide auxiliary spillway with roller compacted concrete (RCC) covered with topsoil. Topsoil will provide additional protection against freezing, thus extending the life of the RCC.
- Constructing an RCC cutoff wall at the downstream end of the RCC spillway and covering the RCC with sacrificial topsoil.
- Raising the dam crest to EL 1207.9 and flattening the downstream slope to 3H:1V.

- replacing the non-standard principal spillway riser.
- Repairing the leaking pipe joint in the existing 30-inch diameter reinforced concrete principal spillway conduit.
- Constructing a new impact basin to stabilize the outlet.
- Constructing a filter diaphragm near the downstream slope around the existing principal spillway conduit and installing new plastic toe drainpipes with a multi-stage filter.
- Project installation cost is estimated to be $6,252,100 of which $4,627,400 will be paid from the Small Watershed Rehabilitation funds and $1,624,700 from local funds.

Varcoe Dam

The Preferred Alternative includes:

- Armoring the 50-foot-wide auxiliary spillway with articulated concrete blocks (ACBs).
- Constructing a reinforced concrete cantilever cutoff wall at the downstream end of the ACB spillway.
- Grading and raising the dam crest to EL 1277.6 ft. and flattening the downstream slope to 3H:1V.
- Modifying the principal spillway low stage orifice to increase the normal pool by 0.14 feet to accommodate the required sediment storage and replacing or repairing the principal spillway riser trash rack and existing gate.
- Constructing a new impact basin to stabilize the outlet.
- Constructing a filter diaphragm near the downstream slope around the existing principal spillway conduit and installing new plastic toe drainpipes with a multi-stage filter.
- Project installation cost is estimated to be $4,278,500 of which $3,337,900 will be paid from the Small Watershed Rehabilitation funds and $940,600 from local funds.

Martin Dam

The Preferred Alternative includes:

- Armoring of the 40-foot-wide auxiliary spillway with RCC and constructing a reinforced concrete cutoff wall at the downstream end of the spillway.
- Raising the dam crest to EL 1281.4 ft, flattening the downstream slope to 3H:1V, constructing a 20-ft wide stability berm (3H:1V) on the upstream slope.
- Replacing and moving the existing principal spillway riser to accommodate the stability berm.
- Constructing a new impact basin to stabilize the outlet.
- Constructing a filter diaphragm near the downstream slope around the existing principal spillway conduit and installing new plastic toe drainpipes with a multi-stage filter.
- Project installation cost is estimated to be $5,813,600 of which $4,353,200 will be paid from the Small Watershed Rehabilitation funds and $1,460,400 from local funds.

Finkleday Dam

The Preferred Alternative includes:

- Armoring of the 60-foot-wide auxiliary spillway with ACBs and constructing a secant pile cutoff wall at the downstream end of the spillway.
- Leveling the dam crest to EL 1281 ft and flattening the downstream slope to 3H:1V.
- Repairing or replacing the principal spillway riser trash rack and existing gate.
- Constructing a new impact basin to stabilize the outlet.
- Constructing a filter diaphragm near the downstream slope around the existing principal spillway conduit and installing new plastic toe drainpipes with a multi-stage filter.
- Project installation cost is estimated to be $4,765,100 of which $3,666,800 will be paid from the Small Watershed Rehabilitation funds and $1,098,300 from local funds.

Resource Information:

Latitude and Longitude

- Garrett Dam – latitude 41.6007, longitude -75.2278
- Varcoe Dam – latitude 41.6011, longitude -75.1965
- Martin Dam – latitude 41.5702, longitude -75.1848
- Finkleday Dam – latitude 41.5868, longitude -75.1886

8-Digit Hydrologic Unit Number

- HUC-8 02040103

Climate and Topography:

The project area is in the Allegheny Plateau climatic area. The topography of the land surrounding the projects consists of mountains and hills of varying steepness. The average yearly temperature in Wayne County is 48.2 degrees Fahrenheit and average yearly precipitation is 42.5 inches (NOAA 2021).

Watershed Size:

- Garrett Dam – 1,024 acres
- Varcoe Dam – 512 acres
- Martin Dam – 352 acres
- Finkleday Dam – 384 acres

Land uses of Area of Initial Analysis (AIA) (acres):

Land Use	Acres in Project Area			
	Garrett Dam	**Varcoe Dam**	**Martin Dam**	**Finkleday Dam**
Cropland		*Negligible*	1.1	
Farmstead		1.1	1.4	
Forest	41.3	53.7	17.3	80.2
Mining/Extraction				0.1
Pasture/Brush	15.4	6.7	53.3	25.8
Residential	13	9.9	4.1	15.7
Water	12.7	11.4	5.8	9.7
NOTE: Land use information obtained from the Wayne County Planning Department (2017).				

Land ownership of Affected Area:

Name/number	Private	State	Federal	County
Garrett Dam	100%	0%	0%	0%
Varcoe Dam	100%	0%	0%	0%
Martin Dam	100%	0%	0%	0%
Finkleday Dam	100%	0%	0%	0%

Population and Demographics:

Garrett Dam & Varcoe Dam (waters flow to same tributary)

- Estimated population – 125.
- Minority population (race and ethnicity) – 1.6%.
- Percent population below poverty level – 13.4%.
- Population age 25 and over are high school graduates or higher – 94%.
- Per capita income - $27,030

Martin Dam & Finkleday Dam (waters flow to same tributary)

- Estimated population – 66.
- Minority population (race and ethnicity) – 8.2%.
- Percent population below poverty level – 11.5%.
- Population age 25 and over are high school graduates or higher – 89%.
- Per capita income - $25,322.

Resource Concerns Identified Through Scoping:

- Prime and Unique Farmland
- Waters of the United States
- Water Quality
- Wild and Scenic Rivers
- Wetlands and Vernal Pools
- Floodplain Management
- Air Quality

- Special Status Plants
- Noxious Weed and Invasive Plants
- Riparian Areas
- Endangered and Threatened Wildlife and Species of Concern
- Invasive Fish and Wildlife
- Migratory Birds/Bald Eagles
- Cultural Resources
- Environmental Justice
- Visual/Aesthetics and Scenic Beauty
- Regulating Ecosystem Service – Flood and Disease Control
- Supporting Ecosystem Services – Nutrient Cycling, Soil Formation
- Cultural Ecosystem Services – Recreation Use, Aesthetic Viewsheds

Alternative Plans Considered:
Non-structural alternative (applies to all dams) – Reducing the hazard classification of the dam to meet significant or low hazard dam criteria, relocating or floodproofing all structures within the resultant dam breach inundation areas, modification or relocation of roadways and stream crossings within the breach inundation areas, and the procurement of deed restrictions on property between 100-year and breach elevations.

Decommissioning alternative (applies to all dams) – Requires removing the flood detention capacity of the dam and re-connecting and restoring the stream channels upstream and downstream.

Future Without Federal Investment (FWOFI) alternative (applies to all dams) – Constructed breach of the dam and re-establish a stable stream channel through the former reservoir.

Garrett Dam
All rehabilitation alternatives include: flattening of the downstream slope, a new PSW riser, a new impact basin, a new filter diaphragm, new toe drains and a chimney drain. In addition, alternative-specific features are provided below:

Alternative 1 – Construct 100-foot RCC armored ASW and RCC cutoff wall, raise top of dam to EL 1207.9.

Alternative 2 – Construct 85-ft wide Labyrinth Weir.

Alternative 3 – Construct160-ft wide Labyrinth Weir.

Varcoe Dam
All rehabilitation alternatives include: flattening of the downstream slope, a new impact basin, a new filter diaphragm, new toe drains, and repairs/modifications of the PSW riser. In addition, alternative-specific features are provided below:

Alternative 1 – Construct 50-ft wide ACB armored ASW and reinforced concrete cutoff wall, grade top of dam to EL 1277.6.

Alternative 2 – Construct 50-ft wide RCC armored ASW and RCC cutoff wall, grade top of dam to EL 1277.6.

Alternative 3 – Construct 65-ft wide ACB armored ASW and reinforced concrete cutoff wall, level top of dam to EL 1277.1 (design settled elevation).

Martin Dam

All rehabilitation alternatives include: flattening of the downstream slope, a stability berm on the upstream side of the dam, a new PSW riser, a new impact basin, a new filter diaphragm, and new toe. In addition, alternative specific improvement are provided below:

Alternative 1 – Construct 40-ft wide ASW armored with RCC, raise dam to EL 1281.4.

Alternative 2 – Construct 42-ft wide Labyrinth Weir.

Alternative 3 – Construct 75-ft wide ASW armored with RCC.

Finkleday Dam

All rehabilitation alternatives include: flattening of the downstream slope, a new impact basin, a new filter diaphragm, new toe drains, and repairs of the PSW riser. In addition, alternative-specific features are provided below:

Alternative 1 – Construct 60-ft wide ASW armored with ACBs and RCC cutoff wall.

Alternative 2 – Construct 60-ft wide ASW armored with ACBs and secant pile cutoff wall.

Alternative 3 – Construct 60-ft wide ASW armored with RCC and RCC cutoff wall.

Mitigation

The following mitigation measures are associated with all dams and the respective alternatives, unless otherwise noted:

- To minimize impacts to wetlands abutting the impoundment and WOTUS, during construction, a cofferdam or similar structure will be installed to avoid the need to drain the entire impoundment to facilitate work.
- All disturbed areas post construction will be regraded, stabilized, and seeded.
- Sediment and erosion controls, such as turbidity curtains, silt fences, and/or straw bales, or similar will be employed to avoid impacts to water quality.

<u>Garrett Dam</u>

- There are anticipated to be approximately 0.17 acres of adverse permanent wetlands impacts from Alternatives 1, 2, and 3. Therefore, an equivalent acreage of new wetlands, with similar or elevated form and function, within the general vicinity of the project site will be created.

Martin Dam

- There are anticipated to be approximately 0.22 acres of permanent wetlands impacts from Alternatives 1, 2, 3. Therefore, an equivalent acreage of new wetlands within the general vicinity of the project site will be created.

- No permanent wetlands impacts are anticipated for Finkleday Dam or Varcoe Dam.

Mitigation will be carried out during and post construction by the construction contractor as part of the project actions. Mitigation may be the purchase of credits or paying "in lieu of" fees.

Project Costs (Dollars):
Garrett Dam

	PL-83-566 Funds		**Other Funds**		**Total**	
Category	**Dollars**	**%**	**Dollars**	**%**	**Dollars**	**%**
Construction	$2,922,800	66.4%	$1,480,200	33.6%	$4,403,000	100%
Mitigation	$80,600	65.0%	$43,400	35.0%	$124,000	100%
Engineering Technical Assistance	$1,500,000	99.7%	$5,000	0.3%	$1,505,000	100%
Geotechnical Investigation	$80,000	100%	$0	0%	$80,000	100%
Relocation	n/a	n/a	n/a	n/a	n/a	n/a
Land Rights Acquisition	n/a	n/a	$83,600	100%	$83,600	100%
Project Administration	$44,000	89.8%	$5,000	10.2%	$49,000	100%
Permits	n/a	n/a	$7,500	100%	$7,500	100%
TOTAL COSTS	**$4,627,400**	**74.0%**	**$1,624,700**	**26.0%**	**$6,252,100**	**100%**
Annual O&M (non-Federal)	n/a	n/a	$6,000	100%	$6,000	100%

Varcoe Dam

	PL-83-566 Funds		Other Funds		Total	
Category	**Dollars**	**%**	**Dollars**	**%**	**Dollars**	**%**
Construction	$1,732,900	69.7%	$754,100	30.3%	$2,487,000	100%
Mitigation	$0	0%	$0	0%	$0	0%
Engineering Technical Assistance	$1,500,000	99.7%	$5,000	0.3%	$1,505,000	100%
Geotechnical Investigation	$80,000	100%	$0	0%	$80,000	100%
Relocation	n/a	n/a	n/a	n/a	n/a	n/a
Land Rights Acquisition	n/a	n/a	$169,000	100%	$169,000	100%
Project Administration	$25,000	83.3%	$5,000	16.7%	$30,000	100%
Permits	n/a	n/a	$7,500	100%	$7,500	100%
TOTAL COSTS	**$3,337,900**	**78.0%**	**$940,600**	**22.0%**	**$4,278,500**	**100%**
Annual O&M (non-Federal)	n/a	n/a	$6,000	100%	$6,000	100%

Martin Dam

	PL-83-566 Funds		Other Funds		Total	
Category	**Dollars**	**%**	**Dollars**	**%**	**Dollars**	**%**
Construction	$2,609,200	65.7%	$1,362,800	34.3%	$3,972,000	100%
Mitigation	$89,000	65.0%	$48,000	35.0%	$137,000	100%
Engineering Technical Assistance	$1,500,000	99.7%	$5,000	0.3%	$1,505,000	100%
Geotechnical Investigation	$115,000	100%	$0	0%	$115,000	100%
Relocation	n/a	n/a	n/a	n/a	n/a	n/a
Land Rights Acquisition	n/a	n/a	$32,100	100%	$32,100	100%
Project Administration	$40,000	88.9%	$5,000	11.1%	$45,000	100%
Permits	n/a	n/a	$7,500	100%	$7,500	100%
TOTAL COSTS	**$4,353,200**	**74.9%**	**$1,460,400**	**25.1%**	**$5,813,600**	**100%**
Annual O&M (non-Federal)	n/a	n/a	$6,300	100%	$6,300	100%

Finkleday Dam

	PL-83-566 Funds		Other Funds		Total	
Category	**Dollars**	**%**	**Dollars**	**%**	**Dollars**	**%**
Construction	$2,025,800	65.9%	$1,049,200	34.1%	$3,075,000	100%
Mitigation	$0	0%	$0	0%	$0	0%
Engineering Technical Assistance	$1,500,000	99.7%	$5,000	0.3%	$1,505,000	100%
Geotechnical Investigation	$110,000	100%	$0	0%	$110,000	100%
Relocation	n/a	n/a	n/a	n/a	n/a	n/a
Land Rights Acquisition	n/a	n/a	$31,600	100%	$31,600	100%
Project Administration	$31,000	86.1%	$5,000	13.9%	$36,000	100%
Permits	n/a	n/a	$7,500	100%	$7,500	100%
TOTAL COSTS	**$3,666,800**	**77.0%**	**$1,098,300**	**23.0%**	**$4,765,100**	**100%**
Annual O&M (non-Federal)	n/a	n/a	$6,500	100%	$6,500	100%

Project Costs All Four Dams (Dollars)

	PL-83-566 Funds		Other Funds		Total	
Category	**Dollars**	**%**	**Dollars**	**%**	**Dollars**	**%**
Construction	$9,290,700	66.7%	$4,646,300	33.3%	$13,937,000	100%
Mitigation	$169,600	65.0%	$91,400	35.0%	$261,000	100%
Engineering Technical Assistance	$6,000,000	99.7%	$20,000	0.3%	$6,020,000	100%
Geotechnical Investigation	$385,000	100%	$0	0%	$385,000	100%
Relocation	n/a	n/a	n/a	n/a	n/a	n/a
Land Rights Acquisition	n/a	n/a	$316,300	100%	$316,300	100%
Project Administration	$140,000	87.4%	$20,000	12.6%	$160,000	100%
Permits	n/a	n/a	$30,000	100%	$30,000	100%
TOTAL COSTS	**$15,985,300**	**75.7%**	**$5,124,000**	**24.3%**	**$21,109,300**	**100%**
Annual O&M (non-Federal)	n/a	n/a	$24,800	100%	$24,800	100%

Project Benefits:
The planning policy used for this plan/environmental document (Principles, Requirements, and Guidelines or PR&G) state that Federal investments in water resources as a whole should strive to maximize public benefits, with appropriate consideration of costs. Public benefits (i.e., positive ecosystem services) encompass environmental, economic, and social goals; include monetary and non-monetary effects; and allow for the consideration of both quantified and unquantified measures. The preferred alternatives will allow the Sponsors to comply with applicable dam safety and performance standards, to reduce the potential for loss of life, and to continue protection of existing property and infrastructure downstream of the dam. The preferred alternatives maximize net public benefits. For economics, average annual monetary benefits for each dam are displayed below in the National Economic Efficiency section, as are average annual cost and net benefits. For each dam, the Probable Maximum Precipitation (PMP) storm event will not result in overtopping, thus reducing the threat of a catastrophic dam failure (breach). Environmentally adverse impacts will be minimized during construction. Long-term there would be adverse, although negligible, environmental impacts.

In addition, one other overarching concern associated with dam rehabilitation analyses is the intent of the program to minimize threat to human life. Minimizing the threat to human life is central to the dam rehabilitation program. Agency policy allows for use of the other social effects goal to make the case for rehabilitating any high hazard classification floodwater detention structure, even if the associated Benefit/Cost (B/C) ratio is less than 1:1. This is due to a priority placed on protecting lives. Also, trying to monetize the value of life, or in the case of dams, avoidance of loss of life, is fraught with subjective value judgments. Threat to human life can therefore be used to supersede purely economic considerations when deemed appropriate.

Number of direct beneficiaries/ Population at Risk (PAR):

Garrett	Varcoe	Martin	Finkleday
6,800/152	6,800/33	10,400/85	9,600/58

Other Beneficial Effects:
The following beneficial effects are associated with all dams and the respective alternatives, unless otherwise noted:

- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.
- Provides downstream flood protection for the residents in the area, as well as those working, recreating, or traversing within the downstream floodplains.
- Eliminates the liability associated with continuing to operate a dam that does not meet current Pennsylvania and NRCS safety and performance standards.
- Retains the existing aquatic and terrestrial habitat in and around the dam.
- Will meet current Pennsylvania and NRCS safety and performance standards for a high hazard potential dam.

Garrett Dam

- Reduces the threat to loss of life to approximately 152 people who live, work, and/or drive in the breach zone.
- Protects 8 residences, 40 commercial structures, numerous outbuildings (sheds, barns, etc.), 10 stream crossings (bridges), and 13 roadways downstream within the breach inundation zone.
- Provides protection to roadways/crossings for over 3,400 vehicles and their occupants who utilize the roads downstream of Garrett Dam daily (using an average of 2 people per vehicle results in about 6,800 motorists).
- Provides identified benefits, as defined previously, for an additional 60 years.

Varcoe Dam

- Reduces the threat to loss of life to approximately 33 people who live, work, and/or drive in the breach zone.
- Protects 3 residences, 3 commercial structures, numerous outbuildings (sheds, barns, etc.), 3 stream crossings (bridges), and 6 roadways downstream within the breach inundation zone.
- Provides protection to roadways/crossings for over 3,400 vehicles and their occupants who utilize the roads downstream of Varcoe Dam daily (using an average of 2 people per vehicle results in about 6,800 motorists).
- Provides identified benefits, as defined previously, for an additional 50 years.

Martin Dam

- Reduces the threat to loss of life to approximately 85 people who live, work, and/or drive in the breach zone.
- Protects 5 residences, 11 commercial structures, 2 public properties, numerous outbuildings (sheds, barns, etc.), 8 stream crossings (bridges), and 13 roadways downstream within the breach inundation zone.
- Provides protection to roadways/crossings for over 5,200 vehicles and their occupants who utilize the roads downstream of Martin Dam daily (using an average of 2 people per vehicle results in about 10,400 motorists).
- Provides identified benefits, as defined previously, for an additional 100 years.

Finkleday Dam

- Reduces the threat to loss of life to approximately 58 people who live, work, and/or drive in the breach zone.
- Protects 4 residences, 8 commercial structures, numerous outbuildings (sheds, barns, etc.), 4 stream crossings (bridges), and 9 roadways downstream within the breach inundation zone.
- Provides protection to roadways/crossings for over 4,800 vehicles and their occupants who utilize the roads downstream of Finkleday Dam daily (using an average of 2 people per vehicle results in about 9,600 motorists).
- Provides identified benefits, as defined previously, for an additional 100 years.

Benefit to Cost Ratio (current discount rate 2.25%):

Garrett Dam	Varcoe	Martin	Finkleday
1.1:1.0	0.8:1.0	0.6:1.0	0.5:1.0

National Economic Efficiency Effects (NEE):

Category	Garrett Dam	Varcoe	Martin	Finkleday
Annual Benefits	$218,900	$124,900	$87,400	$59,500
Annual Costs	$199,000	$149,800	$157,500	$130,600
Net Benefits	$19,900	(-$24,900)	(-$70,100)	(-$71,100)

Although net monetary benefits are negative for three of the four dams, non-monetary benefits dealing with dam safety and public welfare (described above as other beneficial effects) far outweigh negative monetary benefits.

Funding schedule: The most likely scenario is for each dam to be implemented over four years including the design and construction.

Garrett Dam

Budget Year	Federal Funds (PL-566)						Non-Federal Funds (Local)						
	Eng. Serv.	Geo-Tech	Proj. Admin.	Mitigation	Construction	Total	Eng. Serv.	Real Property	Proj. Admin.	Mitigation	Construction	Permits	Total
1	$556,000	$80,000	$12,000			$648,000	$1,500	$83,600	$1,500			$7,500	$94,100
2	$264,000		$12,000			$276,000	$1,500		$1,500				$3,000
3	$340,000		$10,000	$80,600	$1,461,400	$1,892,000	$1,000		$1,000	$43,400	$740,100		$785,500
4	$340,000		$10,000		$1,461,400	$1,811,400	$1,000		$1,000		$740,100		$742,100
Total	**$1,500,000**	**$80,000**	**$44,000**	**$80,600**	**$2,922,800**	**$4,627,400**	**$5,000**	**$83,600**	**$5,000**	**$43,400**	**$1,480,200**	**$7,500**	**$1,624,700**

Varcoe Dam

Budget Year	Federal Funds (PL-566)						Non-Federal Funds (Local)						
	Eng. Serv.	Geo-Tech	Proj. Admin.	Mitigation	Construction	Total	Eng. Serv.	Real Property	Proj. Admin.	Mitigation	Construction	Permits	Total
1	$556,000	$80,000	$7,000			$643,000	$1,500	$169,000	$1,500			$7,500	$179,500
2	$264,000		$7,000			$271,000	$1,500		$1,500				$3,000
3	$340,000		$6,000	$0	$866,500	$1,212,500	$1,000		$1,000	$0	$377,100		$379,100
4	$340,000		$5,000		$866,400	$1,211,400	$1,000		$1,000		$377,000		$379,000
Total	**$1,500,000**	**$80,000**	**$25,000**	**$0**	**$1,732,900**	**$3,337,900**	**$5,000**	**$169,000**	**$5,000**	**$0**	**$754,100**	**$7,500**	**$940,600**

Martin Dam

Budget Year	Federal Funds (PL-566)						Non-Federal Funds (Local)						
	Eng. Serv.	Geo-Tech	Proj. Admin.	Mitigation	Construction	Total	Eng. Serv.	Real Property	Proj. Admin.	Mitigation	Construction	Permits	Total
1	$556,000	$115,000	$12,000			$683,000	$1,500	$32,100	$1,500			$7,500	$42,600
2	$264,000		$12,000			$276,000	$1,500		$1,500				$3,000
3	$340,000		$8,000	$89,000	$1,304,600	$1,741,600	$1,000		$1,000	$48,000	$681,400		$731,400
4	$340,000		$8,000		$1,304,600	$1,652,600	$1,000		$1,000		$681,400		$683,400
Total	**$1,500,000**	**$115,000**	**$40,000**	**$89,000**	**$2,609,200**	**$4,353,200**	**$5,000**	**$32,100**	**$5,000**	**$48,000**	**$1,362,800**	**$7,500**	**$1,460,400**

Finkleday Dam

Budget Year	Federal Funds (PL-566)						Non-Federal Funds (Local)						
	Eng. Serv.	Geo-Tech	Proj. Admin.	Mitigation	Construction	Total	Eng. Serv.	Real Property	Proj. Admin.	Mitigation	Construction	Permits	Total
1	$556,000	$110,000	$9,000			$675,000	$1,500	$31,600	$1,500			$7,500	$42,100
2	$264,000		$8,000			$272,000	$1,500		$1,500				$3,000
3	$340,000		$7,000	$0	$1,012,900	$1,359,900	$1,000		$1,000	$0	$524,600		$526,600
4	$340,000		$7,000		$1,012,900	$1,359,900	$1,000		$1,000		$524,600		$526,600
Total	**$1,500,000**	**$110,000**	**$31,000**	**$0**	**$2,025,800**	**$3,666,800**	**$5,000**	**$31,600**	**$5,000**	**$0**	**$1,049,200**	**$7,500**	**$1,098,300**

Period of Analysis (POA):

Garrett Dam	Varcoe	Martin	Finkleday
64 years	54 years	104 years	104 years

Project Life:

Garrett Dam	Varcoe	Martin	Finkleday
60 years	50 years	100 years	100 years

Environmental Effects/Impacts:

Garrett Dam

Resource	Impact
Prime and Unique Farmland	There are no prime farmland soils in the LOD. Short term adverse impacts to farmland soils of statewide importance are considered negligible and short-term. These soils have been previously disturbed. The project will not result in the permanent conversion of farmland to non-farm use.
Waters of the United States	The impoundment created by the dam, the associated flowing waters entering and leaving the dam, and the freshwater wetlands are Waters of the U.S. (WOTUS). Long-term, direct, adverse impacts are anticipated to occur to WOTUS from project action.
Water Quality	The project is anticipated to result in short-term, direct, negligible, adverse, and long-term, direct, negligible, beneficial impacts to water quality.
Wild and Scenic Rivers	The nearest Wild and Scenic River is the Delaware River which is located approximately 5.5 miles downstream of the project site. There are no anticipated impacts from the project that would affect this river segment. No Nationwide Rivers Inventory segments are in the vicinity of the dam.
Wetlands & Vernal Pools	The project is anticipated to result in short-term and long-term, direct, minor, adverse impacts to wetlands. No vernal pools were identified in the project area, as evidenced by a wetland delineation performed in December 2020 using USACE methods per the 1987 manual and regional supplement.
Floodplain Management	There will be no change in the current levels of flood protection downstream as a result of project activity. There are anticipated to be short-term, negligible, adverse, direct impacts to the floodplain area immediately around the Dam during construction.

Air Quality	The project is anticipated to result in short-term, direct, negligible, adverse impacts to air quality within the LOD and immediate area. No long-term impacts are anticipated within the vicinity of the project.
Special Status Plants	The Pennsylvania Natural Heritage Program Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Report indicated that there are no known impacts to threatened, endangered, or special concern plant species in the project area.
Noxious Weed and Invasive Plants	To prevent the spread of the invasive plant species common reed, Pennsylvania Department of Transportation (PennDOT) and/or PADEP best management practices will be implemented.
Riparian Areas	Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 35 ft.
Threatened/ Endangered Wildlife & Species of Concern	The United States Fish and Wildlife Service (USFWS), Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Game Commission (PGC) and Pennsylvania Department of Conservation and Natural Resources (DCNR) were consulted regarding threatened and endangered species and special concern species and resources within the project area. All consulted agencies indicated that there are no known impacts to these species or resources.
Migratory Birds/Bald Eagles	Impacts to bald and golden eagles and migratory birds are considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. No long-term effects are anticipated.
Cultural Resources	In a letter dated 02 February 2023, the Pennsylvania State Historic Preservation Officer (PA SHPO) concurred with the NRCS determination that Garrett Dam is ineligible for the National Register of Historic Places. The PA SHPO had previously indicated in a letter dated 21 April 2021 that they had no archaeological resources concerns associated with the project. The Section 106 process was completed with eight tribes who claim ancestral lands within Wayne County, PA. The Delaware Tribe of Indians requested testing or protection of any previously undisturbed areas. The PA SHPO, Stockbridge-Munsee Community Band of Mohican Indians, and the Delaware Tribe of Indians requested to be notified if the scope of the planned work changed or if anything unexpected was encountered during construction.

Visual/Aesthetics and Scenic Beauty	Short- and long-term, direct, negligible, adverse impacts to scenic beauty are expected.
Environmental Justice/Civil Rights	No Environmental Justice (EJ) Communities in project area. No disparate treatment.
Ecosystem Services	
Regulating flood & disease control	Long-term, direct, moderate, beneficial impacts to flood and disease control are anticipated.
Supporting nutrient cycling, soil formation	Short-term negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from the preferred alternative and therefore, to the Supporting Ecosystem Service.
Cultural recreation use, aesthetic viewsheds	Short-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds are expected.

Varcoe Dam

Resource	Impact
Prime and Unique Farmland	There is no prime farmland in the LOD. Short-term adverse impacts to farmland soils of statewide importance are considered negligible, and short-term. The staging area is composed of farmland of statewide importance. These soils are not anticipated to be adversely impacted by the proposed activities because this area has been used as a staging and stockpile area previously. The project will not result in the permanent conversion of farmland to non-farm use.
Waters of the United States	The impoundment created by the dam, the associated flowing waters entering and leaving the dam, and the freshwater wetlands are WOTUS. Long-term, direct, adverse impacts are anticipated to occur to WOTUS from project action.
Water Quality	The project is anticipated to result in short-term, direct, negligible, adverse and long-term, direct, negligible, beneficial impacts to water quality.
Wild and Scenic Rivers	The nearest Wild and Scenic River is the Delaware River which is located approximately 5.5 miles downstream of the project site. There are no anticipated impacts from the project that would affect this river segment. No Nationwide Rivers Inventory segments are in the vicinity of the dam.

Wetlands & Vernal Pools	The project is anticipated to result in short-term, direct, minor, adverse impacts to wetlands. No long-term impacts to wetlands are anticipated. No vernal pools were identified in the project area, as evidenced by a wetland delineation performed in December 2020 using USACE methods per the 1987 manual and regional supplement.
Floodplain Management	There will be no change in the current levels of flood protection downstream as a result of project activity. There are anticipated to be short-term, negligible, adverse, direct impacts to the floodplain area immediately around the dam during construction.
Air Quality	The project is anticipated to result in short-term, direct, negligible, adverse impacts to air quality. No long-term impacts are anticipated.
Special Status Plants	The PNDI Environmental Review Report indicated that there are no known impacts to threatened, endangered, or special concern plant species in the project area.
Noxious Weed and Invasive Plants	The project is anticipated to result in short-term, direct, negligible, adverse impacts to invasive plants; BMPs will be implemented to prevent long-term effects.
Riparian Areas	Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 33 ft.
Threatened/ Endangered Wildlife & Species of Concern	The USFWS, PFBC, PGC, and DCNR were consulted regarding threatened and endangered species and special concern species and resources within the project area. All agencies indicated that there are no known impacts to these species or resources.
Migratory Birds/Bald Eagles	Impacts to bald and golden eagles and migratory birds are considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. No long-term effects are anticipated.

Cultural Resources	In a letter dated 02 February 2023, PA SHPO concurred with the NRCS determination that Varcoe Dam is ineligible for the National Register of Historic Places. The PA SHPO had previously indicated in a letter dated 21 April 2021 that they had no archaeological resources concerns associated with the project. The Section 106 process was completed with eight tribes who claim ancestral lands within Wayne County, PA. The Delaware Tribe of Indians requested testing or protection of any previously undisturbed areas. The PA SHPO, Stockbridge-Munsee Community Band of Mohican Indians, and the Delaware Tribe of Indians requested to be notified if the scope of the planned work changed or if anything unexpected was encountered during construction.
Visual/Aesthetics and Scenic Beauty	Short- and long-term, direct, negligible, adverse impacts to scenic beauty are expected.
Environmental Justice/Civil Rights	No EJ Communities in project area. No disparate treatment.

<u>Ecosystem Services</u>

Regulating flood & disease control	Long-term, direct, moderate, beneficial impacts to flood and disease control are anticipated.
Supporting nutrient cycling, soil formation	Short- and long-term negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from the preferred alternative and therefore, to the Supporting Ecosystem Service.
Cultural recreation use, aesthetic viewsheds	Short-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds are expected.

Martin Dam

<u>Resource</u>	<u>Impact</u>
Prime and Unique Farmland	Short term adverse impacts to prime farmland soils and farmland soils of statewide importance are considered negligible and short-term. These soils have been previously disturbed. The project will not result in the permanent conversion of farmland to non-farm use.
Waters of the United States	The impoundment created by the dam, the associated flowing waters entering and leaving the dam, and the freshwater wetlands are WOTUS. Long-term, direct, adverse impacts are anticipated to occur to WOTUS from project action.

Water Quality	The project is anticipated to result in short-term, direct, negligible, adverse and long-term, direct, negligible, beneficial impacts to water quality.
Wild and Scenic Rivers	The nearest Wild and Scenic River is the Delaware River which is located approximately 5.5 miles downstream of the project site. There are no anticipated impacts from the project that would affect this river segment. No Nationwide Rivers Inventory segments are in the vicinity of the dam.
Wetlands & Vernal Pools	The project is anticipated to result in short-term, direct, minor, adverse and long-term, direct, negligible, adverse impacts to wetlands. No vernal pools were identified in the project area, as evidenced by a wetland delineation performed in December 2020 using USACE methods per the 1987 manual and regional supplement.
Floodplain Management	There will be no change in the current levels of flood protection downstream as a result of project activity. There are anticipated to be short-term, negligible, adverse, direct impacts to the floodplain area immediately around the dam during construction
Air Quality	The project is anticipated to result in short-term, direct, negligible, adverse impacts to air quality. No long-term impacts are anticipated.
Special Status Plants	The PNDI Environmental Review Report indicated that there are no known impacts to threatened, endangered, or special concern plant species in the project area.
Noxious Weed and Invasive Plants	The project is anticipated to result in short-term, direct, negligible, adverse impacts to invasive plants; BMPs will be implemented to prevent long-term effects.
Riparian Areas	Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 58 ft.
Threatened/ Endangered Wildlife & Species of Concern	The USFWS, PFBC, PGC, and DCNR were consulted regarding threatened and endangered species and special concern species and resources within the project area. The USFWS requires one “avoidance measure” for the project because of the presence of northern long-eared bat roosts in the vicinity of the project area. Tree removal is not permitted from June 1 to July 31 to avoid prohibited incidental take of northern long-eared bats during the pup season.

Migratory Birds/Bald Eagles	Impacts to bald and golden eagles and migratory birds are considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. No long-term effects are anticipated.
Cultural Resources	In a letter dated 02 February 2023, PA SHPO concurred with the NRCS determination that Martin Dam is ineligible for the National Register of Historic Places. The PA SHPO had previously indicated in a letter dated 21 April 2021 that they had no archaeological resources concerns associated with the project. The Section 106 process was completed with eight tribes who claim ancestral lands within Wayne County, PA. The Delaware Tribe of Indians requested testing or protection of any previously undisturbed areas. The PA SHPO, Stockbridge-Munsee Community Band of Mohican Indians, and the Delaware Tribe of Indians requested to be notified if the scope of the planned work changed or if anything unexpected was encountered during construction.
Visual/Aesthetics and Scenic Beauty	Short- and long-term, direct, negligible, adverse impacts to scenic beauty are expected.
Environmental Justice/Civil Rights	No EJ Communities in project area. No disparate treatment.

Ecosystem Services

Regulating flood & disease control	Long-term, direct, moderate, beneficial impacts to flood and disease control are anticipated.
Supporting nutrient cycling, soil formation	Short- and long-term, direct, negligible impacts to nutrient cycling and soil formation are anticipated.
Cultural recreation use, aesthetic viewsheds	Short-term, direct, adverse, moderate impacts and long-term, direct, negligible, adverse impacts to recreational use and aesthetic viewsheds are expected

Finkleday Dam

Resource	Impact
Prime and Unique Farmland	There are no prime farmland soils in the LOD. Short term adverse impacts to farmland soils of statewide importance are considered negligible and short-term. These soils have been previously disturbed. The project will not result in the permanent conversion of farmland to non-farm use.

Waters of the United States	The impoundment created by the dam, the associated flowing waters entering and leaving the dam, and the freshwater wetlands are WOTUS. Long-term, direct, adverse impacts are anticipated to occur to WOTUS from project action.
Water Quality	The project is anticipated to result in short-term, direct, negligible, adverse and long-term, direct, negligible, beneficial impacts to water quality
Wild and Scenic Rivers	The nearest Wild and Scenic River is the Delaware River which is located approximately 5.5 miles downstream of the project site. There are no anticipated impacts from the project that would affect this river segment. No Nationwide Rivers Inventory segments are in the vicinity of the dam.
Wetlands & Vernal Pools	The project is anticipated to result in short-term, direct, minor, adverse impacts to wetlands. No long-term impacts to wetlands are anticipated. No vernal pools were identified in the project area, as evidenced by a wetland delineation performed in December 2020 using USACE methods per the 1987 manual and regional supplement.
Floodplain Management	There will be no change in the current levels of flood protection downstream as a result of project activity. There are anticipated to be short-term, negligible, adverse, direct impacts to the floodplain area immediately around the dam during construction
Air Quality	The project is anticipated to result in short-term, direct, negligible, adverse impacts to air quality. No long-term impacts are anticipated
Special Status Plants	The PNDI Environmental Review Report indicated that one endangered plant species, Torrey's Bulrush, is located in the vicinity of the project, but that no impact to the species is anticipated. (Documented in letter dated 12 July 2022).
Noxious Weed and Invasive Plants	The project is anticipated to result in short-term, direct, negligible, adverse impacts to invasive plants; BMPs will be implemented to prevent long-term effects.
Riparian Areas	Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 25 ft

Threatened/ Endangered Wildlife & Species of Concern	The USFWS, PGC, PFBC, and DCNR were consulted regarding threatened and endangered species and special concern species and resources within the project area. DCNR indicated that although species/resources under DCNR's jurisdiction may be within the vicinity of the project, no impact to these species/resources are likely.
Migratory Birds/Bald Eagles	Impacts to bald and golden eagles and migratory birds are considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. No long-term effects are anticipated.
Cultural Resources	In a letter dated 02 February 2023, PA SHPO concurred with the NRCS determination that Finkleday Dam is ineligible for the National Register of Historic Places. The PA SHPO had previously indicated in a letter dated 21 April 2021 that they had no archaeological resources concerns associated with the project. The Section 106 process was completed with eight tribes who claim ancestral lands within Wayne County, PA. The Delaware Tribe of Indians requested testing or protection of any previously undisturbed areas. The PA SHPO, Stockbridge-Munsee Community Band of Mohican Indians, and the Delaware Tribe of Indians requested to be notified if the scope of the planned work changed or if anything unexpected was encountered during construction.
Visual/Aesthetics and Scenic Beauty	Short- and long-term, direct, negligible, adverse impacts to scenic beauty are expected
Environmental Justice/Civil Rights	No EJ Communities in project area. No disparate treatment.
<u>Ecosystem Services</u>	
Regulating flood & disease control	Long-term, direct, moderate, beneficial impacts to flood and disease control are anticipated.
Supporting nutrient cycling, soil formation	Short- and long-term, direct, negligible, adverse impacts to nutrient cycling and soil formation are anticipated.
Cultural recreation use, aesthetic viewsheds	Short-term, direct, adverse, moderate impacts and long-term, direct, negligible, adverse impacts to recreational use and aesthetic viewsheds are expected

Major Conclusions:

The proposed project action for the four dams identified in this plan will provide the sponsors desired flood protection for the next fifty to one hundred years with minimal economic, environmental, and social impacts.

Areas of Controversy
Controversial Issues: NONE

Issues to be resolved: NONE

Evidence of Unusual Congressional or Local Interest: NONE

Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? YES

CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

The present dams do not meet current NRCS and PADEP safety and performance standards, posing a risk of a breach of these structures. Therefore a "Change in Major Project Features" is anticipated as being needed. This type of change requires the preparation of a Supplemental Plan.

General deficiencies of all four dams include spillways not meeting the PSH criteria, principal spillway conduit undersized, and FBH criteria not met by majority of the dams. Specific needs for the individual dams are covered in the Purpose and Need for Action Section.

FEDERAL OBJECTIVE

Investments in this proposed action reflect national priorities, encourage economic development, and protect the environment by:

(1) seeking to maximize sustainable economic development.

(2) seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and

(3) protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

PURPOSE AND NEED FOR ACTION

Purpose:

Garrett Dam, Varcoe Dam, Martin Dam, and Finkleday Dam

The "Purpose" is to sustain continuity of **Flood Prevention (Flood Damage Reduction)** for Garrett, Varcoe, Martin, and Finkleday watersheds in a safe manor while minimizing environmental, economic, and social impacts.

Need:

The dams of this plan have a high potential for a catastrophic breach because they do not meet current safety and performance standards of the NRCS or Pennsylvania Department of Environmental Protection (PADEP). A breach event would eliminate the Flood Prevention (Flood Damage Reduction) for which they were put in place. Some of the expected damages are noted in the following paragraphs. Restoring these structures to current safety and performance standards would provide continuity of service with respect to Flood Prevention (Flood Damage Reduction). The effects of such a breach are loss of life, and flood damages to homes, commercial and public facilities, and infrastructure. Garrett and Varcoe Dams have a common downstream floodplain. The same exists for Martin and Finkleday Dams. Because the dams have common downstream floodplains, flood damage reduction analysis results for Garrett and Varcoe are similar as are results for Martin and Finkleday.

General deficiencies of the dams include spillways not meeting the PSH criteria, principal spillway conduit undersized, and FBH criteria not met by majority of the dams.

Garrett Dam: There is a potential for loss of life from a catastrophic dam failure due to the existence of 10 stream crossings (bridges) and 13 roadways downstream of this structure within the breach inundation zone. In addition, people living and/or working in 8 residences and 40 commercial buildings would be at risk from a catastrophic dam failure.

Varcoe Dam: There is a potential for loss of life from a catastrophic dam failure due to the existence of 3 stream crossings (bridges) and 6 roadways downstream of this structure within the breach inundation zone. In addition, people living and/or working in 3 residences and 3 commercial buildings would be at risk from a catastrophic dam failure.

Garrett Dam and Varcoe Dams currently provide flood damage reduction for 12 crossings (bridges), 14 roadways, 12 residences, and 25 commercial properties. The continuation of flood damage reduction is needed to protect downstream properties and infrastructure from flooding while not increasing flooding upstream of the dam. There are no critical facilities (hospitals, nursing homes, prisons, schools, etc.) located within the 500-year floodplain.

Martin Dam: There is a potential for loss of life from a catastrophic dam failure due to the existence of 8 stream crossings (bridges) and 13 roadways downstream of this structure within the breach inundation zone. In addition, people living and/or working in 5 residences, 11 commercial buildings, and 2 public buildings would be at risk from a catastrophic dam failure.

Finkleday Dam: There is a potential for loss of life from a catastrophic dam failure due to the existence of 4 stream crossings (bridges) and 9 roadways downstream of this structure within the breach inundation zone. In addition, people living and/or working in 4 residences and 8 commercial buildings would be at risk from a catastrophic dam failure.

Martin and Finkleday Dams currently provides flood damage reduction for 6 crossings (bridges), 14 roadways, 19 residences, 15 commercial properties, and 4 public buildings. The continuation of flood damage reduction is needed to protect downstream properties and infrastructure from flooding while not increasing flooding upstream of the dam. There are no critical facilities (hospitals, nursing homes, prisons, schools, etc.) located within the 500-year floodplain.

NOTE: It should be noted that the effect of a dam failure (catastrophic breach) was measured as the net impact between a Probable Maximum Precipitation (PMP) storm event with no breach compared to a PMP storm event with a breach. Under the PMP without a breach scenario, many properties would be impacted by flooding. Thus, in identifying population at risk (PAR) these properties were not accounted for under the PMP with a breach scenario. The PAR is not a part of the economic analysis. However, for the economic analysis in some instances there were more buildings, crossings, and roadways affected by flood damages from recurring interval storms (i.e., 500-year and lesser) than by dam failure.

SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The watershed for each dam has been established by the hydrologic watershed boundary. A scoping process was used to identify issues of economic, environmental, cultural, and social importance in the watershed. Sponsors, technical agencies, and local citizens attended two public scoping meetings. Resource and Ecosystem Service concerns that were indicated to be significant to project decision-making were identified during the scoping process. An interdisciplinary planning team composed of experts in the following disciplines were present during scoping to provide insights into engineering, biology, economics, resource conservation, water quality, and soils.

The public scoping meetings were held on November 19, 2019, at the Wayne County, Pennsylvania, Emergency Operation Center. The rehabilitation impacts of the Garrett Dam, Varcoe Dam, Martin Dam, and Finkleday Dam were discussed. Forty-eight people attended the two public scoping meetings.

Various alternative measures to address the deficiencies of the four dams were mentioned during the scoping meeting. The specific measures discussed fall into the following four categories:

1. No Action – the action that would be taken in the absence of federal funds for dam rehabilitation, known as the Future Without Federal Investment
2. Decommissioning – removal of a dam while providing flood protection.
    a. Relocation of structures
    b. Floodproofing
3. Rehabilitation – Structural rehabilitation
    a. Roller-compacted concrete in the existing auxiliary spillway location
    b. Roller-compacted concrete over the top of the dam to harden it
    c. Armoring the spillways with articulated concrete block to allow for higher flows
4. Non-structural –
    a. Relocation of structures potentially impacted from a Probable Maximum Flood
    b. Floodproofing (including elevating buildings)

The NRCS conservation measure physical effects network diagrams for “Dam” and “Critical Area Seeding” were used during scoping. These diagrams identify ecosystem flows that potentially would be affected by project action. They also identified potential cumulative effects which provided an initial starting point for cumulative effects analysis.

Table A summarizes the concerns indicated to be significant to decision-making related to the project. Those resource issues and ecosystem services not marked with an “X” fall under one of the following categories:

a) Not likely to be impacted by the alternatives evaluated in this plan.
b) Not required by NRCS policy to evaluate.
c) Not required by Executive Order or Environmental Law to evaluate.

Those resource items and ecosystem services marked with an “X” fall under one of the following categories:

a) Likely to be impacted by the alternatives evaluated in this plan.
b) Required by NRCS policy to evaluate.
c) Required by Executive Order or Environmental Law to evaluate.

Table A – Scoping Results for Rehabilitation of Lackawaxen Tributaries Dams

ITEM/ CONCERN	**Relevant to Decision Making**				**Rationale**
	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam	
SOILS					
Land use					The area was disturbed during the original construction. The proposed action will have a Limit of Disturbance (LOD) which nearly coincides with the original footprint
Soil Resources	X	X	X	X	On a watershed scale the attributes associated with soils will not change in the long term. Soils have been identified as significant to decision making because changes during construction such as compaction and erosion are likely to occur.
Prime and Unique Farmland and Farmland of Statewide Importance	X	X	X	X	The LODs do contain Prime and Unique Farmland or Farmland of Statewide Importance.

ITEM/ CONCERN	Relevant to Decision Making				Rationale
	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam	
WATER RESOURCES					
Sole Source Aquifers					The Lackawaxen discharges to the Delaware River Streamflow Zone /New Jersey Coastal Plains Aquifer SSA (SSA ID SSA23b). There will be no effect to the aquifer due to of the scale and scope of project. BMPs will be used during construction.
Water Quality	X	X	X	X	The Clean Water Act requires that effects of a Federal Action be evaluated for its impacts to waters of the U.S. Ground disturbing practices can impact water quality.
Regional Water Mgt. Plans (including Coastal Zone Mgt. Areas)					There are not any regional plans in the project area.
Floodplain Management	X	X	X	X	These dams occur in floodplains. The E.O. states no unavoidable measures should be placed in a floodplain.
Streams, Lakes and Wetlands (Waters of the United States)	X	X	X	X	There are wetlands within the project area and the E.O. requires that impacts be mitigated.
Wild and Scenic Rivers	X	X	X	X	The nearest wild and scenic river is the Delaware River located approximately 5.5 miles downstream of the project sites.

ITEM/ CONCERN	Relevant to Decision Making				Rationale
	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam	
AIR					
Air Quality					The area is not in a nonattainment area.
Clean Air Act	X	X	X	X	The Clean Air Act requires that all pollution standards be met.
PLANTS					
Forest Resources					There are no trees in the LOD.
Natural Areas					There are no trees in the LOD.
Endangered and Threatened Species	X	X	X	X	Projects of this type can impact T&E species.
Invasive Species	X	X	X	X	These species can be spread during construction. It is important to know if they are present and where so appropriate mitigation can occur.
Riparian Areas	X	X	X	X	The project has the potential to impact riparian areas which contain wetlands.
ANIMALS					
Fish and Wildlife					The conditions in the LOD will not change with implementation of the preferred alternative.
Essential Fish Habitat					There is no Essential Fish Habitat in the LOD.
Coral Reefs					There are no coral reefs in the watershed.
Endangered and Threatened Species	X	X	X	X	Projects of this type can impact threatened and endangered (T&E) species.
Invasive Species	X	X	X	X	These species can be spread during construction.

ITEM/ CONCERN	Relevant to Decision Making				Rationale
	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam	
Migratory Birds/Bald Eagles/Golden Eagles	X	X	X	X	Federal Law protects these species.
HUMANS					
Public Health and Safety	X	X	X	X	There is a threat to public health and safety during an uncontrolled breach of the dam. Flood protection provides a benefit to public health and safety.
Scenic Beauty	X	X	X	X	Scenic Beauty is part of the human environment as noted in 7 CFR 650.
Scientific Resources					No scientific resources are present in the watershed.
Social / Cultural Issues	X	X	X	X	Project action has the potential to impact transportation by providing flood protection.
Historic Properties/Cultural Resources	X	X	X	X	While the dams are over 50 years old, NRCS has determined that they are ineligible for the National Register of Historic Places. The Delaware Tribe of Indians has expressed concerns as to the effects of construction to potentially unrecorded resources within the LODs.
Environmental Justice and Civil Rights	X	X	X	X	These projects do have the potential to disproportionally benefit non-disadvantaged groups (non-minorities).

ITEM/ CONCERN	Relevant to Decision Making				Rationale
	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam	
Local and Regional Economy					This project is not large enough in scope to have a regional impact.
Public Recreation					This project will not impact public recreation in the area. The dams are not available for public recreation.
Park Lands					No park lands are in the LOD.

Table B – Scoping Results for Ecosystem Services

ECOSYSTEM SERVICES	Relevant to Decision Making				Rationale
	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam	
Provisioning (tangible goods provided for direct human use and consumption)					
Food					The project will not impact any of the Provisioning Ecosystem Service categories because they don't exist in the LOD.
Fiber					
Water					
Timber					
Biomass					
Regulating (maintain world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe)					
Flood and Disease Control	X	X	X	X	Dam purpose is flood control
Water Filtration					The project will not impact any of the other Regulating Ecosystem Service categories based on the NRCS network diagrams for the "Dam" or "Critical Area Seeding" which are the dominant project measures.
Climate Stabilization					
Crop Pollination					
Supporting (underlying processes maintaining conditions for life on Earth)					
Nutrient Cycling	X	X	X	X	Soils likely impacted
Soil Formation	X	X	X	X	Soils likely impacted
Primary Production					Not a significant green plant production area.
Cultural (make the world a place in which people want to live)					
Recreational Use	X	X	X	X	Passive, private recreation services are provided by existing sites
Spiritual					No known spiritual values were identified during scoping.
Aesthetic Viewsheds	X	X	X	X	Project provides this service

ECOSYSTEM SERVICES	Relevant to Decision Making				Rationale
	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam	
Tribal Values	X	X	X	X	Required by NRCS policy and 36 CFR 800.

AFFECTED ENVIRONMENT

This section of the plan describes the elements of the natural, social, and economic environments within the project area that might be affected by the rehabilitation alternatives. Emphasis is placed on the current status of each element and any trends that may be evident both upstream and downstream of the alternatives. Non-affected areas of the watersheds are discussed in the March 1958 Lackawaxen Tributaries Watershed Work Plan. That information has not been duplicated in this document as there have been no changes to those resources or the effects of the project since the Work Plan was completed in 1958.

The dams discussed in this plan are shown in the table below.

Name/number	Total drainage acres	PADEP ID	NID ID
Garrett Dam / PA-413	1,024	D64-194	PA00097
Varcoe Dam / PA-415	512	D64-172	PA00088
Martin Dam / PA-419	352	D64-170	PA00086
Finkleday Dam / PA-421	384	D64-171	PA00087

LACKAWAXEN WATERSHED ENVIRONMENTAL REVIEW

Land Ownership (Potentially Impacted)

Name/number	Private	State	Federal	County
Garrett Dam / PA-413	100%	0%	0%	0%
Varcoe Dam / PA-415	100%	0%	0%	0%
Martin Dam / PA-419	100%	0%	0%	0%
Finkleday Dam / PA-421	100%	0%	0%	0%

Physical Environment

Project Location

This project involves four dams in Wayne County, located in northeastern Pennsylvania. The structures are located on tributaries to the Lackawaxen River. The physical location of dams in this plan are as described below.

- Garrett Dam is located in Wayne County latitude 41.6007, longitude -75.2278
- Varcoe Dam is located in Wayne County latitude 41.6011, longitude -75.1965
- Martin Dam is located in Wayne County latitude 41.5702, longitude -75.1848

- Finkleday Dam is located in Wayne County latitude 41.5868, longitude -75.1886.

Topography
Wayne County, located in northeastern Pennsylvania, lies in between two mountain ranges, the Appalachian range and the Pocono range. The topography of the land in the Lackawaxen Watershed consists of mountains and hills of varying steepness.

Soils
The soils in the watershed have not changed from the March 1958 Lackawaxen Tributaries Watershed Work Plan. The soils at each dam site have been highly disturbed due to the original construction of the dams. After construction, topsoil was not applied to each dam prior to seeding. Soil at the dam sites are primarily comprised of reddish loamy till derived from sandstone, siltstone, and shale.

Geology
The bedrock geologic units identified within and near the project area are the Catskill Formation from the Devonian period made up of non-marine gray and red shales and sandstones and the Long Run and Walcksville Members of the Catskill Formation. Both units are from the Devonian period and are made up primarily of sandstone, as well as siltstone, shale, and mudstone. There are glacial deposits up to 35 feet thick of till and moraine material, made up of unstratified coarse gravels, sands, silts, and clays in the project area (USDA 1958).

Climate
Wayne County lies within the Allegheny Plateau climatic area, one of four climatic regions of Pennsylvania. The rugged topography causes the area to experience more changeable temperatures and more frequent precipitation, both snow and rain, than other parts of the state. Because the region does not lie along a coastline, it seldom experiences hurricanes or other low-pressure systems with tropical origins. Thunderstorms are quite common in the warmer months and account for most of the summer rainfall (Pennsylvania State Climatologist 2020). The average yearly temperature in Wayne County is 48.2 degrees Fahrenheit and average yearly precipitation is 42.5 inches (NOAA 2021).

To determine possible impacts of climate change on the project area we contacted several government entities studying climate change. The list of these entities included, National Oceanic Atmospheric Administration (NOAA), Northern Institute of Applied Climate Science (NIACS), and USDA climate hubs. These entities directed us to several climate models.

The climate models indicate that future changes will likely include the following:
- More intense, longer duration precipitation events in the East
- Increased frequency of flood events in the East
- There may be more incidence of drought primarily in the West

Most of guidance related to climate change talks about facilitating resilience in communities to enable recovery from the anticipated storm events.

The complete list of government entities contacted for this project, that are responsible to climate studies is provided in the Administrative Record.

Biological/Ecological Environment

Water Resources

Waters of the United States (WOTUS)
The impoundments created by the dams in this project, the associated flowing waters entering and leaving the dams, and the associated freshwater wetlands are WOTUS (EPA 2019a). The EPA has not classified any of the flowing waters in the project areas on their 305b report. These are the only WOTUS identified in the project areas.

Wetlands
There are freshwater wetlands present in each dam's project area, primarily adjacent to the streams and the dams' impoundments (see Figures C-2, C-5, C-8, and C-11).

Water Quality
There are no impaired waters (EPA 303(d) listed waters) present in Wayne County (Pennsylvania Department of Environmental Protection [PADEP] 2020a). The project dams in this plan all occur in Wayne County. The streams in the project areas are cold water fisheries.

Water Quantity
The dams in this plan are all single-purpose floodwater retarding structure and do not contain storage for water supply. The dams are being operated in accordance with all permit requirements.

Water Use/Efficiency
The waters of the project reservoir are not being consumptively used by agriculture or the associated community therefore use efficiency is not a concern.

Wild and Scenic Rivers
Wild, scenic, or recreational rivers or NRI river segments are not present in or near the project areas. The nearest designated river is the scenic and recreational Delaware River, located approximately 5.5 miles east of the project areas.

Vernal Pools
There are no mapped vernal pools present in the project areas (PNHP 2019a). No vernal pools were identified in the LODs during the wetland delineation performed in December 2020 using USACE methods per the 1987 manual and regional supplement.

Flooding
Storm events with a recurrence interval of 100 years or lower are attenuated by the structures evaluated in this plan, with the exception of Garrett Dam. Storm events with higher recurrence

interval engage the auxiliary spillway and provide much lower attenuation and flood reduction downstream.

Air

The watershed is in Wayne County, PA. There are no non-attainment zones in Wayne County for any of the NAAQS (EPA 2019b) standards.

Plants

Terrestrial Vegetation

The dominant land cover types in the area are woody wetlands, deciduous forest, mixed forest, and pasture/hay.

Common wetland trees, shrubs, and plants likely to inhabit woody wetlands within the project area include red maple (*Acer rubrum*), highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), smooth alder (*Alnus serrulata*), eastern hemlock (*Tsuga canadensis),* red spruce (*Picea rubens*), among others (PNHP 2019b). Plants that are likely to inhabit the herbaceous wetland areas include a variety of graminoid species, including various grasses, sedges, and rushes. Some common species include canary-grass (*Phalaris arundinacea*), big bluestem (*Andropogon gerardii*), Indian-grass (*Sorghastrum nutans*), and common-reed (*Phragmites australis*) (PNHP 2019b).

Dominant trees species in deciduous forests in the Allegheny Plateau region of Pennsylvania include red maple (*Acer rubrum*), red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*) (PNHP 2019b). Evergreen forests in this region typically include eastern hemlock (*Tsuga canadensis*), eastern white pine (*Pinus strobus*), pitch pine (*Pinus rigida*), among others (PNHP 2019b).

Special Status Plant Species

The PNDI report did not identify any threatened, endangered, or special concern plant species in the vicinity of Garrett, Martin, or Varcoe dams via the PNDI environmental review. DCNR indicated that the state-listed endangered Torrey's Bulrush (*Schoenoplectus torreyi*) may be present in the Finkleday Dam LOD. Torrey's Bulrush is a grass-like plant that forms patches in shallow water.

Endangered and Threatened Plant Species

A USFWS IPaC report did not list any federally threatened or endangered plant species in the LODs.

Noxious Weed and Invasive Plant Species

Noxious weeds in Pennsylvania are either categorized as Class A, noxious weeds that are intended to be eradicated; or Class B, noxious weeds that cannot feasibly be eradicated (Pennsylvania Department of Agriculture 2020). There have been no noxious weeds or invasive species mapped on the iMapInvasives interactive web map within the LOD (Pennsylvania iMapInvasives 2020). However, some small areas of common reed (*Phragmites australis*), which is a DCNR Rank 1 invasive plant species, was observed in the LODs in the areas identified

as freshwater pond and freshwater emergent wetlands. DCNR classifies common reed as a Rank 1 invasive plant species, defined as being a severe threat and includes exotic plant species that possess characteristics of invasive species and spreads easily into native plant communities and displace native vegetation (DCNR 2020).

Animals

Federally Listed Endangered and Threatened Species

The USFWS IPaC report returned two federally threatened mammal species as potentially present in the project areas: the Indiana bat (*Myotis sodalis*) and the northern long-eared bat (NLEB) (*Myotis septentrionalis*) (USFWS 2020).

Indiana Bat (*Myotis sodalis*)

During the summer, the Indiana bat inhabits small to medium river and stream corridors with well-developed riparian woods and upland forests. They prefer to roost under peeling bark of dead and dying trees. Breeding begins in late summer and early fall when swarming occurs near hibernacula. For the remaining winter months, the bats hibernate in caves and mines in dense clusters (USFWS 2019b). USFWS has classified the area surrounding the Dams to be suitable habitat for the Indiana bat. However, occurrences of these bats have not been reported, no hibernacula have been identified, and no known surveys have been conducted on the site.

Northern Long-Eared Bat (*Myotis septentrionalis*)

During the summer, NLEBs roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). NLEBs are flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. Breeding begins in late summer or early fall when males begin to swarm near hibernacula, the caves or mines where Northern long-eared bats will hibernate during the winter (USFWS 2019c). USFWS has classified the area surrounding the Dams to be suitable habitat for the Northern long-eared bat. However, occurrences of these bats have not been reported, no hibernacula have been identified, and no known surveys have been conducted on the site.

State Wildlife Species of Concern

DCNR and Pennsylvania Natural Heritage Program (PNHP) maintain a list of state threatened and endangered animal species by county. Wayne County contains one reptile listed species, the timber rattlesnake (*Crotalus horridus*), two listed bird species, the American bittern (*Botaurus lentiginosus*) and the northern harrier (*Circus cyaneus*) and two listed mammal species, the northern flying squirrel (*Glaucomys sabrinus*) and the northern long-eared bat (*Myotis septrionalis*) (PNHP 2019c). Pennsylvania species of greatest conservation need are "protected" in the Commonwealth. It is unlawful to harm or harass these species outside of legal hunting/fishing seasons or without proper permits or licenses from the PGC, PFBC, and/or USFWS. The Pennsylvania Wildlife Action Plan describes conservation actions for threats to endangered species. The

Invasive Species

There is one known occurrence of an invasive animal species in the Finkleday Dam project site. The Chinese Mystery Snail (*Cipangopaludina chinensis malleata*) was observed during a site

visit in November 2019. There are no known invasive animal species at the Garrett, Martin, or Varcoe dams' project sites.

Migratory Birds/Bald and Golden Eagles

The USFWS IPaC report for the project area identified migratory birds that could potentially utilize the dam impoundment or the surrounding project areas. These species may include: Bald eagle (*Haliaeetus leucocephalus*), Black-capped chickadee (*Poecile atricapillus*), Bobolink (*Dolichonyx oryzivorus*), Wood thrush (*Hylocichla mustelina*), and the Yellow-bellied sapsucker (*Sphyrapicus varius*) (USFWS 2020). All of these birds, except for the bald eagle, are identified as bird species of conservation concern (BCC). BCCs are both migratory and non-migratory birds that are designated by USFWS as amongst the highest conservation priorities.

Ecosystem Health

The structure of the ecosystems associated with the Lackawaxen dams all have similar characteristics. Each dam site is currently in operation, providing flood protection, and have similar surrounding ecosystems. The ecosystem structure surrounding each dam consist of mixed forest, riverine creek habitat, a maintained grass covered auxiliary spillway, maintained grass covered earthen dam area and an impounded water area upstream of the dam.

During site visits to each of the dam sites, the entire extent of the existing structure and adjacent land areas were walked and visually assessed. The areas adjacent to the dam and spillway were primarily made up of mixed forest with native shrubs and grass. The vegetation and habitat appeared healthy, and none of the sites or adjacent land areas exhibited signs of obvious ecological degradation (i.e., severe erosion gullies, runnels, patches of dead vegetation, etc.). Evidence of natural succession was present in areas adjacent to the dam sites. Turbidity was not identified as a concern in the creeks feeding the impoundments, in the impoundments themselves, or immediately downstream. Based on these observed conditions it was determined that the ecosystem functions were being performed adequately and the systems were stable and in good health which provides evidence of the resiliency of the sites related to flooding.

SUB-WATERSHED PHYSICAL ENVIRONMENT

The "Area of Initial Analysis (AIA)" was used to define the physical environment's Land Use/Land Cover. The AIA is an area which may possibly be impacted by project action. It is larger than the limit of disturbance (LOD) or area of potential effect (APE) which had yet to be determined during the initial stages of planning. Therefore, the planning team identified a general area around each dam site which is where it was foreseeable that alternative actions could occur during implementation. Each of these areas was centered around the dam site and based on several different variables (ex. terrain features, environmental receptors, impoundment size, etc.) and therefore are dynamic.

Land Use/Cover Garrett Dam Project Area of Initial Analysis

Based on aerial observations and NLCD land cover data, the area around the dam is mainly forested with a few residences surrounding the dam site. A map of the area is provided in Appendix C.

Land Use	Acres	Description
Forest	41.3	Areas covered with trees, both evergreen and deciduous.
Pasture/Brush	15.4	Open unforested areas, shrubs, etc. present.
Residential	13	Improvements, yards, driveways, etc.
Water	12.7	Open water bodies (ponds, lakes, rivers, large streams)
NOTE: Land use information obtained from the Wayne County Planning Department (2017).		

Land Use/Cover Varcoe Dam Project Area of Initial Analysis

Based on aerial observations and NLCD land cover data, the area around the dam is primarily forested, identified as deciduous and mixed forests. There are a few structures surrounding the dam. A map of the area is provided in Appendix C.

Land Use	Acres	Description
Forest	53.7	Areas covered with trees, both evergreen and deciduous.
Cropland	negligible	Actively farmed fields (striated/unstriated).
Farmstead	1.1	Dwellings, barns, outbuildings, yards, etc.
Pasture/Brush	6.7	Open unforested areas, shrubs, etc. present.
Residential	9.9	Improvements, yards, driveways, etc.
Water	11.4	Open water bodies (ponds, lakes, rivers, large streams).
NOTE: Land use information obtained from the Wayne County Planning Department (2017).		

Land Use/Cover Martin Dam Project Area of Initial Analysis

Based on aerial observations and NLCD land cover data, the area around the dam is primarily farmland, identified as pasture/hay, and forested areas. There are a few structures surrounding the dam. A map of the area is provided in Appendix C.

Land Use	Acres	Description
Forest	17.3	Areas covered with trees, both evergreen and deciduous.
Cropland	1.1	Actively farmed fields (striated/unstriated).
Farmstead	1.4	Dwellings, barns, outbuildings, yards, etc.
Pasture/Brush	53.3	Open unforested areas, shrubs, etc. present.
Residential	4.1	Improvements, yards, driveways, etc.
Water	5.8	Open water bodies (ponds, lakes, rivers, large streams).
NOTE: Land use information obtained from the Wayne County Planning Department (2017).		

Land Use/Cover Finkleday Dam Project Area of Initial Analysis

Based on aerial observations and NLCD land cover data, the area around the dam is mainly forested with a few residences surrounding the dam site. A map of the area is provided in Appendix C.

Land Use	Acres	Description
Forest	80.2	Areas covered with trees, both evergreen and deciduous.
Mining/Extraction	0.1	Areas of obvious mining/extraction activities.
Pasture/Brush	25.8	Open unforested areas, shrubs, etc. present.
Residential	15.7	Improvements, yards, driveways, etc.
Water	9.7	Open water bodies (ponds, lakes, rivers, large streams)
NOTE: Land use information obtained from the Wayne County Planning Department (2017).		

SUB-WATERSHED BIOLOGICAL/ECOLOGICAL ENVIRONMENT

Maps of the Limit of Disturbance (LODs) are presented in Appendix C.

Prime and unique farmlands, and farmland of statewide importance

Garrett Dam
There are no prime farmland soils identified within the onsite Limit of Disturbance (LODs).

Farmland soils of statewide importance are present in the Alternatives 1, 2, and 3 LOD, and the No Action LOD where Oquaga channery loam (3–8 percent slopes and 8–15 percent slopes) are present (USDA NRCS 2019a). These soils cover 4.12 acres within the LODs and are covered in grass.

Varcoe Dam
There are no prime farmland soils identified within the onsite LODs or the LOD of the offsite staging area (USDA NRCS 2019a).

Farmland soils of statewide importance comprise 0.08 acres of the Alternatives 1, 2, and 3 LOD and the No Action Alternative LOD, where Wellsboro channery loam (8–15 percent slopes) is present (USDA NRCS 2019a).

The entirety of the offsite staging area, 4.8 acres, is comprised of farmland soils of statewide importance.

Martin Dam
Prime farmland soil is present in the LOD for Alternatives 1, 2, and 3 and the No Action Alternative LOD where Wellsboro channery loam (3–8 percent slopes) is present. Prime farmland covers 0.20 acres in both LODs within the access road west of the Dam (USDA NRCS 2019a).

Farmland soils of statewide importance are present in the LOD for Alternatives 1, 2, and 3 and the No Action Alternative LOD where Morris channery loam (3–8 percent and 8–15 percent slopes) and Wellsboro channery loam (8–15 percent and 15–25 percent slopes) are present (USDA NRCS 2019a). These soils cover approximately 4.51 acres within the LODs.
The entirety of the offsite staging area, 7.24 acres, is comprised of farmland soils of statewide importance.

Finkleday Dam
There is no prime farmland in the project area.

Farmland of statewide importance cover approximately 49 acres within the project area and are primarily forested. The Limit of Disturbance (LOD) area for the alternatives contains various amounts of farmland of statewide importance. Farmland soils of statewide importance comprise approximately 2.73 acres in the LOD. The offsite staging area contains approximately 4.8 acres of soils of statewide importance.

Water Resources
Wetlands (This text applies to all dams)
Freshwater wetlands in Pennsylvania are protected and regulated by PADEP and the U.S. Army Corps of Engineers (USACE). Any project that could affect wetlands must comply with both state and federal regulations. Wetlands at each project site were delineated in December 2020 using USACE wetland delineation guidelines and classified using the Cowardin system. Wetlands in the No Action LOD were classified based on a combination of delineated wetlands and U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) through publicly available online data (USFWS 2019a). In 1979, USFWS adopted *Classification of Wetlands and Deepwater Habitats of the United States* by Cowardin et al. as the agency's official wetland classification system. Wetlands from the NWI database are generated using NWI data and have been collected using high altitude aerial photography and field verified by USFWS for accuracy (Dahl et al. 2015).

Vernal Pools (This text applies to all dams)
The PNHP maintains a vernal pool database, which identifies both confirmed and unconfirmed vernal pools in Pennsylvania. The database was accessed through the PNHP website, and there are no mapped vernal pools present in or near the LOD (PNHP 2019a). Additionally, no vernal pools were identified during the December 2020 wetland delineation.

Garrett Dam
Water Quantity
Garrett Dam has a flood control storage capacity of 245.5 acre-ft at the crest of the auxiliary spillway elevation and 4.1 ac-ft of storage volume at the normal pool level. The dam is a single-purpose floodwater retarding structure and does not contain storage for water supply.

Waters of the United States
Based on the definition of WOTUS, the impoundment, the wetlands, and Holbert Creek are WOTUS (EPA 2019a; USACE 2012). The impoundment is an approximately 3.30-acre freshwater pool and Holbert Creek is an approximately 3.5-mile-long tributary of the Lackawaxen River.

Wetlands
Wetlands present in the LOD for Alternatives 1, 2, and 3 include 0.27 acres of freshwater emergent wetlands and 0.40 acres of freshwater pond wetlands. The No Action Alternative LOD

contains 0.27 acres of freshwater emergent wetlands, 0.24 acres of freshwater forested/shrub wetlands and 2.60 acres of freshwater pond wetlands.

Garrett Dam Wetland Communities in the Limit of Disturbance

Wetlands Type	Cowardin Description	General Description	Rehabilitation LOD (acres)	No Action LOD (acres)
Freshwater forested/shrub	Palustrine forested and/or Palustrine shrub	Woody wetlands, forested swamp, shrub bog	0	0.24
Freshwater emergent	Palustrine emergent	Herbaceous marsh, fen, swale, or wet meadow. Characterized by erect, rooted, herbaceous hydrophytes. Usually dominated by perennial plants	0.27	0.27
Freshwater pond	Palustrine unconsolidated bottom, palustrine aquatic bed	Pond	0.4	2.60
Total wetlands			0.31	3.11

Floodplain Management

Based on review of the Federal Emergency Management Agency (FEMA) flood insurance rate map for the study area (Panel 42127C0301D) effective 16 May 2013, the study area upstream of the dam is located in Zone A, a special flood hazard area (FEMA 2020). The area is subject to inundation by a 1-percent-annual-chance flood event generally determined using approximate methodologies. The areas downstream of the dam are located in Zone AE with base flood elevations ranging from 1,140 to 1,177 ft. Garrett Dam was one of seven dams constructed by the United States Department of Agriculture – Soil Conservation Service (now NRCS) to protect the Lackawaxen watershed and prevent flooding in the surrounding areas. The Sponsors are required to participate in the National Flood Insurance Program to receive federal assistance. Furthermore, if critical facilities are in the 500-year inundation zone, protection of the facilities would have to be considered in the planning process. There are no critical facilities in the 500-year inundation zone based on hydraulic modeling performed as part of this project.

Varcoe Dam

Water Quantity

Varcoe Dam has flood control storage capacity of 166.2 acre-ft at the auxiliary spillway crest elevation and 1.9 ac-ft of storage volume at the normal pool level. The dam is a single-purpose floodwater retarding structure and does not contain storage for water supply.

Waters of the United States

Based on the definition of WOTUS, the impoundment, the wetlands, and stream are WOTUS (EPA 2019a; USACE 2012). The approximate 2.45-acre impoundment forms a freshwater pool, and the stream is an approximate 2-mile-long tributary of Holbert Creek.

Wetlands

Wetlands present in the LOD include approximately 0.21 acres of freshwater emergent wetlands and approximately 0.29 acres of freshwater pond wetlands. The No Action Alternative LOD contains 0.57 acres of freshwater emergent and 1.96 acres of freshwater pond wetlands.

Varcoe Dam Wetland Communities in the Limit of Disturbance

Wetlands Type	Cowardin Description	General Description	Rehabilitation LOD (acres)	No Action Alternative LOD (acres)	Offsite staging area (acres)
Freshwater emergent	Palustrine emergent	Herbaceous marsh, fen, swale, or wet meadow. Characterized by erect, rooted, herbaceous hydrophytes. Usually dominated by perennial plants	0.21	0.57	0
Freshwater pond	Palustrine unconsolidated bottom, palustrine aquatic bed	Pond	0.29	1.96	0
Total wetlands			0.50	2.53	0

Floodplain Management

Based on review of the FEMA flood insurance rate map for the study area (Panel 42127C0302D) effective 16 May 2013 (Appendix D), the dam is located in Zone A, a special flood hazard area (FEMA 2020). The area is subject to inundation by a 1-percent-annual-chance flood event generally determined using approximate methodologies (FEMA 2014). Varcoe Dam was one of seven dams constructed in the 1960s to protect the Lackawaxen watershed and prevent flooding in the surrounding areas. The offsite staging area is located in Zone X, an area of minimal flood hazard (FEMA 2020). The Sponsors are required to participate in the National Flood Insurance Program to receive federal assistance. Furthermore, if critical facilities are in the 500-year inundation zone, protection of the facilities would have to be considered in the planning process. There are no critical facilities in the 500-year inundation zone based on hydraulic modeling performed as part of this project.

Martin Dam

Water Quantity

Martin Dam has a flood control storage capacity of approximately 97.4 acre-ft at the ASW crest elevation and 6.2 ac-ft of storage volume at the normal pool level. The dam is a single-purpose floodwater retarding structure and does not contain storage for water supply.

Waters of the United States

Based on the definition of WOTUS, the impoundment, wetlands, and stream are WOTUS (EPA 2019a; USACE 2012). The impoundment is an approximately 2.33-acre freshwater pool and the stream is an approximately 2.5-mile-long tributary of Indian Orchard Brook.

Wetlands

Wetlands present in the LOD for Alternatives 1, 2, and 3 include 0.39 acres of freshwater emergent wetlands and 0.57 acres of freshwater pond wetlands. The No Action Alternative LOD contains 0.57 acres of freshwater emergent wetlands and 2.11 acres of freshwater pond wetlands.

Martin Dam Wetland Communities in the Limit of Disturbance

Wetland Type	Cowardin Description	General Description	Rehabilitation LOD (acres)	No Action Alternative LOD (acres)	Offsite staging area (acres)
Freshwater emergent	Palustrine emergent	Herbaceous marsh, fen, swale, or wet meadow Characterized by erect, rooted, herbaceous hydrophytes. Usually dominated by perennial plants	0.39	0.57	0
Freshwater pond wetlands	Palustrine unconsolidated bottom, palustrine aquatic bed	Pond	0.57	2.11	0
Total wetlands			0.96	2.68	0

Floodplain Management

Based on review of the Federal Emergency Management Agency (FEMA) flood insurance rate map for the study area (Panels 42127C0304D and 42127C0308D) effective 16 May 2013 (Appendix B), base flood elevations or inundation extents for the 1-percent-annual-annual-chance flooding have not be determined for the immediate areas upstream or downstream of the dam and the project area is considered to be in Zone X, an area of minimal flood hazard (FEMA 2020). Martin Dam was one of seven dams constructed to reduce the flood risk in the Lackawaxen watershed. The Sponsors are required to participate in the National Flood Insurance Program to receive federal assistance. Furthermore, if critical facilities are in the 500-year

inundation zone, protection of the facilities would have to be considered in the planning process. There are no critical facilities in the 500-year inundation zone based on hydraulic modeling performed as part of this project.

Finkleday Dam

Water Quantity

Finkleday Dam has a flood control storage capacity of approximately 140.1 acre-ft at the ASW crest elevation and 7.4 ac-ft of storage volume at the normal pool level. The dam is a single-purpose floodwater retarding structure and does not contain storage for water supply.

Waters of the United States

Based on the definition of WOTUS, the impoundment, wetlands, and Indian Orchard Brook are WOTUS (EPA 2019a, USACE 2012). The impoundment is an approximately 5.6-acre freshwater pool and Indian Orchard Brook is an approximately 5-mile-long tributary of the Lackawaxen River.

Wetlands

Wetlands present in the LOD for Alternatives 1 and 3 include 0.04 acres of freshwater forested/shrub wetlands, 0.07 of freshwater emergent wetlands, and 0.33 acres of freshwater pond wetlands. Wetlands present in the LOD for Alternative 2 include 0.02 acres of freshwater forested/shrub wetlands, 0.07 acres of freshwater emergent wetlands, and 0.33 acres of freshwater pond wetlands. The No Action Alternative LOD contains 0.37 acres of freshwater emergent, 0.02 acres of freshwater forested/shrub wetlands, and 5.03 acres of freshwater pond wetlands.

Finkleday Dam Wetland Communities in the Limit of Disturbance

Wetland Type	Cowardin Description	General Description	Alt. 1	Alt. 2	Alt. 3	No Action	Offsite staging area
			LOD (acres)				(acres)
Freshwater forested/shrub	Palustrine forested and/or Palustrine shrub	Woody wetlands, forested swamp, shrub bog	0.04	0.02	0.04	0.02	0
Freshwater emergent	Palustrine emergent	Herbaceous marsh, fen, swale, or wet meadow. Characterized by erect, rooted, herbaceous hydrophytes. Usually dominated by perennial plants	0.07	0.07	0.07	0.37	0

Wetland Type	Cowardin Description	General Description	Alt. 1	Alt. 2	Alt. 3	No Action	Offsite staging area
			LOD (acres)				(acres)
Freshwater pond	Palustrine unconsolidated bottom, palustrine aquatic bed	Pond	0.33	0.33	0.33	5.03	0
Total wetlands			0.44	0.42	0.44	5.42	0

Floodplain Management

The project area is in Zone A, a special flood hazard area (FEMA 2020). The area is subject to inundation by a 1-percent-annual-chance flood event generally determined using approximate methodologies (FEMA 2014). Finkleday Dam was one of seven dams constructed to protect the Lackawaxen watershed and prevent flooding in the surrounding areas. The Sponsors are required to participate in the National Flood Insurance Program to receive federal assistance. Furthermore, if critical facilities are in the 500-year inundation zone, protection of the facilities would have to be considered in the planning process. There are no critical facilities in the 500-year inundation zone based on hydraulic modeling performed as part of this project.

Plants

Vegetation (This text applies to all dams)

Vegetation communities and land cover types present in the LODs were identified by the National Land Cover Database (NLCD, 2019). Several discrete land cover types occur within the LODs, with the most dominant land cover types being pasture/hay, deciduous forest, and woody wetlands. Descriptions and acreages of the different land cover types are included in the tables below.

Common wetland trees, shrubs, and plants likely to inhabit woody wetlands within the LODs include red maple (*Acer rubrum*), highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), smooth alder (*Alnus serrulata*), Eastern hemlock (*Tsuga canadensis),* red spruce (*Picea rubens*), among others (PNHP 2019b). Plants that are likely to inhabit the herbaceous wetland areas include a variety of graminoid species, including various grasses, sedges, and rushes. Some common species include reed canarygrass (*Phalaris arundinacea*), big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), and common reed (*Phragmites australis*) (PNHP 2019b).

Dominant trees species in deciduous forests in the Allegheny Plateau region of Pennsylvania include red maple (*Acer rubrum*), red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*) (PNHP 2019b). Evergreen forests in this region typically include Eastern hemlock (*Tsuga canadensis*), Eastern white pine (*Pinus strobus*), pitch pine (*Pinus rigida*), among others (PNHP 2019b).

Garrett Dam

Land Cover Types in the Limit of Disturbance

Land Cover/ Vegetation Type	Description	Rehabilitation LOD (acres)	No Action Alternative LOD (acres)
Open Water	Areas of open water with generally less than 25 percent cover of vegetation or soil.	0	0.98
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.	1.44	1.44
Pasture/Hay	Contains areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle and not tilled. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	6.37	6.37
Woody Wetlands	Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0.51	1.49
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0	1.14

Notes: The LODs includes the onsite staging area.
Wetlands acreages presented in this table are from NLCD, which is based on satellite imagery. Wetland acreages presented in the "Wetland Communities in the LOD" were obtained through field delineations and are considered to be more accurate.

Riparian Areas

Riparian habitat exists in the transitional areas generally defined by topography, between uplands and watercourses adjacent to Holbert Creek. Within the LOD, there are currently approximately 75 linear ft of stream (Holbert Creek) with riparian zones buffering each side. Vegetation cover in the riparian corridor of the LOD is categorized as woody wetlands, pasture/hay, emergent herbaceous wetlands, deciduous forest, and mixed forest.

Varcoe Dam

Land Cover Types in the Limit of Disturbance

Land Cover/ Vegetation Type	Description	Rehabilitation LOD (acres)	No Action Alternative LOD (acres)	Offsite staging area (acres)
Open Water	Areas of open water with generally less than 25 percent cover of vegetation or soil.	0	0.27	0
Developed, Open Space	Areas with a mixture of some constructed materials but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	0.06	0.06	0.69
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.	1.65	1.65	0.28
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.	1.47	1.47	0.05
Grassland/ Herbaceous	Areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing.	0	0	3.8
Pasture/Hay	Contains areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle and not tilled. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	0.76	0.76	0
Woody Wetlands	Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	2.47	0.88	0
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0.66	0.93	0

Note: Wetlands acreages presented in this table are from NLCD, which is based on satellite imagery. Wetland acreages presented in the "Wetland Communities in the LOD" were obtained through field delineations and are considered to be more accurate.

Riparian Areas

Riparian habitat exists in the transitional areas generally defined by topography, between uplands and watercourses adjacent to Laurella Creek. Within the LOD, there are approximately 210 ft of stream with riparian zones buffering each side. Vegetation cover in the riparian corridor of the project area is categorized as woody wetlands, pasture/hay, deciduous forest, and mixed forest. No riparian areas were identified in the offsite staging area.

Martin Dam

Land Cover Types in the Limit of Disturbance

Land Cover/ Vegetation Type	Description	Rehabilitation LOD (acres)	No Action Alternative LOD (acres)	Offsite staging area (acres)
Open Water	Areas of open water with generally less than 25 percent cover of vegetation or soil.	0.59	1.47	0
Developed, Open Space	Areas with a mixture of some constructed materials but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	0.23	0.23	0.37
Developed, Low Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20–49 percent of total cover. These areas most commonly include single-family housing units.	0.22	0.22	0.15
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.	0.55	0.55	0
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.	0.75	0.75	0
Grassland/herbaceous	Areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing.	0.22	0.22	0
Pasture/Hay	Contains areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle and not tilled. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	4.16	4.27	6.75
Woody Wetlands	Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0.02	0.18	0

Note: Wetlands acreages presented in this table are from NLCD, which is based on satellite imagery. Wetland acreages presented in the "Wetland Communities in the LOD" were obtained through field delineations and are considered to be more accurate.

Riparian Areas

Riparian habitat exists in the transitional areas generally defined by topography, between uplands and watercourses adjacent to the unnamed stream. Within the LOD, there are currently approximately 300 ft of stream with riparian zones buffering each side. Vegetation cover in the

riparian corridor of the LOD is categorized as woody wetlands, pasture/hay, emergent herbaceous wetlands, and grassland/herbaceous. No riparian areas were identified in the offsite staging area.

Finkleday Dam

Land Cover Types in the Limit of Disturbance

Land Cover/ Vegetation Type	Description	Rehabilitation LOD - Alternatives 1 and 3 (acres)	Rehabilitation LOD - Alternative 2 (acres)	No Action Alternative LOD (acres)	Offsite staging area (acres)
Open Water	Areas of open water with generally less than 25 percent cover of vegetation or soil.	0.32	0.32	3.24	0
Developed, Open Space	Areas with a mixture of some constructed materials but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	0.16	0.16	0.16	0.69
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.	4.56	3.83	3.90	0.28
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.	2.26	2.26	3.24	0.05
Evergreen Forest	Contains areas dominated by trees generally greater than 5 meters tall and greater than 20 percent total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.	0.02	0.02	0.02	0
Grassland/ Herbaceous	Areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing.	0	0	0.22	3.8
Pasture/Hay	Contains areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle and not tilled. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	0.78	0.78	1.29	0

Land Cover/ Vegetation Type	Description	Rehabilitation LOD - Alternatives 1 and 3 (acres)	Rehabilitation LOD - Alternative 2 (acres)	No Action Alternative LOD (acres)	Offsite staging area (acres)
Woody Wetlands	Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0.44	0.44	0.14	0
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0	0	0.39	0

Note: Wetlands acreages presented in this table are from NLCD, which is based on satellite imagery. Wetland acreages presented in the "Wetland Communities in the LOD" were obtained through field delineations and are considered to be more accurate.

Riparian Areas

Riparian habitat exists in the transitional areas generally defined by topography, between uplands and watercourses adjacent to Indian Orchard Brook and the impoundment. Vegetation cover in the riparian corridor of the project area is categorized as woody wetlands, pasture/hay, grassland/herbaceous, deciduous forest, mixed forest, and evergreen forest.

Ecosystem Services

The following ecosystem service investigation approach is based on DR 9500-013 guidance. It utilizes additional guidance stated in 40 CFR 1502.15, NWPM (501.38 A. (1)), and in DM 9500-013 (P. 17, 31, 38) the intensity of planning is dependent on the potential significance of the project action. It has particular application to the development of Supplemental Watershed Plans where conservation measures have previously been installed (e.g., Dam Rehabilitation Projects).

To understand ecosystem flows related to project action the NRCS Conservation Practice Physical Effects (CPPE) network diagrams were employed. The specific diagrams for practices anticipated to be implemented were reviewed. Linkages were defined between the network diagram direct effects and the 16 ecosystem services to be considered in project planning (DM 9500-013). The direct effect was used as the surrogate measure for impacts to a related ecosystem service. This conceptual model connection was presented during scoping to identify the ecosystem services that would be significant to decision making. The analysis indicated that three categories of ecosystem services would likely be impacted. These categories include, Regulating, Supporting, and Cultural services. These categories are discussed in more detail below as well as the specific services in each "Service Category" that are anticipated to be impacted by project action. The associated metrics used to evaluate service impacts are also discussed in the following paragraphs.

Regulating

Regulating ecosystem services are services which help maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe.

These benefits are obtained through moderation or control of ecosystem processes, including regulation of local climate, air, or soil quality; carbon sequestration; flood, erosion, or disease control; and pollination. There is inherent uncertainty when trying to predict impacts on regulating ecosystem services, given that our ideas of climate change and potential environmental catastrophes are based on models and simulations.

Flood and Disease Control (category)

The Lackawaxen Tributaries dams were constructed for the purpose of flood control of downstream areas. The construction of the dams has limited the frequency and extent of flooding events, and as a result, lowered chance of disease spreading through contaminated flood waters.

Surrogate Metric for Flood and Disease Control

The key metric used as the surrogate measure of the flood control service (and by default disease control) is the number of structures (i.e., bridges and buildings) located within the 100-year floodplain downstream of the dam. The residents and businesses within this zone will be directly impacted by changes in flood control. The number of structures impacted will be used as the ecosystem service metric. This is because the inundation and destruction of structures are more likely to impact human lives than the inundation of floodplain acres. As such, the metric used to evaluate alternative effects is the number of structures impacted under existing conditions as compared to each Alternative. This is because reducing flood damages and the potential loss of life is a critical ecosystem service for the project area.

The installation of the dam has limited the frequency and extent of flooding events, and as a result, the risk of pathogens, harmful bacteria (e.g., fecal coliform), and vector borne disease spreading through contaminated flood waters is decreased. Disease control is not used as a metric for this service, it is only noted as a likely associated benefit therefore not evaluated.

Supporting

Supporting services refer to the underlying processes maintaining conditions for life on Earth, including nutrient cycling, soil formation, and primary production. There is inherent uncertainty when trying to determine impacts of the project on supporting ecosystem services since there are many factors unrelated to the project that can affect processes such as nutrient cycling and soil formation.

Nutrient Cycling (category)

Nutrient cycling in ecosystems is the exchange of organic and inorganic material back into the production of energy and matter. The nutrient cycle involves animals, plants, bacteria, fungi, as well as mineral components of the soil.

Surrogate Metric for Nutrient Cycling

The key surrogate metric which will be used to represent nutrient cycling will be vegetation. The addition or removal of vegetation will have a significant impact on nutrient cycling. The change in the extent of vegetation in the Limit of Disturbance (LOD) for each alternative will be analyzed.

Soil Formation (category)
Factors that affect soil formation include parent material, climate, topography, biological factors, and time (USDA NRCS 2020).

Surrogate Metric for Soil Formation
The key surrogate metric which will be used to represent impacts to soil formation will be the extent and magnitude of the change of perviousness in the LOD.

Cultural
Cultural services make the world a place in which people want to live. These services are the non-material benefits that ecosystems provide to human societies and culture, including opportunities for recreation, tourism, aesthetic or artistic appreciation, and spirituality. Uncertainty within cultural ecosystem services lies within society's restructuring of what is deemed culturally important as well as future management actions outside the realm of this project.

Recreational Use (category)
There is no designated public recreational land within the project area. The impoundments are not available to the public for recreation.

Surrogate Metric for Recreational Use
The key surrogate metrics used to represent recreational use will be the reservoir size.

Aesthetic Viewsheds (category)
Scenic beauty, as defined by the USDA National Environmental Compliance Handbook Part 610.35, takes into consideration landforms, water, vegetation, and structures, some of which are present within the project area (USDA NRCS 2016). The landforms in the project area include small hills and other small geologic formations. Viewshed maps are provided in Appendix C.

Surrogate Metric for Viewsheds
The key surrogate metrics used to represent aesthetic viewsheds are the extent of the impoundment within the viewshed of the home and the acreage of natural green landscape within viewshed of the home.

Site	Regulating Services	Supporting Services	Cultural Services
Garrett Dam	*Flood and Disease Control* • Structures in the 100-yr Floodplain: 18 (9 homes and 9 businesses) • Structures in the 500-yr Floodplain: 37 (12 homes and 25 businesses)	*Nutrient Cycling* • Established Vegetation, 8.29 Ac. *Soil Formation* • Impervious Surface in LOD, 0.0 Ac.	*Recreational Use* • Surface Area of the reservoir, 3.3 Ac. *Aesthetic Viewsheds* • Natural Green Landscape in Viewshed of LOD, 2.3 Ac. • Impoundment in Viewshed, 0.5 Ac.

Site	Regulating Services	Supporting Services	Cultural Services
Varcoe Dam	*Flood and Disease Control* • Structures in the 100-yr Floodplain: 18 (9 homes and 9 businesses) • Structures in the 500-yr Floodplain: 21 (12 homes and 9 businesses)	*Nutrient Cycling* • Established Vegetation in LOD, 5.63 Ac. *Soil Formation* • Impervious Surface in LOD, 0.0 Ac.	*Recreational Use* • Surface Area of the Reservoir, 2.45 Ac. *Aesthetic Viewsheds* • Natural Green Landscape in Viewshed of LOD, 0.08 Ac.
Martin Dam	*Flood and Disease Control* • Structures in the 100-yr Floodplain, 27 (12 homes, 14 businesses, and 1 public bldg.) • Structures in the 500-yr Floodplain: 37 (18 homes, 15 businesses, and 4 public bldgs.)	*Nutrient Cycling* • Established Vegetation in LOD, 6.25 Ac. *Soil Formation* • Impervious Surface in LOD, 0.0 Ac.	*Recreation Use* • Surface Area of the Reservoir, 2.33 Ac. *Aesthetic Viewsheds* • Natural Green Landscape in Viewshed of LOD, 0.32 Ac.
Finkleday Dam	*Flood and Disease Control* • Structures in the 100-yr Floodplain, 27 (12 homes, 14 businesses, and 1 public bldg.) • Structures in the 500-yr Floodplain: 37 (18 homes, 15 businesses, and 4 public bldgs.)	*Nutrient Cycling* • Established Vegetation in LOD, 7.65 Ac. *Soil Formation* • Impervious Surface, 0.0 Ac.	*Recreational Use* • Surface Area of the Reservoir, 5.6 Ac. *Aesthetic Viewsheds* • Natural Green Landscape in Viewshed of LOD, 7.65 Ac. • Impoundment in Viewshed, 5.6 Ac.

SUB-WATERSHED ECONOMIC CONDITIONS

The tributaries on which Garrett and Varcoe Dams are located come together downstream of both dams to form a common floodplain. The same occurs for Martin and Finkleday Dams. Because of the common floodplain below the dams, the breach inundation zones (affected areas) for Garrett and Varcoe Dams were combined into one affected area. The same was done for Martin and Finkleday Dams. Therefore, these sub-watersheds were paired for social analysis because of their proximity in addition to the fact that the sub-watersheds paired are on tributaries to the same water course.

Income

Garrett and Varcoe Dams

The affected area's per capita income ($27,030) is 135% higher than Honesdale Borough, 106% higher than Wayne County, but just 86% of the Commonwealth of Pennsylvania. When looking at median household income, the trend diversifies more, with the affected area being 167% of Honesdale Borough, but 94% and 86% of Wayne County and the Commonwealth of Pennsylvania, respectively.

When compared to median household income breakdown, the affected area appears to be a slightly more affluent area overall than any of the other three. For lower household incomes (less than $25,000), about 12% of the affected area's population falls into this category, while the other three are much higher: Honesdale Borough (39.2%), Wayne County (22.9%), and Commonwealth of Pennsylvania (21.5%). The same trend is similar for the other income categories, with the exception of Wayne County for the $25,000 - $50,000 category.

Martin and Finkleday Dams

Although less than Garrett and Varcoe Dams, the affected area's per capita income ($25,322) is 127% higher than Honesdale Borough, about the same as Wayne County, but only 80% of the Commonwealth of Pennsylvania. When looking at median household income, the trend is about the same as per capita income – 175% higher than Honesdale Borough, about the same as Wayne County but lower than the Commonwealth of Pennsylvania.

The data from the "Demographics and Socio-Economics of Breach Inundation Zones" table which follows provides a median household income breakdown which reflects the same trend for the affected area compared to the other three entities as does Garrett and Varcoe Dams. The Martin and Finkleday Dams' area appears to be slightly more affluent overall than any of the other three. For lower household incomes (less than $25,000), about 18% of the affected area's population falls into this category, while the other three are higher.

Employment/Unemployment

Garrett and Varcoe Dams

Using the American Community Survey 5-year Estimates for 2013-2017, about 58% of the population in the affected area were in the labor force. The percentage of civilian unemployed in the labor force was 7.4%. Figures for the other entities were 47.5% in the labor force and

6.8% unemployed for Honesdale Borough, 51.6% in the labor force and 6.5% unemployment (Wayne County), and 62.6% and 6.5% (Commonwealth of Pennsylvania), respectively. According to the U.S. Bureau of Labor Statistics, recent unemployment rates are as follows: Honesdale Borough (8.3%), Wayne County (6.4%) and Commonwealth of Pennsylvania (7.4%), all Spring 2021. Unemployment data was not available for the affected area, but it is within reason that the affected area's unemployment rate is comparable to Honesdale Borough.

Martin and Finkleday Dams
About 54% of the population in the affected area were in the labor force, slightly lower than in case of Garrett and Varcoe Dams. However, the percentage of civilian unemployed in the labor force was lower - 3.5%. The latter rate compares more favorably with recent U.S. Bureau of Labor Statistics unemployment rates as recorded above.

Poverty
Garrett and Varcoe Dams
Statistics in *Demographics and Socio-Economics of Breach Inundation Zones* table show that population living below the poverty level for the affected area (13.4%) is quite a bit lower than Honesdale Borough (19.3%), higher than Wayne County (11.1%), but comparable the Commonwealth of Pennsylvania (13.1%).

Martin and Finkleday Dams
The population living below the poverty level in the affected area (11.5%) is quite a bit lower than Honesdale Borough (19.3%) and somewhat lower than the Commonwealth of Pennsylvania (13.1%) but comparable to Wayne County (11.1%).

SUB-WATERSHED SOCIAL/HUMAN ENVIRONMENT

Age
Garrett and Varcoe Dams
About 76% of the people living within the affected area are 18 years old and above, comparable to Honesdale Borough (75%) and the Commonwealth of Pennsylvania (76%), but lower than Wayne County (81%). However, for those age 65 years and older, the affected area, Honesdale Borough, and Wayne County have similar percentages (21 – 24%) while the Commonwealth of Pennsylvania exhibits a younger population (17%).

Martin and Finkleday Dams
About 79% of the people living within the affected area are 18 years old and above. As expected, this has similar comparisons with the other three entities as for Garrett and Varcoe Dams. The same result as noted above also applies to those age 65 years and older.

Education
Garrett and Varcoe Dams
Over 94% of the population in the affected area is a high school graduate or higher. This compares to about 90%, 89%, and 90% for Honesdale borough, Wayne County, and the

Commonwealth of Pennsylvania. However, the percentage of those with bachelor's degrees or higher in the affected area is comparable to both Honesdale Borough and Wayne County.

Martin and Finkleday Dams
About 89% of the population in the affected area is a high school graduate or higher, which is nearly identical to the other three entities. However, the percentage of those with bachelor's degrees or higher in the affected area is lower than Honesdale Borough, Wayne County, and the Commonwealth of Pennsylvania.

Housing
Garrett and Varcoe Dams
As presented in the *Demographics and Socio-Economics of Breach Inundation Zones* table, about 84% of the population in the affected area are homeowners, which is nearly double that of Honesdale Borough (49.6%) and even higher than Wayne County (79%) and the Commonwealth of Pennsylvania (69%).

Martin and Finkleday Dams
About 85% of the population in the affected area are homeowners, which, like for Garrett and Varcoe Dams, is nearly double that of Honesdale Borough (49.6%) and even higher than Wayne County (79%) and the Commonwealth of Pennsylvania (69%).

Cultural Resources / Historic Properties
The National Register of Historic Places (NRHP), which is managed by the National Park Service within the Department of the Interior, maintains a list of national historical places deemed worthy of preservation. There are no historic properties listed on the NRHP within the APE of each dam. The closest historic site is the Honesdale Residential Historic District, approximately 2 miles southwest of Garrett Dam (National Park Service, 2020).

All structures within the APEs were evaluated for eligibility in the NHRP. The APEs included the original footprint of construction for each dam, staging areas, and ingress/egress areas. NRCS determined that, while the dams are over 50 years old, they are not eligible for the NRHP. NRCS also determined that the ruins of a barn within the APE at Martin Dam and a springhouse within Finkleday Dam's APE were not eligible for the NHRP. PA NRCS SHPO concurred with these determinations.

Residential structures which could view the dam were not considered to be within the APE as they would not be directly affected by any of the rehabilitation alternatives. Effects, if any, would be transient in nature during construction and would generally be shielded by topography and vegetation.

The areas within the identified APEs that include the footprint of original dam construction have been significantly disturbed. Previously undisturbed areas, including some staging areas and access roads, were identified by PA SHPO as ranging from low to high levels of probability (based on locations of previously identified sites, distance to water, land forms, soil type, etc.) of having an unidentified pre-contact site.

The Section 106 process was completed with nine tribes (Absentee-Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Oklahoma, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Onondaga Nation, Shawnee Tribe, and Stockbridge-Munsee Community Band of Mohican Indians) to identify tribal resources within the APEs. Through consultation, the Delaware Tribe of Indians stated that the project area has a low/medium sensitivity for our ancestral materials and treaty resources.

Visual/Aesthetics and Scenic Beauty

The visual/aesthetics and scenic beauty value associated with the dams of this project are all similar. As stated in the Ecosystem Services narrative only the reservoir size and natural green vegetation acreages in the LOD are slightly different. These facets provide value to the users in their own environmental context.

Population and Race

Garrett and Varcoe Dams

The estimated population of the affected area is 125 and the number of households is 40 according to the U.S. Census Bureau projections (American Community Survey 5-year Estimates for 2013-2017). According to the U.S. Census Bureau, Honesdale Borough's population was 4,874 in 2000; 4,514 in 2010; and 4,277 in 2018, indicating a slight decline over the last few decades. Also, Wayne County has also seen a slight decline in population recently, going from 52,848 in 2010 to 51,276 in 2018. It is estimated that the affected area has seen a similar trend during the same time period. Minority population by race and ethnicity is very low in the affected area (1.6%) as it is in Honesdale Borough (8.6%) and Wayne County (10.2%) compared to the Commonwealth of Pennsylvania (25.7%).

Martin and Finkleday Dams

The estimated population of the affected area is 66 and the number of households is 22 according to the U.S. Census Bureau projections (American Community Survey 5-year Estimates for 2013-2017). As mentioned earlier Honesdale Borough and Wayne County's population have experienced a slight decline over the last few decades. It is estimated that the affected area has seen a similar trend during the same time period. Compared to Garrett and Varcoe Dams, minority population by race and ethnicity is higher in the affected area (8.2%) which is comparable to Honesdale Borough and Wayne County) but much lower than the Commonwealth of Pennsylvania.

Tribal Communities

Most Native Americans were forced to leave Pennsylvania during the 1700s, when eastern tribes were being displaced by colonial expansion. These tribes are not extinct, but except for the descendants of Pennsylvania Indians who assimilated into white society, they do not currently live in Pennsylvania. Federally-recognized tribes with ancestral lands in Wayne County include Absentee-Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Oklahoma, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Onondaga Nation, Shawnee Tribe, and Stockbridge-Munsee Community Band of Mohican Indians (U.S. Department of Housing and Urban Development, 2020 and PennDOT, 2019).

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires each Federal agency to make environmental justice a part of its mission. Agencies must identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations, low-income populations and Indian Tribes. The primary means to attain compliance with environmental justice considerations are: (1) Assessing the presence of environmental justice communities in a project area that may experience disproportionately high and adverse human health or environmental effects, and (2) The inclusion of low-income minority, Tribal, or other specified populations in the planning process. Additionally, E.O. 12898 established an Interagency Working Group on environmental justice chaired by the EPA Administrator and comprised of the heads of 11 departments or agencies, including the U.S. Department of Agriculture.

The USDA Departmental Regulation (DR) 5600-002 provides detailed determination procedures for NEPA and non-NEPA activities and suggests social and economic effects to consider when assessing whether there are disproportionately high and adverse human health or environmental effects to environmental justice communities in a project area.

Using EPA's "EJSCREEN" tool an environmental justice and civil rights analysis was conducted for areas downstream of the dams within the affected areas. The following table presents the results of utilizing EJSCREEN regarding the demographics and socio-economics of the affected populations compared to Honesdale Borough, Wayne County and the Commonwealth of Pennsylvania.

Demographics and Socio-Economics of Breach Inundation Zones, Honesdale Borough, Wayne County, and Commonwealth of Pennsylvania

Category	Affected Population Below Garrett/ Varcoe [1/]	Affected Population Below Martin/ Finkleday [1/]	Honesdale Borough	Wayne County	Pennsylvania
Total Persons	125	66	4,294	51,656	12,790,505
Persons Below Poverty Level	13.4%	11.5%	19.3%	11.1%	13.1%
Households in Area (#)	40	22	2,108	19,202	5,007,442
Race					
White	98.6%	96.3%	97.5%	94.0%	81.1%
African-American	0.2%	0.9%	0.3%	3.4%	11.1%
American Indian and Alaska Native	0.0%	0.0%	0.4%	0.3%	0.2%
Asian	0.2%	0.9%	0.0%	0.6%	3.3%

Category	Affected Population Below Garrett/ Varcoe [1/]	Affected Population Below Martin/ Finkleday [1/]	Honesdale Borough	Wayne County	Pennsylvania
Native Hawaiian and Other Pacific Islander	0.0%	0.0%	0.0%	0.0%	0.0%
Other Race	0.0%	0.0%	0.0%	0.4%	2.0%
Multiracial	1.0%	1.9%	1.8%	1.3%	2.3%
Ethnicity					
Hispanic or Latino	0.2%	4.5%	6.1%	4.2%	6.8%
Not Hispanic or Latino	99.8%	95.5%	93.9%	95.8%	93.2%
Age Breakdown					
Age 0 - 18 years old	23.8%	21.3%	24.8%	19.1%	23.8%
Age 18+	76.2%	78.7%	75.2%	80.9%	76.2%
Age 65 years and older	21.2%	22.8%	23.9%	22.4%	17.1%
Gender					
Males	48.7%	54.3%	43.3%	53.1%	48.9%
Females	51.3%	45.7%	56.7%	46.9%	51.1%
Education Level (age 25 and over)					
Less than 9th grade	3.0%	3.0%	3.9%	2.9%	3.3%
9th - 12th grade	2.8%	8.3%	6.6%	7.5%	6.8%
High School Diploma	40.8%	40.1%	42.1%	43.4%	35.6%
Some College, no degree	29.2%	30.8%	19.2%	18.5%	16.1%
Associate degree	10.8%	10.1%	6.2%	7.2%	8.2%
Percent High School Graduate or Higher	94.2%	88.7%	89.5%	89.3%	89.9%
Percent Bachelor's Degree or Higher	23.2%	18.6%	22.0%	20.9%	30.1%
Language Spoken at Home					
English Only	96.0%	96.0%	NA	NA	93.9%
Language Other Than English	4.0%	4.0%	NA	NA	6.1%
Income Breakdown (Households)					
Less than $15,000	8.0%	8.0%	23.4%	10.8%	11.5%
$15,000 - $25,000	4.2%	10.2%	15.8%	11.1%	10.0%
$25,000 - $50,000	26.9%	27.0%	30.9%	25.4%	22.7%
$50,000 - $75,000	22.3%	18.5%	18.0%	21.0%	18.1%
$75,000+	38.6%	36.3%	11.9%	31.7%	37.6%
Median Household Income	$48,879	$51,354	$29,306	$52,161	$56,951

Category	Affected Population Below Garrett/ Varcoe [1/]	Affected Population Below Martin/ Finkleday [1/]	Honesdale Borough	Wayne County	Pennsylvania
Per Capita Income					
Total Population	$27,030	$25,322	$19,969	$25,569	$31,476
Occupied Housing Units by Tenure					
Owner Occupied	84.1%	84.9%	49.6%	79.2%	69.0%
Renter Occupied	15.9%	15.1%	50.4%	20.8%	31.0%
Employed Population Age 16+ Years					
In Labor Force	57.6%	54.4%	47.5%	51.6%	62.6%
Civilian Unemployed in Labor Force	7.4%	3.5%	6.8%	6.5%	6.5%

[1/] Data represents population within breach inundation zone downstream of dam.

All the public meetings were widely advertised using local media to ensure Environmental Justice related communities in the Area of Potential effect were informed of this proposed project action.

Transportation

There are multiple transportation avenues within the project area. Below Garrett and Varcoe Dams are several local roads (mostly hard top) that are accessible to residents. These roads have access to Honesdale Borough, where major highways dissect the Borough. Martin and Finkleday Dams also have multiple local roads below them, in particular Route 652, also referred to as Beach Lake Highway. Route 652 meets U.S. Route 6 in Honesdale Borough. U.S. Route 6 is classified as a Principal Arterial Highway and runs west to east starting in Canaan Township passing through Waymart Borough, Prompton Borough, Texas Township, Honesdale Borough, Palmyra Township and Hawley Borough. It is the principal west-east route through the County and is used to bring most goods in and out of the County.

Public Health and Safety

Garrett Dam

There are an estimated 104 people who live and/or work in 8 houses and 40 commercial buildings below the dam whose lives could be at risk should the dam breach. And, about 48 motorists driving on 13 roadways and 10 stream crossings could also be at risk from unexpected breach floodwaters. Emergency vehicle routes, school bus routes, and first responders' reactions could be delayed or interrupted due to road and bridge damages from a breach.

Varcoe Dam

There are an estimated 15 people who live and/or work in 3 houses and 3 commercial buildings below the dam whose lives could be at risk should the dam breach. And, about 18 motorists driving on 6 roadways and 3 stream crossings could also be at risk from unexpected breach

floodwaters. Emergency vehicle routes, school bus routes, and first responders' reactions could be delayed or interrupted due to road and bridge damages from a breach.

Martin Dam

There are an estimated 41 people who live and/or work in 5 houses, 11 commercial buildings, and 2 public buildings below the dam whose lives could be at risk should the dam breach. And, about 44 motorists driving on 13 roadways and 8 stream crossings could also be at risk from unexpected breach floodwaters. Emergency vehicle routes, school bus routes, and first responders' reactions could be delayed or interrupted due to road and bridge damages from a breach.

Finkleday Dam

There are an estimated 28 people who live and/or work in 4 houses and 8 commercial buildings below the dam whose lives could be at risk should the dam breach. And, about 30 motorists driving on 9 roadways and 4 stream crossings could also be at risk from unexpected breach floodwaters. Emergency vehicle routes, school bus routes, and first responders' reactions could be delayed or interrupted due to road and bridge damages from a breach.

Summary

In summary, the demographics of the Garret/Varcoe Dams and the Martin/Finkleday Dams affected areas as compared to Honesdale Borough, Wayne County, and the Commonwealth of Pennsylvania overall reflect evidence of higher per capita income, lower poverty levels, higher median household income, and a small presence of a minority population.

The presence or absence of environmental justice groups within each watershed was assessed using EPA's EJSCREEN tool and confirmed by the PADEP Environmental Justice Public Participation Policy. The Environmental Justice Public Participation Policy defines an EJ Area as any census tract where 20 percent or more individuals live at or below the federal poverty line, and/or 30 percent or more of the population identifies as a non-white minority, based on data from the U.S. Census Bureau and the federal guidelines for poverty (https://www.dep.pa.gov/PublicParticipation/OfficeofEnvironmentalJustice/Pages/PA-Environmental-Justice-Areas.aspx). Based on these guidelines, PADEP does not identify any EJ communities within the affected areas downstream of the dams. Even though disadvantaged communities do not appear to be present, efforts were made to involve all interested parties in the planning process.

Projected Future Watershed Conditions

Population Projections

According to The Center for Rural Pennsylvania, *Pennsylvania Population Projections 2010-2040,* Wayne County's population is projected to increase 0.1% during 2020 – 2030 but then decline 6.2% during 2030 – 2040.

Land Use Projections

Wayne County participates in Act 319, also known as the Clean & Green Act, which permits the County Assessment Office to provide a reduced assessment on eligible agricultural and

woodland properties. This preferential tax assessment program bases property taxes on use values rather than fair market values. This ordinarily results in tax savings for landowners. The Pennsylvania General Assembly enacted the program in 1974 as a tool to encourage protection of the Commonwealth's valuable farmland, forestland and open spaces. Currently, more than 9.3 million acres are enrolled statewide.

A landowner who breaches the covenant is subject to seven years of rollback taxes at 6% interest per year. The rollback tax is the difference between what was paid under Clean and Green versus what would have been paid, if the property had not been enrolled, plus 6% simple interest per year.

Because of the popularity of the Clean and Green Act in Wayne County, as well as the severity of the penalties for breaching the covenant, it was assumed that limited changes in land use within Wayne County would occur over the period of analysis of the project.

STATUS OF OPERATION AND MAINTENANCE

Operation and maintenance of the structures are the responsibility of the Wayne County Commissioners. The Commissioners have operated and maintained the dams in accordance with the operation and maintenance agreements in place. This has been verified through inspection reports including the NRCS dam assessments completed to determine eligibility of the dams for the USDA, NRCS Dam Rehabilitation Program.

SUB-WATERSHED SEDIMENTATION

All four dams were originally designed to detain future sediment and provide flood storage. Bathymetric and sediment surveys were completed by Aterra-Schnabel JV to estimate the remaining sediment storage capacity and the historical sediment accumulation rate. Wayne County participates in Act 319, also known as the Clean & Green Act. This act reduces the density of developments and limits future development in the watersheds. Furthermore, there has been significant reduction in agricultural activities and reforestation has increased. Therefore, it was assumed that sedimentation rates will remain at or below the measured historical sedimentation rates.

Submerged Sedimentation Rates

Dam Site	Historical Planned [ac-ft/yr]	Historical Actual [ac-ft/yr]	Future [ac-ft/yr]
Garrett Dam	0.36	0.064	0.064
Varcoe Dam	0.164	0.048	0.048
Martin Dam	0.229	0.028	0.028
Finkleday Dam	0.25	0.065	0.065

BREACH ANALYSIS

A breach analysis was performed for all dams using the static (sunny-day) breach, the hydrologic (PMF), and the seismic breach scenarios using the process-based WinDAM C computer model. Table D-24 in Appendix D describes the key inputs for WinDAM C, including soil parameters, which were based on the geotechnical exploration performed as part of this project. The WinDAM C generated breach hydrographs were routed using the 2-D HEC-RAS hydraulic model to develop dam breach inundation maps, confirm the hazard classification, and to evaluate the consequences of dam breach. Resulting peak breach flows are provided in Table D-25 in Appendix D.

SUB-WATERSHED HAZARD CLASSIFICATION

The static dam breach scenario, with pool elevation at the auxiliary spillway crest and with non-storm conditions downstream, was considered the limiting case for determination of hazard classification. The dam breach analysis was performed for each dam individually and the results showed that numerous structures, roads and bridges would be impacted and would experience flood depths greater than one foot resulting in likely loss of life. Therefore, based on Federal guidelines, there is no justification for lowering the high hazard potential classification of any of the dams. A summary of State and NRCS dam hazard classification is provided below.

Dam Site	State Dam Classification	NRCS Dam Classification
Garret Dam	Class C, Hazard Category 1	High Hazard Potential
Varcoe Dam	Class C, Hazard Category 1	High Hazard Potential
Martin Dam	Class C, Hazard Category 1	High Hazard Potential
Finkleday Dam	Class C, Hazard Category 1	High Hazard Potential

POTENTIAL MODES OF FAILURE

Dams are built for the conditions that existed or could reasonably be anticipated at the time of their original design. Often these design assumptions become obsolete and/or the physical condition of the structure deteriorates, which can increase the risk of dam failure. Several potential failure modes were evaluated for each of the four dams to address these concerns.

Failure Potential Due to Embankment Slope Instability

In general, embankment dam instability occurs when a load or force is exerted on soil that exceeds the soil's ability to resist the load. Slope instability typically takes the form of a circular- or wedge-shaped failure on one of the slopes, commonly referred to as slide or slump. A downstream slope failure that extends fully through the dam and intersects the reservoir can initiate a dam overtopping failure. A downstream slope failure that mobilizes enough soil to expose the saturated zone below the phreatic surface within a dam, can initiate uncontrolled seepage and lead to a dam failure. An upstream slope could fail during a rapid drawdown of the reservoir and could potentially plug or damage the principal spillway.

The following tables summarize compliance with NRCS and Pennsylvania Department Environmental Protection (PADEP) factor of safety criteria for each dam along with a qualitative rating for failure potential due to embankment slope instability.

Failure Potential Due to Upstream Slope Instability

Dam Site	Compliance with NRCS and PADEP Factor of Safety Criteria		
	Normal Pool Steady State Seepage	**Flood Surcharge FBH Event**	**Normal Pool Rapid Drawdown**
Garrett Dam	*Yes*	*Yes*	*Yes*
Varcoe Dam	*Yes*	*Yes*	*Yes*
Martin Dam	*Yes*	*Yes*	*No*
Finkleday Dam	*Yes*	*Yes*	*Yes*

Failure Potential Due to Downstream Slope Instability

Dam Site	Compliance with NRCS and PADEP Factor of Safety Criteria	
	Normal Pool Steady Seepage	**Flood Surcharge FBH Event**
Garrett Dam	*Yes*	*Yes*
Varcoe Dam	*No*	*No*
Martin Dam	*No*	*No*
Finkleday Dam	*Yes*	*Yes*

Hydrologic Capacity and Spillway Integrity

Hydrologic failure of a dam occurs when the auxiliary spillway is breached or when the dam is overtopped and fails. Under current NRCS criteria for high hazard potential dams, the auxiliary spillway must have sufficient integrity and capacity to completely pass the full PMF event. All four dams were evaluated using the WinDAM C computer program for overtopping failure and spillway integrity. The table below provides a summary of the analysis.

Dam Site	Dam Overtopped During FBH	Dam Breaches During FBH	Spillway Breaches During FBH
Garrett Dam	*Yes*	*Yes*	*Yes*
Varcoe Dam	*Yes*	*No*[1]	*Yes*
Martin Dam	*Yes*	*Yes*	*Yes*
Finkleday Dam	*No*	*No*	*Yes*

[1] WinDAM results for Varcoe Dam indicated that overtopping breach is not a credible failure scenario because the duration and the extent of the overtopping does not result in breaching of the dam.

Note that beavers are naturally attracted to reservoirs and often build dens along the upstream slopes of embankment dams. Beaver have also been known to block spillways with their dens. There is evidence of beaver activity and blockages of the PSW riser at Garrett Dan, that subsequently contributed to unintended ASW flow during a recent precipitation event. Potential Failure Modes associated with beaver activity were not specifically evaluated as part of this study; however, the spillway rehabilitation measures evaluated (i.e., improved trash rack, replacement PSW riser, ASW armoring) will reduce the risk of damage caused by beaver activity.

Failure Potential Due to Seismic Loading

Dynamic loading can cause permanent deformation of the embankment or foundation if the stress changes cause shear or tensile strength to be exceeded. Loose, saturated, cohesionless soils, when subject to earthquake shaking and initial shearing, can contract as the soil particles are rearranged. Since the water within the pore spaces is virtually incompressible, this results in an increase in pore water pressure and decreasing shearing resistance. If the pore pressure increase is enough to reduce the effective stress to nearly zero, the soil is said to have liquefied, and the soil experiences a significant reduction in shear strength. Extensive shear strength reduction beneath an embankment slope can trigger a flow slide which, in turn, can result in a very rapid dam failure. In dense, saturated cohesionless soils, these large shear displacements may not occur.

All four dams are located within an area of low to moderate seismic hazard. The results of the geotechnical investigations, testing, and analyses indicate the dam embankments and foundation soils at each site are not susceptible to liquefaction due to ground motions resulting from design-level earthquake loading.

Whether or not the embankment or its foundation liquefies completely, pore pressure can increase, resulting in a decrease in shearing resistance. If enough reduction occurs, over a sufficient extent, large deformations can result in failure. Overtopping erosion failure can occur if crest deformations exceed the freeboard at the time of the deformations.

A pseudo-static slope analysis was performed to assess the potential for embankment deformation and compliance with PADEP factor of safety criteria for the maximum credible earthquake (MCE), which is defined as the 2,500-year return period. These results are summarized in the following table.

Embankment (Upstream Slope) Failure Potential Due to Seismic Loading

Dam Site	Compliance with PADEP Factor of Safety Criteria
Garrett Dam	*Yes*
Varcoe Dam	*Yes*
Martin Dam	*No*
Finkleday Dam	*Yes*

Embankment (Downstream Slope) Failure Potential Due to Seismic Loading

Dam Site	Compliance with PADEP Factor of Safety Criteria
Garrett Dam	*Yes*
Varcoe Dam	*No*
Martin Dam	*No*
Finkleday Dam	*No*

Stability analyses were also performed to assess the potential for a seismic induced failure of the existing principal spillway risers, which may result in plugging the principal spillway. The results indicate that the existing risers at each dam meet the required factors of safety for overturning and sliding.

Failure Potential Due to Uncontrolled Embankment and Foundation Seepage

Uncontrolled embankment and foundation seepage can significantly increase the likelihood of failure, particularly if the following exists: (1) unfiltered seepage exit; (2) sufficient exit gradient to initiate backward erosion piping; (3) embankment or foundation soils that can support a stable roof over the developing pipe; and (4) sufficient seepage flow to advance the pipe to the impoundment causing an uncontrolled release. Seepage increases observed with a corresponding rise in pool elevation is often times an indication of a potential problem, as is cloudy or muddy seepage or "sand boils". Effective foundation and embankment drainage systems mitigate this failure mode by filtering, collecting and safely conveying the seepage away from the dam. Seepage can also cause dam failure by saturating the embankment, thus weakening the dam, or by increasing internal pressure within the embankment.

Contributing factors related to a seepage induced failure for each dam are briefly summarized below:

- Garrett Dam: The dam is equipped with a toe drain and filter diaphragm, but the as-built materials do not meet NRCS filter compatibility and the drain includes a CMP, which is susceptible to corrosion.

- Varcoe Dam: The dam is equipped with filter blanket drain, but no filter diaphragm. The as-built materials do not meet NRCS filter compatibility, but they are anticipated to function adequately as a filter.

- Martin Dam: Relief wells were recommended in the original design to drain water bearing lenses of sand and gravel in foundation near the principal spillway, but they were never installed. The existing dam is equipped with a toe drain, but no filter diaphragm. The as-built drainage materials do not meet NRCS filter compatibility criteria, but they are anticipated to function adequately as a filter. The existing toe drain has a CMP which is susceptible to corrosion.

- Finkleday Dam: There is a spring located to the right of the downstream toe which was identified on the As-Builts at the time of construction. However, the seepage source has not been confirmed. The dam is equipped with a toe drain, but no filter diaphragm. The as-built materials do not meet NRCS filter compatibility criteria but are anticipated to function adequately as a filter. The existing toe drain has a CMP which is susceptible to corrosion.

Failure Potential Due to Structural Deterioration

The materials used in the principal spillway system and pond drains are subject to weathering and chemical reactions within the soil, water, and atmosphere. Metal components can rust and corrode, and could leak and, if not addressed, ultimately cause an uncontrolled release of the reservoir (pond drain gate failure) or blockage of the principal spillway riser (trash rack failure).

Concrete risers and conduits can deteriorate and crack, through which leaks can develop leading to internal erosion of embankment or foundation materials. Visible portions of the concrete spillway risers and conduits appeared to be in generally good condition, with the exception of some surface deterioration and spalled concrete at the water line. Some unsealed joints were observed during inspection of the principal spillway conduits, but no open or leaky joints were identified.

SUB-WATERSHED CONSEQUENCES OF DAM FAILURE

The following conditions apply to all dams.

- Population at risk (PAR) was based on the difference between the two breach scenarios for the hydrologic condition – PMP without breach vs. PMP with breach.
- Static breach (full-pool) results only reflect the breach condition.
- There was no PAR for the Seismic breach condition since floodwaters did not impact any buildings, roadways, or crossings.
- For Roadways and Crossings, the presence of PAR was based on overflow of >=1.0 feet.

Unless otherwise noted, one vehicle per road would be affected by a breach. Assumed two motorists per vehicle.

NOTE: The following tables reflect how the number of people who would be at risk of loss of life from a breach of a dam were estimated. However, monetary damages inflicted on the buildings, roadways, and crossings from a breach of a dam were not estimated because monetary damages from a breach are not a part of the economic analysis. The economic analysis is based on the probability of recurrent storm events and their consequential impact to buildings, roadways, crossings, and other properties downstream. Therefore, it should not be implied that these tables are associated with the economic analysis. See Appendix D for a complete summary of the economic analysis.

Garrett Dam

Type	Hydrologic			Static		
	Buildings (#)	**PAR/Bldg (#)**	**PAR (#)**	**Buildings (#)**	**PAR/Bldg (#)**	**PAR (#)**
Residential	8	3	24	3	3	9
Commercial	40	2	80	2	2	4
Public	0	0	-	0	-	0
Totals	48	-	104	5	-	13
	Number (#)	**Vehicles (#)**	**PAR (#)**	**Number (#)**	**Vehicles (#)**	**PAR (#)**
Roadways	13 [1/]	14	28	10	10	20
Crossings	10	10	20	10	10	20
Totals	23	24	48	20	20	40
Grand Totals	**-**	**-**	**152**	**-**	**-**	**53**

[1/] One road is a major road (4-lane); so, number of affected vehicles = two.

Varcoe Dam

Type	Hydrologic			Static		
	Buildings (#)	**PAR/Bldg (#)**	**PAR (#)**	**Buildings (#)**	**PAR/Bldg (#)**	**PAR (#)**
Residential	3	3	9	0	-	0
Commercial	3	2	6	2	2	4
Public	0	0	-	0	-	0
Totals	6	-	15	2	-	4
	Number (#)	**Vehicles (#)**	**PAR (#)**	**Number (#)**	**Vehicles (#)**	**PAR (#)**
Roadways	6	6	12	10	10	20
Crossings	3	3	6	8	8	16
Totals	9	9	18	18	18	36
Grand Totals	**-**	**-**	**33**	**-**	**-**	**40**

Martin Dam

Type	Hydrologic			Static		
	Buildings (#)	**PAR/Bldg (#)**	**PAR (#)**	**Buildings (#)**	**PAR/Bldg (#)**	**PAR (#)**
Residential	5	3	15	4	3	12
Commercial	11	2	22	7	2	14
Public	2	2	4	1	2	2
Totals	18	-	41	12	-	28

	Number (#)	Vehicles (#)	PAR (#)	Number (#)	Vehicles (#)	PAR (#)
Roadways	13 [1/]	14	28	12	12	24
Crossings	8	8	16	8	8	16
Totals	21	22	44	20	20	40
Grand Totals	**-**	**-**	**85**	**-**	**-**	**68**

[1/] One road is a major road (4-lane); so, number of affected vehicles = two.

Finkleday Dam

Type	Hydrologic			Static		
	Buildings (#)	**PAR/Bldg (#)**	**PAR (#)**	**Buildings (#)**	**PAR/Bldg (#)**	**PAR (#)**
Residential	4	3	12	3	3	9
Commercial	8	2	16	4	2	8
Public	0	0	-	0	-	0
Totals	12	-	28	7	-	17
	Number (#)	**Vehicles (#)**	**PAR (#)**	**Number (#)**	**Vehicles (#)**	**PAR (#)**
Roadways	9 [1/]	10	20	8	8	16
Crossings	4 [2/]	5	10	4	4	8
Totals	13	15	30	12	12	24
Grand Totals	**-**	**-**	**58**	**-**	**-**	**41**

[1/] One road is a major road (4-lane); so, number of affected vehicles = two.
[2/] One crossing is on a major road (4-lane); so, number of affected vehicles = two.

The environmental damages from a dam failure would be significant. In addition to the damage caused by the water, the sediment stored in the pool area would be flushed downstream in the event of a catastrophic breach. Based on the flow velocities during the breach, significant scouring of the stream channel would occur downstream. Sediment would be deposited in the floodplain. This would constrict the floodplain and cause additional flooding in subsequent storm events. Deposition of sediment in the floodplain would also restrict normal use of the land which may cause water quality problems in the future. It is unlikely that a catastrophic breach would remove all the fill material used to build the dam. Some of the embankment material remaining after a breach would also eventually erode into the stream, contributing to the downstream sediment deposition. Over time, the sediment could migrate downstream into the Lackawaxen River.

ALTERNATIVES

RATIONALE FOR ALTERNATIVE FORMULATION

During the inventory planning process several deficiencies were identified in the dams evaluated in this plan. When the deficiencies of each of the dams were compared to the sponsors' Purpose and Need statements it was apparent that various measures were needed for each dam site.

FORMULATION PROCESS

The same formulation process was used for all alternative plans. Guidance for the process was provided by the NRCS National Water Management Center (NWMC) staff in Little Rock, Arkansas. The process includes an incremental analysis of the alternatives. The process begins with identifying alternatives that meet the project's Purpose and Need statement. This "Statement" is the same for all dams in this planning document. It requires that alternatives meet current safety and performance standards and provide the level of flood protection that was provided originally by the dams in this plan. A suite of alternatives was developed to meet the "Statement." There were four alternatives that were included based on NRCS policy. These alternatives are:

1. FWOP – Future Without Project (No Action)
2. Non-structural alternative
3. Decommissioning of the existing structures
4. Rehabilitation of the dam

All initial alternatives undergo a screening evaluation involving the "Four Tests" that are presented in the following text as well as the criteria provided in DM 9500-013. "Alternatives that may at first appear reasonable but clearly become unreasonable because of cost, logistics, existing technology, social, or environmental reasons may also be eliminated from further analysis." (DM 9500-013 P. 18)

The alternatives which were not eliminated during initial screening then were carried through to the detailed evaluation phase. This phase required alternatives to be evaluated against additional criteria using Principles, Requirements, and Guidelines (PR&G). A list of which follows:

- PR&G – Federal Objective
- PR&G – General Requirements
- PR&G – Guiding Principles
- PR&G – "Four Tests" of Completeness, Effectiveness, Efficiency, and Acceptability

The "Consideration of Guiding Principles – PR&G" tables show how the alternatives were evaluated against the Guiding Principles. The "Consideration of Federal Objective - PR&G" tables show how the alternatives were evaluated against the Federal Objective components.

After this part of the evaluation is complete an alternative was identified as the National Economic Efficiency (NEE) alternative. The alternatives that met the above criteria were then compared to the Future Without Federal Investment alternative in three areas:

1. environmental (including ecosystem services) effects

2. economic contribution
3. social contribution

The tradeoffs related to the alternatives were defined during the comparison process. At the end of the process a Recommended Alternative was identified. The sponsors then selected their "Preferred" alternative from the final suite of alternatives.

This process follows procedures set forth in the NRCS National Watershed Program Manual and other guidance referenced below:

- The Principles and Requirements for Federal Investments in Water Resources, March 2013
- USDA Departmental Regulation 9500-013
- USDA Departmental Manual 9500-013
- Interagency Guidelines (promulgated by Public Law 110-114)
- NRCS National Resource Economics Handbook Part 611

UNILATERAL CLIMATE CHANGE RESILIENCE FACETS OF ALTERNATIVES

To address climate change, each construction alternative includes steps to build ecological resiliency. A level of resiliency will be accomplished by recommending the use of grass species that are more drought and flood tolerant during revegetation. Resilience is also achieved by reducing the impacts of flood causing storms to the downstream community.

FINANCING

Financing is only discussed for the Preferred Alternative (Recommended Alternative) and is included in that section of the plan. The section also discusses the rationale for selection.

ALTERNATIVES ELIMINATED FROM DETAILED STUDY

Two alternatives that were eliminated from detailed study included decommissioning and non-structural. Both are required to be considered as alternatives based on PL-566 law and NRCS policy. They were eliminated from detailed consideration because these alternatives either did not meet the proposed purpose or need for federal action, they were exorbitantly expensive, or they were logistically impractical to implement.

Decommissioning describes an alternative which requires removing the flood detention capacity of the dam by cutting a notch in the existing embankment, re-connecting and restoring the stream channels upstream and downstream of the dam in a non-erosive manner, and providing downstream flood protection up to the 100-year recurrence event.

The non-structural alternative involves upgrading the dam to meet significant or low hazard dam criteria; relocating or floodproofing all structures within the dam breach inundation areas, modification or relocation of roadways and stream crossings within the breach inundation areas, and the procurement of deed restrictions on property between 100-year and breach elevations to prevent future development within the breach zone.

The tributaries on which Garrett and Varcoe Dams are located come together downstream of both dams to form a common floodplain. The same occurs for Martin and Finkleday Dams. Because of the common floodplain below the dams, the number of affected properties for one dam could be the same for another dam.

NOTE: The effect of a dam failure was measured as the net impact between a hydrologic (PMP) storm event with no breach compared to a hydrologic (PMP) storm event with a breach. Under the former scenario, many properties would be impacted by flooding. Thus, these properties were not accounted for under the PMP with a breach scenario. This is why in the following sections at times more properties are affected by decommissioning and non-structural alternatives than are affected by a dam failure (breach).

Garrett Dam

Decommission Dam

If Garrett Dam were removed, the 8 homes and 40 businesses downstream (total of 48 buildings) would no longer be at risk from flooding caused by a breach of the dam. However, this alternative must address the purpose and need to sustain continuity of flood prevention (flood damage reduction) in a safe manner while minimizing environmental, economic, and social impacts. With decommissioning of the dams, 11 homes and 24 businesses would be subjected to increases in flooding for storms up to and including the 100-year flood. The table below reflects a comparison of the flooding impacts for the decommissioning alternative versus any of the three structural alternatives (impacts are consistent for each structural alternative) for the 100- and 50-year storm events.

Flooding Impacts* at Buildings - Garrett Dam

Type of Building	# of Bldgs	100-year	# of Bldgs	50-year
	Decommissioning Alternative			
Residential Houses	11	0.0 – 2.9	9	0.0 - 2.2
Commercial Buildings	24	0.1 – 3.1	9	0.2 - 2.5
	Structural Alternative (Alt. 1, 2, or 3)			
Residential Houses	9	0.0 – 2.1	6	0.0 - 1.7
Commercial Buildings	9	0.1 – 2.4	7	0.1 - 1.8

* Depths above first floor elevation (feet). Depths of 0.0 feet indicate the presence of basements, which would flood at depths below first floor elevation.

In addition, 14 roadways and 12 stream crossings would need to be upgraded without the dam in place. Additionally, utilities would need to be protected.

Downstream flooding conditions would be similar to those that existed prior to construction of the dams. A cost of $29 - $31 million was estimated that would include the relocation of the

affected properties (11 residences and 24 businesses). Due to the potential cost of relocating so many buildings, the cost of floodproofing the affected buildings was also estimated. This, too, proved very expensive - estimated conservatively at $16 - $18 million. Along with addressing the flooding of the buildings, this alternative would also require modifying 14 roadways and 12 stream crossings so that additional flooding would not impact vehicles as they traveled along these roads. At a minimum the partial removal of the dam's embankment would be required to eliminate the structure's ability to store water. NOTE: Cost also includes estimate to decommission the dam but not to upgrade stream crossings/roadways. Due to the exorbitant costs of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Non-Structural – Relocate or Floodproof Structures

For Garrett Dam there are 48 buildings to relocate or floodproof downstream of the dam in the breach area. Conservatively, the estimated cost of relocation was estimated at over $38 million dollars, and the estimated cost to floodproof was $14 - $16 million. Floodproofing was less expensive compared to the decommissioning alternative although more total buildings are affected (48 vs. 45). The reason is for both alternatives most of the affected buildings are in a strip mall. It was assumed the best way to floodproof these buildings would be to construct some sort of levee or dike to protect multiple buildings. For both alternatives this cost is similar. However, there are more residences requiring protection under the decommissioning alternative as compared to the non-structural alternative, thus boosting the overall cost higher. For the non-structural alternative, the dam remains in place, as opposed to the decommissioning alternative, which involves partially removing the dam, thus boosting costs even higher. NOTE: Cost estimate does not include procurement of deed restrictions between the 100-year and breach elevations in order to assure future development in that area does not occur. Nor does it include modification/elevation of 23 roadways/stream crossings that would be impacted by a breach, endangering motorists. Because of exorbitant costs of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Varcoe Dam

Decommission Dam

If Varcoe Dam were removed, the 3 homes and 3 businesses downstream (total of 6 buildings) would no longer be at risk from flooding caused by a breach of the dam. With decommissioning of the dam, 11 homes and 24 businesses would be subjected to increases in flooding for storms up to and including the 100-year flood. The table below reflects a comparison of the flooding impacts for the decommissioning alternative versus any of the three structural alternatives (impacts are consistent for each structural alternative) for the 100- and 50-year storm events.

Flooding Impacts* at Buildings - Varcoe Dam

Type of Building	# of Bldgs	100-year	# of Bldgs	50-year
	Decommissioning Alternative			
Residential Houses	11	0.0 – 2.9	9	0.0 - 2.2

Type of Building	# of Bldgs	100-year	# of Bldgs	50-year
Commercial Buildings	24	0.1 – 3.1	9	0.2 - 2.5
	Structural Alternative (Alt. 1, 2, or 3)			
Residential Houses	9	0.0 – 2.1	6	0.0 - 1.7
Commercial Buildings	9	0.1 – 2.4	7	0.1 - 1.8

* Depths above first floor elevation (feet). Depths of 0.0 feet indicate the presence of basements, which would flood at depths below first floor elevation.

In addition, 14 roadways and 12 stream crossings would need to be upgraded without the dam in place. Additionally, utilities would need to be protected.

Downstream flooding conditions would be similar to those that existed prior to construction of the dams. A cost of $29 - $31 million was estimated that would include the relocation of the affected properties (11 residences and 24 businesses). Due to the potential cost of relocating so many buildings, the cost of floodproofing the affected buildings was also estimated. This, too, proved very expensive - estimated conservatively at $16 - $18 million. Along with addressing the flooding of the buildings, this alternative would also require modifying 14 roadways and 12 stream crossings so that additional flooding would not impact vehicles as they traveled along these roads. At a minimum the partial removal of the dam's embankment would be required to eliminate the structure's ability to store water. NOTE: Cost also includes estimate to decommission the dam but not to upgrade stream crossings/roadways. Due to the exorbitant costs of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Non-Structural – Relocate or Floodproof Structures

For Varcoe Dam there are 6 buildings to relocate or floodproof downstream of the dam in the breach area. Conservatively, the estimated cost of relocation was estimated at $10 million dollars, and the estimated cost to floodproof is $5 million. NOTE: Cost estimate does not include procurement of deed restrictions between the 100-year and breach elevations in order to assure future development in that area does not occur. Nor does it include modification/elevation of 9 roadways/stream crossings that would be impacted by a breach, endangering motorists. Because of exorbitant costs of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Martin Dam

Decommission Dam

If Martin Dam were removed, the 5 homes, 11 businesses, and 2 public buildings downstream (total of 18 buildings) would no longer be at risk from flooding caused by a breach of the dam. With this alternative 13 homes, 14 businesses, and 1 public building would be subjected to increases in flooding for storms up to and including the 100-year flood. The table below reflects a comparison of the flooding impacts for the decommissioning alternative versus any of the three

structural alternatives (impacts are consistent for each structural alternative) for the 100- and 50-year storm events.

Flooding Impacts* at Buildings - Martin Dam

Type of Building	# of Bldgs	100-year	# of Bldgs	50-year
	Decommissioning Alternative			
Residential Houses	13	0.0 – 3.3	11	0.0 - 2.4
Commercial Buildings	14	0.1 – 2.7	13	0.2 - 2.4
Public Buildings	1	0.0 – 1.2	1	0.0 – 0.8
	Structural Alternative (Alt. 1, 2, or 3)			
Residential Houses	11	0.0 – 2.9	8	0.0 - 2.1
Commercial Buildings	14	0.1 – 2.5	11	0.1 - 2.2
Public Buildings	1	0.0 – 0.8	1	0.0 – 0.5

* Depths above first floor elevation (feet). Depths of 0.0 feet indicate the presence of basements, which would flood at depths below first floor elevation.

In addition, 14 roadways and 6 stream crossings would need to be upgraded without the dam in place. Additionally, utilities would need to be protected.

Downstream flooding conditions would be similar to those that existed prior to construction of the dams. A cost of $18 - $20 million was estimated that would include the relocation of the affected properties (13 residences, 14 businesses, and 1 public building). Due to the potential cost of relocating so many buildings, the cost of floodproofing the affected buildings was also estimated. This, too, proved very expensive - estimated conservatively at $15 - $17 million. Along with addressing the flooding of the buildings, this alternative would also require modifying 14 roadways and 6 stream crossings so that flooding would not impact vehicles as they traveled along these roads. At a minimum the partial removal of the dam's embankment would be required to eliminate the structure's ability to store water. NOTE: Cost also includes estimate to decommission the dam but not to upgrade stream crossings/roadways. Due to the exorbitant cost of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Non-Structural – Relocate or Floodproof Structures

For Martin Dam there are 18 buildings to relocate or floodproof downstream of the dam in the breach area. Conservatively, the estimated cost of relocation was estimated at $8 - $9 million dollars, and the estimated cost to floodproof was $7 - $8 million. NOTE: Cost estimate does not include procurement of deed restrictions between the 100-year and breach elevations in order to assure future development in that area does not occur. Nor does it include modification/elevation of 21 roadways/stream crossings that would be impacted by a breach, endangering motorists.

Because of exorbitant costs of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Finkleday Dam

Decommission Dam

If Finkleday Dam were removed, the 4 homes and 8 businesses downstream (total of 12 buildings) would no longer be at risk from flooding caused by a breach of the dam. With this alternative 13 homes, 14 businesses, and 1 public building would be subjected to increases in flooding for storms up to and including the 100-year flood. The table below reflects a comparison of the flooding impacts for the decommissioning alternative versus any of the three structural alternatives (impacts are consistent for each structural alternative) for the 100- and 50-year storm events.

Flooding Impacts* at Buildings - Finkleday Dam

Type of Building	# of Bldgs	100-year	# of Bldgs	50-year
	Decommissioning Alternative			
Residential Houses	13	0.0 – 3.3	11	0.0 - 2.4
Commercial Buildings	14	0.1 – 2.7	13	0.2 - 2.4
Public Buildings	1	0.0 – 1.2	1	0.0 – 0.8
	Structural Alternative (Alt. 1, 2, or 3)			
Residential Houses	11	0.0 – 2.9	8	0.0 - 2.1
Commercial Buildings	14	0.1 – 2.5	11	0.1 - 2.2
Public Buildings	1	0.0 – 0.8	1	0.0 – 0.5

* Depths above first floor elevation (feet). Depths of 0.0 feet indicate the presence of basements, which would flood at depths below first floor elevation.

In addition, 14 roadways and 6 stream crossings would need to be upgraded without the dam in place. Additionally, utilities would need to be protected. Downstream flooding conditions would be similar to those that existed prior to construction of the dams. A cost of $18 - $20 million was estimated that would include the relocation of the affected properties (13 residences, 14 businesses, and 1 public building). Due to the potential cost of relocating so many buildings, the cost of floodproofing the affected buildings was also estimated. This, too, proved very expensive - estimated conservatively at $15 - $17 million. Along with addressing the flooding of the buildings, this alternative would also require modifying 14 roadways and 6 stream crossings so that flooding would not impact vehicles as they traveled along these roads. At a minimum the partial removal of the dam's embankment would be required to eliminate the structure's ability to store water. NOTE: Cost also includes estimate to decommission the dam but not to upgrade stream crossings/roadways. Due to the exorbitant cost of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

Non-Structural – Relocate or Floodproof Structures

For Finkleday Dam there are 12 buildings to relocate or floodproof downstream of the dam in the breach area. Conservatively, the estimated cost of relocation was estimated at $7 - $8 million dollars, and the estimated cost to floodproof was $5 - $7 million. NOTE: Cost estimate does not include procurement of deed restrictions between the 100-year and breach elevations in order to assure future development in that area does not occur. Nor does it include modification/elevation of 13 roadways/stream crossings that would be impacted by a breach, endangering motorists. Because of exorbitant costs of relocating or floodproofing structures, this alternative was not studied in detail and was eliminated from further study.

ALTERNATIVES STUDIED IN DETAIL

The alternatives presented in the following sections will not change the hazard class of the structure with the exception of the FWOFI which removes the dam therefore no hazard class. It will remain High Hazard Potential based on the potential loss of life and property damage if the dam were to breach. All of the alternatives presented with the exception of the FWOFI will meet NRCS and state current safety and performance standards if implemented (the FWOFI may not meet NRCS standards). The proposed alternatives are designed in accordance with NRCS standards to pass the PMF without overtopping the dams. The same criteria also minimize the potential for failure due to the remaining modes of failure. Risk of property damage and loss of life increases for storms of a greater magnitude than the NRCS design criteria. The frequency and intensity of storm events as they relate to climate change are unknown. However, east of the Mississippi River two impacts of climate change are expected when compared to conditions of the 20th century:

- More intense, longer duration precipitation events
- Increased frequency of flood events

Mitigation (This text applies to all dams)

Mitigation of unavoidable wetland impacts would include the creation of an equivalent acreage of new wetlands within the general vicinity of the project site. On-site wetland replacement is the preferred mitigation method of PADEP; however, PADEP has established the Pennsylvania Wetlands Replacement Project to provide monetary funds in lieu of creating wetlands. Since on-site wetland creation is preferred, only the costing for wetlands creation was included. It is also anticipated that USACE may have additional mitigation requirements if wetland impacts exceed the 0.5-acre threshold.

All disturbed areas post construction will be regraded, stabilized, and seeded to restore the area to a natural state. During construction sequencing, sediment and erosion controls, such as turbidity curtains, silt fences, and/or straw bales, or similar will be employed to avoid impacts to water quality.

The construction contractor will be responsible for the implementation of all constructed mitigation.

Future Without Federal Investment Alternative (This text applies to all dams)
In a letter dated December 8, 2020, to Denise Coleman, State Conservationist, USDA-NRCS, Pennsylvania, the Sponsors indicated that without federal assistance, they would breach the dams to remove the flooding hazard associated with a catastrophic failure of the structures. This is referred to as the Future Without Federal Investment (FWOFI) alternative as the sponsors are responsible for all costs related to this alternative.

The FWOFI alternative, also known as the No Action alternative, would involve a constructed breach of the dam and re-establish a stable stream channel through the former reservoir. A channel with riprap slope protection would be constructed through the dam by partially excavating the embankment and removing the principal spillway riser and concrete conduit. Excavated materials would be placed in the existing auxiliary spillway and, along with the remaining embankment, stabilized with vegetation. The current levels of downstream flood protection would be lost, and there would be an increase in flood frequency for downstream properties and infrastructure. In the absence of federal funding for the project, the "FWOFI Alternative" would be implemented and funded by Wayne County.

Mitigation
Additional mitigation efforts for this alternative include placing excavated soil material from the dam embankment in the upper areas of the auxiliary spillway. In addition, riprap protection along the stream channel will be installed to minimize potential erosion.

Garrett Dam
Future Without Federal Investment Alternative
Mitigation
There are anticipated to be approximately 1.88 acres of permanent wetlands impacts from the No Action Alternative. These impacts are unavoidable due to the nature of the work of breaching the dam.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$1,164,500	$34,500	$1,000

[1/] - Amortized at 2.25% over 64 years.

Alternatives with Federal Assistance
Mitigation (This text applies to Garrett Dam Alternative Nos. 1, 2, and 3)
There are anticipated to be approximately 0.17 acres of permanent wetlands impacts from these alternatives. These impacts are unavoidable due to the nature of the work within the ASW. To minimize impacts to wetlands abutting the impoundment and WOTUS, during construction, a cofferdam or similar structure will be installed to avoid the need to drain the entire impoundment to facilitate work on the dam and appurtenances.

Alternative No. 1 (NEE)

This alternative involves armoring the 100-foot-wide auxiliary spillway with RCC covered with topsoil and constructing a RCC cutoff wall at the downstream end of the RCC spillway. The cutoff wall will prevent high flows from undermining the RCC and breaching the spillway crest. The RCC armored spillway will be covered with sacrificial topsoil. The dam crest will be raised up to 2.5 feet to EL 1207.9 and the downstream slope will be flattened to 3H:1V. The non-standard principal spillway riser replaced. The leaking pipe joint in the existing 30-inch diameter reinforced concrete principal spillway conduit will be repaired. The principal spillway conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic toe drainpipes will be installed with a multi-stage filter meeting NRCS criteria and with an improved alignment to facilitate future inspection. There will be no change in the current levels of flood protection downstream as a result of project activity.

However, it should be noted that the dam does not provide a full attenuation of the 100-year recurrence flood event. Nine houses and nine businesses would still have a risk of loss of life from the 100-year storm event. Flooding in homes would range from 0.0 – 2.1 feet and 0.1 – 2.4 feet in the businesses. NOTE: the 0.0 depth represents the presence of basements in the homes, which would flood at depths below first floor elevations. See Appendix C for locations of buildings, velocities of floodwaters, etc.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$6,252,100	$193,000	$6,000

[1/] - Amortized at 2.25% over 64 years.
Total cost includes wetland mitigation cost.

Alternative No. 2

This alternative involves constructing a 5-cycle, 85-ft wide labyrinth weir within the existing auxiliary spillway channel. An approach channel will be excavated to EL 1195.2 upstream of the labyrinth weir. A cast-in place concrete drop structure/energy dissipator will be constructed downstream of the labyrinth weir with a cast-in place concrete cutoff at the terminus to prevent high flows from undermining the spillway. A vegetated outlet channel will be excavated downstream of the energy dissipator to approximately EL 1190. The dam crest will be leveled to approximately EL 1205.4 and the downstream slope will be flattened to 3H:1V. The non-standard principal spillway riser will be replaced. The pipe joints in the existing 30-inch diameter reinforced concrete principal spillway conduit will be repaired. The principal spillway conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic toe drainpipes will be installed with a multi-stage filter meeting NRCS criteria and with an improved alignment to facilitate future inspection. There

will be no change in the current levels of flood protection downstream as a result of project activity.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$7,096,300	$218,900	$6,000

[1/] - Amortized at 2.25% over 64 years.
Total cost includes wetland mitigation cost.

Alternative No. 3

This alternative involves constructing an 8-cycle, 160-ft wide labyrinth weir within the existing auxiliary spillway channel and extending into the dam footprint. The auxiliary spillway crest will be raised to EL 1203.7, the computed peak stage for the 24-hr/100-yr event. An approach channel will be excavated to EL 1195.7 upstream of the labyrinth weir. A cast-in place concrete drop structure/energy dissipator will be constructed downstream of the labyrinth weir with a cast-in place concrete cutoff at the terminus to prevent high flows from undermining the spillway. A vegetated outlet channel will be excavated downstream of the energy dissipator to approximately EL 1190. The dam crest will be leveled to approximately EL 1205.4 and the downstream slope will be flattened to 3H:1V. The non-standard principal spillway riser will be replaced. The pipe joints in the existing 30-inch diameter reinforced concrete principal spillway conduit will be repaired. The principal spillway conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic toe drainpipes will be installed with a multi-stage filter meeting NRCS criteria and with an improved alignment to facilitate future inspection.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$8,724,300	$268,800	$6,000

[1/] - Amortized at 2.25% over 64 years.
Total cost includes wetland mitigation cost.

Varcoe Dam

Future Without Federal Investment Alternative

Mitigation

There are anticipated to be approximately 0.44 acres of permanent wetlands impacts from the No Action Alternative. These impacts are unavoidable due to the nature of the work of breaching the dam.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$777,300	$25,000	$1,000

[1/] - Amortized at 2.25% over 54 years.

Alternatives With Federal Assistance

Mitigation (This text applies to Varcoe Dam Alternative Nos. 1, 2, and 3)

No permanent wetlands impacts are anticipated from these alternatives. To minimize temporary impacts to wetlands and WOTUS, during construction, a cofferdam or similar structure will be installed to avoid the need to drain the entire impoundment to facilitate work on the dam and appurtenances.

Alternative No. 1 (NEE)

This alternative involves armoring the 50-foot-wide auxiliary spillway with articulated concrete blocks. A reinforced concrete starter wall will be constructed at the upstream end of the ACB spillway along with a reinforced concrete cantilever cutoff wall at the downstream end of the ACB spillway. The cutoff wall will prevent high flows from undermining the ACBs and breaching the spillway crest. The dam crest will be graded and raised where needed to EL 1277.6 ft and the downstream slope will be flattened to 3H:1V slope. The principal spillway low stage orifice will be modified to increase the normal pool by 0.14 ft to accommodate the required sediment storage and a footbridge will be installed for access to the riser. The principal spillway riser trash rack and existing gate will be repaired or replaced. A concrete sealant will be applied to the worn concrete surfaces in the riser and conduit. The principal spillway conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. New plastic pipe toe drains will be near the toe of the dam slope and the existing bituminous coated corrugated metal pipe auxiliary spillway drains will be removed and replaced with plastic pipe. There will be no change in the current levels of flood protection downstream as a result of project activity. However, nine houses and nine businesses would still have a risk of loss of life from the 100-year storm event. Flooding in the homes would range from 0.0 – 2.1 feet and 0.1 – 2.4 feet in the businesses. NOTE: the 0.0 depth represents the presence of basements in the homes, which would flood at depths below first floor elevations. See Appendix C for locations of buildings, velocities of floodwaters, etc.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$4,278,500	$143,800	$6,000

[1/] - Amortized at 2.25% over 54 years.

Alternative No. 2

This alternative involves armoring the 50-foot-wide auxiliary spillway with RCC which will be covered with 6-inches of topsoil. A reinforced concrete weir wall will be constructed at the upstream end of the RCC spillway along with a RCC cutoff wall at the downstream end of the RCC spillway. The cutoff wall will prevent high flows from undermining the RCC and breaching the spillway crest. The dam crest will be graded and raised where needed to EL 1277.6 ft and the downstream slope will be flattened to 3H:1V slope. The principal spillway low stage orifice will be modified to increase the normal pool by 0.14 ft to accommodate the required sediment storage and a footbridge will be installed for access to the riser. The principal spillway riser trash rack and existing gate will be repaired or replaced. A concrete sealant will be applied to the worn concrete surfaces in the riser and conduit. The principal spillway conduit will be extended, and

a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. New plastic pipe toe drains will be near the toe of the dam slope and the existing bituminous coated corrugated metal pipe auxiliary spillway drains will be removed and replaced with plastic pipe. There will be no change in the current levels of flood protection downstream due to project activity.

Alternative Cost

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$4,927,500	$165,400	$6,000

[1/] - Amortized at 2.25% over 54 years.

Alternative No. 3

This alternative involves widening the existing auxiliary spillway to 65 feet and armoring it with articulated concrete blocks. A reinforced concrete starter wall will be constructed at the upstream end of the ACB spillway along with a reinforced concrete cutoff wall at the downstream end of the ACB spillway. The cutoff wall will prevent high flows from undermining the ACBs and breaching the spillway crest. The dam crest will be graded to EL 1277.1 ft and the downstream slope will be flattened to 3H:1V slope. The principal spillway low stage orifice will be modified to increase the normal pool by 0.14 ft to accommodate the required sediment storage. The principal spillway riser trash rack and existing gate will be repaired or replaced. A concrete sealant will be applied to the worn concrete surfaces in the riser and conduit. The principal spillway conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. New plastic pipe toe drains will be near the toe of the dam slope and the existing bituminous coated corrugated metal pipe auxiliary spillway drains will be removed and replaced with plastic pipe. There will be no change in the current levels of flood protection downstream as a result of project activity.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$4,558,700	$153,100	$6,000

[1/] - Amortized at 2.25% over 54 years.

Martin Dam

Future Without Federal Investment Alternative

Mitigation

There are anticipated to be approximately 1.61 acres of permanent wetlands impacts from the No Action Alternative. These impacts are unavoidable due to the nature of the work.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$1,204,400	$30,100	$1,000

[1/] - Amortized at 2.25% over 104 years.

Alternatives with Federal Assistance

Mitigation (This text applies to Martin Dam Alternative Nos. 1, 2, and 3)

There are anticipated to be approximately 0.22 acres of permanent wetlands impacts from these alternatives. These impacts are unavoidable due to the nature of the construction work required to rehabilitate the dam. To minimize impacts to wetlands abutting the impoundment and WOTUS, during construction, a cofferdam or similar structure will be installed to avoid the need to drain the entire impoundment to facilitate work on the dam and appurtenances.

Alternative No. 1 (NEE)

This alternative involves armoring the 40-foot-wide auxiliary spillway with RCC and constructing a reinforced concrete end sill and cutoff wall at the downstream end of the RCC spillway. The cutoff wall will prevent high flows from undermining the RCC spillway and breaching the spillway crest. The dam crest will be raised to EL 1281.4 ft and downstream slopes will be flattened to 3H:1V. A stability berm will be constructed on the upstream slope with a 3H:1V slope. The existing principal spillway riser will be replaced and moved upstream by extending the conduit due to construction of stability berm and flattening of the slope. A footbridge will be installed for access to the riser. At the downstream end, the principal spillway conduit will also be extended and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic pipe toe drains will be installed near the toe of the dam slope. There will be no change in the current levels of flood protection downstream as a result of project activity. However, eleven houses, fourteen businesses, and one public building would still have a risk of loss of life from the 100-year storm event. Flooding in the homes would range from 0.0 – 2.9 feet, 0.1 – 2.5 feet in the businesses, and 0.0 – 0.8 feet in the public building. NOTE: the 0.0 depth represents the presence of basements in the homes and the public building, which would flood at depths below first floor elevations. See Appendix C for locations of buildings, velocities of floodwaters, etc.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$5,813,600	$151,200	$6,300

[1/] - Amortized at 2.25% over 104 years.

Total cost includes wetland mitigation cost.

Alternative No. 2

This alternative involves constructing a 42-ft wide 3-cycle reinforced concrete labyrinth weir with a RCC outlet chute with a reinforced concrete end sill and cutoff wall at the downstream end of the RCC spillway. The cutoff wall will prevent high flows from undermining the RCC spillway and breaching the spillway crest. The existing dam crest will be graded at EL 1278.5 ft and downstream slopes will be flatten to 3H:1V. A stability berm will be constructed on the upstream slope with a 3H:1V slope. The existing principal spillway riser will be replaced and moved upstream by extending the conduit due to construction of stability berm and flattening of the slope. A footbridge will be installed for access to the riser. At the downstream end, the principal spillway conduit will also be extended, and a new impact basin will be constructed to

stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic pipe toe drains will be installed near the toe of the dam slope. There will be no change in the current levels of flood protection downstream as a result of project activity.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$6,195,200	$158,900	$6,300

[1/] - Amortized at 2.25% over 104 years.
Total cost includes wetland mitigation cost.

Alternative No. 3

This alternative involves widening the auxiliary spillway to 75 ft and constructing a reinforced concrete ogee weir at the control section with a converging RCC outlet chute. A reinforced concrete end sill and cutoff wall will be constructed at the downstream end of the RCC spillway. The cutoff wall will prevent high flows from undermining the RCC spillway and breaching the spillway crest. The existing dam crest will be graded at EL 1278.5 ft and downstream slopes will be flatten to 3H:1V. A stability berm will be constructed on the upstream slope with a 3H:1V slope. The existing principal spillway riser will be replaced and moved upstream by extending the conduit due to construction of stability berm and flattening of the slope. A footbridge will be installed for access to the riser. At the downstream end, the principal spillway conduit will also be extended and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic pipe toe drains will be installed near the toe of the dam slope. There will be no change in the current levels of flood protection downstream as a result of project activity.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$6,568,200	$168,400	$6,300

[1/] - Amortized at 2.25% over 104 years.
Total cost includes wetland mitigation cost.

Finkleday Dam

Future Without Federal Investment Alternative

Mitigation

There are anticipated to be approximately 4.17 acres of permanent wetlands impacts from the No Action Alternative. These impacts are unavoidable due to the nature of the work of breaching the dam. Mitigation actions would include the creation of an equivalent acreage of new wetlands within the general vicinity of the project site. Additional mitigation efforts for this alternative include placing excavated soil material from the dam embankment in the upper areas of the ASW. In addition, installing riprap protection along the stream channel to minimize potential erosion.

During construction sequencing, sediment and erosion controls, such as turbidity curtains, silt fences, and/or straw bales, or similar will be employed to avoid impacts to water quality.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$869,300	$21,700	$1,000

[1/] - Amortized at 2.25% over 104 years.

Alternatives with Federal Assistance

Mitigation (This text applies to Finkleday Dam Alternative Nos. 1, 2, and 3)

No permanent wetlands impacts are anticipated from these alternatives. To minimize temporary impacts to wetlands and Waters of the US, during construction, a cofferdam or similar structure will be installed to avoid the need to drain the entire impoundment to facilitate work dam and appurtenances.

Alternative No. 1

This alternative involves armoring the 60-foot-wide auxiliary spillway with articulated concrete blocks and constructing a RCC cutoff wall at the downstream end of the ACB spillway. The RCC wall will prevent high flows from undermining the ACBs and breaching the spillway crest. The dam crest will be leveled at existing EL 1281.0 ft and the downstream slope will be flattened to 3H:1V slope. The principal spillway riser trash rack and existing gate will be repaired or replaced. A footbridge will be installed for access to the riser. A concrete sealant will be applied to the worn concrete surfaces in the riser and conduit. The principal spillway conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic pipe toe drains will be installed near the toe of the dam slope. The existing springhouse will be removed, and the existing drainage will be improved to stabilize the area. There will be no change in the current levels of flood protection downstream as a result of project activity.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$4,960,100	$129,100	$6,500

[1/] - Amortized at 2.25% over 104 years.

Alternative No. 2 (NEE)

This alternative involves armoring the 60-foot-wide auxiliary spillway with articulated concrete blocks and constructing a secant pile cutoff wall at the downstream end of the ACB spillway. The secant wall will prevent high flows from undermining the ACBs and breaching the spillway crest. The dam crest will be leveled at existing EL 1281.0 ft and the downstream slope will be flattened to 3H:1V slope. The principal spillway riser trash rack and existing gate will be repaired or replaced. A footbridge will be installed for access to the riser. A concrete sealant will be applied to the worn concrete surfaces in the riser and conduit. The principal spillway

conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic pipe toe drains will be installed near the toe of the dam slope. The existing springhouse will be removed, and the existing drainage will be improved to stabilize the area. There will be no change in the current levels of flood protection downstream as a result of project activity. However, eleven houses, fourteen businesses, and one public building would still have a risk of loss of life from the 100-year storm event. Flooding in the homes would range from 0.0 – 2.9 feet, 0.1 – 2.5 feet in the businesses, and 0.0 – 0.8 feet in the public building. NOTE: the 0.0 depth represents the presence of basements in the homes and the public building, which would flood at depths below first floor elevations. See Appendix C for locations of buildings, velocities of floodwaters, etc.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$4,765,100	$124,100	$6,500

[1/] - Amortized at 2.25% over 104 years.

Alternative No. 3

This alternative involves armoring the 60-foot-wide auxiliary spillway with RCC and constructing a RCC cutoff wall at the downstream end of the RCC spillway. The RCC wall will prevent high flows from undermining the RCC spillway and breaching the spillway crest. The dam crest will be leveled at existing EL 1281 ft and the downstream slope will be flattened to 3H:1V slope. The principal spillway riser trash rack and existing gate will be repaired or replaced. A footbridge will be installed for access to the riser. A concrete sealant will be applied to the worn concrete surfaces in the riser and conduit. The principal spillway conduit will be extended, and a new impact basin will be constructed to stabilize the outlet. In addition, a filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit. The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout. New plastic pipe toe drains will be installed near the toe of the dam slope. The existing springhouse will be removed, and the existing drainage will be improved to stabilize the area. There will be no change in the current levels of flood protection downstream as a result of project activity.

Alternative Costs

TOTAL COST	AVERAGE ANNUAL COST [1/]	O & M COST
$5,250,100	$136,600	$6,500

[1/] - Amortized at 2.25% over 104 years.

SUMMARY AND COMPARISON OF ALTERNATIVE PLANS

Garrett Dam

The following table summarizes the effects of each alternative considered. Refer to the Environmental Consequences section for additional information.

Summary and Comparison of Alternative Plans

Item or Concern	FWOFI No Federal Action – (Dam Removal) [1/]	Alternative 1 (NEE) – 100-foot RCC armored ASW with RCC cutoff wall and raised dam crest	Alternative 2 – Labyrinth Weir (five cycle) drop structure	Alternative 3 – Labyrinth Weir (eight cycle), raise ASW crest
Structural	Breach the dam	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.
Total Project Investment	$1,164,500	$6,252,100	$7,096,300	$8,724,300
Total Beneficial Annualized	$0	$218,900	$218,900	$218,900
Total Adverse Annualized	$34,500	$199,000	$224,900	$274,800
Net Beneficial	(-$34,500)	$19,900	(-$6,000)	(-$55,900)
Annual Remaining Flood Damages	$842,700	$623,800	$623,800	$623,800
Estimated OM&R[2/]	$1,000	$6,000	$6,000	$6,000
Soils	***Prime, Unique & Statewide Importance:*** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, moderate, adverse ***Sedimentation:*** Long-term, direct, minor, beneficial	***Prime, Unique & Statewide Importance:*** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique & Statewide Importance:*** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique & Statewide Importance:*** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect

Item or Concern	FWOFI No Federal Action – (Dam Removal) [1/]	Alternative 1 (NEE) – 100-foot RCC armored ASW with RCC cutoff wall and raised dam crest	Alternative 2 – Labyrinth Weir (five cycle) drop structure	Alternative 3 – Labyrinth Weir (eight cycle), raise ASW crest
Water Resources	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, moderate, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, moderate, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Water Quantity:*** Short- and long-term, direct, moderate, adverse ***Floodplains:*** Short-term, negligible, adverse, direct; Long-term, direct, adverse, moderate	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts	***WOTUS:*** Short-term, direct, negligible, adverse; no long-term impacts ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts	***WOTUS:*** Short-term, direct, negligible, adverse; no long-term impacts ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; Long-term, direct, beneficial
Air Quality	Short-term, direct, negligible, adverse; no long-term effects	Short-term, direct, negligible, adverse; no long-term effects	Short-term, direct, negligible, adverse; no long-term effects	Short-term, direct, negligible, adverse; no long-term effects

Item or Concern	FWOFI No Federal Action – (Dam Removal) [1/]	Alternative 1 (NEE) – 100-foot RCC armored ASW with RCC cutoff wall and raised dam crest	Alternative 2 – Labyrinth Weir (five cycle) drop structure	Alternative 3 – Labyrinth Weir (eight cycle), raise ASW crest
Plants	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, beneficial ***Special Status (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Plant Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Plant Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Plant Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; no long-term impacts	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Plant Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; no long-term impacts

Item or Concern	FWOFI No Federal Action – (Dam Removal) [1/]	Alternative 1 (NEE) – 100-foot RCC armored ASW with RCC cutoff wall and raised dam crest	Alternative 2 – Labyrinth Weir (five cycle) drop structure	Alternative 3 – Labyrinth Weir (eight cycle), raise ASW crest
Animals	***Fish:*** Short-term, direct, minor, adverse; Warm-water species: long-term, direct, moderate, adverse; Cold-water species: long-term, direct, negligible, beneficial ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, moderate, beneficial ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, negligible, adverse; no long-term impacts ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, negligible, adverse; no long-term impacts ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, negligible, adverse; no long-term impacts ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts
Ecosystem Services	***Regulating:*** Short – and Long-term, direct, significant, adverse ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, moderate, adverse	***Regulating:*** **Short- and** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; no long-term impacts	***Regulating:*** Short- and Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse

Item or Concern	FWOFI No Federal Action – (Dam Removal) [1/]	Alternative 1 (NEE) – 100-foot RCC armored ASW with RCC cutoff wall and raised dam crest	Alternative 2 – Labyrinth Weir (five cycle) drop structure	Alternative 3 – Labyrinth Weir (eight cycle), raise ASW crest
Humans	***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, adverse; long-term, direct, major, adverse ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, moderate ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area. ***Local and Regional Economy:*** Short-term, direct, minor, adverse; long-term, direct, major, adverse	***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area. ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive	***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area. ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive	***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Cultural Resources/Historic Properties:*** No effect ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area. ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive

[1/] The FWOFI alternative represents the Sponsor's choice in the event federal assistance is not available. Costs will be 100% borne by the Sponsor.
[2/] "Estimated OM&R" stands for Operation, Maintenance and Replacement Costs.

Alternatives and Associated Ecosystem Services – PR&G

Alternatives				
	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Alternatives				
Locally Preferred		X		
National Economic Efficiency (NEE)		X		
Brief Description of Major Project Features	Constructed breach of the dam and re-establish a stable stream channel	100-foot RCC armored ASW with RCC cutoff wall and raised dam crest	Labyrinth Weir (five cycle) drop structure	Labyrinth Weir (eight cycle), raise ASW crest
Total Project Investment	$1,164,500	$6,252,100	$7,096,300	$8,724,300
Monetized Net Benefits	(-$34,500)	$19,900	(-$6,000)	(-$55,900)
Provisioning Services	NA	NA	NA	NA
Regulating Services				
Flood and Disease Control	Loss of flood protection to 35 structures in 100-year floodplain.	Retains full PMP, maintains current level of flood protection. 18 structures in 100-year floodplain.	Retains full PMP, maintains current level of flood protection. 18 structures in 100-year floodplain.	Retains full PMP, maintains current level of flood protection. 18 structures in 100-year floodplain.
Cultural Services				
Recreational Use	Surface Area of the Pond 0.0 Ac.	Surface Area of the Pond 3.3 Ac.	Surface Area of the Pond 3.3 Ac.	Surface Area of the Pond 3.3 Ac.
Aesthetic Viewsheds	Natural Green Landscape in Viewshed of the LOD 2.8 (acres), plus 0.5	Natural Green Landscape in Viewshed of the LOD 2.3 (acres)	Natural Green Landscape in Viewshed of the LOD 2.1 (acres)	Natural Green Landscape in Viewshed of the LOD 2.02 (acres)

Alternatives				
	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
	Impoundment in Viewshed (acres) 0.0	Impoundment in Viewshed (acres) 0.5	Impoundment in Viewshed (acres) 0.5	Impoundment in Viewshed (acres) 0.5
Supporting Services				
Nutrient Cycling	11.29 acres of vegetation	8.29 acres of vegetation	8.07 acres of vegetation	7.84 acres of vegetation
Soil Formation	0.0 Ac. Semi-impervious Surface Created	0.0 Ac. Semi-impervious Surface Created	0.22 Ac. Semi-impervious Surface Created	0.45 Ac. Semi-impervious Surface Created

Consideration of Guiding Principles – PR&G

PR&G Guiding Principles	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Healthy and Resilient Ecosystem	0*	+	+	+
Sustainable Economic Development	-	++	+	+
Floodplains	0	0	0	0
Public Safety	-	+	+	+
Environmental Justice	0	0	0	0
Watershed Approach	+	+	+	+

*This neutral determination is based on the conversion of one healthy established ecosystem type to another habitat ecosystem type, and each of these ecosystems have inherent benefits and negative impacts on the landscape. For more details, see the Environmental Consequences.

Consideration of Federal Objective - PR&G

Components	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Maximize Sustainable Economic Development	-	++	+	+
Avoid Unwise Use of Floodplains	0	0	0	0
Protect & Restore Functions of Natural Systems	0	+	+	+

Varcoe Dam

The following table summarizes the effects of each alternative considered. Refer to the Environmental Consequences section for additional information.

Summary and Comparison of Alternative Plans

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 (NEE) – 50-ft wide ASW armored with ACBs	Alternative 2 – 50-ft wide ASW armored with RCC	Alternative 3 – 65-ft wide ASW armored with ACBs
Structural	Breach the dam	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.
Total Project Investment	$777,300	$4,278,500	$4,927,500	$4,558,700
Total Beneficial Annualized	$0	$124,900	$124,900	$124,900
Total Adverse Annualized	$25,000	$149,800	$171,400	$159,100
Net Beneficial	(-$25,000)	(-$24,900)	(-$46,500)	(-$34,200)
Annual Remaining Flood Damage	$808,100	$683,200	$683,200	$683,200
Estimated OM&R[2/]	$1,000	$6,000	$6,000	$6,000
Soils	***Prime, Unique & Statewide Importance:*** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, moderate, adverse ***Sedimentation:*** Short- and Long-term, direct, minor, beneficial	***Prime, Unique & Statewide Importance:*** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique &*** **Statewide Importance:** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique &*** **Statewide Importance:** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 50-ft wide ASW armored with ACBs	Alternative 2 – 50-ft wide ASW armored with RCC	Alternative 3 – 65-ft wide ASW armored with ACBs
Water Resources	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, moderate, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, moderate, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Water Quantity:*** Short and long-term, direct, moderate, adverse ***Floodplains:*** Short-term, negligible, adverse, direct; Long-term, direct, adverse, moderate	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; no long-term effects ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term effects	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; no long-term effects ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term effects	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; no long-term effects ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term effects
Air Quality	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 50-ft wide ASW armored with ACBs	Alternative 2 – 50-ft wide ASW armored with RCC	Alternative 3 – 65-ft wide ASW armored with ACBs
Plants	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, beneficial ***Special Status & (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status & (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status & (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status & (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 50-ft wide ASW armored with ACBs	Alternative 2 – 50-ft wide ASW armored with RCC	Alternative 3 – 65-ft wide ASW armored with ACBs
Animals	***Fish:*** Short-term, direct, minor, adverse; Warm-water species: long-term, direct, moderate, adverse; Cold-water species: long-term, direct, negligible, beneficial ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, moderate, beneficial ***Special Status Animal Species:*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species:*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species:*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species:*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 50-ft wide ASW armored with ACBs	Alternative 2 – 50-ft wide ASW armored with RCC	Alternative 3 – 65-ft wide ASW armored with ACBs
Ecosystem Services	***Regulating:*** Short- and Long-term, direct, significant, adverse ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, moderate, adverse	***Regulating:*** Short and Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible	***Regulating:*** Short- and Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible	***Regulating:*** Short- and Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 (NEE) – 50-ft wide ASW armored with ACBs	Alternative 2 – 50-ft wide ASW armored with RCC	Alternative 3 – 65-ft wide ASW armored with ACBs
Humans	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, moderate ***Local and Regional Economy:*** Short-term, direct, minor, adverse; long-term, direct, major, adverse ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, adverse; long-term, direct, major, adverse ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area.

[1/] The FWOFI alternative represents the Sponsor's choice in the event federal assistance is not available. Costs will be 100% borne by the Sponsor.
[2/] "Estimated OM&R" stands for Operation, Maintenance and Replacement Costs.

Alternatives and Associated Ecosystem Services

Alternatives				
	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Alternatives				
Locally Preferred		X		
National Economic Efficiency (NEE)		X		
Brief Description of Major Project Features	Sponsors' Remove Dam [1/]	50-ft wide ASW armored with ACBs	50-ft wide ASW armored with RCC	65-ft wide ASW armored with ACBs
Total Project Investment	$777,300	$4,278,500	$4,927,500	$4,558,700
Monetized Net Benefits	(-$25,000)	(-$24,900)	(-$46,500)	(-$34,200)
Provisioning Services	NA	NA	NA	NA
Regulating Services				
Flood and Disease Control	Loss of flood protection to 35 structures in 100-year floodplain.	Retains full PMP, maintains current level of flood protection. 18 structures in 100-year floodplain.	Retains full PMP, maintains current level of flood protection. 18 structures in 100-year floodplain.	Retains full PMP, maintains current level of flood protection. 18 structures in 100-year floodplain.
Cultural Services				
Recreational Use	Surface Area of the Pond 0.0 Ac.	Surface Area of the Pond 2.53 Ac.	Surface Area of the Pond 2.53 Ac.	Surface Area of the Pond 2.53 Ac.
Aesthetic Viewsheds	Natural Green Landscape in Viewshed of the LOD 0.08 (acres)	Natural Green Landscape in Viewshed of the LOD 0.08 (acres)	Natural Green Landscape in Viewshed of the LOD 0.08 (acres)	Natural Green Landscape in Viewshed of the LOD 0.08 (acres)

Supporting Services	Percentage of Green Landscape in Project Area	Percentage of Green Landscape in Project Area	Percentage of Green Landscape in Project Area	Percentage of Green Landscape in Project Area
Nutrient Cycling	Established Vegetation 7.6 Ac.	Established Vegetation 5.38 Ac.	Established Vegetation 5.63 Ac.	Established Vegetation 5.34 Ac.
Soil Formation	Impervious Surface 0.0 (acres)	Impervious Surface 0.25 (acres)	Impervious Surface 0.0 (acres)	Impervious Surface 0.29 (acres)

Consideration of Guiding Principles – PR&G

PR&G Guiding Principles	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Healthy and Resilient Ecosystem	0*	+	+	+
Sustainable Economic Development	-	++	+	+
Floodplains	0	0	0	0
Public Safety	-	+	+	+
Environmental Justice	0	0	0	0
Watershed Approach	+	+	+	+

*This neutral determination is based on the conversion of one healthy established ecosystem type to another habitat ecosystem type, and each of these ecosystems have inherent benefits and negative impacts on the landscape. For more details, see the Environmental Consequences.

Consideration of Federal Objective - PR&G

Components	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Maximize Sustainable Economic Development	-	++	+	+
Avoid Unwise Use of Floodplains	0	0	0	0
Protect & Restore Functions of Natural Systems	0	+	+	+

Martin Dam

The following table summarizes the effects of each alternative considered. Refer to the Environmental Consequences section for additional information.

Summary and Comparison of Alternative Plans

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 (NEE) – 40-ft wide ASW armored with RCC and raised dam	Alternative 2 – 42-ft wide Labyrinth Weir	Alternative 3 – 75-ft wide ASW armored with RCC
Structural	Breach the dam	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.
Total Project Investment	$1,204,400	$5,813,600	$6,195,200	$6,568,200
Total Beneficial Annualized	$0	$87,400	$87,400	$87,400
Total Adverse Annualized	$30,100	$157,500	$165,200	$174,700
Net Beneficial	(-$30,100)	(-$70,100)	(-$77,800)	(-$87,300)
Annual Remaining Flood Damages	$507,200	$419,800	$419,800	$419,800
Estimated OM&R[2/]	$1,000	$6,300	$6,300	$6,300

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 40-ft wide ASW armored with RCC and raised dam	Alternative 2 – 42-ft wide Labyrinth Weir	Alternative 3 – 75-ft wide ASW armored with RCC
Soils	***Prime, Unique*** **&** **Statewide Importance:** Prime farmland soils and soils of statewide importance are anticipated to experience short-term, adverse, negligible impacts ***Sedimentation:*** Long-term, direct, minor, beneficial	***Prime, Unique*** **&** **Statewide Importance:** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique*** **&** **Statewide Importance:** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique*** **&** **Statewide Importance:** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 40-ft wide ASW armored with RCC and raised dam	Alternative 2 – 42-ft wide Labyrinth Weir	Alternative 3 – 75-ft wide ASW armored with RCC
Water Resources	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, moderate, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, moderate, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Water Quantity:*** Short- and long-term, direct, moderate, adverse ***Floodplains:*** Short-term, negligible, adverse, direct; Long-term, direct, adverse, moderate	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts
Air Quality	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 40-ft wide ASW armored with RCC and raised dam	Alternative 2 – 42-ft wide Labyrinth Weir	Alternative 3 – 75-ft wide ASW armored with RCC
Plants	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, beneficial ***Special Status& (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status & (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status & (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status & (T&E) Plant Species:*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, minor, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 40-ft wide ASW armored with RCC and raised dam	Alternative 2 – 42-ft wide Labyrinth Weir	Alternative 3 – 75-ft wide ASW armored with RCC
Animals	***Fish:*** Short-term, direct, minor, adverse; Warm-water species: long-term, direct, moderate, adverse; Cold-water species: long-term, direct, negligible, beneficial ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, moderate, beneficial ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term impacts
Ecosystem Services	***Regulating:*** Long-term, direct, significant, adverse ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, moderate, adverse	***Regulating:*** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam 1/	Alternative 1 (NEE) – 40-ft wide ASW armored with RCC and raised dam	Alternative 2 – 42-ft wide Labyrinth Weir	Alternative 3 – 75-ft wide ASW armored with RCC
Humans	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, moderate ***Local and Regional Economy*** Short-term, direct, minor, adverse; long-term, direct, major, adverse ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, adverse; long-term, direct, major, adverse ***Environmental Justice and Civil Rights***: short-term and long-term, no tribal communities or EJ groups present in project area	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety***: Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights***: short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety***: Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights***: short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety***: Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights***: short-term and long-term, no tribal communities or EJ groups present in project area.

[1/] The FWOFI alternative represents the Sponsor's choice in the event federal assistance is not available. Costs will be 100% borne by the Sponsor.
[2/] "Estimated OM&R" stands for Operation, Maintenance and Replacement Costs.

Alternatives and Associated Ecosystem Services

Alternatives				
	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Alternatives				
Locally Preferred		X		
National Economic Efficiency (NEE)		X		
Brief Description of Major Project Features	Sponsors' Remove Dam [1/]	40-ft wide ASW armored with RCC and raised dam	42-ft wide Labyrinth Weir	75-ft wide ASW armored with RCC
Total Project Investment	$1,204,400	$5,813,600	$6,195,200	$6,568,200
Monetized Net Benefits	(-$30,100)	(-$70,100)	(-$77,800)	(-$87,300)
Provisioning Services	NA	NA	NA	NA
Regulating Services				
Flood and Disease Control	Structures in 100-year floodplain - 28	Retains full PMF: maintains original level of flood protection. 27 structures in 100-year floodplain	Retains full PMF: maintains original level of flood protection. 27 structures in 100-year floodplain	Retains full PMF: maintains original level of flood protection. 27 structures in 100-year floodplain
Cultural Services				
Recreational Use	Surface Area of the Pond 0.0 Ac.	Surface Area of the Pond 2.21 Ac.	Surface Area of the Pond 2.21 Ac.	Surface Area of the Pond 2.21 Ac.
Aesthetic Viewsheds	Natural Green Landscape in Viewshed of the LOD 0.32 (acres)	Natural Green Landscape in Viewshed of the LOD 0.31 (acres)	Natural Green Landscape in Viewshed of the LOD 0.31 (acres)	Natural Green Landscape in Viewshed of the LOD 0.31 (acres)

Alternatives				
	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Supporting Services				
Nutrient Cycling	Established Vegetation 8.33 (acres)	Established Vegetation 6.1 (acres)	Established Vegetation 6.09 (acres)	Established Vegetation 6.02 (acres)
Soil Formation	Impervious Surface 0.0 (acres)	Impervious Surface 0.27 (acres)	Impervious Surface 0.28 (acres)	Impervious Surface 0.35 (acres)

Consideration of Guiding Principles – PR&G

PR&G Guiding Principles	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Healthy and Resilient Ecosystem	0*	+	+	+
Sustainable Economic Development	-	++	+	+
Floodplains	0	0	0	0
Public Safety	-	+	+	+
Environmental Justice	0	0	0	0
Watershed Approach	-	+	+	+

*This neutral determination is based on the conversion of one healthy established ecosystem type to another habitat ecosystem type, and each of these ecosystems have inherent benefits and negative impacts on the landscape. For more details, see the Environmental Consequences.

Consideration of Federal Objective - PR&G

Components	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Maximize Sustainable Economic Development	-	++	+	+
Avoid Unwise Use of Floodplains	0	0	0	0
Protect & Restore Functions of Natural Systems	0	+	+	+

Finkleday Dam

The following table summarizes the effects of each alternative considered. Refer to the Environmental Consequences section for additional information.

Summary and Comparison of Alternative Plans

Item or Concern	**FWOFI No Federal Action – Sponsors' Remove Dam** [1/]	**Alternative 1 – 60-ft wide ACB armored ASW with RCC cutoff wall**	**Alternative 2 (NEE) – 60-ft wide ACB armored ASW with secant pile cutoff wall**	**Alternative 3 – 60-ft wide RCC armored ASW with RCC cutoff wall**
Structural	Breach the dam	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.	Upgrade dam to meet dam safety criteria.
Total Project Investment	$869,300	$4,960,100	$4,765,100	$5,250,100
Total Beneficial Annualized	$0	$59,500	$59,500	$59,500
Total Adverse Annualized	$21,700	$135,600	$130,600	$143,100
Net Beneficial	(-$21,700)	(-$76,100)	(-$71,100)	(-$83,600)
Annual Remaining Flood Damages	$507,500	$448,000	$448,000	$448,000
Estimated OM&R[2/]	$1,000	$6,500	$6,500	$6,500

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 – 60-ft wide ACB armored ASW with RCC cutoff wall	Alternative 2 (NEE) – 60-ft wide ACB armored ASW with secant pile cutoff wall	Alternative 3 – 60-ft wide RCC armored ASW with RCC cutoff wall
Soils	***Prime, Unique*** **& Statewide Importance:** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, moderate, adverse ***Sedimentation:*** Short- and Long-term, direct, minor, beneficial	***Prime, Unique*** **& Statewide Importance:** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique*** **& Statewide Importance:** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect	***Prime, Unique*** **& Statewide Importance:** Prime & Unique: not applicable. Farmland soil of statewide importance: short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Sedimentation:*** No effect

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 – 60-ft wide ACB armored ASW with RCC cutoff wall	Alternative 2 (NEE) – 60-ft wide ACB armored ASW with secant pile cutoff wall	Alternative 3 – 60-ft wide RCC armored ASW with RCC cutoff wall
Water Resources	***WOTUS.:*** Short-term, direct, negligible, adverse; long-term, direct, moderate, adverse ***Wetlands:*** Short-term, direct, minor, adverse; long-term, direct, moderate, adverse ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Water Quantity:*** Short- and Long-term, direct, moderate, adverse ***Floodplains:*** Short-term, negligible, adverse, direct; Long-term, direct, adverse, moderate	***WOTUS.:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; no long-term impacts ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; no long-term impacts ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts	***WOTUS:*** Short-term, direct, negligible, adverse; long-term, direct, minor, adverse ***Wetlands:*** Short-term, direct, minor, adverse; no long-term impacts ***Water Quality:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Water Quantity:*** No effect ***Floodplains:*** Short-term, negligible, adverse, direct; no long-term impacts
Air Quality	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts	Short-term, direct, negligible, adverse; no long-term impacts

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 – 60-ft wide ACB armored ASW with RCC cutoff wall	Alternative 2 (NEE) – 60-ft wide ACB armored ASW with secant pile cutoff wall	Alternative 3 – 60-ft wide RCC armored ASW with RCC cutoff wall
Plants	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, beneficial ***Special Status Plant Species (T&E):*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status Plant Species (T&E):*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status Plant Species (T&E):*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse	***Dominant Vegetation Communities:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse ***Special Status Plant Species (T&E):*** No effect ***Noxious Weed and Invasive Species:*** Short-term, direct, negligible, adverse; BMPs will be implemented to prevent long-term effects. ***Riparian Areas:*** Short-term, direct, minor, adverse; long-term, direct, minor, adverse

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 – 60-ft wide ACB armored ASW with RCC cutoff wall	Alternative 2 (NEE) – 60-ft wide ACB armored ASW with secant pile cutoff wall	Alternative 3 – 60-ft wide RCC armored ASW with RCC cutoff wall
Animals	***Fish:*** Short-term, direct, minor, adverse; Warm-water species: long-term, direct, moderate, adverse; Cold-water species: long-term, direct, negligible, beneficial ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, moderate, beneficial ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects	***Fish:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Wildlife:*** Short-term, direct, minor, adverse; long-term, direct, negligible, adverse ***Special Status Animal Species (T&E):*** No effect ***Invasive Fish and Wildlife Species:*** No effect ***Migratory Birds/Bald and Golden Eagles:*** Short-term, direct, negligible, adverse; no long-term effects

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 – 60-ft wide ACB armored ASW with RCC cutoff wall	Alternative 2 (NEE) – 60-ft wide ACB armored ASW with secant pile cutoff wall	Alternative 3 – 60-ft wide RCC armored ASW with RCC cutoff wall
Ecosystem Services	***Regulating:*** Long-term, direct, significant, adverse ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, beneficial ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, moderate, adverse	***Regulating:*** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse	***Regulating:*** Long-term, direct, moderate, beneficial ***Supporting:*** Short-term, direct, negligible, adverse; long-term, direct, negligible, adverse ***Cultural:*** Short-term, direct, moderate, adverse; long-term, direct, negligible, adverse

Item or Concern	FWOFI No Federal Action – Sponsors' Remove Dam [1/]	Alternative 1 – 60-ft wide ACB armored ASW with RCC cutoff wall	Alternative 2 (NEE) – 60-ft wide ACB armored ASW with secant pile cutoff wall	Alternative 3 – 60-ft wide RCC armored ASW with RCC cutoff wall
Humans	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, moderate ***Local and Regional Economy:*** Short-term, direct, minor, adverse; long-term, direct, major, adverse ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, adverse; long-term, direct, major, adverse ***Environmental Justice and Civil Rights:*** short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights***: short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights***: short-term and long-term, no tribal communities or EJ groups present in project area.	***Cultural Resources/Historic Properties:*** No effect ***Scenic Beauty:*** Short-term, direct, negligible, adverse; long-term, direct, adverse, negligible ***Local and Regional Economy:*** Short-term, direct, minor, positive; long-term, direct, major, positive ***Public Health and Safety:*** Loss of Life from breach: Short-term, direct, major, positive; long-term, direct, major, positive; Flooding, short-term, direct, major, positive; long-term, direct, major, positive ***Environmental Justice and Civil Rights***: short-term and long-term, no tribal communities or EJ groups present in project area.

[1/] The FWOFI alternative represents the Sponsor's choice in the event federal assistance is not available. Costs will be 100% borne by the Sponsor.
[2/] "Estimated OM&R" stands for Operation, Maintenance and Replacement Costs.

Alternatives and Associated Ecosystem Services

Alternatives				
	No Action (FWOFI)	Alternative 1	Alternative 2 (NEE)	Alternative 3
Alternatives				
Locally Preferred			X	
National Economic Efficiency (NEE)			X	
Brief Description of Major Project Features	Sponsors' Remove Dam [1/]	60-ft wide ACB armored ASW with RCC cutoff wall	60-ft wide ACB armored ASW with secant pile cutoff wall	60-ft wide RCC armored ASW with RCC cutoff wall
Total Project Investment	$869,300	$4,960,100	$4,775,100	$5,250,100
Monetized Net Benefits	(-$21,700)	(-$76,100)	(-$71,100)	(-$83,600)
Provisioning Services	NA	NA	NA	NA
Regulating Services				
Flood and Disease Control	Structures in 100-year floodplain - 28	Structures in 100-year floodplain - 27	Structures in 100-year floodplain - 27	Structures in 100-year floodplain - 27
Cultural Services				
Recreational Use	Size of impoundment 0.0 (acres)	Size of impoundment 5.6 (acres)	Size of impoundment 5.6 (acres)	Size of impoundment 5.6 (acres)
Aesthetic Viewsheds	Impoundment view 0.0 (acres)	Impoundment view 5.6 (acres)	Impoundment view 5.6 (acres)	Impoundment view 5.6 (acres)

Alternatives				
	No Action (FWOFI)	Alternative 1	Alternative 2 (NEE)	Alternative 3
Aesthetic Viewsheds, Natural Landscape View	Natural Green Landscape in Viewshed of the LOD 12.98 (acres)	Natural Green Landscape in Viewshed of the LOD 7.02 (acres)	Natural Green Landscape in Viewshed of the LOD 6.28 (acres)	Natural Green Landscape in Viewshed of the LOD 7.2 (acres)
Supporting Services				
Nutrient Cycling	Established Vegetation 12.98 (acres)	Established Vegetation 7.02 (acres)	Established Vegetation 6.28 (acres)	Established Vegetation 7.2 (acres)
Soil Formation	Impervious Surface 0.0 (acres)	Impervious Surface 0.18 (acres)	Impervious Surface 0.175 (acres)	Impervious Surface 0.0 (acres)

Consideration of Guiding Principles – PR&G

PR&G Guiding Principles	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Healthy and Resilient Ecosystem	0*	+	+	+
Sustainable Economic Development	-	+	++	+
Floodplains	0	0	0	0
Public Safety	-	+	+	+
Environmental Justice	0	0	0	0
Watershed Approach	-	+	+	+

*This neutral determination is based on the conversion of one healthy established ecosystem type to another habitat ecosystem type, and each of these ecosystems have inherent benefits and negative impacts on the landscape. For more details, see the Environmental Consequences.

Consideration of Federal Objective - PR&G

Components	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Maximize Sustainable Economic Development	-	+	++	+
Avoid Unwise Use of Floodplains	0	0	0	0
Protect & Restore Functions of Natural Systems	0	+	+	+

ENVIRONMENTAL CONSEQUENCES

Alternative plans of action can result in a multitude of potential effects on resources upstream and downstream of the dam. This section describes anticipated effects on resource and ecosystem services concerns identified by the Sponsors, the public, and agency personnel in the Scoping meeting and the public meetings. The six Guiding Principles of the Principles and Requirements were used in the alternative evaluations. The "Existing Conditions" presented in this section is a brief summary of the information provided in the "Affected Environment" section of this plan.

PHYSICAL ENVIRONMENT

Prime and Unique Farmland and Farmland of Statewide Importance

Garrett Dam

Existing Conditions

There are no prime farmland soils identified within the onsite LODs.

Farmland soils of statewide importance are present in the Alternatives 1, 2, and 3 LOD, and the No Action LOD where Oquaga channery loam (3–8 percent slopes and 8–15 percent slopes) are present (USDA NRCS 2019a). These soils cover 4.12 acres within the LODs and are covered in grass.

FWOFI

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, moderate, and adverse impacts to soils are expected from the No Action Alternative. Approximately 0.30 acres of soils in the dam embankment area (Holly silt loam) will be partially excavated during the constructed breach of the dam, causing both short- and long-term adverse impacts to these soils from the permanent removal of the soils from that location. The excavated material will be deposited on the existing ASW and stabilized with a native seed mix.

The constructed breach of the dam will result in the elimination of the impoundment, impacting the soils surrounding the impoundment by reducing the amount of water saturation of the soils. This Alternative will result in the conversion of the upstream impoundment back to a stream channel above the dam in the existing flood pool, which is anticipated to have long-term impacts on soils. The soils once totally submerged by the water will be re-exposed and begin natural soil formation processes similar to those in a traditional floodplain area. This change from a water body to a stream channel will also have a moderate impact on wetland soils currently present around the parameter of the flood pool. Additionally, soils in the downstream floodplain may experience erosion and scouring caused by increased flows and flooding after the dam is breached and no longer retarding stream flows. The No Action Alternative will eliminate the cumulative impacts to soils that resulted from the construction of the original dam. Soils that have been inundated since the construction of the dam will no longer be flooded once the impoundment is eliminated with the FWOFI Alternative.

The No Action Alternative will cause ground disturbing activities in areas designated as farmland soils of statewide importance in the staging and access areas, approximately 4.12 acres. Adverse impacts to farmland soils of statewide importance are considered negligible and short-term

because the soils will be scraped and stockpiled to prepare the area for the access road and staging area and will then be placed back in their original areas post construction and regraded and seeded. There are no anticipated indirect effects to this resource. There are no prime farmland soils in the LOD.

Long-term, direct, minor, beneficial impacts to sedimentation are anticipated from the FWOFI Alternative. The capture of sediment behind dams can have profound impacts on the geomorphology, stream function, aquatic habitat and ecosystem health. Under this alternative, the natural sediment transport systems and functions of the stream will be restored in the area of the dam and downstream tributaries resulting in natural stream functions and dynamics.

Alternative 1

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, negligible, and adverse impacts to soils are expected from Alternative 1. No indirect effects were identified during analysis. Additionally, although three other dam sites in the Lackawaxen Tributaries watershed will also undergo rehabilitation, it is not anticipated that any new cumulative impacts to soils will occur, even if all four projects were to be undertaken simultaneously. Cumulative impacts to soils resulting from the original construction of the dam, including inundation of soils, will continue to occur from this alternative.

Alternative 1 will result in short-term, minor, direct, adverse impacts to all soils within the LOD. Short-term adverse effects to soils may include temporary disruption and compaction via heavy construction equipment and vehicles, staging/stockpiling of materials, and general construction work. Disrupted areas will be regraded to match pre-construction conditions to the maximum extent practicable. Soils from disturbed areas within the LOD will be segregated and stockpiled and will then be used to stabilize the LOD post construction with a tackifier and an approved native or adaptive seed mix which is adaptable to potential climate changes.

Long-term, negligible, direct, adverse effects include the excavation of soils (Oquaga channery loam, 8–25 percent slopes, rubbly) to install the RCC ASW and the associated RCC cutoff wall downstream of the dam. Soils in the ASW will also experience long-term compaction due to the installation of RCC; however, these impacts are considered negligible given that the majority of these soils were previously compacted and disturbed during the original construction of the dam.

Approximately 4.12 acres of the LOD is comprised of farmland soils of statewide importance, all of which lies within the onsite staging and access area. These soils are anticipated to be adversely but negligibly impacted by the installation of the access road and the staging and stockpiling of materials. Because of the installation of the RCC ASW, a concrete batch will also be erected in the staging area in order to produce the large quantities of concrete needed for the RCC construction. Adverse impacts to farmland soils of statewide importance are considered negligible and short-term because the soils will be scraped and stockpiled to prepare the area for the access road and staging area and will then be placed back in their original areas post construction and regraded and seeded. There are no anticipated indirect or cumulative effects to soils of statewide importance. There are no prime farmland soils in the LOD.

This Alternative is not anticipated to affect sedimentation rates at or below the dam.

Alternative 2

The alternative is anticipated to have impacts to soil resources of a similar intensity, duration, and magnitude as Alternative 1. However, it is anticipated that there will be additional soils impacts to Oquaga channery loam (8–25 percent slopes, rubbly) due to the excavation of the approach channel and outlet channel associated with the labyrinth weir. Oquaga channery loam (8–25 percent slopes, rubbly) is not a prime or unique farmland soil; and therefore, impacts from excavation of these soils is considered negligible. Alternative 2 will cause ground disturbing activities in areas designated as farmland soils of statewide importance in the staging and access areas, approximately 4.12 acres. Adverse impacts to farmland soils of statewide importance are considered negligible and short-term because the soils will be scraped and stockpiled to prepare the area for the access road and staging area and will then be placed back in their original areas post construction and regraded and seeded. There are no anticipated indirect or cumulative effects to this resource. There are no prime farmland soils in the LOD.

Alternative 3

This alternative is anticipated to have impacts to soil resources of a similar intensity, duration, and magnitude as Alternatives 1 and 2. However, it is anticipated that there will be additional soils impacts to Oquaga channery loam (8–25 percent slopes, rubbly) due to the excavation of the approach channel and outlet channel associated with the labyrinth weir. Oquaga channery loam (8–25 percent slopes, rubbly) is not a prime or unique farmland soil; and therefore, impacts from excavation of these soils is considered negligible. Alternative 3 will cause ground disturbing activities in areas designated as farmland soils of statewide importance in the staging and access areas, approximately 4.12 acres. Adverse impacts to farmland soils of statewide importance are considered negligible and short-term because the soils will be scraped and stockpiled to prepare the area for the access road and staging area. These soils will then be placed back in their original areas post construction and regraded and seeded. There are no anticipated indirect or cumulative effects to this resource. There are no prime farmland soils in the LOD.

Varcoe Dam

Existing Conditions

There are no prime farmland soils identified within the onsite LODs or the LOD of the offsite staging area (USDA NRCS 2019a).

Farmland soils of statewide importance comprise 0.08 acres of the Alternatives 1, 2, and 3 LOD and the No Action Alternative LOD, where Wellsboro channery loam (8–15 percent slopes) is present (USDA NRCS 2019a).

The entirety of the offsite staging area, 4.8 acres, is comprised of farmland soils of statewide importance.

FWOFI

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, moderate, and adverse impacts to soils are expected from the No Action Alternative. Approximately 0.17 acres of soils in the dam embankment area (Wellsboro channery loam, rubbly, 3–8 percent) will be partially excavated during the constructed breach of the dam, causing both short- and long-term

adverse impacts to these soils from the permanent movement removal of the soils. The excavated material will be deposited on the existing ASW and stabilized with a native seed mix.

Ground disturbing impacts in areas designated as farmland soils of statewide importance (0.08 acres in the onsite access road) are considered adverse but negligible. The soils will be scraped and stockpiled to prepare the area for the access road and will then be placed back in their original areas post construction and regraded and seeded. Farmland soils of statewide importance in the offsite staging area are not anticipated to be adversely affected because the location is already used as a staging and stockpiling area.

The constructed breach of the dam will result in the elimination of the impoundment, impacting the soils surrounding the impoundment by reducing the amount of water saturation of soils. This Alternative will result in the converting of the upstream impoundment back to a stream channel above the dam in the existing flood pool. This conversion will have long-term impacts on soils as the soils once totally submerged by the water will be re-exposed and begin natural soil formation processes similar to those in a traditional floodplain area. This change from a water body to a stream channel will also have a moderate impact on wetland soils currently present around the parameter of the flood pool. Additionally, soils in the downstream floodplain may experience erosion and scouring caused by increased flows and flooding after the dam is breached, and no longer retarding storm flows. The No Action Alternative will eliminate the cumulative impacts to soils that resulted from the construction of the original dam. Soils that have been inundated since the construction of the dam will no longer be flooded once the impoundment is eliminated with the FWOFI Alternative.

Long-term, direct, minor, beneficial impacts to sedimentation are anticipated from the FWOFI Alternative. The capture of sediment behind dams can have profound impacts on the geomorphology, stream function, aquatic habitat and ecosystem health. Under this alternative, the natural sediment transport systems and functions of the stream will be restored in the area of the dam and downstream tributaries resulting in natural stream functions and dynamics.

Alternative 1

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, negligible, and adverse impacts to soils are expected from Alternative 1. No indirect effects were identified during analysis. Additionally, although three other dam sites in the Lackawaxen Tributaries watershed will also undergo rehabilitation, it is not anticipated that any new cumulative impacts to soils will occur, even if all four projects were to be undertaken simultaneously. Cumulative impacts to soils resulting from the original construction of the dam, including inundation of soils, will continue to occur from this alternative.

Alternative 1 will result in short-term, minor, direct, adverse impacts to all soils within the LOD. Short-term adverse effects to soils may include temporary disruption and compaction via heavy construction equipment and vehicles, staging/stockpiling of materials, and general construction work. Disrupted areas will be regraded to match pre-construction conditions to the maximum extent practicable. Soils from disturbed areas within the LOD will be segregated and stockpiled and will then be used to stabilize the LOD post construction with a tackifier and an approved native or adaptive seed mix, which is adaptable to potential climate changes.

Long-term, negligible, direct, adverse effects include the excavation of soils (Wellsboro channery loam, 3–8 percent slopes, rubbly) to install the ACB exit channel and the associated reinforced concrete cutoff wall downstream of the dam. Soil in the ASW will also experience long-term compaction due to the installation of ACBs; however, these impacts are considered negligible given that most of these soils were previously compacted and disturbed during the original construction of the dam.

The LODs contain just 0.08 acres of farmland soils of statewide importance, which lies in the southernmost end of the onsite access road. These soils are anticipated to be adversely but negligibly impacted by the installation of the access road. Adverse impacts to farmland soils of statewide importance are considered negligible and short-term because the soils will be scraped and stockpiled to prepare the area for the access road. The soils will then be placed back in their original areas post construction and regraded and seeded. There are no anticipated indirect or cumulative effects to soils of statewide importance. There is no prime farmland in the LOD. With this Alternative, the normal pool will be slightly increased (by 0.14 acre-ft) which will accommodate the required sediment storage of the dam for the next 50 years.

There are approximately 4.8 acres of soils in the offsite staging area. These soils are not anticipated to be adversely impacted by the proposed activities because this area has been used as a staging and stockpile area, as recently as 2012, for various other infrastructure projects (unassociated). As such, the impacts to this area are anticipated to be negligible. The NRCS Web Soil Survey (WSS) indicated that all 4.8 acres of the offsite staging area are classified as farmland soils of statewide importance. However, this information has not been updated to reflect recent usage and development of the site. The offsite staging area will be shared with another nearby dam rehabilitation project (Finkleday Dam).

This Alternative is not anticipated to affect sedimentation rates at or downstream of the dam.

Alternative 2

The alternative is anticipated to have impacts to soil resources of a similar intensity, duration, and magnitude as Alternative 1. However, construction activities will slightly differ because of the proposed installation of an RCC ASW rather than an ACB exit channel. This Alternative is expected to cause slightly more compaction to the soils in the ASW because of the placement of large quantities of concrete as well as the laydown of topsoil over the RCC spillway. Long-term adverse soil impacts are still expected to be negligible. Additionally, the construction of the RCC will require a concrete batch plant to be erected in the offsite staging area, causing more disturbance and compaction to the soils because of the placement of the batch plant and added trucks accessing the site. Ground disturbing impacts in areas designated as farmland soils of statewide importance (0.08 acres) will be adverse but negligible. The soils will be scraped and stockpiled to prepare the area for the access road and will then be placed back in their original areas post construction and regraded and seeded.

Alternative 3

This alternative is anticipated to have impacts on soil resources of a similar intensity, duration, and magnitude as Alternative 1. However, slightly more impacts to soils in the ASW area are expected from Alternative 2 because this Alternative is proposing to widen the ASW by 15 ft,

resulting in more excavated soils and some additional compaction. Ground disturbing impacts in areas designated as farmland soils of statewide importance (0.08 acres) will be adverse but negligible. The soils will be scraped and stockpiled to prepare the area for the access road and will then be placed back in their original areas post construction and regraded and seeded.

Martin Dam

Existing Conditions

Prime farmland soil is present in the LOD for Alternatives 1, 2, and 3 and the No Action Alternative LOD where Wellsboro channery loam (3–8 percent slopes) is present. Prime farmland covers 0.20 acres in both LODs within the access road west of the dam (USDA NRCS 2019a).

Farmland soils of statewide importance are present in the LOD for Alternatives 1, 2, and 3 and the No Action Alternative LOD where Morris channery loam (3–8 percent and 8–15 percent slopes) and Wellsboro channery loam (8–15 percent and 15–25 percent slopes) are present (USDA NRCS 2019a). These soils cover approximately 4.51 acres within the LODs.

The entirety of the offsite staging area is comprised of farmland soils of statewide importance.

FWOFI

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, moderate, and adverse impacts to soils are expected from the No Action Alternative. Approximately 0.28 acres of soils in the dam embankment area (Morris channery loam, 0–8 percent, rubbly) will be partially excavated during the constructed breach of the dam, causing both short- and long-term adverse impacts to these soils from the permanent removal of the soils. The excavated material will be deposited on the existing ASW and stabilized with a native seed mix.

Prime farmland soils and soils of statewide importance are anticipated to experience short-term, adverse, negligible impacts from ground disturbing activities during construction work. Except for soils that lie in the ASW, all prime farmland soils and soils of statewide importance will be placed back in their original location, regraded, and reseeded. Farmland soils of statewide importance in the offsite staging area are not anticipated to be adversely affected by project work because the location is already used as a staging and stockpiling area.

The constructed breach of the dam will result in the elimination of the impoundment, impacting the soils surrounding the impoundment by reducing the amount of water saturation of the soils. This Alternative will result in the converting of the upstream impoundment back to a stream channel above the dam in the existing flood pool. This conversion will have long-term impacts on soils as the soils once totally submerged by the water will be re-exposed and begin natural soil formation processes similar to those in a traditional floodplain area. This change from a water body to a stream channel will also have a moderate impact on wetland soils currently present around the parameter of the flood pool. Additionally, soils in the downstream floodplain may experience erosion and scouring caused by increased flows and flooding after the dam is breached, and no longer retarding storm flows. The No Action Alternative will eliminate the cumulative impacts to soils that resulted from the construction of the original dam. Soils that

have been inundated since the construction of the dam will no longer be flooded once the impoundment is eliminated with the FWOFI Alternative.

Long-term, direct, minor, beneficial impacts to sedimentation are anticipated from the FWOFI Alternative. The capture of sediment behind dams can have profound impacts on the geomorphology, stream function, aquatic habitat and ecosystem health. Under this alternative, the natural sediment transport systems and functions of the stream will be restored in the area of the dam and downstream tributaries resulting in natural stream functions and dynamics.

Alternative 1

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, negligible, and adverse impacts to soils are expected from Alternative 1. No indirect effects were identified during analysis. Additionally, although three other dam sites in the Lackawaxen Tributaries watershed will also undergo rehabilitation, it is not anticipated that any new cumulative impacts to soils will occur, even if all four projects were to be undertaken simultaneously. Cumulative impacts to soils resulting from the original construction of the dam, including inundation of soils, will continue to occur from this alternative.

Alternative 1 will result in short-term, minor, direct, adverse impacts to all soils within the LOD. Short-term adverse effects to soils may include temporary disruption and compaction via heavy construction equipment and vehicles, staging/stockpiling of materials, and general construction work. Disrupted areas will be regraded to match pre-construction conditions to the maximum extent practicable. Soils from disturbed areas within the LOD will be segregated and stockpiled and will then be used to stabilize the LOD post construction with a tackifier and an approved native or adaptive seed mix which is adaptable to potential climate changes.

Long-term, negligible, direct, adverse effects include the excavation of soils (Wellsboro channery loam, 8–15 percent slopes) to install the RCC ASW and the associated reinforced concrete end sill and cutoff wall downstream of the dam. Soils in the ASW will also experience long-term compaction due to the installation of the RCC ASW; however, these impacts are considered negligible given that most of these soils were previously compacted and disturbed during the original construction of the dam. Soils abutting the impoundment (Morris channery loam, rubbly, 0–8 percent slopes) are also anticipated to be impacted from the construction of the stability berm.

Soils that are excavated for the armoring of the ASW will be used to raise the top of dam elevation and flatten the slopes downstream. A small amount of additional soil (1600 cubic yards) may be required and it is expected that the sponsors will secure a site where borrow material can be obtained.

Approximately 0.20 acres of the LOD is comprised of prime farmland soils, which lie on the site access road. Additionally, 0.55 acres of highly erodible cropland lie along the access road. These soils will only be disturbed by the installation of the road and the movement of construction vehicles during the approximately 24 months of construction work. Adverse impacts to prime farmland soils are considered negligible and short-term because the soils will be scraped and

stockpiled to prepare the area for the access road, and then placed back in their original areas post construction.

Approximately 4.51 acres of the LOD is comprised of farmland soils of statewide importance, some of which lie in the dam embankment area and ASW. The farmland soils in the ASW are anticipated to experience long-term effects from the installation of the RCC; however, these soils were previously impacted during the original construction of the dam and are not used for farming. Farmland soils of statewide importance in the onsite access road are anticipated to experience adverse but negligible ground disturbing impacts from the installation of the access road and movement of construction vehicles. These soils are only expected to experience short-term negligible effects because the soils will be placed back in their original location and regraded and reseeded post construction.
The entirety of the 7.24-acre offsite staging area is comprised of farmland soils of statewide importance. The 7.24 acres of soils in the offsite staging area are not anticipated to be adversely impacted by the proposed activities because this area has been used as a staging and stockpile area, as recently as 2020, for other unassociated infrastructure projects. As such, adverse impacts to this area are anticipated to be negligible. The NRCS WSS indicated that all 7.24 acres of the offsite staging area are classified as farmland soils of statewide importance. However, this information has not been updated to reflect recent usage and development of the site. Because of the installation of the RCC ASW, a concrete batch will be erected in the offsite staging area to produce the large quantities of concrete needed for the RCC construction.

This Alternative is not anticipated to affect sedimentation rates at or downstream of the dam.

Alternative 2
Alternative 2 is anticipated to have impacts to soil resources of a similar intensity and duration as Alternative 1. However, it is anticipated that there will be additional ground disturbing impacts to soils on the upstream end of the ASW where additional soils will be excavated for the approach channel to the labyrinth weir. Prime farmland soils and soils of statewide importance are anticipated to experience short-term, adverse, negligible impacts from ground disturbing activities during construction work; all areas comprised of prime farmland and soils of statewide importance had been previously disturbed. Additionally, 0.55 acres of highly erodible cropland lie along the access road. These soils will only be disturbed by the installation of the road and the movement of construction vehicles during the approximately 24 months of construction work.

Alternative 3
This alternative is anticipated to have impacts to soil resources of a similar intensity and duration as Alternative 2. However, the RCC ASW, Ogee weir, and approach channel are wider than the ASW and labyrinth weir of Alternative 2 and will impact a slightly larger area of soils. Because the majority of these soils were previously impacted, short and long-term impacts are still anticipated to be negligible. Prime farmland soils and soils of statewide importance are anticipated to experience short-term, adverse, negligible impacts from ground disturbing activities during construction work; all areas comprised of prime farmland and soils of statewide importance had been previously disturbed. Additionally, 0.55 acres of highly erodible cropland lie along the access road. These soils will only be disturbed by the installation of the road and

the movement of construction vehicles during the approximately 24 months of construction work.

Finkleday Dam

Existing Conditions

There are no prime farmland soils identified within the onsite LODs or the LOD of the offsite staging area (USDA NRCS 2019a).

Farmland soils of statewide importance comprise 2.73 acres of Alternative 1 and 3 LOD, 2.23 acres of the Alternative 2 LOD, and 2.31 acres of the No Action Alternative LOD. Soils classified as farmland of statewide importance include Morris channery loam (8–15 percent slopes and 3–8 percent slopes) and Wyoming gravelly sandy loam (8–15 percent slopes) (USDA NRCS 2019a).

The entirety of the offsite staging area, 4.8 acres, is comprised of farmland soils of statewide importance.

FWOFI

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, moderate, and adverse impacts to soils are expected from the No Action Alternative. Approximately 0.21 acres of soils in the dam embankment area (Morris channery loam, 0–8 percent) will be partially excavated during the constructed breach of the dam, causing both short- and long-term adverse impacts to these soils from the permanent removal of the soils. The excavated material will be deposited on the existing ASW and stabilized with a native seed mix.

Additionally, the 2.31 acres of farmland soils of state of statewide importance in the southern access road will be temporarily disturbed by the movement of construction vehicles. However, this road is an existing driveway and project work will only require widening. Therefore, adverse impacts to these farmland soils of statewide importance are considered negligible. Farmland soils of statewide importance in the offsite staging area are not anticipated to be adversely affected because the location is already used as a staging and stockpiling area.

The constructed breach of the dam will result in the elimination of the impoundment, impacting the soils surrounding the impoundment by reducing the amount of water saturation of the soils. This alternative will result in the converting of the upstream impoundment back to a stream channel above the dam in the existing flood pool. This conversion will have long-term impacts on soils as the soils once totally submerged by the water will be re-exposed and begin natural soil formation processes like those in a traditional floodplain area. This change from a water body to a stream channel will also have a moderate impact on wetland soils currently present around the parameter of the flood pool. The No Action Alternative will eliminate the cumulative impacts to soils that resulted from the construction of the original dam. Soils that have been inundated since the construction of the dam will no longer be flooded once the impoundment is eliminated with the FWOFI Alternative.

Long-term, direct, minor, beneficial impacts to sedimentation are anticipated from the FWOFI Alternative. The capture of sediment behind dams can have profound impacts on the

geomorphology, stream function, aquatic habitat and ecosystem health. Under this alternative, the natural sediment transport systems and functions of the stream will be restored in the area of the dam and downstream tributaries resulting in natural stream functions and dynamics.

Alternative 1

Short-term, direct, minor, and adverse impacts to soils; and long-term, direct, negligible, and adverse impacts to soils are expected from Alternative 1. No indirect effects were identified during analysis. Additionally, although three other dam sites in the Lackawaxen Tributaries watershed will also undergo rehabilitation, it is not anticipated that any new cumulative impacts to soils will occur, even if all four projects were to be undertaken simultaneously. Cumulative impacts to soils resulting from the original construction of the dam, including inundation of soils, will continue to occur from this alternative.

Alternative 1 will result in short-term, minor, direct, adverse impacts to all soil types in the LOD. Short-term adverse effects to soils may include temporary disruption and compaction via heavy construction equipment and vehicles, staging/stockpiling of materials, and general construction work. Disrupted areas will be regraded to match pre-construction conditions to the maximum extent practicable. Soils from disturbed areas within the LOD will be segregated and stockpiled and will then be used to stabilize the LOD post construction with a tackifier and an approved native or adaptive seed mix which is compatible with potential climate change.

Long-term, negligible, direct, adverse effects include the excavation of soils (Morris channery loam, 3–8 percent slopes, rubbly) to install the ACB exit channel and the associated RCC cutoff wall downstream of the dam. Soils in the ASW will also experience long-term compaction due to the installation of ACBs; however, these impacts are considered negligible given that the majority of these soils were previously compacted during the original construction of the dam.
Approximately 2.73 acres of the LOD for Alternative 1 is comprised of farmland soils of statewide importance, most of which lies within the onsite staging and access area. These soils are anticipated to be adversely but negligibly impacted by the widening of the access road to the south (existing driveway). The access road connecting to the southern toe of the ASW has also previously been disturbed although it does not contain an existing access road. Adverse impacts to these farmland soils of statewide importance are considered negligible and short-term. There are no anticipated indirect or cumulative effects to this resource. There is no prime farmland in the LOD. Soils in the 1.54-acre homeowner access road, which are partially comprised of farmland soils of statewide importance, may experience temporary compaction and disturbance from vehicle traffic accessing the home. Impacts to these soils are anticipated to be adverse but minor, because it will involve the installation of a new road.
This alternative is not anticipated to affect sedimentation rates at the dam.

There are approximately 4.8 acres of soils in the offsite staging area. These soils are not anticipated to be adversely impacted by the proposed activities because this area has been used as a staging and stockpile area, as recently as 2012, for various other infrastructure projects (unassociated). As such, the impacts to this area are anticipated to be negligible. The NRCS WSS indicated that all 4.8 acres of the offsite staging area are classified as farmland soils of statewide importance. However, this information has not been updated to reflect recent usage

and development of the site. The offsite staging area will be shared with another nearby dam rehabilitation project (Varcoe Dam).

Alternative 2
Alternative 2 is anticipated to have impacts to soil resources of a similar intensity, duration, and magnitude as Alternative 1. However, because of the use of a secant pile cutoff wall, it does not require an additional access road to the toe of the ASW, as Alternative 1 does, resulting in fewer ground disturbing activities in areas designated as farmland soils of statewide importance approximately 2.23 acres in total. It is also expected that there will be slightly fewer impacts to soils in the ASW area because the secant pile cutoff wall covers a smaller area than the RCC cutoff wall, resulting in slightly fewer excavated soils and compaction.

Alternative 3
Alternative 3 is anticipated to have impacts on soil resources of a similar intensity, duration, and magnitude as Alternative 1. However, construction activities will differ because of the proposed installation of an RCC ASW rather than an ACB exit channel. This alternative is expected to cause slightly more compaction to the soils in the ASW because of the placement of large quantities of concrete as well as the laydown of topsoil over the RCC ASW. It will require the placement of a concrete batch in the offsite staging area during construction sequencing. However, because the offsite staging area is already used for another infrastructure project, the placement of the concrete batch plant is not anticipated to cause adverse effects to the farmland soils of statewide importance in this location. This alternative will result in temporary ground disturbing activities in areas designated as farmland soils of statewide importance along both the new access road to the north and the existing access road to the south, approximately 2.73 acres in total. Long-term adverse soil impacts are still expected to be negligible.

ECOLOGICAL ENVIRONMENT

Water Resources

Garrett Dam

Existing Conditions
Based on the definition of WOTUS, the impoundment, the wetlands, and Holbert Creek are WOTUS (EPA 2019a; USACE 2012). The impoundment is an approximately 3.30-acre freshwater pool and Holbert Creek is an approximately 3.5-mile-long tributary of the Lackawaxen River.

Neither Holbert Creek nor the Lackawaxen River is classified as an impaired stream (EPA 2020).

The reservoir is not used as a potable or agricultural water source, so water quantity is not a concern with regard to these uses. It has a flood storage capacity of 245.5 ac-ft.

Based on review of the FEMA flood insurance rate map for the study area (Panel 42127C0302D) effective 16 May 2013, the dam is located in Zone A, a special flood hazard area (FEMA 2020). The area is subject to inundation by a 1-percent-annual-chance flood event, but no hydraulic analyses have been performed by FEMA to determine the base flood elevation (FEMA 2014).

FWOFI

Short-term, direct, moderate, adverse impacts and long-term, direct, moderate, adverse impacts will occur to water resources as a result of the No Action Alternative. The No Action Alternative will also result in cumulative impacts to water resources because the removal of the dam will allow the streams, wetlands, and riparian corridors to return to their natural condition, prior to construction of the original dam.

The constructed breach of the dam will result in the elimination of the 3.30-acre freshwater impoundment, causing short and long-term, moderate effects to WOTUS. Holbert Creek will naturally re-establish a stream channel through the drained impoundment, creating approximately 984 linear ft of stream channel through the old flood pool within the LOD. The impoundment is currently classified as freshwater pond wetlands (using the Cowardin System), surrounded by fringe freshwater emergent wetlands. After the constructed breach of the dam, the upstream impoundment will be replaced by a stream buffered by approximately 30 ft of freshwater emergent wetlands on either side of the channel (approximately 1.06 acres of freshwater emergent wetlands). Over time, the upland areas adjacent to this new stream channel will slowly change over to an early successional habitat, unless they are maintained as pasture or grazing land. The installation of riprap protection along the dam embankment would permanently impact 0.01 acres of freshwater emergent wetlands downstream of the dam. Consequently, the No Action Alternative would result in a permanent net loss of 1.88 acres of total wetlands, after the freshwater pond wetlands are eliminated and replaced with fringe freshwater emergent wetlands and riprap protection is installed.

Wetland Impacts

	Temporary wetland impacts (acres)	**Permanent wetland impacts (acres)**	**Wetlands created (acres)**	**Net permanent wetlands impacts (acres)**
No Action Alternative LOD	0.17	2.94	1.06	-1.88

The No Action Alternative is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (turbidity curtain) and are not expected to have lasting effects on water quality. Some additional sediments may be transported to surface waters as the natural stream channel re-establishes through the impoundment. There are anticipated to be long-term, direct, adverse, negligible impacts to water quality as the dam will no longer be in place to trap sediment resulting in additional sediment being carried downstream. No exceedances of EPA water quality use standards are expected as a result of this alternative.

There will be long-term impacts to water quantity from the No Action Alternative because the dam will no longer be in place, which would eliminate the approximately 245.5 acre-ft flood

control storage capacity. The elimination of the impoundment also eliminates the potential for thermal heating of the water upstream of the dam.
There will be no effects to wild or scenic rivers or NRI river segments as a result of project work.

The No Action Alternative is anticipated to result in long-term, direct, adverse, moderate impacts to floodplain management in the Borough of Honesdale because the current levels of flood protection will be lost after the dam is breached. Because of the loss of flood protection, Wayne County will likely need to request a Letter of Map Revision from FEMA for the downstream floodplains.

Alternative 1
Short-term, direct, negligible, adverse impacts and long-term, direct, negligible, adverse impacts will occur to water resources as a result of Alternative 1. No indirect effects or cumulative effects were identified during analysis. Adverse cumulative impacts to water resources, which have been ongoing since the original dam construction, will continue to occur after dam rehabilitation. The dam will continue to obstruct the natural flow of the riverine system. No new cumulative impacts to water resources are anticipated from project action.

Short-term, direct, adverse, negligible effects and long-term, direct, adverse, minor effects to WOTUS may occur as a result of Alternative 1. The waterbodies in the LOD, Holbert Creek and the impoundment, will experience temporary and permanent disturbances from construction activities at the dam embankment area. A cofferdam or other similar device will be installed during construction to maintain the hydrology of the impoundment and associated wetlands, as well as to maintain dry working conditions. The cofferdam will allow for only the immediate area around the dam to be temporarily drawn down to facilitate construction and repairs, and then removed once work is complete. The size of the impoundment, 3.3 acres, is not anticipated to change significantly due to project work. Permanent impacts to WOTUS are anticipated to occur from the extension of the downstream toe of the dam and the accompanying principal spillway conduit extension. The impacts to the Holbert Creek will be 35 linear ft of permanent impacts to the stream. This effect to WOTUS is deemed long-term, direct, adverse, and minor.

It is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream from construction related activities. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (i.e., turbidity curtain, silt fence, straw bales, etc.) and are not expected to have lasting negative effects on water quality. Project work is not expected to impact the non-impairment status of the waterbodies. The dam will facilitate trapping sediment and other water particulates for the service life of the rehabilitated structure (i.e., 60 years) once the dam is rehabilitated. Long-term impacts to water quality are deemed direct, negligible, and beneficial. Waterbodies are expected to maintain their existing non-impairment status. The impounded water behind the dam will continue to experience thermal heating.

There will be no change in the current levels of flood protection downstream as a result of project activity. There are anticipated to be short-term, negligible, adverse, direct impacts to the floodplain area immediately around the dam during construction.

This alternative is anticipated to result in short-term and long-term, direct, minor, adverse impacts to wetlands. Construction work is expected to temporarily impact the approximately 0.14 acres of freshwater emergent and freshwater pond wetlands abutting the dam embankment. It is anticipated that there will be unavoidable permanent impacts to the 0.17 acres of freshwater emergent wetlands located in the ASW from the construction of the RCC. These wetlands likely formed after settling occurred in the ASW. Although the RCC is only expected to partially cover these wetlands, all 0.17 acres of freshwater emergent wetlands in the ASW will likely be permanently impacted by construction work.

Wetland Impacts

	Temporary wetland impacts (acres)	**Permanent wetland impacts (acres)**	**Wetlands created (acres)**	**Net permanent wetlands impacts (acres)**
Alternative 1 LOD	0.14	0.17	0	-0.17

There will be no effects to water quantity because the design will keep the same principal spillway conduit elevation which is the controlling factor for the impoundment size. There will be no effects to wild or scenic rivers or NRI river segments as a result of project work.

Alternative 2

Alternative 2 is anticipated to have impacts to water resources of similar intensity, duration, and magnitude as Alternative 1. However, Alternative 2 does not involve extending the principal spillway conduit; and therefore, will not result in permanent impacts to the stream channel in the LOD. The installation of the 5-cycle labyrinth weir and excavation of the approach channel for this Alternative will also permanently impact the 0.17 acres of freshwater emergent wetlands in the ASW (same impacts as Alternative 1).

Alternative 3

Alternative 3 is anticipated to have impacts to water resources of similar intensity, duration, and magnitude as Alternative 1. However, Alternative 3 does not involve extending the principal spillway conduit; and therefore, will not result in permanent impacts to the stream in the LOD. the installation of the 8-cycle labyrinth weir and excavation of the approach channel for this Alternative will also permanently impact the 0.17 acres of freshwater emergent wetlands in the ASW (same impacts as Alternative 1).

Additionally, the raising of the ASW crest associated with this Alternative will increase the current level of flood protection provided by the dam for the 100-year, 24-hour storm event, causing beneficial but negligible impacts to the floodplain and the management of floodwaters downstream of the dam including in the Borough of Honesdale.

Varcoe Dam

Existing Conditions

Based on the definition of WOTUS, the impoundment, the wetlands, and stream are WOTUS (EPA 2019a; USACE 2012). The approximate 2.45-acre impoundment forms a freshwater pool, and the stream is an approximate 2-mile-long tributary of Holbert Creek.

Neither Laurella Creek nor the Lackawaxen River is classified as an impaired stream (EPA 2020).

The reservoir is not used as a potable or agricultural water source, so water quantity is not a concern with regard to these uses. It has a flood storage capacity of 166.2 ac. ft.

Based on review of the FEMA flood insurance rate map for the study area (Panel 42127C0302D) effective 16 May 2013, the dam is located in Zone A, a special flood hazard area (FEMA 2020). The area is subject to inundation by a 1-percent-annual-chance flood event, but no hydraulic analyses have been performed by FEMA to determine the base flood elevation (FEMA 2014).

FWOFI

Short-term, direct, minor, adverse impacts and long-term, direct, moderate, adverse impacts will occur to water resources as a result of the No Action Alternative. The No Action Alternative will also result in cumulative impacts to water resources because the removal of the dam will allow the streams, wetlands, and riparian corridors to return to their natural condition, prior to construction of the original dam.

The constructed breach of the dam will result in the elimination of the freshwater impoundment, causing short- and long-term, moderate effects to WOTUS. Laurella Creek will naturally re-establish a stream channel through the drained impoundment, creating approximately 1,680 linear ft of stream channel in the old flood pool within the LOD. The impoundment is currently classified as freshwater pond wetlands (using the Cowardin system), surrounded by fringe freshwater emergent wetlands. After the constructed breach of the dam, the upstream impoundment will be replaced by a stream buffered by approximately 30 ft of freshwater emergent wetlands on either side of the channel (approximately 2.09 acres of freshwater emergent wetlands). Over time, the upland areas adjacent to this new stream channel will slowly change over to an early successional habitat. Consequently, the No Action Alternative would result in a permanent net loss of 0.44 acres of total wetlands, after the freshwater pond wetlands are eliminated and replaced with fringe freshwater emergent wetlands along the newly established stream channel.

Wetlands Impacts

	Temporary wetland impacts (acres)	**Permanent wetland impacts (acres)**	**Wetlands created (acres)**	**Net permanent wetlands impacts (acres)**
No Action Alternative LOD	0	2.53	2.09	-0.44

The No Action Alternative is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (turbidity curtain) and are not expected to have lasting effects on water quality. Some additional sediments may be transported to surface waters as the natural stream channel re-establishes through the impoundment. There are anticipated to be long-term, direct, adverse, negligible impacts to water quality as the dam will no longer be in place to trap sediment resulting in additional sediment being carried downstream. No exceedances of EPA water quality standards are expected as a result of this alternative.

There will be long-term impacts to water quantity from the No Action Alternative because the dam will no longer be in place, which would eliminate the approximately 166.2 acre-ft flood control storage capacity. The elimination of the impoundment also eliminates the potential for thermal heating of the water upstream of the dam.

There will be no effects to wild or scenic rivers or NRI river segments as a result of project work.

The No Action Alternative will cause long-term, direct, adverse, moderate impacts to floodplain management in the Borough of Honesdale because the current levels of flood protection will be lost after the dam is breached. Because of the loss of flood protection, Wayne County will likely need to request a Letter of Map Revision from FEMA for the downstream floodplains.

Alternative 1

Short-term, direct, minor, adverse impacts and long-term, direct, negligible, adverse impacts will occur to water resources as a result of Alternative 1. No indirect effects or cumulative effects were identified during analysis. Adverse cumulative impacts to water resources, which have been ongoing since the original dam construction, will continue to occur after dam rehabilitation. The dam will continue to obstruct the natural flow of the riverine system. No new cumulative impacts to water resources are anticipated from project action.

Short-term, direct, adverse, negligible effects and long-term, direct, adverse, minor effects to WOTUS may occur as a result of Alternative 1. The waterbodies in the LOD, Laurella Creek and the impoundment, will experience temporary disturbance and permanent disturbances from construction activities at the dam embankment area. A cofferdam or other similar device will be installed during construction to maintain the hydrology of the impoundment and associated wetlands. The cofferdam will allow for only the immediate area around the dam to be temporarily drawn down to facilitate construction and repairs, and then removed once work is complete. Permanent impacts to WOTUS are anticipated to occur from: (1) the increase of the normal pool, which will increase the impoundment size by approximately 0.08 acres; and (2) the extension of the downstream toe of the dam and the accompanying principal spillway conduit extension. The impacts to Laurella Creek will be the permanent loss of 33 linear ft of stream. These effects to WOTUS are deemed long-term, direct, adverse, and minor.

This alternative is anticipated to result in short-term, direct, minor, adverse impacts to wetlands. Out of the 5.63-acre LOD, only 0.50 acres are classified as wetlands and may be temporarily

disturbed by project construction work. This includes freshwater emergent and freshwater pond wetlands associated with the impoundment. There is the potential for negligible long-term impacts to wetlands along the edge of the impoundment if some wetlands change from pond wetlands to emergent wetlands.

Wetlands Impacts

	Temporary wetland impacts (acres)	Permanent wetland impacts (acres)	Wetlands created (acres)	Net permanent wetlands impacts (acres)
Alternative 1 LOD	0.50	0	0	0

Alternative 1 is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream from construction related activities. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (i.e., turbidity curtain, silt fence, straw bales, etc.) and are not expected to have lasting negative effects on water quality. Project work is not expected to impact the non-impairment status of the waterbodies. The dam will facilitate trapping sediment and other water particulates for the service life of the rehabilitated structure (i.e., 50 years) once the dam is rehabilitated. Long-term impacts to water quality are deemed direct, negligible, and beneficial. Waterbodies are expected to maintain their existing non-impairment status. The impounded water behind the dam will continue to experience thermal heating.

The water quantity of the dam as defined by the normal pool will be increased because dam rehabilitation is proposing to increase the height of the principal spillway conduit which will increase the normal pool by 0.14 ft.

There will be no effects to wild or scenic rivers or NRI river segments as a result of project work.

There will be no change in the current levels of flood protection downstream as a result of project activity. There are anticipated to be negligible, adverse, short-term, direct impacts to the floodplain area immediately around the dam during construction.

No water resources were identified on or adjacent to the offsite staging area.

Alternatives 2 and 3

Alternatives 2 and 3 are anticipated to have impacts to water resources of similar intensity, duration, and magnitude as Alternative 1. Permanent stream impacts and permanent wetlands impacts are anticipated to be the same as Alternative 1.

Martin Dam

Existing Conditions

Based on the definition of WOTUS, the impoundment, wetlands, and stream are WOTUS (EPA 2019a; USACE 2012). The impoundment is an approximately 2.33-acre freshwater pool and the stream is an approximately 2.5-mile-long tributary of Indian Orchard Brook.

The Lackawaxen River is not currently classified as an impaired stream (EPA 2020).

The reservoir is not used as a potable or agricultural water source, so water quantity is not a concern with regard to these uses. Martin Dam has a flood control storage capacity of approximately 97.4 acre-ft at the ASW crest elevation.

Based on review of the Federal Emergency Management Agency (FEMA) flood insurance rate map for the study area (Panels 42127C0304D and 42127C0308D) effective 16 May 2013, the dam is located in Zone X, an area of minimal flood hazard (FEMA 2020). The area is outside of the 500-year flood level and is not susceptible to a 100-year flood.

FWOFI

Short-term, direct, moderate, adverse impacts and long-term, direct, moderate, adverse impacts will occur to water resources due to the No Action Alternative. The No Action Alternative will also result in cumulative impacts to water resources because the removal of the dam will allow the streams, wetlands, and riparian corridors to return to their natural condition, prior to construction of the original dam.

The constructed breach of the dam will result in the elimination of the 97.4 ac-ft freshwater impoundment, causing short- and long-term, moderate effects to WOTUS. The unnamed stream will naturally re-establish a stream channel through the drained impoundment, creating approximately 773 ft of linear stream channel through the old flood pool within the LOD. The impoundment is currently classified as freshwater pond wetlands (using the Cowardin System), surrounded by fringe freshwater emergent wetlands. After the constructed breach of the dam, the upstream impoundment will be replaced by a stream buffered by approximately 30 ft of freshwater emergent wetlands on either side of the channel (approximately 0.87 acres of freshwater emergent wetlands). Over time, the upland areas adjacent to this new stream channel will slowly change over to an early successional habitat, unless it is maintained as pasture or grazing land. Consequently, the No Action Alternative would result in a permanent net loss of 1.61 acres of total wetlands, after the freshwater pond wetlands are eliminated and replaced with fringe freshwater emergent wetlands and riprap protection is installed. The 0.20 acres of freshwater emergent wetlands along the southern eastern edges of the LOD may experience temporary impacts from disturbance from construction work. The streams and impoundment (WOTUS) are also anticipated to experiences short-term, negligible, adverse impacts from construction work.

Wetlands Impacts

	Temporary wetland impacts (acres)	Permanent wetland impacts (acres)	Wetlands created (acres)	Net permanent wetland impacts (acres)
No Action Alternative LOD	0.74	2.48	0.87	-1.61

The No Action Alternative is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (turbidity curtain) and are not expected to have lasting effects on water quality. Some additional sediments may be transported to surface waters as the natural stream channel re-establishes through the impoundment. There are anticipated to be long-term, direct, adverse, negligible impacts to water quality as the dam will no longer be in place to trap sediment resulting in additional sediment being carried downstream. No exceedances of EPA water quality standards are expected as a result of this alternative.

There will be long-term impacts to water quantity from the No Action Alternative because the dam will no longer be in place, which would eliminate the approximately 97.4 acre-ft flood control storage capacity. The elimination of the impoundment also eliminates the potential for thermal heating of the water upstream of the dam.

There will be no effects to wild or scenic rivers or NRI river segments as a result of project work.

The No Action Alternative will cause long-term, direct, adverse, moderate impacts to floodplain management in the Borough of Honesdale because the current levels of flood protection will be lost after the dam is breached. Because of the loss of flood protection, Wayne County will likely need to request a Letter of Map Revision from FEMA for the downstream floodplains.

Alternative 1

Short-term, direct, negligible and minor, adverse impacts and long-term, direct, negligible, adverse impacts will occur to water resources as a result of Alternative 1. No indirect effects or cumulative effects were identified during analysis. –Adverse cumulative impacts to water resources, which have been ongoing since the original dam construction, will continue to occur after dam rehabilitation. The dam will continue to obstruct the natural flow of the riverine system. No new cumulative impacts to water resources are anticipated from project action.

Short-term, direct, adverse, negligible effects and long-term, direct, adverse, minor effects to WOTUS may occur as a result of Alternative 1. The waterbodies in the LOD, the unnamed stream and the impoundment, will experience temporary and permanent disturbances from construction activities at the dam embankment area. A cofferdam or other similar device will be installed during construction to maintain the hydrology of the impoundment and associated

wetlands. The cofferdam will allow for only the immediate area around the dam to be temporarily drawn down to facilitate construction and repairs, and then removed once work is complete. Permanent impacts to WOTUS are anticipated to occur from: (1) the extension of the upstream embankment into the existing impoundment area from the extension of the downstream toe of the dam and the accompanying principal spillway conduit extension. The impacts to the unnamed tributary will be 58 linear ft of permanent impacts to the stream. These effects to WOTUS are deemed long-term, direct, adverse, and minor. The impacts to the upstream impoundment area are outlined in subsequent paragraphs because the impoundments area is classified as a "freshwater pond wetland" by the Cowardin system.

Alternative 1 is anticipated to result in short-term, direct, minor, adverse and long-term, direct, negligible, adverse impacts to wetlands. Out of the 6.82-acre LOD, 0.96 acres are classified as wetlands and may be temporarily disturbed by project construction work. This includes freshwater emergent wetlands abutting the impoundment and abutting the stream downstream of the dam, and freshwater pond wetlands associated with the impoundment. Short-term wetlands impacts are expected to be minor and adverse. The construction of the berm and extension of the upstream embankment toe of the dam is anticipated to cause long-term, minor, adverse impacts to 0.10 acres of freshwater emergent wetlands and 0.12 acres of freshwater pond wetlands.

Wetlands Impacts

	Temporary wetland impacts (acres)	**Permanent wetland impacts (acres)**	**Wetlands created (acres)**	**Net permanent wetland impacts (acres)**
Alternative 1 LOD	0.74	0.22	0	-0.22

Alternative 1 is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream from construction related activities. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (i.e., turbidity curtain, silt fence, straw bales, etc.) and are not expected to have lasting negative effects on water quality. Project work is not expected to impact the non-impairment status of the waterbodies. The dam will facilitate trapping sediment and other water particulates for the service life of the rehabilitated structure (i.e., 100 years) once the dam is rehabilitated. Long-term impacts to water quality are deemed direct, negligible, and beneficial. Waterbodies are expected to maintain their existing non-impairment status. The impounded water behind the dam will continue to experience thermal heating.

There will be no effects to water quantity because the design will keep the same principal spillway conduit elevation which is the controlling factor for the impoundment size. There will be no effects to wild or scenic rivers or NRI river segments as a result of project work.

There will be no change in the current levels of flood protection downstream due to project activity. There are anticipated to be short-term, negligible, adverse, direct impacts to the floodplain area immediately around the dam during construction.

No water resources were identified on or adjacent to the offsite staging area.

Alternative 2
Alternative 2 is anticipated to have impacts to water resources of similar intensity, duration, and magnitude as Alternative 1. However, with Alternative 2, the extension of the downstream toe of the dam and the accompanying principal spillway conduit extension will result in 45 linear ft of permanent impacts to the unnamed stream. Permanent impacts to the impoundment and wetlands will be from the construction of the berm and extension of the upstream embankment toe of dam, which will permanently impact 0.10 acres of freshwater emergent wetlands and 0.12 acres of freshwater pond wetlands (the impoundment) (same wetland impacts as Alternative 1).

Alternative 3
Alternative 3 is anticipated to have impacts to water resources of similar intensity, duration, and magnitude as Alternative 1. However, with Alternative 3, the extension of the downstream toe of the dam and the accompanying principal spillway conduit extension will result in 45 linear ft of permanent impacts to the unnamed stream. Permanent impacts to the impoundment and wetlands will be from the construction of the berm and extension of the upstream embankment toe of dam, which will permanently impact 0.10 acres of freshwater emergent wetlands and 0.12 acres of freshwater pond wetlands (the impoundment) (same wetland impacts as Alternative 1).

Finkleday Dam
Existing Conditions
Based on the definition of WOTUS, the impoundment, wetlands, and Indian Orchard Brook are WOTUS (EPA 2019a, USACE 2012). The impoundment is an approximately 5.6-acre freshwater pool and Indian Orchard Brook is an approximately 5-mile-long tributary of the Lackawaxen River.

There are no impaired water bodies in the LOD.

The water bodies in the LOD do not provide a human or agricultural water source. The reservoir surface area is stable as are the tributary streams. Finkleday Dam has a flood control storage capacity of approximately 140.1 acre-ft at the ASW crest elevation.

The project area is located in FEMA Zone A. Finkleday is one of seven dams built to reduce flood damages in the Lackawaxen watershed. The area is flooded by the one percent annual flood event. FEMA has not conducted hydraulic analysis to determine the base flood elevation. The offsite staging area is located in Zone X, an area of minimal flood hazard (FEMA 2020).

FWOFI
Future Without Federal Investment:
Short-term, direct, moderate, adverse impacts and long-term, direct, moderate, adverse impacts are anticipated to occur to water resources as a result of the No Action Alternative. The No

Action Alternative will also result in cumulative impacts to water resources because the removal of the dam will allow the streams, wetlands, and riparian corridors to return to their natural condition, prior to construction of the original dam.

The constructed breach of the dam will result in the elimination of the 5.6-acre freshwater impoundment, causing short- and long-term, moderate effects to WOTUS. Indian Orchard Brook will naturally re-establish through the stream channel, creating approximately 1,048 linear ft of stream in the LOD. The impoundment is currently classified as freshwater pond wetlands (using the Cowardin System), surrounded by fringe freshwater emergent wetlands. After the constructed breach of the dam, the upstream impoundment will be replaced by a stream buffered by approximately 30 ft of freshwater emergent wetlands on either side of the channel (approximately 1.24 acres of freshwater emergent wetlands). Over time, the upland areas adjacent to this new stream channel will slowly change over to an early successional habitat, unless they are maintained a pasture or grazing land. The installation of riprap protection along the dam embankment would permanently impact 0.01 acres of freshwater forested wetlands downstream of the dam. Consequently, the No Action Alternative would result in a permanent net loss of 4.17 acres of total wetlands, after the freshwater pond wetlands are eliminated and replaced with fringe freshwater emergent wetlands and riprap protection is installed.

Wetlands Impacts

	Temporary wetland impacts (acres)	**Permanent wetland impacts (acres)**	**Wetlands created (acres)**	**Net permanent wetlands impacts (acres)**
No Action Alternative LOD	0.01	5.41	1.24	-4.17

The No Action Alternative is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (i.e. turbidity curtain, straw bales, etc.) and are not expected to have lasting effects on water quality. Some additional sediments may be transported to surface waters as the natural stream channel re-establishes through the impoundment. There are anticipated to be long-term, direct, adverse, negligible impacts to water quality as the dam will no longer be in place to trap sediment resulting in additional sediment being carried downstream.

There will be long-term impacts to water quantity from the No Action Alternative because the dam will no longer be in place, which would eliminate the approximately 5.6-acre impoundment and the 7.4-acre-ft volume of the normal pool. The elimination of the impoundment also eliminates the potential for thermal heating of the water upstream of the dam.

There will be no effects to wild or scenic rivers as a result of project work.

The No Action Alternative is anticipated to result in long-term, direct, adverse, moderate impacts to floodplain management in the Borough of Honesdale because the current levels of flood protection will be lost after the dam is breached.

Alternative 1

Short-term, direct, negligible and minor, adverse impacts; and long-term, direct, negligible, adverse impacts will occur to water resources as a result of Alternative 1. No indirect effects were identified during analysis. Adverse cumulative impacts to water resources, which have been ongoing since the original dam construction, will continue to occur after dam rehabilitation. The dam will continue to obstruct the natural flow of the riverine system. No new cumulative impacts to water resources are anticipated from project action.

Short-term, direct, adverse, negligible effects and long-term, direct, adverse, minor effects to WOTUS may occur as a result of Alternative 1. The waterbodies in the LOD, Indian Orchard Brook and the impoundment, will experience temporary and permanent disturbances from construction activities at the dam embankment area. A cofferdam or other similar device will be installed during construction to maintain the hydrology of the impoundment. The cofferdam will allow for only the immediate area around the dam to be drawn down to facilitate construction and repairs, and then removed once work is complete. Permanent impacts to WOTUS are anticipated to occur from the extension of the downstream toe of the dam and the accompanying principal spillway conduit extension. The impacts to Indian Orchard Brook will be 25 linear ft of permanent impacts to the stream. This effect to WOTUS is deemed long-term, direct, adverse, and minor.

Alternative 1 is anticipated to result in short-term, direct, minor, adverse impacts to wetlands. Out of the 7.2-acre LOD, only 0.44 acres are classified as wetlands and may be temporarily disturbed by project construction work. This includes freshwater forested wetlands immediately south of the Dam, abutting Indian Orchard Brook, and freshwater pond and emergent wetlands associated with the impoundment. Since none of the construction sequencing will occur within the onsite wetlands, no permanent effects to wetlands are expected to occur.

Wetlands Impacts

	Temporary wetland impacts (acres)	**Permanent wetland impacts (acres)**	**Wetlands created (acres)**	**Net permanent wetlands impacts (acres)**
Alternative 1 LOD	0.44	0	0	0

Alternative 1 is anticipated to result in short-term, direct, negligible, adverse impacts to water quality. Construction work may temporarily impact water quality by increasing the total suspended solid loads and turbidity of the impoundment and stream from construction related activities. These potential impacts are anticipated to be mitigated through the implementation of practices such as soil stabilization and sediment and erosion controls (i.e., turbidity curtain, silt fence, straw bales, etc.) and are not expected to have lasting negative effects on water quality. The dam will facilitate in trapping sediment and other water particulates for the service life of the rehabilitated structure (i.e., 100 years) once the dam is rehabilitated. Long-term impacts to

water quality are deemed direct, negligible, and beneficial. Waterbodies are expected to maintain their non-impairment status. The impounded water behind the dam will continue to experience thermal heating.

There will be no effects to water quantity because the design will keep the same principal spillway conduit elevation which is the controlling factor for the impoundment size. There will be no effects to wild or scenic rivers or NRI river segments as a result of project work.

There will be no change in the current levels of flood protection downstream as a result of project activity. There are anticipated to be short-term, negligible, adverse, direct impacts to the floodplain area during construction.

No water resources were identified on or adjacent to the offsite staging area.

Alternative 2

This alternative is anticipated to have impacts to water resources of similar intensity, duration, and magnitude as Alternative 1. However, the LOD for Alternative 2 does not include the additional access road to the toe of the ASW, resulting in 0.02 acres fewer impacts (temporary) to freshwater forested wetlands. This alternative will permanently impact the length of stream by 25 linear ft because of the extension of the principal spillway conduit downstream of the dam.

Wetlands Impacts

	Temporary wetland impacts (acres)	Permanent wetland impacts (acres)	Wetlands created (acres)	Net permanent wetlands impacts (acres)
Alternative 2 LOD	0.42	0	0	0

Alternative 3

Alternative 3 is anticipated to have impacts to water resources of similar intensity, duration, and magnitude as Alternative 1. This alternative will permanently impact the length of stream by 25 linear ft because of the extension of the principal spillway conduit downstream of the dam. Impacts to wetlands are anticipated to be the same as Alternative 1.

Regional Water Resource Plans (including Coastal Zone Management Areas)

None of the projects in the watershed area are located in a designated coastal zone management area and no other Regional Water Resource Plans exist in the area.

Climate

The impacts to climate discussed in the following apply to all alternatives of all projects in this plan. Hydrocarbons and other greenhouse gas emissions have a great impact on climate change. This project is small in scale compared to construction of a highway or large building complex. The period of contribution (the construction period) is relatively short, being one year or less. The contributing forces being heavy equipment operation is minimal in terms of the number of pieces of equipment mobilized for the project. For these reasons it is expected that there will not be a significant impact on the climate from any of the project actions.

The climate change resiliency of the project areas will be enhanced by climate change hardy plant species being used for critical area seeding after construction is complete. Resiliency to climate change is also provided by the rehabilitated structures mitigating damages from flood causing storms.

Air Quality

Existing Conditions (This text applies to all dams)

National Ambient Air Quality Standards (NAAQS) pollutants include carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead. There are several air monitoring stations throughout Pennsylvania. There are no non-attainment zones in Wayne County for any of the NAAQS (EPA 2019a). As all concentrations in the area are below the standards, Garrett Dam is located in an attainment area.

Greenhouse gases (GHGs) include carbon dioxide, methane, nitrous oxide, and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (EPA 2016). Except for routine maintenance at the dam site, including grass mowing, there are no emissions sources at the dam site. GHG emission standards are being met at the Site.

Short-term, direct, negligible, adverse impacts to air quality are anticipated from all of the alternatives. The project will involve the use of heavy diesel and gasoline machinery, as well as trucking of project equipment and materials. This will result in a temporary increase in GHG emissions, which have the potential to adversely impact air quality. Trucking of materials and equipment to and from the site will also result in the temporary generation of particulate matter associated with driving trucks on dirt roads. Project work is not anticipated to affect the attainment status of the area. As no permanent sources of emissions will be created, the project is not anticipated to have long-term or cumulative effects on ambient air quality or local GHG emissions.

Plants

Existing Conditions (This text applies to all dams)

There are not any federally threatened or endangered plant species in the respective LOD. There are no DCNR critical habitat areas in or directly adjacent to the LOD.

There have been no noxious weeds or invasive species mapped on the iMapInvasives interactive web map within the respective LOD (Pennsylvania iMapInvasives 2020). However, some small areas of Common reed (*Phragmites australis*), which is a DCNR Rank 1 invasive plant species, was observed in the LOD in the areas identified as freshwater pond and freshwater emergent wetlands.

A healthy resilient ecosystem is not achieved with the FWOFI alternative because of the following ecological impacts:

- A mature biodiverse ecosystem is not allowed to develop.
- The runoff storage capacity is reduced due to its early seral stage condition.
- The immature nature of the ecosystem reduces its ability recover from an environmental event.

The alternatives which involve rehabilitation of a dam will promote a healthy resilient ecosystem for the following reasons:

- A mature biodiverse ecosystem is allowed to develop.
- The runoff storage capacity is maintained due to the retention of a mature biodiverse ecosystem.
- The mature nature of the ecosystem facilitates its ability recover from an environmental event.

Garrett Dam

Existing Conditions

Within the LOD, there are currently approximately 75 linear ft of stream (Holbert Creek) with riparian zones buffering each side.

FWOFI

Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from the No Action Alternative. No indirect effects were identified during analysis.

Long-term and cumulative, minor, beneficial impacts to vegetation at the dam embankment (maintained grass) will be permanently impacted from the excavation of the dam (approximately 0.30 acres). The current grassed vegetation will be replaced by riverine and riparian vegetation after Holbert Creek naturally re-establishes through the stream channel and covered with riprap protection. The impoundment area is also expected to fill in with riverine, riparian, freshwater wetlands, and upland vegetation. After the stream naturally re-establishes through the impoundment, it is estimated that there will be 984 linear ft of stream in the LOD, with riparian areas buffering each side. Cumulative beneficial impacts are anticipated to include soil stabilization, creation of a vegetated riparian corridor, and nutrient reduction.

Short-term, adverse, minor impacts to vegetation throughout the rest of the LOD will occur from the movement of construction vehicles and placement of equipment. The ASW vegetation will be disturbed by the placement of the excavated embankment material atop the spillway including the freshwater emergent wetland vegetation.

The PNDI Environmental Review Report indicated that there are no known impacts to threatened and endangered plant species in the project area. The PNDI report is included in the Administrative Record.

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT best management practices (BMPs) will be implemented.

A healthy resilient ecosystem is not achieved with this alternative because of the following ecological impacts:

- A mature biodiverse ecosystem is not allowed to develop.
- The runoff storage capacity is reduced due to its early seral stage condition.

- The immature nature of the ecosystem reduces its ability recover from an environmental event.

Alternative 1 (NEE)

Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from Alternative 1. No indirect effects were identified during analysis. Cumulative impacts to plants and vegetation that occurred as a result of construction of the original dam will continue to occur with this alternative. No new or additional cumulative impacts were identified from this alternative.

The majority of the land cover within the LOD is classified as deciduous forest and pasture/hay by the NLCD. Vegetation in the LOD will experience short-term impacts from construction work in the dam embankment area. It is estimated that a maximum of approximately 0.40 acres of trees will need to be cleared for construction, particularly along the access route from the staging area to the dam, and along the southern area of the existing ASW. However, trees will only be cleared as necessary to facilitate construction. Once construction is complete, the site will be regraded and seeded, and the natural succession of the vegetation will re-establish the site where allowable.

Additionally, the movement of construction vehicles throughout the LOD may disturb underlying vegetation; the construction team will utilize mapped access routes to limit the amount of vegetation disturbed. Any areas disturbed by vehicles and equipment staging or compacted by heavy equipment will be regraded and revegetated with an appropriate native seed mix or native plantings to the maximum extent practicable. The staging and access area is a cleared grassed area, classified as pasture/hay. The staging of equipment on this land is not anticipated to cause any long-term impacts, but it is anticipated that the area will be scraped of topsoil for staging, but then regraded and replanted post construction.

The ASW, which is currently grassed, will experience long-term impacts from the construction of the RCC spillway and the RCC cutoff wall, impacting approximately 0.33 acres of vegetation. The entirety of the RCC ASW will be covered with topsoil and replanted with native grass post-construction. Impacts to wetland vegetation in the ASW is discussed in Section 3.8.

Riparian areas, which buffer Holbert Creek (approximately 75 linear ft in the LOD), exist downstream of the dam. Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment, such as the installation of new toe drains and the construction of a new impact basin. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 35 ft due to the extension of the principal spillway conduit at the downstream end of the dam.

The PNDI Environmental Review Report indicated that there are no known impacts to threatened and endangered plant species in the project area.

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT BMPs will be implemented.

Alternative 2
Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 2 are expected to be similar to those of Alternative 1. The installation of the labyrinth weir is only expected to permanently impact 0.22 acres of grassland in the ASW. It is anticipated that there will be additional impacts to the vegetated land in the ASW due to the excavation required for the approach channel and outlet channel. The length of the riparian corridor in the LOD is not anticipated to be impacted with this Alternative.

Alternative 3
Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 3 are expected to be similar to those of Alternative 1. The installation of the labyrinth weir is expected to permanently impact 0.45 acres of grassland in the ASW. It is also anticipated that there will be additional impacts to the vegetated land in the ASW due to the excavation required for the approach channel and outlet channel. The length of the riparian corridor in the LOD is not anticipated to be impacted with this Alternative.

Varcoe Dam
Existing Conditions
Within the LOD, there are approximately 210 ft of stream with riparian zones buffering each side.

FWOFI
Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from the No Action Alternative. No indirect effects were identified during analysis.

Long-term and cumulative, minor, beneficial impacts to vegetation at the dam embankment (maintained grass) will be permanently impacted from the excavation of the dam (approximately 0.17 acres). The current grassed vegetation will be replaced by riverine and riparian vegetation after Laurella Creek naturally re-establishes through the stream channel and covered with riprap protection. The impoundment area is also expected to fill in with riverine, riparian, freshwater wetlands, and upland vegetation. After the stream naturally re-establishes, through the impoundment, it is estimated that there will be 1,680 ft of stream in the LOD, with riparian areas buffering each side. Cumulative beneficial impacts are anticipated to include soil stabilization, creation of a vegetated riparian corridor, and nutrient reduction.

Short-term, adverse, minor impacts to vegetation throughout the rest of the LOD will occur from the movement of construction vehicles and placement of equipment. The ASW vegetation will be disturbed by the placement of the excavated embankment material atop the spillway.

The PNDI Environmental Review Report indicated that there are no known impacts to threatened and endangered plant species in the project area.

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT BMPs will be implemented.

Alternative 1

Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from Alternative 1. No indirect effects were identified during analysis. Cumulative impacts to plants and vegetation that occurred as a result of construction of the original dam will continue to occur with this alternative. No new or additional cumulative impacts were identified from this alternative.

The majority of the land cover within the LOD is classified as deciduous forest and grassland/herbaceous by the NLCD. Vegetation in this area will experience short-term impacts due to construction work. Trees will only be cleared as necessary to facilitate construction (maximum 2.20 acres), particularly in the staging and access area. Once construction is complete, the site will be reseeded, and the natural succession of the forest will be allowed to re-establish on the site.

The ASW, which is currently grassed, will be permanently disturbed by the construction of the ACB exit channel and reinforced cutoff wall, impacting approximately 0.50 acres of grassed vegetation, classified as pasture/hay. However, vegetation will be able to grow among the spacing between the ACBs, minimizing permanent vegetation impacts.

The movement of construction vehicles throughout the LOD may disturb underlying vegetation; the construction team will utilize mapped access routes to limit the amount of vegetation disturbed. Any areas disturbed by vehicles and equipment staging or compacted by heavy equipment will be regraded and revegetated with an appropriate native seed mix or native plantings to the maximum extent practicable post construction.

Riparian areas, which buffer Laurella Creek (approximately 210 ft in the LOD), exist downstream of the dam. Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment, such as the installation of new toe drains. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 33 ft due to the extension of the principal spillway conduit at the downstream end of the dam.

Vegetation in the offsite staging area, primarily classified as grassland/herbaceous, will be temporarily disturbed by the stockpiling of equipment and materials and movement of construction vehicles. However, this area is already used as a staging area and there is little established vegetation; therefore, any adverse impacts to vegetation, short- or long-term, are expected to be negligible.

The PNDI Environmental Review Report indicated that there are no known impacts to threatened and endangered plant species in the project area.

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT BMPs will be implemented.

Alternative 2

Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 2 are expected to be similar to those of Alternative 1 because both involve similar construction activities. However, vegetation impacts at the ASW will differ because the RCC ASW will cover all existing vegetation along the ASW, impacting around 0.52 acres of vegetation, classified as pasture/hay. Post-construction, the entirety of the RCC slope, including the side slopes will be covered with topsoil and reseeded with native plants. The length of riparian corridor in the LOD is expected to be permanently reduced by 33 ft because of the extension of the principal spillway conduit at the downstream end of the dam.

Alternative 3

Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 3 are expected to be similar to those of Alternative 1 because both involve similar construction activities. There will be slightly more impacts to vegetation because the ASW will be widened by 15 ft, increasing the amount of impacted vegetation to 0.58 acres. Short- and long-term impacts are still expected to be negligible. The length of riparian corridor in the LOD is expected to be permanently reduced by 33 ft because of the extension of the principal spillway conduit at the downstream end of the dam.

Martin Dam

Existing Conditions

Within the LOD, there are currently approximately 300 ft of stream with riparian zones buffering each side.

FWOFI

Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from the No Action Alternative. No indirect effects were identified during analysis.

Long-term and cumulative, minor, beneficial impacts to vegetation at the dam embankment (maintained grass) will be permanently impacted from the excavation of the dam (approximately 0.28 acres). The current grassed vegetation will be replaced by riverine and riparian vegetation after the stream naturally re-establishes through the stream channel and is covered with riprap protection. The impoundment area is also expected to fill in with riverine, riparian, freshwater wetlands, and upland vegetation. After the stream naturally re-establishes, through the impoundment, it is estimated that there will be 773 linear ft of stream in the LOD, with riparian areas buffering each side. Cumulative beneficial impacts are anticipated to include soil stabilization, creation of a vegetated riparian corridor, and nutrient reduction.

Short-term, adverse, minor impacts to vegetation throughout the rest of the LOD will occur from the movement of construction vehicles and placement of equipment. The ASW vegetation will be disturbed by the placement of the excavated embankment material atop the spillway.

The PNDI Environmental Review Report indicated that there are no known impacts to threatened and endangered plant species in the project area. The PNDI report is included in

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT BMPs will be implemented.

Alternative 1

Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from Alternative 1. No indirect effects were identified during analysis. Cumulative impacts to plants and vegetation that occurred as a result of construction of the original dam will continue to occur with this alternative. No new or additional cumulative impacts were identified from this alternative.

The majority of the land cover within the LOD is classified as pasture/hay by NLCD. Vegetation in this area will experience short-term impacts due to construction work. Trees will only be cleared as necessary to facilitate construction (maximum 1.25 acres), particularly immediately west of the ASW and east of the dam crest. Once construction is complete, the site will be reseeded, and the natural succession of the forest will be allowed to re-establish the site, where allowable.

The ASW, which is currently grassed, will be permanently disturbed by the construction of the RCC ASW, RCC stepped chute, RCC apron, and reinforced concrete cutoff wall, impacting approximately 0.27 acres of grassed vegetation, classified as pasture/hay. The flattening of the downstream backslope will temporarily disturb the grassed vegetation in that location. On the downstream side, the installation of the berm and flattening of the slope is expected to increase the amount of vegetation cover by approximately 0.12 acres.

The movement of construction vehicles throughout the LOD may disturb underlying vegetation; the construction team will utilize mapped access routes to limit the amount of vegetation disturbed. Any areas disturbed by vehicles and equipment staging or compacted by heavy equipment will be regraded and revegetated with an appropriate native seed mix or native plantings to the maximum extent practicable.

Riparian areas, which buffer the unnamed stream (approximately 300 ft in the LOD), exist downstream of the dam. Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment, such as the installation of new toe drains and construction of a new impact basin. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 58 ft due to the extension of the principal spillway conduit at the downstream end of the dam.

Vegetation in the offsite staging area, primarily classified as pasture/hay, will be temporarily disturbed by the stockpiling of equipment and materials and movement of construction vehicles. However, this area is already used as a staging area and there is little established vegetation; therefore, any adverse impacts to vegetation, short- or long-term, are expected to be negligible.

The PNDI Environmental Review Report indicated that there are no known impacts to threatened and endangered plant species in the project area.

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT BMPs will be implemented.

Alternative 2

Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 2 are expected to be similar to those of Alternative 1. The installation of the labyrinth weir, RCC ASW, RCC stepped chute, and RCC apron is expected to permanently impact around 0.28 acres of grassland (classified as pasture/hay) in the ASW. However, it is anticipated that there will be additional impacts to the vegetated land in the ASW due to the excavation required for the approach channel (approximately 0.12 acres). The length of riparian corridor in the LOD is expected to be permanently reduced by 45 ft because of the extension of the principal spillway conduit at the downstream end of the dam.

Alternative 3

Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 3 are expected to be similar to those of Alternative 1. However, the installation of the Ogee weir, RCC ASW, RCC stepped chute, and RCC apron is expected to permanently impact 0.37 acres of grassland (classified as pasture/hay) in the ASW. It is also anticipated that there will be additional impacts to the vegetated land in the ASW due to the excavation required for the approach channel (approximately 0.17). The length of riparian corridor in the LOD is expected to be permanently reduced by 45 ft because of the extension of the principal spillway conduit at the downstream end of the dam.

Finkleday Dam

Existing Conditions:

Riparian habitat exists in the transitional areas generally defined by topography, between uplands and watercourses adjacent to Indian Orchard Brook. Within the LODs, there are currently approximately 110 ft of stream (Indian Orchard Brook) with riparian zones buffering each side. No riparian areas were identified in the offsite staging area.

FWOFI

Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from the No Action Alternative. No indirect effects were identified during analysis.

Long-term and cumulative, minor, beneficial impacts to vegetation at the dam embankment (maintained grass) will be permanently impacted from the excavation of the dam (approximately 0.25 acres). The current grassed vegetation will be replaced by riverine and riparian vegetation after Indian Orchard Brook naturally re-establishes through the stream channel and will be covered with riprap protection. The impoundment area is also expected to fill in with riverine, riparian, freshwater wetlands, and upland vegetation. After the stream naturally re-establishes

through the impoundment, it is estimated that there will be an approximately 1,048 ft long riparian corridor in the LOD. Cumulative beneficial impacts are anticipated to include soil stabilization, creation of a vegetated riparian corridor, and nutrient reduction.

No impacts to special status plant species (endangered and threatened species) are anticipated as there are no confirmed occurrences in the LOD. However, this will be confirmed through consultation with PNHP. To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). It is not anticipated that excavation will occur in the areas where common reed was observed.

The PNDI Environmental Review report indicated that the endangered plant species Torrey's Bulrush (*Schoenoplectus torreyi*) may be present in the LOD. Upon further review DCNR determined that no impact to the species is likely based on the immediate location, resource location, and the nature of the project.

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT BMPs will be implemented.

Alternative 1

Short-term, direct, minor, adverse impacts and long-term, direct, minor, adverse impacts to terrestrial vegetation will result from Alternative 1. No indirect effects were identified during analysis. Cumulative impacts to plants and vegetation that occurred as a result of construction of the original dam will continue to occur with this alternative. No new or additional cumulative impacts were identified from this alternative.

The majority of the land cover within the LOD is classified as deciduous forest and grassland/herbaceous by the NLCD. Vegetation in the LOD will experience short-term impacts from construction work in the dam embankment area. It is estimated that a maximum of approximately 3.88 acres of trees will need to be cleared for construction, particularly along the homeowner's access road, the southern access route, and along the eastern edge of the ASW. Trees will only be cleared as necessary to facilitate construction. Once construction is complete, the site will be regraded and seeded, and the natural succession of the vegetation will re-establish on the site where allowable.

Additionally, the movement of construction vehicles throughout the LOD may disturb underlying vegetation; the construction team will utilize mapped access routes to limit the amount of vegetation disturbed. Any areas disturbed by vehicles and equipment staging or compacted by heavy equipment will be regraded and revegetated with an appropriate native seed mix or native plantings to the maximum extent practicable.

The ASW, which is currently grassed, will experience long-term impacts from the construction of the ACB exit channel and the RCC cutoff wall, impacting approximately 0.36 acres of vegetation. However, vegetation will be able to grow among the spacing between the ACBs,

minimizing permanent vegetation impacts. The entirety of the ASW will be replanted with native grass post-construction.

Riparian areas, which buffer Indian Orchard Brook, exist downstream of the dam. Short-term impacts to riparian zones may occur as a result of construction work near the dam embankment, such as the installation of new toe drains. Long-term, direct, adverse, minor impacts are anticipated to occur to riparian areas because the length of riparian corridor in the LOD is expected to be permanently reduced by 25 ft due to the extension of the principal spillway conduit at the downstream end of the dam.

Vegetation in the offsite staging area, primarily classified as grassland/herbaceous, will be temporarily disturbed by the stockpiling of equipment and materials and movement of construction vehicles. However, this area is already used as a staging area and there is little established vegetation; therefore, any adverse impacts to vegetation, short- or long-term, are expected to be negligible.

The PNDI Environmental Review report indicated that the endangered plant species Torrey's Bulrush (*Schoenoplectus torreyi*) may be present in the LOD. Upon further review DCNR determined that no impact to the species is likely based on the immediate location, resource location, and the nature of the project.

To prevent the spread of the invasive plant species common reed, PennDOT recommends avoiding excavation in areas containing the invasive plant (PennDOT 2014). If areas of common reed are impacted, the PennDOT BMPs will be implemented.

Alternative 2

Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 2 are expected to be similar to those of Alternative 1 because both involve similar construction activities. Slightly fewer impacts to vegetation are expected from Alternative 2 because this alternative does not require an access to the toe of the ASW. This reduces the maximum acreage of trees that may need to be cleared to facilitate access to the site to 1.98 acres. Additionally, the secant pile cutoff wall does not extend as far as the RCC cutoff wall associated with Alternative 1, impacting 0.35 acres of vegetation in the ASW. The length of riparian corridor in the LOD is expected to be permanently reduced by 25 ft because of the extension of the principal spillway conduit at the downstream end of the dam.

Alternative 3

Short-term, long-term, and cumulative terrestrial vegetation impacts from Alternative 3 are expected to be similar to those of Alternative 1. However, vegetation impacts at the ASW will differ because the RCC ASW will cover all existing vegetation along the ASW (0.35 acres). Post-construction, the entirety of the RCC slope, including the side slopes will be covered with topsoil and reseeded with native plants. The length of riparian corridor in the LOD is expected to be permanently reduced by 25 ft because of the extension of the principal spillway conduit at the downstream end of the dam.

Animals

Existing Conditions (This text applies to all dams)

The USFWS IPaC report returned two federally threatened mammal species as potentially present in the LOD: the Indiana bat (*Myotis sodalis*) and the Northern long-eared bat (*Myotis septentrionalis*) (USFWS 2020). Wayne County contains 1 reptile listed species, 3 listed bird species, and 2 listed mammal species (PNHP 2019c) but none identified in the LOD. There is no Natural Heritage Area Core Habitat in the LOD. There have been no nesting eagles observed within the LOD. A number of migratory birds may pass through the LOD but none of the USFWS Birds of Conservation Concern have been observed.

Garrett Dam

FWOFI

Short-term, direct, minor, adverse impacts to fish and wildlife and long-term, direct, moderate, beneficial impacts to fish and wildlife are expected from the No Action Alternative. No significant indirect are anticipated from this alternative.

This alternative is anticipated to result in short-term, minor, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Some forested areas, likely used by wildlife species as habitat, may need to be removed along the eastern border of the LOD. Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

Long-term and cumulative, moderate, beneficial impacts to wildlife species are also expected to occur because removal of the impoundment will create additional vegetated areas that wildlife can use for foraging while still providing water and wetlands within the new riparian corridor, which will establish in the drained flood pool. Long-term adverse effects to wildlife species will occur from the removal of the impoundment and the adjacent foraging areas; however, it is anticipated that the restoration of the site to a pre-impoundment undisturbed condition will outweigh these impacts. Cumulative beneficial impacts are anticipated to include increased wildlife diversity from the expanded habitat.

There have not been any Northern long-eared bats or Indiana bats identified inhabiting the site and the project is anticipated to have no effect or not likely to adversely affect those species. A consultation letter describing project action was submitted to the USFWS on 3 December 2021. The PNDI Environmental Review report indicated that there are no known impacts to state listed species. To eliminate any possible impacts to bat species, tree cutting (of trees greater than 3-in. diameter in breast height) will occur outside of the Northern long-eared bat and Indiana bat pup season (1 June to 31 July). Project work is not anticipated to result in adverse effects to federally or state listed animal species.

There are no known occurrences of bald or golden eagle nesting areas in the LOD. The closest bald eagle nest is 1.5 miles to 3.5 miles away, depending on the dam site. Invasive species are not known to exist in the LOD. Migratory birds may be temporarily impacted by the obstruction of foraging habitat during construction work. However, there is a similar suitable habitat in the immediate vicinity that could be used by these species during construction. As such, impacts to bald and golden eagles and migratory birds is considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in long-term effects to bald or golden eagles.

Long-term, minor, adverse impacts to warmwater fish species are anticipated to occur because the No Action Alternative will result in the removal of the impoundment, which warmwater species are currently anticipated to inhabit. Long-term, moderate, beneficial impacts to cold-water fish species (i.e. trout) will also result from this Alternative. The removal of the dam embankment will remove the existing barrier to fish species, particularly trout, who inhabit Holbert Creek. The removal of this barrier has the potential to allow naturally reproducing trout populations to reach historically accessible spawning areas, habitat, and historically isolated genetic populations. This is considered a beneficial cumulative impact to cold water fish species.

Alternative 1 (NEE)

Short-term, direct, minor, adverse impacts to fish and wildlife and long-term, direct, negligible, adverse impacts to wildlife are expected from Alternative 1. No indirect effects or cumulative effects were identified during analysis that on their own or in combination with other events could cause adverse or beneficial impacts resulting from the project.

Alternative 1 is anticipated to result in direct, short-term, adverse, negligible impacts to fish species because construction work around the principal spillway riser will be contained within a sheet pile enclosure or cofferdam that will not require the draining of the impoundment. It is anticipated that the installation of the water control structure will temporarily displace fish during installation, and from the draining of the area around the riser during construction. Fish can relocate to other undisturbed locations in the impoundment during project work. No impact to fish species diversity within the impoundment or stream is expected.

Alternative 1 is anticipated to result in short-term, minor, adverse impacts and long-term, negligible, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Some forested areas, likely used by wildlife species as habitat, may need to be removed along the eastern border of the LOD. Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

There have not been any Northern long-eared bats or Indiana bats identified inhabiting the site and the project is anticipated to have no effect or not likely to adversely affect those species. A consultation letter describing project action was submitted to the USFWS on 3 December 2021.

The PNDI Environmental Review report indicated that there are no known impacts to state listed species. To eliminate any possible impacts to bat species, tree cutting (of trees greater than 3-in. diameter in breast height) will occur outside of the Northern long-eared bat and Indiana bat pup season (1 June to 31 July). Project work is not anticipated to result in adverse effects to federally or state listed animal species.

There are no known occurrences of bald or golden eagle nesting areas in the LOD. The closest bald eagle nest is 1.5 miles to 3.5 miles away, depending on the dam site. Invasive species are not known to exist in the LOD. Migratory birds may be temporarily impacted by the obstruction of foraging habitat during construction work. However, there is a similar suitable habitat in the immediate vicinity that could be used by these species during construction. As such, impacts to bald and golden eagles and migratory birds is considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in long-term effects to bald or golden eagles.

Alternative 2
Short-term, long-term, and cumulative impacts to fish and wildlife, threatened and endangered species, invasive species, migratory birds, and bald and golden eagles are expected to be of the same as Alternative 1.

Alternative 3
Short-term, long-term, and cumulative impacts to fish and wildlife, threatened and endangered species, invasive species, migratory birds, and bald and golden eagles are expected to be of the same as Alternative 1.

Varcoe Dam
FWOFI
Short-term, direct, minor, adverse impacts to fish and wildlife and long-term, direct, moderate, beneficial impacts to fish and wildlife are expected from the No Action Alternative. No indirect effects were identified during analysis.

This alternative will result in short-term, minor, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Some forested areas, likely used by wildlife species as habitat, will also need to be removed in the staging and access areas to allow access to the site. Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

Long-term and cumulative, moderate, beneficial impacts to wildlife species are also expected to occur because removal of the impoundment will create additional vegetated areas that wildlife can use for foraging while still providing water and wetlands within the new riparian corridor which will establish in the drained flood pool. Long-term adverse effects to wildlife species will

occur from the removal of the impoundment and the adjacent foraging areas; however, it is anticipated that the restoration of the site to a pre-impoundment undisturbed condition will outweigh these impacts. Cumulative beneficial impacts are anticipated to include increased wildlife diversity from the expanded habitat.

There have not been any Northern long-eared bats or Indiana bats identified inhabiting the site and the project is anticipated to have no effect or not likely to adversely affect those species. A consultation letter describing project action was submitted to the USFWS on 3 December 2021. The PNDI Environmental Review report indicated that there are no known impacts to state listed species. To eliminate any possible impacts to bat species, tree cutting (of trees greater than 3-in. diameter in breast height) will occur outside of the Northern long-eared bat and Indiana bat pup season (1 June to 31 July). Project work is not anticipated to result in adverse effects to federally or state listed animal species.

There are no known occurrences of bald or golden eagle nesting areas in the LOD. The closest bald eagle nest is 1.5 miles to 3.5 miles away, depending on the dam site. Invasive species are not known to exist in the LOD. Migratory birds may be temporarily impacted by the obstruction of foraging habitat during construction work. However, there is a similar suitable habitat in the immediate vicinity that could be used by these species during construction. As such, impacts to bald and golden eagles and migratory birds is considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in long-term effects to bald or golden eagles.

Long-term, moderate, adverse impacts to warmwater fish species are anticipated to occur because the No Action Alternative will result in the removal of the impoundment, which warm water species are currently anticipated to inhabit. Long-term, moderate, beneficial impacts to cold-water fish species (i.e., trout) will also result from this Alternative. The removal of the dam embankment will remove the existing barrier to fish species who inhabit Laurella Creek. The removal of this barrier has the potential to allow naturally reproducing trout populations to reach historically accessible spawning areas, habitat, and historically isolated genetic populations. This is considered a beneficial cumulative impact to cold water fish species.

Alternative 1

Short-term, direct, minor, adverse impacts to fish and wildlife and long-term, direct, negligible, adverse impacts to wildlife are expected from Alternative 1. No indirect effects or cumulative effects were identified during analysis that on their own or in combination with other events could cause adverse or beneficial impacts resulting from the project.

Alternative 1 will result in direct, short-term, adverse, negligible impacts to fish species, because construction work around the principal spillway riser will be contained within a sheet pile enclosure or cofferdam that will not require the draining of the impoundment. It is anticipated that the installation of the water control structure will temporarily displace fish during installation and from the draining of the area around the riser during the construction process. Fish can relocate to other undisturbed locations in the impoundment during project work. No impact to fish species diversity within the impoundment or stream is expected.

Alternative 1 will result in short-term, minor, adverse impacts and long-term, negligible, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Some forested areas, likely used by wildlife species as habitat, will also need to be removed in the staging and access areas to allow access to the site. Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

Alternative 2
Short-term, long-term, and cumulative impacts to fish and wildlife, threatened and endangered species, invasive species, migratory birds, and bald and golden eagles are expected to be the same as Alternative 1.

Alternative 3
Short-term, long-term, and cumulative impacts to fish and wildlife, threatened and endangered species, invasive species, migratory birds, and bald and golden eagles are expected to be the same as Alternative 1.

Martin Dam
FWOFI
Short-term, direct, minor, adverse impacts to fish and wildlife and long-term, direct, moderate, beneficial impacts to fish and wildlife are expected from the No Action Alternative.

This alternative will result in short-term, minor, adverse impacts and long-term, negligible, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Some forested areas, likely used by wildlife species as habitat, may need to be removed along the eastern border of the LOD. Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

Long-term and cumulative, moderate, beneficial impacts to wildlife species are also expected to occur because removal of the impoundment will create additional vegetated areas that wildlife can use for foraging while still providing water and wetlands within the new riparian corridor which will establish in the drained flood pool. Long-term adverse effects to fish and wildlife species will occur from the removal of the impoundment and the adjacent foraging areas; however, it is anticipated that the restoration of the site to a pre-impoundment undisturbed condition will outweigh these impacts. Cumulative beneficial impacts are anticipated to include increased wildlife diversity from the expanded habitat.

There have not been any Northern long-eared bats or Indiana bats identified inhabiting the site and the project is anticipated to have no effect or not likely to adversely affect those species. A consultation letter describing project action was submitted to the USFWS on 3 December 2021. The PNDI Environmental Review report indicated that there are no known impacts to state listed species. The PNDI report indicated that the project is in the vicinity of a northern long-eared bat maternity roost. To avoid prohibited incidental take of northern long-eared bats during the pup season, the USFWS requests tree removal not be conducted from June 1 to July 31. Project work is not anticipated to result in adverse effects to federally or state listed animal species.

There are no known occurrences of bald or golden eagle nesting areas in the LOD. The closest bald eagle nest is 1.5 miles to 3.5 miles away, depending on the dam site. Invasive species are not known to exist in the LOD. Migratory birds may be temporarily impacted by the obstruction of foraging habitat during construction work. However, there is a similar suitable habitat in the immediate vicinity that could be used by these species during construction. As such, impacts to bald and golden eagles and migratory birds is considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in long-term effects to bald or golden eagles.

Long-term, minor, adverse impacts to warmwater fish species are anticipated to occur because the No Action Alternative will result in the removal of the impoundment, which warm water species are currently anticipated to inhabit. Long-term, moderate, beneficial impacts to cold-water fish species (i.e., trout) will also result from this Alternative. The removal of the dam embankment will remove the existing barrier to fish species who inhabit the stream. The removal of this barrier has the potential to allow naturally reproducing trout populations to reach historically accessible spawning areas, habitat, and historically isolated genetic populations. This is considered a beneficial cumulative impact to cold water fish species.

Alternative 1

Short-term, direct, minor, adverse impacts to fish and wildlife and long-term, direct, negligible, adverse impacts to wildlife are expected from Alternative 1. No indirect effects or cumulative effects were identified during analysis that on their own or in combination with other events could cause adverse or beneficial impacts resulting from the project.

The alternative will result in direct, short-term, adverse, negligible impacts to fish species because construction work around the principal spillway riser will be contained within a sheet pile enclosure or cofferdam that will not require the draining of the impoundment. It is anticipated that the installation of the water control structure will temporarily displace fish during installation from the draining of the area around the riser during construction. Fish can relocate to other undisturbed locations in the impoundment during project work. No impact to fish species diversity within the impoundment or stream is expected.

It will also result in short-term, minor, adverse impacts and long-term, negligible, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Some forested areas, likely used by wildlife species as habitat, may need to be removed along the eastern border

of the LOD. Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

There have not been any Northern long-eared bats or Indiana bats identified inhabiting the site and the project is anticipated to have no effect or not likely to adversely affect those species. A consultation letter describing project action was submitted to the USFWS on 3 December 2021. The PNDI Environmental Review report indicated that there are no known impacts to state listed species. The PNDI report indicated that the project is in the vicinity of a northern long-eared bat maternity roost. To avoid prohibited incidental take of northern long-eared bats during the pup season, the USFWS requests tree removal not be conducted from June 1 to July 31. Project work is not anticipated to result in adverse effects to federally or state listed animal species.

There are no known occurrences of bald or golden eagle nesting areas in the LOD. The closest bald eagle nest is 1.5 miles to 3.5 miles away, depending on the dam site. Invasive species are not known to exist in the LOD. Migratory birds may be temporarily impacted by the obstruction of foraging habitat during construction work. However, there is a similar suitable habitat in the immediate vicinity that could be used by these species during construction. As such, impacts to bald and golden eagles and migratory birds is considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in long-term effects to bald or golden eagles.

Alternative 2
Short-term, long-term, and cumulative impacts to fish and wildlife, threatened and endangered species, migratory birds, and bald and golden eagles are expected to be the same as Alternative 1.

Alternative 3
Short-term, long-term, and cumulative impacts to fish and wildlife threatened and endangered species, migratory birds, and bald and golden eagles are expected to be the same as Alternative 1.

Finkleday Dam
FWOFI
Short-term, direct, minor, adverse impacts to fish and wildlife; and long-term, direct, moderate, beneficial impacts to fish and wildlife are expected from the No Action Alternative.

This alternative is anticipated to result in short-term, minor, adverse impacts and long-term, negligible, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants as their habitats. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is

anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

Long-term and cumulative, moderate, beneficial impacts to wildlife species are also expected to occur because removal of the impoundment will create additional vegetated areas that wildlife can use for foraging. Long-term adverse effects to wildlife species will occur from the removal of the impoundment and the adjacent foraging areas, however it is anticipated that the restoration of the site to a pre-impoundment undisturbed condition will outweigh these impacts. Cumulative beneficial impacts are anticipated to include increased wildlife diversity from the expanded habitat.
There have not been any Northern long-eared bats or Indiana bats identified inhabiting the site and the project is anticipated to have no effect or not likely to adversely affect those species. A consultation letter describing project action was submitted to the USFWS on 3 December 2021. The PNDI Environmental Review report indicated that there are no known impacts to state listed species. To eliminate any possible impacts to bat species, tree cutting (of trees greater than 3-in. diameter in breast height) will occur outside of the Northern long-eared bat and Indiana bat pup season (1 June to 31 July). Project work is not anticipated to result in adverse effects to federally or state listed animal species.

There are no known occurrences of bald or golden eagle nesting areas in the LOD. The closest bald eagle nest is 1.5 miles to 3.5 miles away, depending on the dam site. Invasive species are not known to exist in the LOD. Migratory birds may be temporarily impacted by the obstruction of foraging habitat during construction work. However, there is a similar suitable habitat in the immediate vicinity that could be used by these species during construction. As such, impacts to bald and golden eagles and migratory birds is considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in long-term effects to bald or golden eagles.

Long-term, minor, adverse impacts to warmwater fish species are anticipated to occur because the No Action Alternative will result in the removal of the impoundment, which warmwater species are currently anticipated to inhabit. Long-term, moderate, beneficial impacts to cold-water fish species are anticipated to occur because the No Action Alternative will naturally re-establish the stream through the channel. The removal of the dam embankment will remove the existing barrier to fish species, particularly trout, who inhabit Indian Orchard Brook. The removal of this barrier will allow naturally reproducing trout populations to reach historically accessible spawning areas and habitat once again. This is considered a beneficial cumulative impact to cold water fish species.

Chinese mystery snail, a Pennsylvania state-listed invasive species, was observed in the dam impoundment during a site visit in November 2019. It is known that the species is also present both upstream and downstream of the dam. Project work is not expected to increase the presence or distribution of the Chinese mystery snail, given that the snail is already present upstream and downstream of the project site. In addition, the most common route to spread the species is via recreational activities such as fishing and boating (The Pennsylvania State University, Pennsylvania Sea Grant 2015).

Alternative 1

Short-term, direct, minor, adverse impacts to fish and wildlife and long-term, direct, negligible, adverse impacts to wildlife are expected from Alternative 1. No indirect effects or cumulative effects were identified during analysis that on their own or in combination with other events could cause adverse or beneficial impacts resulting from the project.

Alternative 1 is anticipated to result in direct, short-term, adverse, negligible impacts to fish species because construction work around the principal spillway riser will be contained within a sheet pile enclosure or cofferdam that will not require the draining of the impoundment. It is anticipated that the installation of the water control structure will temporarily displace fish from their habitat within the drained area and may disturb fish during the construction process. Fish can relocate to other undisturbed locations in the impoundment during project work. It is not anticipated that project work will impact the trout population in the Class A trout stream. No impact to fish species diversity within the impoundment or stream is expected.

Alternative 1 is anticipated to result in short-term, minor, adverse impacts and long-term, negligible, adverse impacts to wildlife associated with disruption of habitat during construction, which is anticipated to last up to 24 months (with a construction shutdown during winter months). Potential tree cutting in the LOD will result in temporary displacement of birds and other wildlife who use the trees and plants as their habitats. In addition, the noises associated with construction are likely to displace wildlife temporarily. There are similar forested riparian corridors upstream and downstream of the site for birds and wildlife to relocate to during construction. It is anticipated that wildlife will return to the construction area soon after construction is complete and after new vegetation is established.

There have not been any Northern long-eared bats or Indiana bats identified inhabiting the site and the project is anticipated to have no effect or not likely to adversely affect those species. A consultation letter describing project action was submitted to the USFWS on 3 December 2021. The PNDI Environmental Review report indicated that there are no known impacts to state listed species. To eliminate any possible impacts to bat species, tree cutting (of trees greater than 3-in. diameter in breast height) will occur outside of the Northern long-eared bat and Indiana bat pup season (1 June to 31 July). Project work is not anticipated to result in adverse effects to federally or state listed animal species.

There are no known occurrences of bald or golden eagle nesting areas in the LOD. The closest bald eagle nest is 1.5 miles to 3.5 miles away, depending on the dam site. Invasive species are not known to exist in the LOD. Migratory birds may be temporarily impacted by the obstruction of foraging habitat during construction work. However, there is a similar suitable habitat in the immediate vicinity that could be used by these species during construction. As such, impacts to bald and golden eagles and migratory birds is considered short-term, adverse, and negligible because of the potential to impact a small area potentially used for foraging. Project work will not result in long-term effects to bald or golden eagles.

Chinese mystery snail, a Pennsylvania state-listed invasive species, was observed in the dam impoundment during a site visit in November 2019. It is known that the species is also present both upstream and downstream of the dam. Project work is not expected to increase the presence

or distribution of the Chinese mystery snail, given that the snail is already present upstream and downstream of the project site. In addition, the most common route to spread the species is via recreational activities such as fishing and boating (The Pennsylvania State University, Pennsylvania Sea Grant 2015).

Alternative 2
Short-term, long-term, and cumulative impacts to fish and wildlife, threatened and endangered species, invasive species, migratory birds, and bald and golden eagles as a result of Alternative 2 are expected to be the same as those of Alternative 1.

Alternative 3
Short-term, long-term, and cumulative impacts to fish and wildlife, threatened and endangered species, invasive species, migratory birds, and bald and golden eagles as a result of Alternative 3 are expected to be the same as those of Alternative 1.

ECOSYSTEM SERVICES

Regulating Ecosystem Services - Flood and Disease Control

The uncertainties related to predicting climate impacts on ecosystem services is the same for all dam sites, so it is stated once below.

There is inherent uncertainty when trying to predict impacts on ecosystem services, given that our ideas of climate change and potential environmental catastrophes are based on models and simulations which rely on assumptions and available data. Climate change is a key source of uncertainty associated with flood control because it has the potential to increase the frequency and intensity of storm events in the near future, and in turn, increase the risk of a dam breach. Thus, the uncertainty of the future effects from climate changes may result in a greater risk of flood damages because the dam may not have the capability to mitigate for the intensity of future weather patterns. No indirect effects to this service were identified during analysis.

Garrett Dam

Existing Conditions
There are 18 structures in the 100-year floodplain.

FWOFI
There will be 35 structures in the 100-year floodplain.

Long-term, significant, adverse, direct impacts to flood and disease control are anticipated to result from the No Action Alternative. The current levels of downstream flood protection would be lost, and there would be an increase in flood frequency and larger potential to spread disease through floodwaters. The threat to loss of life and property from a catastrophic breach of the dam would be removed with decommissioning of the structure, causing adverse cumulative impacts.

Alternative 1
Long-term and cumulative, direct, moderate, beneficial impacts to flood and disease control are anticipated from Alternative 1 and therefore to the Regulating Ecosystem Service within the LOD.

Alternative 1 will benefit flood and disease control in the Borough of Honesdale because the actions will rehabilitate the dam so that it maintains its current level of flood protection, reduces the risk of a catastrophic dam breach, and brings the dam up to state and NRCS standards. This is expected to reduce the risk of flooding and, in turn, the risk of disease spreading through flood waters in the Borough of Honesdale.

A total of 18 structures exists in the 100-year floodplain of Garrett Dam. This Alternative is not expected to alter the number of structures in the downstream 100-year floodplain.

Alternative 2
Impacts to flood and disease control from Alternative 2 are anticipated to be similar to those of Alternative 1 because both alternatives will rehabilitate the dam to the same level of protection and bring the dam up to state and NRCS standards.

Alternative 3
Impacts to flood and disease control from Alternative 3 are anticipated to be similar to those of Alternative 1.

Varcoe Dam
Existing Conditions
There are 18 structures in the 100-year floodplain.

FWOFI
There will be 35 structures in the 100-year floodplain.
Long-term, significant, adverse, direct impacts to flood and disease control are anticipated to result from the No Action Alternative. The current levels of downstream flood protection would be lost, and there would be an increase in flood frequency and larger potential to spread disease through floodwaters. After the constructed breach of the dam, the threat to loss of life and property from a catastrophic breach would be removed with decommissioning of the structure, causing adverse cumulative impacts.

Alternative 1
Long-term and cumulative, direct, beneficial impacts to flood and disease control are anticipated from Alternative 1; and therefore, to the Regulating Ecosystem Service within the LOD.

Alternative 1 will benefit flood and disease control in the Borough of Honesdale because the actions will rehabilitate the dam so that it maintains its current level of flood protection, reduces the risk of catastrophic dam breach, and brings the dam up to state and NRCS standards. This is expected to reduce the risk of flooding, and in turn, the risk of disease spreading through flood waters in the Borough of Honesdale.

A total of 18 structures exists in the Varcoe Dam downstream 100-year floodplain. This Alternative is not expected to alter the number of structures in the downstream 100-year floodplain breach inundation area.

Alternative 2
Impacts to flood and disease control from Alternative 2 are anticipated to be similar to those of Alternative 1 because it will rehabilitate the dam to the same level of protection and bring the dam up to state and NRCS standards.

Alternative 3
Impacts to flood and disease control from Alternative 3 are anticipated to be similar to those of Alternative 1 because it will rehabilitate the dam to the same level of protection and bring the dam up to state and NRCS standards.

Martin Dam
Existing Conditions
There are 27 structures in the 100-year floodplain.

FWOFI
There will be 28 structures in the 100-year floodplain.

Long-term, significant, adverse, direct impacts to flood and disease control are anticipated to result from the No Action Alternative. The current levels of downstream flood protection would be lost, and there would be an increase in flood frequency and larger potential to spread disease through floodwaters. After the constructed breach of the dam, the threat to loss of life and property from a catastrophic breach would be removed with decommissioning of the structure, causing adverse cumulative impacts.

Alternative 1
Long-term and cumulative, direct, moderate, beneficial impacts to flood and disease control are anticipated from Alternative 1; and therefore, to the Regulating Ecosystem Service within the LOD.

This alternative will benefit flood and disease control in the Borough of Honesdale because the actions will rehabilitate the dam so that it maintains its current level of flood protection, reduces the risk of catastrophic dam breach, and brings the dam up to state and NRCS standards. This is expected to reduce the risk of flood, and in turn, the risk of disease spreading through flood waters in the Borough of Honesdale.

A total of 27 structures exists in the 100-year floodplain for Martin Dam. This Alternative is not expected to alter the number of structures in the downstream 100-year floodplain.

Alternative 2
Impacts to flood and disease control from Alternative 2 are anticipated to be similar to those of Alternative 1 because both alternatives will rehabilitate the dam to the same level of protection and bring the dam up to state and NRCS standards.

Alternative 3
Impacts to flood and disease control from Alternative 3 are anticipated to be similar to those of Alternative 1 because both alternatives will rehabilitate the dam to the same level of protection and bring the dam up to state and NRCS standards.

Finkleday Dam
Existing Conditions:
The number of structures located existing within the 100-year floodplain downstream of the dam is 27.

FWOFI
The number of structures located within the 100-year floodplain downstream of the dam is 28. Long-term, significant, adverse, direct impacts to flood and disease control are anticipated to result from the No Action Alternative. The current levels of downstream flood protection would be lost, and there would be an increase in flood frequency and larger potential to spread disease through floodwaters. After the constructed breach of the dam, the threat to loss of life and property from a catastrophic breach would be removed with decommissioning of the structure, causing adverse cumulative impacts.

Alternative 1
Long-term and cumulative, direct, moderate, beneficial impacts to flood and disease control are anticipated from Alternative 1; and therefore, to the Regulating Ecosystem Service within the LOD.
Alternative 1 will benefit flood and disease control in the Borough of Honesdale because the actions will rehabilitate the dam so that it maintains its current level of flood protection and brings the dam up to state and NRCS standards. This is expected to reduce the risk of a catastrophic breach of the dam and, in turn, the risk of disease spreading through flood waters in the Borough of Honesdale.

There are a total of 27 structures in the downstream 100-year floodplain of Finkleday Dam. This alternative is not expected to alter the number of structures in the 100-year floodplain.

Alternative 2
Impacts to flood and disease control from Alternative 3 are anticipated to be similar to those of Alternative 1 because both alternatives will rehabilitate the dam to the same level of protection and bring the dam up to state and NRCS standards.

Alternative 3
Impacts to flood and disease control from Alternative 3 are anticipated to be similar to those of Alternative 1 because both alternatives will rehabilitate the dam to the same level of protection and bring the dam up to state and NRCS standards.

Supporting Ecosystem Services - Nutrient Cycling, Soil Formation
There is inherent uncertainty when trying to determine impacts of these dam projects on supporting ecosystem services since there are many other factors unrelated to the project that can

affect processes such as nutrient cycling and soil formation. No indirect effects or cumulative impacts to this service were identified during analysis.

Garrett Dam

Existing Conditions

Currently there are approximately 8.29 acres of vegetation in the LOD.
There are not any impervious surfaces in the LOD.

FWOFI

There would be 11.29 acres of vegetation, an increase of 3.0 acres.

There would not be any impervious surfaces in the LOD.

Short-term, negligible, direct, adverse impacts and long-term, negligible, direct, beneficial impacts to nutrient cycling and soil formation are expected from the No Action Alternative.

Temporary adverse impacts to nutrient cycling and soil formation due to disturbance from the active construction zone will occur.

The No Action Alternative will ultimately result in an increase in nutrient cycling and soil formation at the dam site causing long-term, direct, negligible, beneficial impacts to Supporting Ecosystem services. The elimination of the impoundment will leave an additional 3.00 acres of land exposed for nutrient cycling and soil formation once vegetation establishes in the drained pool, causing permanent beneficial effects to land supporting ecosystem services in the LOD. This acreage excludes the 0.30 acres of the dam embankment that will be covered in riprap, which will prevent vegetation from establishing in that location. No impervious surfaces will be created with the No Action Alternative.

Alternative 1

Short-term negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from Alternative 1; and therefore, to the Supporting Ecosystem Service within the LOD.

The nutrient cycle of plants within the LOD may be affected by the construction work associated with Alternative 1. Some vegetation, including the grassed areas of the top of dam and ASW, will be disturbed, excavated, and/or compacted, which will impact the nutrient cycle of the vegetation and soils. The installation of the RCC ASW will cover a total of approximately 0.33 acres of grassed vegetation but will be covered with topsoil and reseeded after construction work is complete, ultimately allowing nutrient cycling to occur once again. Therefore, long-term impacts to nutrient cycling are considered negligible from this Alternative. Trees will be removed for project work as necessary to help facilitate construction, primarily along the southern edge of the ASW (maximum 0.40 acres). The construction team will try to use land, which had been previously cleared to minimize the number of trees removed. Long-term impacts to the nutrient cycle may result from the removal of some trees; however, because very few trees will be removed and new trees will be planted, impacts to the nutrient cycle are anticipated to be negligible.

Short- and long-term effects to soil formation are expected to be negligible because only 0.33 acres of soil will be covered by an impervious surface from the installation of the RCC ASW. The RCC ASW will then be covered with topsoil and reseeded after construction work is complete, ultimately allowing nutrient cycling and soil formation to occur atop the ASW. Parent material, topography, and existing biological factors, which all affect soil formation, will negligibly inhibit soil formation for soils under the RCC as a result of Alternative 1.

Future climate change and variability have the potential to impact both soil formation and nutrient cycling. Project action is not anticipated to intensify any impacts imposed by climate change.

Alternative 2

Short-term and long-term negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from Alternative 2; and therefore, to the Supporting Ecosystem Service within the LOD.

The nutrient cycle of plants within the LOD may be affected by the construction work associated with Alternative 1. Some vegetation, including the grassed areas of the top of dam and ASW, will be disturbed, excavated, and/or compacted, which will impact the nutrient cycle of the vegetation and soils. The installation of the labyrinth weir will cover a total of approximately 0.22 acres of grassed vegetation. Trees will be removed for project work as necessary to help facilitate construction, primarily along the southern edge of the ASW (maximum 0.40 acres). The construction team will try to use land, which had been previously cleared to minimize the number of trees removed. Long-term impacts to the nutrient cycle may result from the removal of some trees; however, because very few trees will be removed and new trees will be planted, impacts to the nutrient cycle are anticipated to be negligible.

Short- and long-term effects to soil formation are expected to be negligible because only 0.22 acres of soil will be covered by an impervious surface from the installation of the RCC ASW. The RCC ASW will then be covered with topsoil and reseeded after construction work is complete, ultimately allowing nutrient cycling and soil formation to occur atop the ASW. Parent material, topography, and existing biological factors, which all affect soil formation, will negligibly inhibit soil formation for soils under the RCC as a result of Alternative 2.

Future climate change and variability have the potential to impact both soil formation and nutrient cycling. Project action is not anticipated to intensify any impacts imposed by climate change.

Alternative 3

Impacts to nutrient cycling and soil formation from Alternative 3 are anticipated to be similar to those of Alternative 2. However, the installation of the larger labyrinth weir will eliminate 0.45 acres of established vegetation in the LOD, creating 0.45 acres of impervious surface, resulting in additional long-term impacts to nutrient cycling and soil formation. Long-term impacts are still anticipated to be negligible.

Nutrient Cycling Metrics

	Established Vegetation (acres) Post Construction	Change in Established Vegetation (acres)
FWOFI	11.29	3.00
Alternative 1	8.29	-0.33
Alternative 2	8.07	-0.22
Alternative 3	7.84	-0.45

Soil Formation Metrics

	Impervious Surface (acres) Post Construction
FWOFI	0
Alternative 1	0.33
Alternative 2	0.22
Alternative 3	0.45

Varcoe Dam

Existing Conditions

Currently there are approximately 5.63 acres of vegetation currently in the LOD.
There are not any impervious surfaces in the LOD.

FWOFI

There would be 7.6 acres of vegetation, an increase of 2.28 acres.
There would not be any impervious surfaces in the LOD.

Short-term, negligible, direct, adverse impacts and long-term, negligible, direct, beneficial impacts to nutrient cycling and soil formation are expected from the No Action Alternative. Temporary adverse impacts to nutrient cycling and soil formation due to disturbance from the active construction zone will occur, but the impacts are anticipated to be slightly less than those of Alternative 1 because construction work will require less time and fewer materials and equipment.

The No Action Alternative will ultimately result in an increase in nutrient cycling and soil formation at the dam site causing long-term, direct, negligible, beneficial impacts to Supporting Ecosystem services. The elimination of the impoundment will leave an additional 2.28 acres of land exposed for nutrient cycling and soil formation once vegetation establishes in the drained pool area, causing permanent beneficial effects to land supporting ecosystem services in the LOD. This acreage excludes the 0.7 acres of the dam embankment that will be covered in riprap, which will prevent vegetation from establishing in that location. No impervious surfaces will be created with the No Action Alternative.

The offsite staging area is already used as a staging area for other unassociated infrastructure projects and therefore there will be no additional permanent nutrient cycling or soil formation impacts in the offsite staging area.

Alternative 1

Short-term and long-term negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from Alternative 1; and therefore, to the Supporting Ecosystem Service within the LOD.

The nutrient cycle of plants within the LOD may be affected by the construction work associated with Alternative 1. Some vegetation, including the grassed areas of the top of dam, ASW, and downstream back slope will be disturbed and compacted, which will impact the nutrient cycle of the vegetation and soils. The ASW is a total of approximately 0.50 acres; however, only about 0.25 acres of vegetation will be permanently disturbed from the installation of the ACB exit channel and RCC cutoff wall, but many plants will be able to grow among the gaps between the ACBs. Trees will be removed for project work as necessary to help facilitate construction, primarily in the staging area (maximum 2.20 acres). The construction team will try to use land which had been previously cleared to minimize the number of trees removed. Long-term impacts to the nutrient cycle may result from the removal of some trees; however, because very few trees will be removed and new trees will be planted, impacts to the nutrient cycle are anticipated to be negligible.

Soil formation in the LOD and offsite staging area may also be temporarily impacted by the movement of construction vehicles and the staging of materials/equipment on the soils. Access roads will run southeast-northwest through the center of the LOD and most materials and equipment will be stored in the offsite staging area. Long-term effects to soil formation are expected to be negligible because only 0.25 acres of soil will be covered by an impervious surface (ACBs). Parent material, topography, and existing biological factors, which all affect soil formation at the site, will negligibly inhibit soil formation for soils under the RCC as a result of Alternative 1.

The offsite staging area is already used as a staging area for other unassociated infrastructure projects and therefore there will be no additional permanent nutrient cycling or soil formation impacts in the offsite staging area.

Future climate change and variability have the potential to impact both soil formation and nutrient cycling. Project action is not anticipated to intensify any impacts imposed by climate change.

Alternative 2

Short- and long-term impacts to nutrient cycling and soil formation from Alternative 2 are anticipated to be similar to those of Alternative 1 because both involve similar construction activities. Approximately 0.52 acres of vegetation is expected to be permanently impacted and converted to an impervious surface from the installation of the RCC ASW. The RCC ASW will then be covered with topsoil and reseeded after construction work is complete, ultimately allowing nutrient cycling and soil formation to occur atop the ASW.

Alternative 3

Impacts to nutrient cycling and soil formation from Alternative 3 are anticipated to be similar to those of Alternative 1 because both involve similar construction activities. However, slightly

more impacts to nutrient cycling and soil formation may occur as a result of Alternative 3 because the footprint of the ACB exit channel associated with Alternative 3 is slightly larger than the ACB exit channel of Alternative 1; and therefore, 0.29 acres of vegetation would be permanently impacted and covered by an impervious surface.

Nutrient Cycling Metrics

	Established Vegetation (acres) Post Construction	Change in Established Vegetation (acres)
FWOFI	7.6	2.28
Alternative 1	5.38	-0.25
Alternative 2	5.63	-0.52
Alternative 3	5.34	-0.29

Soil Formation Metrics

	Impervious Surface (acres) Post Construction
FWOFI	0
Alternative 1	0.25
Alternative 2	0.52
Alternative 3	0.29

Martin Dam

Existing Conditions

Currently there are approximately 6.25 acres of vegetation currently in the LOD.
There is not any impervious surfaces in the LOD.

FWOFI

There would be 8.33 acres of vegetation, an increase of 2.05 acres.

There would not be any impervious surfaces in the LOD.

Short-term, negligible, direct, adverse impacts and long-term, negligible, direct, beneficial impacts to nutrient cycling and soil formation are expected from the No Action Alternative. Temporary adverse impacts to nutrient cycling and soil formation due to disturbance from the active construction zone will occur, but the impacts are anticipated to be slightly less than those of Alternative 1 because construction work will require less time and fewer materials and equipment.

The No Action Alternative will ultimately result in an increase in nutrient cycling and soil formation at the dam site causing long-term, direct, negligible, beneficial impacts to Supporting Ecosystem services. The elimination of the impoundment will leave an additional 2.05 acres of land exposed for nutrient cycling and soil formation once vegetation establishes in the drained pool, causing permanent beneficial effects to land supporting ecosystem services in the LOD.

This acreage excludes the 0.28 acres of the dam embankment that will be covered in riprap, which will prevent vegetation from establishing in that location. No impervious surfaces will be created with the No Action Alternative.

The offsite staging area is already used as a staging area for other unassociated infrastructure projects; and therefore, there will be no additional permanent nutrient cycling or soil formation impacts in the offsite staging area.

Alternative 1

Short-term and long-term negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from Alternative 1; and therefore, to the Supporting Ecosystem Service within the LOD.

The nutrient cycle of plants within the LOD may be affected by the construction work associated with Alternative 1. Some vegetation, including the grassed areas of the top of dam and ASW, will be disturbed, excavated, and/or compacted, which will impact the nutrient cycle of the vegetation and soils. The installation of the RCC ASW, stepped chute, and apron will cover a total of approximately 0.27 acres of grassed vegetation. However, there will be an increase in 0.12 acres of vegetation due to the extension of the upstream dam embankment into the impoundment, which will be vegetated, resulting in a net decrease in established vegetation of 0.15 acres. Trees will be removed for project work as necessary to help facilitate construction, primarily along the western edge of the ASW and immediately east of them dam (maximum 1.25 acres). The construction team will try to use land, which had been previously cleared to minimize the number of trees removed. Long-term impacts to the nutrient cycle may result from the removal of some trees; however, because very few trees will be removed and new trees will be planted, impacts to the nutrient cycle are anticipated to be negligible.

Short- and long-term effects to soil formation are expected to be negligible because only 0.27 acres of soil will be covered by an impervious surface from the installation of the RCC ASW, stepped chute, and apron. However, parent material, topography, and existing biological factors, which all affect soil formation, will negligibly inhibit soil formation for soils under the RCC as a result of Alternative 1.

The offsite staging area is already used as a staging area for other unassociated infrastructure projects; and therefore, there will be no additional permanent nutrient cycling or soil formation impacts in the offsite staging area.

Future climate change and variability have the potential to impact both soil formation and nutrient cycling. Project action is not anticipated to intensify any impacts imposed by climate change.

Alternative 2

Impacts to nutrient cycling and soil formation from Alternative 2 are anticipated to be similar to those of Alternative 1. The extension of the dam embankment upstream will create an additional 0.12 acres of vegetation, but the installation of the labyrinth weir and the associated RCC spillway components will eliminate 0.28 acres of established vegetation in the LOD, resulting in

a net decrease in established vegetation of 0.16 acres. The installation of the RCC spillway will create 0.28 acres of impervious surface.

Alternative 3

Impacts to nutrient cycling and soil formation from Alternative 3 are anticipated to be similar to those of Alternative 1. The extension of the dam embankment upstream will create an additional 0.12 acres of vegetation, but the installation of the wider Ogee weir and associated RCC spillway components will eliminate 0.35 acres of established vegetation in the LOD, totaling a net decrease in established vegetation of 0.16 acres. The installation of the ogee weir and RCC spillway will create 0.35 acres of impervious surface. Long-term impacts are still anticipated to be negligible.

Nutrient Cycling Metrics

	Established Vegetation (acres) Post Construction	Change in Established Vegetation (acres)
FWOFI	8.33	2.05
Alternative 1	6.10	-0.15
Alternative 2	6.09	-0.16
Alternative 3	6.02	-0.23

Soil Formation Metrics

	Impervious Surface (acres) Post Construction
FWOFI	0
Alternative 1	0.27
Alternative 2	0.28
Alternative 3	0.35

Finkleday Dam

Existing Conditions:

Currently there are approximately 7.65 acres of vegetation currently in the LOD. There is not any impervious surfaces in the LOD.

FWOFI

There would be 12.98 acres of vegetation, an increase of 5.33 acres.

There would not be any impervious surfaces in the LOD.

Short-term, negligible, direct, adverse impacts and long-term, negligible, direct, beneficial impacts to nutrient cycling and soil formation are expected from the No Action Alternative.

Temporary adverse impacts to nutrient cycling and soil formation may occur from ground disturbing activities (i.e., excavation of the dam) associated with the No Action Alternative.

However, the No Action Alternative will ultimately result in an increase in nutrient cycling and soil formation at the dam site causing long-term, direct, negligible, beneficial impacts to Supporting Ecosystem services. No impervious surfaces will be created with the No Action Alternative.

Post construction there would be 12.98 vegetative acres.

Alternative 1

Short-term and long-term negligible, direct, adverse impacts to nutrient cycling and soil formation are expected from Alternative 1; and therefore, to the Supporting Ecosystem Service within the LOD.

The nutrient cycle of plants within the LOD may be affected by the construction work associated with Alternative 1. Some vegetation, including the grassed areas of the top of dam and ASW, will be disturbed and compacted, which will impact the nutrient cycle of the vegetation and soils. The ASW is a total of approximately 0.36 acres; however, only about 0.18 acres of vegetation Is expected to be permanently disturbed from the installation of the ACB exit channel and RCC cutoff wall, because many plants will be able to grow among the gaps between the ACBs. Trees will be removed for project work as necessary to help facilitate construction, primarily in the homeowner's access road and southern access area (maximum 3.88 acres). The construction team will try to use land which had been previously cleared to minimize the number of trees removed. Long-term impacts to the nutrient cycle may result from the removal of some trees; however, because very few trees will be removed and new trees will be planted, impacts to the nutrient cycle are anticipated to be negligible.

Soil formation in the LOD and offsite staging area may also be temporarily impacted by the movement of construction vehicles and the staging of materials/equipment on the soils. Access roads will run east-west through the center of the LOD and most materials and equipment will be stored in the offsite staging area. Long-term effects to soil formation are expected to be negligible because only 0.18 acres of soil will be covered by an impervious surface from the installation of the ACBs. Parent material, topography, and existing biological factors, which all affect soil formation will negligibly inhibit soil formation for soils under the RCC as a result of Alternative 1.

The offsite staging area is already used as a staging area for other unassociated infrastructure projects and therefore there will be no additional permanent nutrient cycling or soil formation impacts in the offsite staging area.

Future climate change and variability have the potential to impact both soil formation and nutrient cycling. Project action is not anticipated to intensify any impacts imposed by climate change.

Alternative 2

Impacts to nutrient cycling and soil formation from Alternative 2 are anticipated to be similar to those of Alternative 1 because both involve similar construction activities. Approximately 0.175 acres of vegetation is expected to be permanently impacted and converted to an impervious surface from the installation of the ACBs on the ASW. Additionally, fewer trees will need to be

removed (maximum 1.98 acres) to facilitate construction because the southern access road is not required for Alternative 2.

Alternative 3

Short- and long-term impacts to nutrient cycling and soil formation from Alternative 3 are anticipated to be similar to those of Alternative 1 because both involve similar construction activities. With this Alternative approximately 0.25 acres of vegetation is expected to be permanently impacted and converted to an impervious surface from the installation of the RCC ASW. The RCC ASW will then be covered with topsoil and reseeded after construction work is complete, ultimately allowing nutrient cycling and soil formation to occur atop the ASW.

Nutrient Cycling Metrics

	Established Vegetation (acres) Post Construction	Change in Established Vegetation (acres)
FWOFI	12.98	5.33
Alternative 1	7.02	-0.18
Alternative 2	6.285	-0.175
Alternative 3	7.20	-0.25

Soil Formation Metrics

	Impervious Surface (acres) Post Construction
FWOFI	0
Alternative 1	0.18
Alternative 2	0.175
Alternative 3	0.25

Cultural Ecosystem Services - Recreation, Aesthetic Viewsheds

Uncertainty within cultural ecosystem services lies within society's restructuring of what is deemed culturally important as well as future management actions outside the realm of this project. No indirect effects to this service were identified during analysis. No significant cumulative effects to this ecosystem service are anticipated from the projects in this plan.

Garrett Dam

Existing Conditions

From a recreational use perspective, the reservoir has 3.3 surface acres.

From the aesthetic viewshed perspective,0.5 acres of the reservoir will continue to be viewable from the home.

Currently there are 2.3 acres of natural green landscape in the viewshed of the LOD.

FWOFI

The surface acres of the reservoir will be nonexistent.

From the aesthetic viewshed perspective, the reservoir is eliminated.

There will remain 2.8 acres of natural green landscape in the viewshed of the LOD.

Short-term, direct, adverse, moderate impacts and long-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds are expected from the No Action Alternative.

Short-term impacts from this Alternative will occur from the active construction site, which will prevent any recreational activity at the site during the approximately 18 months of construction. Aesthetic viewsheds will also be temporarily negatively impacted from the active construction zone.

Long-term and cumulative adverse impacts to recreational use and aesthetic viewsheds will occur once the impoundment is eliminated from the constructed breach of the dam. Holbert Creek will still be available to citizens for recreational use. The aesthetic viewshed of the home will be permanently altered from the loss of its view of 0.50 acres of the impoundment. However, the impoundment will be replaced with natural green landscape; and therefore, in time, the homes will gain an additional 0.50 acres of green landscape view. The impoundment provides intrinsic monetary and personal value which would not be replaced by the vegetated wetland and stream channel if the impoundment was removed.

Alternative 1

Short-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds are expected from Alternative 1; and therefore, to the Cultural Ecosystem Services in the LOD. No long-term impacts to Cultural Ecosystem Services are anticipated.

There are no designated recreational lands or trails within the LOD. However, it is believed that some land in the LOD is occasionally used by residents for passive recreation and the impoundment is occasionally used for recreational fishing. Impacts to recreational use are anticipated to be short-term, adverse, and moderate. Short-term impacts will occur during construction work (approximately 24 months) when residents will temporarily be restricted from the LOD, including access to the impoundment. The size of the impoundment is not expected to change due to project work; and therefore, no long-term impacts to recreational use are anticipated.

One home has a view of the LOD. During project construction work, which is expected to last approximately 24 months total, the aesthetic viewshed of the LOD will be temporarily impacted. Long-term impacts to aesthetic viewsheds were assessed based on the amount of permanent change to the impoundment within viewshed of the home and the acreage of natural green landscape within view of the home. The home's viewshed of the impoundment is not anticipated to change after construction work is complete. Project work is not anticipated to permanently reduce the amount of natural green landscape within viewshed of the home because the RCC spillway will be covered with topsoil and reseeded after construction work is complete. Other dam rehabilitation work will only marginally alter the overall appearance of the dam site. There are no anticipated long-term adverse impacts to aesthetic viewsheds from this Alternative.

Cumulative impacts to both recreation and aesthetic viewsheds from the construction of the original dam, which created the impoundment, will continue to occur with this Alternative.

Alternative 2

Impacts to recreational use from Alternative 2 are anticipated to be the same as those of Alternative 1. Short-term effects to aesthetic viewsheds from this Alternative are also anticipated to be the same as Alternative 1. However, there are anticipated to be long-term, adverse, negligible effects to aesthetic viewsheds from Alternative 2 because the view of natural green landscape will be permanently reduced by 0.20 acres due to the installation of the labyrinth weir in the ASW associated with this Alternative. Impoundment size within view of the home will remain the same.

Alternative 3

Impacts to recreational use from Alternative 3 are anticipated to be the same as those of Alternative 1. Short-term effects to aesthetic viewsheds from this Alternative are also anticipated to be the same as Alternative 1. However, there are anticipated to be long-term, adverse, negligible effects to aesthetic viewsheds from Alternative 2 because the view of natural green landscape will be permanently reduced by 0.28 acres due to the installation of the larger labyrinth weir in the ASW associated with this Alternative. Impoundment size within view of the home will remain the same.

Recreational Use

	Impoundment size (acres) Post construction	**Change in impoundment size (acres)**
FWOFI	0	-3.30
Alternative 1	3.30	0
Alternative 2	3.30	0
Alternative 3	3.30	0

Aesthetic Viewsheds Metrics – Impoundment View

	Impoundment in Viewshed (acres) Post construction	**Change in Impoundment in Viewshed (acres)**
FWOFI	0	-0.50
Alternative 1	0.50	0
Alternative 2	0.50	0
Alternative 3	0.50	0

Aesthetic Viewsheds Metric – Natural Landscape View

	Natural Green Landscape in Viewshed of the LOD (acres) Post Construction	Change in Natural Green Landscape in Viewshed (acres)
FWOFI	2.80	+0.50
Alternative 1	2.30	0
Alternative 2	2.10	-0.20
Alternative 3	2.02	-0.28

Varcoe Dam

Existing Conditions

Currently the reservoir has 2.45 surface acres.

Currently there are 0.08 acres of natural green landscape in the viewshed of the LOD.

FWOFI

There would be a loss of 2.45 surface acres.

There will remain 0.08 acres of natural green landscape in the viewshed of the LOD.

Short-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds are anticipated to occur form the No Action Alternative. Long-term, direct, adverse, moderate impacts to recreational use are expected from the No Action Alternative.

Short-term impacts from this Alternative will occur from the active construction site, which will prevent any recreational activity at the site during the approximately 18 months of construction. Aesthetic viewsheds of the homes with views of the LOD and offsite staging area will also be temporarily negatively impacted from the active construction zone.

Long-term and cumulative adverse impacts to recreational use will occur once the 2.45-acre impoundment is eliminated from the constructed breach of the Dam. Local property owners will no longer be able to utilize the impoundment for fishing or the recreational activities, although Laurella Creek will still be available for recreational use. Project work associated with this Alternative is not expected to impact the home's view of natural landscape. The impoundment provides intrinsic monetary and personal value which would not be replaced by the vegetated wetland and stream channel if the impoundment was removed.

Alternative 1

Short-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds and long-term, direct, adverse, negligible impacts to aesthetic viewsheds are expected from Alternative 1; and therefore, to the Cultural Ecosystem Services in the LOD.

There are no designated public recreational lands or trails within the LOD. However, it is believed that some land in the LOD is occasionally used by residents for passive recreation and

the impoundment is occasionally used for recreational fishing. Impacts to recreational use are anticipated to be short-term, adverse, and moderate. Short-term impacts will occur during construction work (approximately 24 months) when local property owners will temporarily be restricted from the LOD, including access to the impoundment. Long-term, negligible impacts to recreational use because the size of the impoundment is expected to increase by approximately 0.08 acres from the increase to the normal pool associated with dam rehabilitation.

One home has a view of the LOD. During project construction work, which is expected to last approximately 24 months total, the aesthetic viewsheds of the LOD will be temporarily impacted. The home adjacent to the dam has a view of approximately 275 ft of the access road and will be able to see construction vehicles pass their home regularly during project work. Long-term impacts to aesthetic viewsheds were assessed based on the amount of permanent change to the natural green landscape in the LOD within viewshed of the home. Project work associated with this Alternative is not expected to impact the home's view of natural landscape; the 0.08 acres within view of the home is expected to remain natural green landscape. dam rehabilitation will only marginally alter the overall appearance of the dam site. No long-term impacts to the home's aesthetic viewshed are anticipated. Additionally, four homes have views of the offsite staging area. These homes are only anticipated to experience temporary impacts to their aesthetic viewsheds during construction sequencing.

Cumulative impacts to both recreation and aesthetic viewsheds from the construction of the original dam, which created the impoundment, will continue to occur with this Alternative.

Alternative 2

Short-term impacts to recreational use and aesthetic viewsheds from Alternative 2 are anticipated to be of a similar magnitude and intensity to those of Alternative 1. Alternative 2 is expected to permanently increase the impoundment size by 0.08 acres but not anticipated to have long-term impacts to aesthetic viewsheds.

Alternative 3

Short-term impacts to recreational use and aesthetic viewsheds from Alternative 3 are anticipated to be of a similar magnitude and intensity to those of Alternative 1. Alternative 3 is expected to permanently increase the impoundment size by 0.08 acres but not anticipated to have long-term impacts to aesthetic viewsheds.

Recreational Use

	Impoundment Size (acres) Post construction	**Change in Impoundment Size (acres)**
FWOFI	0	-2.45
Alternative 1	2.53	+0.08
Alternative 2	2.53	+0.08
Alternative 3	2.53	+0.08

Aesthetic Viewsheds – Natural Landscape View

	Natural Green Landscape in Viewshed of the LOD (acres) Post construction	Change in Natural Green Landscape in Viewshed (acres)
FWOFI	0.08	0
Alternative 1	0.08	0
Alternative 2	0.08	0
Alternative 3	0.08	0

Martin Dam

Existing Conditions

Currently the reservoir has 2.33 surface acres.

Currently there are 0.32 acres of natural green landscape in the viewshed of the LOD.

FWOFI

There would be a loss of 2.33 surface acres.

There will remain 0.32 acres of natural green landscape in the viewshed of the LOD.

Short-term, direct, adverse, moderate impacts and long-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds are expected from the No Action Alternative.

Short-term impacts from this Alternative will occur from the active construction site, which will prevent any recreational activity at the site during the approximately 18 months of construction. Aesthetic viewsheds of the homes with views of the LOD and offsite staging area will also be temporarily negatively impacted from the active construction zone.

Long-term and cumulative adverse impacts to recreational use will occur once the impoundment is eliminated from the constructed breach of the dam. Local property owners will no longer be able to utilize the impoundment for fishing or the recreational activities, although the stream will still be available for recreational use. The home's view of natural green landscape is not anticipated to be impacted by the No Action Alternative. The impoundment provides intrinsic monetary and personal value which would not be replaced by the vegetated wetland and stream channel if the impoundment was removed.

Alternative 1

Short-term, direct, adverse, moderate impacts to recreational use and aesthetic viewsheds and long-term, direct, adverse, negligible impacts to aesthetic viewsheds are expected from Alternative 1; and therefore, to the Cultural Ecosystem Services in the LOD.

There are no designated recreational lands or trails within the LOD or the offsite staging area. However, it is believed that some land in the LOD is occasionally used by local property owners for passive recreation and the impoundment is occasionally used for recreational fishing.

Impacts to recreational use are anticipated to be short-term, adverse, and moderate. Short-term impacts will occur during construction work (approximately 24 months) when local property owners will temporarily be restricted from the LOD, including access to the impoundment, and the offsite staging area. The size of the impoundment is only expected to be reduced by 0.12 acres from the extension of the upstream embankment into the impoundment; long-term impacts to recreational use are deemed direct, negligible, and adverse because adjacent homeowners will still be able to use the impoundment for recreational activities post construction.

One home has a view of portions of the LOD but does not have a view of the impoundment. During project construction work, which is expected to last approximately 24 months total, the aesthetic viewsheds of the home will be temporarily impacted. Long-term impacts to aesthetic viewsheds were assessed based on the amount of permanent change to natural green landscape within viewshed of the homes. Project work is anticipated to permanently reduce the amount of natural landscape within viewshed of the home by approximately 0.27 acres because of the installation of the RCC. Other dam rehabilitation work will only marginally alter the overall appearance of the dam site within viewshed of the home. Long-term adverse impacts to aesthetic viewsheds are anticipated to be negligible. Additionally, one home has a view of the onsite access road and nine homes have views of the offsite staging area. These homes are only anticipated to experience temporary impacts to their aesthetic viewsheds during construction sequencing.

Cumulative impacts to both and aesthetic viewsheds from the construction of the original dam, which created the impoundment, will continue to occur with this Alternative.

Alternative 2

Impacts to recreational use and aesthetic viewsheds from Alternative 2 are anticipated to be of a similar magnitude and intensity to those of Alternative 1 because both involve similar construction activities. The size of the impoundment is expected to be reduced by 0.12 acres from the extension of the upstream embankment into the impoundment. Dam rehabilitation actions associated with this Alternative will reduce the home's view of natural landscape by 0.01 acres.

Alternative 3

Impacts to recreational use and aesthetic viewsheds from Alternative 3 are anticipated to be of a similar magnitude and intensity to those of Alternative 1 because both involve similar construction activities. The size of the impoundment is expected to be reduced by 0.12 acres from the extension of the upstream embankment into the impoundment. Dam rehabilitation actions associated with this Alternative will reduce the view of natural landscape by 0.01 acres.

Recreational Use

	Size of impoundment (acres) Post construction	Change in impoundment size (acres)
FWOFI	0	-2.33
Alternative 1	2.21	-0.12
Alternative 2	2.21	-0.12
Alternative 3	2.21	-0.12

Aesthetic Viewsheds – Natural Landscape View

	Natural Green Landscape in Viewshed of the LOD (acres) Post construction	Change in Natural Green Landscape in Viewshed (acres)
FWOFI	0.32	0
Alternative 1	0.31	-0.01
Alternative 2	0.31	-0.01
Alternative 3	0.31	-0.01

Finkleday Dam

Existing Conditions

Currently the reservoir has 5.6 surface acres within view.

There are 7.65 acres of natural green landscape.

FWOFI

There would be a loss of the 5.6 reservoir surface acres within view.

There would be 12.98 acres of natural green landscape.

Short-term, direct, adverse, moderate impacts and long-term, direct, adverse, moderate impacts to al use and aesthetic viewsheds are expected from the No Action Alternative.

Short term impacts from this alternative will occur from the active construction site, which will prevent any recreational activity at the site during the approximately 18 months of construction. Aesthetic viewsheds of the LOD and offsite staging area will also be temporarily negatively impacted from the active construction zone.

Long-term adverse impacts to recreational use and aesthetic viewsheds will occur once the impoundment is eliminated from the constructed breach of the dam. The property owners will no longer be able to utilize the impoundment for fishing or the recreational activities, although Indian Orchard Brook will still be available for recreational use. A culvert/bridge will be installed so that the home west of the Dam will maintain access to the site. The aesthetic viewshed of both homes will be permanently altered from the loss of its view of 5.6 acres of the impoundment.

However, the impoundment will be replaced by natural green landscape and therefore, in time, the homes will gain an additional 5.33 acres of natural green landscape view. The impoundment provides intrinsic monetary and personal value which would not be replaced by the vegetated wetland and stream channel if the impoundment was removed.

Alternative 1

Short-term, direct, adverse, moderate impacts and long-term, direct, adverse, negligible impacts to recreational use and aesthetic viewsheds are expected from Alternative 1; and therefore, to the Cultural Ecosystem Services in the LOD.

There are no designated recreational lands or trails within the LOD or the offsite staging area. However, it is believed that some land in the LOD is occasionally used by local property owners for passive recreation and the impoundment is occasionally used for recreational fishing. Impacts to recreational use are anticipated to be short-term, adverse, and moderate. Short-term impacts will occur during construction work (approximately 24 months) when local property owners will temporarily be restricted from the LOD, including access to the impoundment, and the offsite staging area. The size of the impoundment is not expected to change due to project work; and therefore, no long-term impacts to recreational use are anticipated.
Cumulative impacts to both recreation and aesthetic viewsheds from the construction of the original dam, which created the impoundment, will continue to occur with this Alternative.

Alternative 2

Impacts to recreational use and aesthetic viewsheds from Alternative 2 are anticipated to be similar to those of Alternative 1 because both involve similar construction activities. The installation of the ACB spillway associated with this alternative is anticipated to permanently reduce the view of natural green landscape by approximately 0.175 acres.

Alternative 3

Impacts to recreational use from Alternative 3 are anticipated to be similar to those of Alternative 1 because both involve similar construction activities. However, with this alternative, the aesthetic viewshed will not be permanently impacted because the RCC spillway will be covered with topsoil and planted with native seed post-construction and the impoundment size is not anticipated to change.

Recreational Use

	Size of impoundment (acres) Post construction	**Change in impoundment size (acres)**
FWOFI	0	-5.60
Alternative 1	5.60	0
Alternative 2	5.60	0
Alternative 3	5.60	0

Aesthetic Viewsheds – Natural Landscape View

	Natural Green Landscape in Viewshed of the LOD (acres) Post Construction	Change in Natural Green Landscape in Viewshed (acres)
FWOFI	12.98	5.33
Alternative 1	7.02	-0.18
Alternative 2	6.285	-0.175
Alternative 3	7.20	0

HUMANS

Public Health and Safety

Garrett Dam

Existing Conditions

The dam currently fails to meet dam safety and performance criteria for a high hazard potential dam for auxiliary spillway capacity, stability, and integrity. One hundred fifty-two (152) people downstream would be at risk of loss of life should the dam fail.

FWOFI

Under this alternative, the dam would be breached by the Sponsors to remove the flooding hazard associated with a catastrophic failure of the dam. One hundred fifty-two (152) people downstream would not be at risk of loss of life due to a dam failure. However, the downstream area of the dam would return to pre-project (before the dam was constructed) conditions. Thirty-five structures (11 residences and 24 commercial buildings), 14 roadways, and 12 stream crossings would lose flood protection from the dam.

Alternative 1 (NEE Alternative)

The dam would be structurally rehabilitated using current design and safety criteria to provide continued flood protection for 60 years after the rehabilitation project is complete. The threat to loss of life from failure of the dam would be greatly reduced. One-hundred fifty-two people living/working/driving downstream of the dam would be protected. Catastrophic damages to buildings, roadways, bridges, and utilities would also be avoided. Access to the site will be restricted during construction. The following table reflects the flooding impacts of the rehabbed dam as compared to no dam in place. Since the impacts of each alternative are equivalent; the last column represents impacts of each alternative.

Flooding Impacts of No Dam vs. Dam Alternatives

Item	100-year Storm Without Dam	100-year Storm With Rehabbed Dam
Residential (#)	11	9
Flood Depths (ft) *	0.0 – 2.9	0.0 – 2.4
Commercial (#)	24	9
Flood Depths (ft)	0.1 – 3.1	0.4 – 2.6
Roadways (#)	14	12
Stream Crossings (#)	12	8
Flood Depths (ft)	1.2 – 8.3	1.1 – 7.0

* - 0.0 depth reflects flooding in basement.

Alternative 2
Same as Alternative 1.

Alternative 3
Same as Alternative 1.

Varcoe Dam
Existing Conditions
The dam currently fails to meet dam safety and performance criteria for a high hazard potential dam for auxiliary spillway stability and integrity. Thirty-three (33) people downstream would be at risk of loss of life should the dam fail.

FWOFI
Under this alternative, the dam would be breached by the Sponsors to remove the flooding hazard associated with a catastrophic failure of the dam. Thirty-three (33) people downstream would not be at risk of loss of life due to a dam failure. However, the downstream area of the dam would return to pre-project (before the dam was constructed) conditions. Thirty-five structures (11 residences and 24 commercial buildings), 14 roadways, and 12 stream crossings would lose flood protection from the dam.

Alternative 1 (NEE Alternative)
The dam would be structurally rehabilitated using current design and safety criteria to provide continued flood protection for 50 years after the rehabilitation project is complete. The threat to loss of life from failure of the dam would be greatly reduced. Thirty-three people living/working/driving downstream of the dam would be protected. Catastrophic damages to buildings, roadways, bridges, and utilities would also be avoided. Access to the site will be restricted during construction. The following table reflects the flooding impacts of the rehabbed dam as compared to no dam in place. Since the impacts of each alternative are equivalent; the last column represents impacts of each alternative.

Flooding Impacts of No Dam vs. Dam Alternatives

Item	100-year Storm Without Dam	100-year Storm With Rehabbed Dam
Residential (#)	11	9
Flood Depths (ft) *	0.0 – 2.9	0.0 – 2.6
Commercial (#)	24	9
Flood Depths (ft)	0.1 – 3.1	0.5 – 2.8
Roadways (#)	14	13
Stream Crossings (#)	12	10
Flood Depths (ft)	1.2 – 8.3	1.1 – 7.0

* - 0.0 depth reflects flooding in basement.

Alternative 2
Same as Alternative 1.

Alternative 3
Same as Alternative 1.

Martin Dam

Existing Conditions
The dam currently fails to meet dam safety and performance criteria for a high hazard potential dam for auxiliary spillway capacity, stability, and integrity. Eighty-five (85) people downstream would be at risk of loss of life should the dam fail.

FWOFI
Under this alternative, the dam would be breached by the Sponsors to remove the flooding hazard associated with a catastrophic failure of the dam. Eighty-five (85) people downstream would not be at risk of loss of life due to a dam failure. However, the downstream area of the dam would return to pre-project (before the dam was constructed) conditions. Twenty-eight structures (13 residences, 14 commercial buildings, and 1 public building), 14 roadways, and 6 stream crossings would lose flood protection from the dam.

Alternative 1 (NEE Alternative)
The dam would be structurally rehabilitated using current design and safety criteria to provide continued flood protection for 100 years after the rehabilitation project is complete. The threat to loss of life from failure of the dam would be greatly reduced. Eighty-five people living/working/driving downstream of the dam would be protected. Catastrophic damages to buildings, roadways, bridges, and utilities would also be avoided. Access to the site will be restricted during construction. The following table reflects the flooding impacts of the rehabbed dam as compared to no dam in place. Since the impacts of each alternative are equivalent; the last column represents impacts of each alternative.

Flooding Impacts of No Dam vs. Dam Alternatives

Item	100-year Storm Without Dam	100-year Storm With Rehabbed Dam
Residential (#)	13	11
Flood Depths (ft) *	0.0 – 3.3	0.1 – 2.8
Commercial (#)	14	14
Flood Depths (ft)	0.1 – 2.7	0.1 – 2.5
Public (#)	1	1
Flood Depths (ft)	1.2	0.7
Roadways (#)	14	12
Stream Crossings (#)	6	4
Flood Depths (ft)	1.0 – 6.1	1.2 – 5.8

* - 0.0 depth reflects flooding in basement.

Alternative 2
Same as Alternative 1.

Alternative 3
Same as Alternative 1.

Finkleday Dam
Existing Conditions
The dam currently fails to meet dam safety and performance criteria for a high hazard potential dam for auxiliary spillway stability, and integrity. Fifty-eight (58) people downstream would be at risk of loss of life should the dam fail.

FWOFI (Sponsors' Rehabilitation)
Under this alternative, the dam would be breached by the Sponsors to remove the flooding hazard associated with a catastrophic failure of the dam. Fifty-eight (58) people downstream would not be at risk of loss of life due to a dam failure. However, the downstream area of the dam would return to pre-project (before the dam was built) conditions. Twenty-eight structures (13 residences and 14 commercial buildings, and 1 public building), 14 roadways, and 6 stream crossings would lose flood protection from the dam.
Alternative 1
Same as Alternative 2.

Alternative 2 (NEE Alternative)
The dam would be structurally rehabilitated using current design and safety criteria to provide continued flood protection for 100 years after the rehabilitation project is complete. The threat to loss of life from failure of the dam would be greatly reduced. Fifty-eight people living/working/driving downstream of the dam would be protected. Catastrophic damages to buildings, roadways, bridges, and utilities would also be avoided. Access to the site will be restricted during construction. The following table reflects the flooding impacts of the rehabbed

dam as compared to no dam in place. Since the impacts of each alternative are equivalent; the last column represents impacts of each alternative.

Flooding Impacts of No Dam vs. Dam Alternatives

Item	100-year Storm Without Dam	100-year Storm With Rehabbed Dam
Residential (#)	13	11
Flood Depths (ft) *	0.0 – 3.3	0.0 – 3.2
Commercial (#)	14	14
Flood Depths (ft)	0.1 – 2.7	0.1 – 2.6
Public (#)	1	1
Flood Depths (ft)	1.2	1.1
Roadways (#)	14	14
Stream Crossings (#)	6	6
Flood Depths (ft)	1.0 – 3.3	1.1 – 2.8

* - 0.0 depth reflects flooding in basement.

Alternative 3
Same as Alternative 2.

Scenic Beauty
Scenic beauty, as defined by the USDA National Environmental Compliance Handbook Part 610.35, takes into consideration landforms, water, vegetation, and structures, some of which are present within the LOD (USDA NRCS 2016).

FWOFI (This information is applicable to all dams)
There will be short-term, minor, adverse impacts to scenic beauty associated with the active construction zone in the LOD.

Short-term effects to scenic beauty will result from the appearance of an active construction site during the approximately 2 years of project work. There will be long-term effects to scenic beauty from this Alternative due to the elimination of the impoundment after the dam is breached. Long-term effects to scenic beauty are considered adverse and moderate because the constructed breach of the dam will eliminate the impoundment, permanently altering the existing condition and appearance of the dam site, which provides intrinsic monetary and personal value to the landowners.

Garrett Dam
Existing Conditions
The landforms in the LOD include small hills and other small geologic formations. There is one small, shallow water body, which was formed by the construction of Garret Dam and a variety of vegetation communities in the LOD.

The dam is located in a rural residential area and is relatively isolated. Only one home has a view of the dam.

Alternative 1
Short-term, direct, negligible, adverse and long-term, direct, negligible impacts to scenic beauty are expected from Alternative 1. No indirect or cumulative effects were identified during analysis.

This alternative is anticipated to have both short- and long-term negligible adverse effects on scenic beauty. Short-term effects will result from the appearance of an active construction site during the approximately 2 years of project work. There will be negligible long-term impacts to landform, water, and vegetation features of scenic beauty from the necessary alterations to the dam site for rehabilitation; efforts will be made by the design and construction team to maintain the current aesthetics of the dam site. There is one home with a view of the dam and impoundment and four homes with views of the staging area.

Alternative 2
Alternative 2 is anticipated to have impacts to scenic beauty of a similar intensity and duration as Alternative 1. However, there may be some additional long-term effects to scenic beauty because the labyrinth weir will alter the existing look of the dam site slightly more than the RCC ASW. Long-term impacts to scenic beauty are still expected to be negligible.

Alternative 3
Alternative 3 is anticipated to have impacts to scenic beauty of a similar intensity and duration as Alternative 2.

Varcoe Dam
Existing Conditions
There is one small, shallow water body, which was formed by the construction of Varcoe Dam and a variety of vegetation communities in the LOD. The offsite staging area does not contain features of scenic beauty.

The dam and offsite staging area are located in a rural residential area and is relatively isolated. Only one home has a view of the dam and four homes have a view of the offsite staging area.

Alternative 1
Short-term, direct, negligible, adverse and long-term, direct, negligible, and adverse impacts to scenic beauty are expected from Alternative 1. No indirect effects or cumulative effects were identified during analysis that on their own or in combination with other events could cause adverse or beneficial impacts resulting from the project.

Alternative 1 is anticipated to have both short- and long-term negligible adverse effects on scenic beauty. Short-term effects will result from the appearance of an active construction site in the LOD and the staging of materials and equipment in the offsite staging area during the approximately 2 years of project work. There will be negligible long-term impacts to landform,

water, and vegetation features of scenic beauty from the necessary alterations to the dam site for rehabilitation; efforts will be made by the design and construction team to maintain the current aesthetics of the dam site.

Alternative 2
The alternative is anticipated to have impacts to scenic beauty of a similar intensity and duration as Alternative 1.

Alternative 3
The alternative is anticipated to have impacts to scenic beauty of a similar intensity and duration as Alternative 1.

Martin Dam
Existing Conditions
The landforms in the LOD include small hills and other small geologic formations. There is one small, shallow water body, which was formed by the construction of Martin Dam and a variety of vegetation communities in the LOD. The offsite staging area does not contain features of significant scenic beauty.

The dam and offsite staging area are located in a rural residential area and is relatively isolated. Only one home has a view of the dam site and nine homes have a view of the offsite staging area.

Alternative 1
Short-term, direct, negligible, adverse and long-term, direct, negligible impacts to scenic beauty are expected from this alternative. No indirect effects or cumulative effects were identified during analysis that on their own or in combination with other events could cause adverse or beneficial impacts resulting from the project.

This alternative is anticipated to have both short- and long-term negligible adverse effects on scenic beauty. Short-term effects will result from the appearance of an active construction site in the LOD and the staging of materials and equipment in the offsite staging area during the approximately 2 years of project work. There will be negligible, long-term impacts to landform, water, and vegetation features of scenic beauty from the necessary alterations to the dam site for rehabilitation; efforts will be made by the design and construction team to maintain the current aesthetics of the dam site.

Alternative 2
The alternative is anticipated to have impacts to scenic beauty of a similar intensity and duration as Alternative 1. However, there may be some additional long-term effects to scenic beauty because the labyrinth weir will alter the existing look of the dam site slightly more than the RCC ASW. Long-term impacts to scenic beauty are still expected to be negligible.

Alternative 3
This alternative is anticipated to have impacts to scenic beauty of a similar intensity and duration as Alternative 1. However, the wider RCC ASW and Ogee weir may have some additional

impacts to the scenic beauty of the site. Long-term impacts to scenic beauty are still expected to be negligible.

Finkleday Dam

Existing Conditions

The landforms in the LOD include small hills and other small geologic formations. There is one small, shallow water body, which was formed by the construction of Finkleday Dam and a variety of vegetation communities in the LOD. The offsite staging area does not contain features of scenic beauty.

The dam and offsite staging area are located in a rural residential area and is relatively isolated. Two homes have a view of the dam and impoundment and four homes have a view of the offsite staging area.

Alternative 1

Short-term, direct, minor, adverse and long-term, direct, negligible impacts to scenic beauty are expected from Alternative 1. No indirect effects or cumulative effects were identified during analysis that on their own or in combination with other events could cause adverse or beneficial impacts resulting from the project.

The alternative is anticipated to have both short- and long-term negligible adverse effects on scenic beauty. Short-term effects will result from the appearance of an active construction site in the LOD and the staging of materials and equipment in the offsite staging area during the approximately 2 years of project work. There will be negligible long-term impacts to landform, water, and vegetation features of scenic beauty from the necessary alterations to the dam site for rehabilitation; efforts will be made by the design and construction team to maintain the current aesthetics of the dam site.

Alternative 2

This alternative is anticipated to have impacts to scenic beauty of similar intensity, duration, and magnitude as Alternative 1.

Alternative 3

Alternative 3 is anticipated to have impacts to scenic beauty of a similar intensity, duration, and magnitude as Alternative 1.

Cultural Resources / Historic Properties

Existing Conditions (This information is applicable to all dam sites)

NRCS determined that there are no historic properties eligible for the NRHP within the APE of each dam. (The APEs included the original footprint of construction for each dam, staging areas, and ingress/egress areas.) PA SHPO concurred with the NRCS determinations.

The areas within the identified APEs that include the footprint of original dam construction have been significantly disturbed. Previously undisturbed areas, including some staging areas and access roads, were identified by PA SHPO as ranging from low to high levels of probability of

having an unidentified pre-contact site. The Delaware Tribe of Indians stated that the project area has a low/medium sensitivity for our ancestral materials and treaty resources.

FWOFI Alternative (This information is applicable to all dam sites)
The PA SHPO concurred with the NRCS determination of no effect on historic properties (including archaeological resources) within the identified APEs of each dam.

The Stockbridge-Munsee Community Band of Mohican Indians concurred with the determination of no effect to historic properties. They asked to be notified if the scope of work changed or anything unexpected was encountered.

The Delaware Tribe of Indians requested that any undisturbed areas either be protected during construction or a Phase IB archaeological investigation completed to determine if there is an archaeological site present and the results of the investigation be shared with them. In addition, they asked that if any archaeological materials (artifacts, subsurface features, etc.) are discovered during the construction process that work in the immediate area be halted until an archaeologist can view and assess the findings. The Delaware Tribe of Oklahoma also requested that if any human remains are accidentally unearthed during the project, work ceases immediately, and they be contacted regarding the inadvertent discovery.

Garrett Dam
Existing Conditions
The areas within the identified APE that include the footprint of original dam construction have been significantly disturbed. The planned staging area and access road, about half of the APE, have not been disturbed beyond normal cropping practices.

FWOFI
Upon final determination of staging areas and access roads, a Phase IB archaeological investigation will be completed on the undisturbed areas or those areas will be protected during construction. If a Phase IB archaeological investigation is completed, the results will be shared with the tribes and PA SHPO.

Alternative 1
Same as FWOFI Alternative.

Alternative 2
Same as FWOFI Alternative.
Alternative 3
Same as FWOFI Alternative.

Varcoe Dam
Existing Conditions
The areas within the identified APE that include the footprint of original dam construction and historic access road have been significantly disturbed. Most of the planned staging area had been disturbed as part of original construction. However, small portions of the planned staging area have not been disturbed.

FWOFI
Upon final determination of staging areas and access roads, a Phase IB archaeological investigation will be completed on the undisturbed areas or those areas will be protected during construction. If a Phase IB archaeological investigation is completed, the results will be shared with the tribes and PA SHPO.
Alternative 1
Same as FWOFI Alternative.

Alternative 2
Same as FWOFI Alternative.

Alternative 3
Same as FWOFI Alternative.

Martin Dam
Existing Conditions
The areas within the identified APEs that include the footprint of original dam construction have been significantly disturbed. The planned on-site staging area and access road, about a quarter of the APE, have not been disturbed beyond normal cropping practices. The Federal Energy Regulatory Commission completed a Phase I archaeological investigation on the APE of the planned off-site staging area in 2011. No resources were identified during that survey.

FWOFI
Upon final determination of staging areas and access roads, a Phase IB archaeological investigation will be completed on the undisturbed areas or those areas will be protected during construction. If a Phase IB archaeological investigation is completed, the results will be shared with the tribes and PA SHPO.

Alternative 1
Same as FWOFI Alternative.

Alternative 2
Same as FWOFI Alternative.

Alternative 3
Same as FWOFI Alternative.

Finkleday Dam
Existing Conditions
The areas within the identified APEs that include the footprint of original dam construction and access road have been significantly disturbed. The planned alternate access roads have no evidence of historical disturbance. About half of the planned off-site staging area has seen significant disturbance due to previous use as a staging area for other infrastructure construction projects. The remainder of the offsite staging area has not been disturbed beyond normal cropping practices.

FWOFI
Upon final determination of staging areas and access roads, a Phase IB archaeological investigation will be completed on the undisturbed areas or those areas will be protected during construction. If a Phase IB archaeological investigation is completed, the results will be shared with the tribes and PA SHPO.
Alternative 1
Same as FWOFI Alternative.

Alternative 2
Same as FWOFI Alternative.

Alternative 3
Same as FWOFI Alternative.

Environmental Justice and Civil Rights
The presence or absence of environmental justice groups within each watershed was assessed using EPA's EJSCREEN tool and confirmed by the Pennsylvania Department of Environmental Protection (PADEP) Environmental Justice Public Participation Policy. There are no Tribal Communities or other Environmental Justice groups in the area of potential effect of the dam rehabilitation project.

The population figures for each "Existing Condition" were taken from reports generated by EPA's "EJSCREEN - EJSCREEN ACS Summary Report", which used US Census Bureau data. They represent the number of people living below the dam in the breach zone. Although these are the estimated number of people living in the breach zone, they do not represent the number of people at risk of loss of life due to a breach of the dam (population at risk or PAR). Also, they do not include motorists who could be at risk during a breach. See "SUB-WATERSHED CONSEQUENCES OF DAM FAILURE" for a complete summary of PAR.

Garrett Dam
Existing Conditions
There is an estimated population of 125 people and 40 households in the breach zone below the dam.

FWOFI
There are no known disparate impacts from the rehabilitation project – short-term or long-term. Avoiding a dam breach will directly benefit all local residents and taxpayers in general within Honesdale Borough, Wayne County, and the Commonwealth of Pennsylvania.

Alternative 1 (NEE Alternative)
Same as FWOFI Alternative.

Alternative 2
Same as FWOFI Alternative.

Alternative 3

Same as FWOFI Alternative.

Varcoe Dam

Existing Conditions

There is an estimated population of 125 people and 40 households in the breach zone below the dam.

FWOFI

There are no known disparate impacts from the rehabilitation project – short-term or long-term. Avoiding a dam breach will directly benefit all local residents and taxpayers in general within Honesdale Borough, Wayne County, and the Commonwealth of Pennsylvania.

Alternative 1 (NEE Alternative)

Same as FWOFI Alternative.

Alternative 2

Same as FWOFI Alternative.

Alternative 3

Same as FWOFI Alternative.

Martin Dam

Existing Conditions

There is an estimated population of 66 people and 22 households in the breach zone below the dam.

FWOFI

There are no known disparate impacts from the rehabilitation project – short-term or long-term. Avoiding a dam breach will directly benefit all local residents and taxpayers in general within Honesdale Borough, Wayne County, and the Commonwealth of Pennsylvania.

Alternative 1 (NEE Alternative):

Same as FWOFI Alternative.

Alternative 2

Same as FWOFI Alternative.

Alternative 3

Same as FWOFI Alternative.

Finkleday Dam

Existing Conditions

There is an estimated population of 66 people and 22 households in the breach zone below the dam.

FWOFI

There are no known disparate impacts from the rehabilitation project – short term or long term. Avoiding a dam breach will directly benefit all local residents and taxpayers in general within Honesdale Borough, Wayne County, and the Commonwealth of Pennsylvania.

Alternative 1

Same as FWOFI Alternative.

Alternative 2 (NEE Alternative)

Same as FWOFI Alternative.

Alternative 3

Same as FWOFI Alternative.

RISK AND UNCERTAINTY

Hydrology and Hydraulics

Actual damages occurring from each storm event could realistically be higher or lower, depending on soil moisture conditions at the time of a given event, associated debris flows, and other factors such as temporal and spatial distributions of the various storm events.

While climate models indicate that more intense, longer duration precipitation, and increased frequency of flood events are likely in certain areas, they also show greater variability of rainfall. However, these increases do not have a direct correlation to the PMP values as demonstrated by site-specific and state-wide PMP studies completed throughout the US in recent years, many of which resulted in reduction of PMP values when compared to HMR 51. Therefore, potential climatic changes are not expected to alter the PMP values within the design life of the project.

Mathematical, numerical, and computer models have inherent limitations while attempting to simulate complex physical processes, particularly when numerical solutions involve simplifying assumptions (e.g., ignoring depth variations in velocity for 2D hydraulic solutions) and when lumped parameters are used to represent a physical characteristic (e.g., Manning n-values for flow resistance, CNs for watershed retention/losses, etc.).

The SCS Dimensionless Unit Hydrograph method (USDA-NRCS, 2007) was used to transform runoff volumes to flow hydrographs. Unit Hydrograph theory inherently assumes that "discharge at any time is proportional to the volume of runoff and that the time factors affecting hydrograph shape are constant". This linearity assumption is not strictly true when a Unit Hydrograph is applied to storms of varying intensities and temporal and spatial patterns. No adjustments were made to the Unit Hydrograph in the HEC-HMS model to account for non-linearity, although the SCS Dimensionless Unit Hydrograph is generally known to produce conservatively high (i.e., overestimate) peak flows.

Additional uncertainty associated with hydrologic analyses is due to the use of input parameters that are the best approximation of hydrologic conditions in the watershed. The uncertainty and risk could be limited by calibration of the watershed response to rainfall events of the same magnitude; however, the lack of stream gage data limits the potential for calibration.

Very large storm events or deforestation by fire could cause an increased rate of erosion, sedimentation, and deposition.

Engineering

Risk and uncertainty during construction can be reduced by conducting design-phase geotechnical explorations to provide additional characterization of subsurface conditions at locations based on the specific layout and features of the preferred alternative. Subsurface conditions between boring and test pit locations may vary, and the adequacy of the design should be confirmed if unanticipated conditions are encountered during construction.

Professional opinions of future performance of concrete structures are based on visual observations and engineering analyses. While these structures, including the principal spillway

riser (Martin and Finkleday Dams only) and conduit, are expected to perform as intended during design-level hydraulic and seismic loadings within the design life of the structures, risk and uncertainty can be reduced by regular inspection and maintenance, as well as monitoring during and after major flood and seismic events, in accordance with NRCS and PADEP Dam Safety requirements.

Environmental

There are inherent uncertainties of the predicted potential environmental impacts from this project. This is due to a variety of factors including the reliance on online publicly available data sources, limited site-specific field surveys, the estimation of disturbance areas, and the inherent inaccuracies of conceptual level drawings.

Risk deals with data probabilities, and a risk analysis is not warranted with this data as the analysis is tied to the level of intensity of planning and perceived intensity of the anticipated impacts from the project.

Climate

Climate change is another source of uncertainty. The effects on the resources discussed below, may increase, or decrease in magnitude or intensity due to climate change. This may have an impact on anticipated effects on resources in the vicinity of the project, over life of the project, but are anticipated to have minimal impact over the course of planning, design, and construction of the project. Due to the inherent dynamic and uncertain nature of climate change, the impacts of it are often based on the predictive models and acceptable degrees uncertainty in assumptions making future impacts subjective and hard to assess. For example, the climate change literature reviewed for this project implied that precipitation events will be more severe and frequent in the Eastern United States although the degree to which this could occur varies widely, as discussed in the hydrology and hydraulics section above.

Soils

Soil information presented in this report was summarized from USDA NRCS WSS data (USDA NRCS 2019a). There is uncertainty in the predicted soil impacts because of inherent inaccuracy of soils data used and the estimated LOD areas. The NRCS WSS uses order two soil survey data which is not a site-specific survey. It is also likely that there have been physical changes to the land since the last soil survey was conducted which would alter the soil characteristics. Additionally, the LODs were estimated based on experience with the type of activities to take place with each alternative and the exact LODs may change once construction sequencing begins. Climate changes in the project area will likely facilitate richer soils due to increased nutrient cycling.

Water Resources

There is uncertainty related to water quantity, water quality, wetlands, and floodplain management. Water quantity impacts are based on hydrology calculations which require many assumptions during the calculation process, thus increasing the amount of uncertainty of the final water quantity. Water quality impact assessments were based on impacts to water quality from similar construction projects.

Wetland data used to evaluate wetlands impacts was delineated by EA in December 2020 using USACE wetland delineation guidelines and classified using the Cowardin system. However, wetlands data obtained from the USFWS NWI was used to identify wetlands located in the additional areas encompassed by the No Action Alternative LODs. Thus, the absence of field delineations in the areas increases the uncertainty of the wetlands data accuracy for that Alternative. Flood zone data was obtained online from FEMA; however, the flood map panels for the area have not been updated since 2013 and thus the actual flood zones may differ from what is presented.

Climate change in the project area will likely increase flow regimes. Wetlands are likely to expand due to increased moisture.

Air Quality

Wayne County is currently listed as an attainment zone, but this status could change between the date of this report and the start date of construction. There is also uncertainty in the predicted air quality impacts were not calculated on a specific number of trucks. But was based on the qualitative assessment of the amount of equipment expected to be used. The exact number of trucks and machinery necessary for the project and the exact length of construction sequencing is currently unknown due to the conceptual level of the design. The final construction sequence and duration could alter air quality impacts.

Climate change in the project area is likely to provide cleaner air due to particulate matter being carried to the ground via rain events.

Vegetation

Vegetation communities and land cover types present in the project area were mapped using online NLCD data (2016). Information from PNHP was used to obtain a general sense of common trees, bushes, and plant species in Wayne County and the occurrence of state-listed plant species in the county. There is inherent uncertainty in the predicted vegetation impacts because site-specific vegetation surveys were not conducted for the project. An online USFWS IPaC report was also generated for the project. The report did not list any threatened or endangered plant species in the LOD; however, this has the potential to change as new populations of listed species are identified or new plant species become listed. Riparian areas were estimated based on a 30-foot buffer along the streams.

Climate change may change the species of vegetation in the project area and improve the vigor of existing vegetation due to added nutrients.

Animals

Fisheries data for the nearby streams was obtained from PFBC Bureau of Fisheries. However, the most recent survey data was from 2015 (and much of the data was older); fish populations may have changed since the surveys. The actual presence of the species listed in the report was not confirmed with field data collection efforts. It was also assumed that the impounded water upstream of the dams resulted in increased water temperatures, but temperature loggers were not installed to confirm this.

Site-specific wildlife surveys were not conducted as a part of this project. Wildlife species listed in the report were assumed based on the habitat type and from Pennsylvania Game Commission's common wildlife species for Wayne County. An online USFWS IPaC report was also generated for the project. However, IPaC report has the potential to change as new populations of listed species are identified or new animal species become listed. Online sources from DCNR and PNHP were also consulted to determine the occurrence of state listed animal species in Wayne County. This information has the potential to change as new populations of listed species are identified or new animal species become listed.

Climate change will have little effect on animals except for amphibians which may have an increase in habitat.

Human Environment

Determining and quantifying impacts to scenic beauty comes with inherent uncertainty because scenic beauty is typically subjective. Some people may consider scenic beauty impacts from the project greater or less than what was stated in the report.

Climate change impacts to humans in the project area will include possible increase in disease because the new environment will be conducive to the growth of bacteria. Allergens will increase as vegetation becomes more robust.

Staging areas and access route locations were preliminarily determined through consultation with local sponsors and landowners. Agency assumptions regarding cultural archaeological sensitivity were informed through the consultation process with PA SHPO and interested tribes. There is inherent risk that these areas may change between planning and construction. The offsite borrow area for Martin Dam has also not yet been defined. Once the final locations have been determined and appropriate easements obtained, the Agency will re-open the consultation process to make an informed decision regarding intrusive testing of undisturbed areas.

Economic

Because local tax appraisal district records were utilized to obtain the structural values of residences, commercial, and public properties that would be affected by project activities, there is the possibility of under- and/or over-estimated values as compared to fair market values, which could impose uncertainty into the economic analysis. Content values were estimated as a percentage of assessed property values, which also could result in values not reflective of actual values. Estimated floodwater depths for various storms (including the 500-year storm) for each structure were based on the results of the hydrology and hydraulics (H&H) simulation modeling. This could result in greater and/or less risk of flood events. Depth-to-damage functions provided by NRCS were utilized to estimate structural and content damage. Updated functions based on more recent flood events could also provide varying results – increased and/or decreased damages. The risk and uncertainty in the analysis for flood damage reduction could be reduced for the economic analysis, but that would require more intensive primary and secondary data collection. The reasoning for work is to meet the purpose and need of the project. The identification of the NEE alternative is not distorted by the use of these procedures. Thus, it was

determined that increased investment in analysis was not necessary and any reduction in risk and uncertainty would not result in a different identification of the NEE alternative.

There is a need to provide flood protection downstream and to address dam safety and performance deficiencies of the existing high-hazard dams that are not in compliance with NRCS and Commonwealth of Pennsylvania standards. From a financing and administrative standpoint, the Sponsors have committed to NRCS that they are able to fund the required 35% of the total project costs to complete installation of the preferred alternative and can perform the required maintenance on the upgraded structures after construction.

Climate change in the project area may include lost labor and increased costs of living due to an increased flooding frequency.

CONSULTATION, COORDINATION, AND PUBLIC PARTICIPATION

The Sponsors and NRCS decided during the project kickoff meeting that all public meetings would involve the discussion of all four dams included in this plan.

The specific entities invited are identified in the Public Participation Plan (PPP) in the Reviewable Record. The meetings were advertised using local media including local website and Facebook page. Letters of invitation were sent to the local, state, tribal, federal government entities, people living in the breach zones and who had property within the flood pool, and legislative offices. Specific attendee lists are provided in the Reviewable Record.

Several agencies such as the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service and FEMA were considered as potential cooperating agencies in the development of the plan. However, after discussion between NRCS and the Sponsors, it was decided not to invite any of them to be cooperating agencies because there would not be an added value to planning. The various permitting agencies were invited to the scoping and public meetings during planning and can still be involved during the design phase of the project. There is nothing in this plan that is controversial or requires other agencies to participate as cooperating agencies.
Public Outreach Activities

Date	Type	Purpose	Participants
November 18, 2019	Site Visit	Visualize existing conditions	Sponsors, NRCS, and Contractor
October 19, 2019	Public Meeting Invitation Letters/notices	Inform tribes, agencies, and public of project planning scoping meeting	Those identified in the PPP were invited to the meeting
November 19, 2019	Public Meeting	Scoping	Agencies with jurisdiction, legislative reps., nongovernment entities, public, and Sponsors
Monthly Teleconferences	Informational	Project updates	Sponsor, NRCS, & Contractor
April 14, 2021	Public Meeting Invitation Letters	Inform Agencies and Legislators of Potential Project Alternatives	Agencies and Legislators identified in PPP and Public
April 14, 2021	Public Meeting Invitation Letters	Inform tribes, agencies, and public of plan review meeting	Those invited to the project scoping meeting
April 15, 2021	Informational	Discuss deficiencies and alternatives	Sponsors and land owners
April 20, 2021	Tribal Consultation	Review effects of project activities	Tribal Organizations
May 18, 2021	Commissioners Work Meeting	Discuss dam deficiencies and alternatives	Commissioners and Heather Smeltz NRCS Project Engineer

May 20, 2021	Public Meeting Held Onsite and Virtually	Review plan alternatives & effects	Sponsors, NRCS, Publics/Stakeholders and Contractor
December 3, 2021	Tribal Consultation	Formal Consultation Request	Tribal Organizations
December 3, 2021	Required Agency Consultation	Formal Consultation Request	State and Federal Agencies as required by the NWPM
May 15, 2023	Interagency and Public Review	Review Draft Plan	Public, Agencies, Tribal Organizations, Sponsors, and Stakeholders
No definite date	Public Notice	Inform public of FONSI availability	Sponsors publish notice via local media
No definite date	Distribution and Posting of Final Plan to NRCS Website	Inform public of Final Plan	Sponsors mail out and post Final Plan for all agencies, Tribal Organizations and Publics/Stakeholders

Consultations

- NRCS-PA conducted official consultation with environmental agencies and tribal organizations. Copies of the template consultation letter sent to everyone on the contact list, along with the responses received, are included in Appendix A.
- The Pennsylvania SHPO was requested to participate in both the Scoping and Alternatives public meetings. They were also provided site-specific project information by NRCS via the required PA-SHARE portal. They were requested to provide concurrence on the NRCS determinations of eligibility for the NRHP and project effects on potential cultural resources. PA SHPO concurred with the NRCS determinations of no eligible structures with the project APEs and no effect to historic properties. Copies of the SHPO responses are included in Appendix A.
- The PADEP, Division of Dam Safety, was contacted regarding their concerns and interests related to the rehabilitation of these high hazard potential dams via email on several occasions and provided information regarding existing permits and deficiencies that were noted during the regular dam safety inspections. The agency also participated in the initial public/scoping meetings. Formal consultations were completed on December 3, 2021, and no response was received from this outreach.
- The USFWS was contacted regarding Threatened and Endangered Species on December 3, 2021, and no response was received from this outreach.
- The USACE was contacted regarding Clean Water Act permits required for project work and wetland impacts on December 3, 2021. Their response provided information on permit coordination with other agencies and several permit scenarios, depending upon the final magnitude of impacts to regulated waters and wetlands. They encouraged NRCS to contact the PADEP and the USACE to schedule a pre-application meeting to discuss the specifics of your projects once the planning information is finalized for the project. A copy of the USACE response is included in Appendix A.

- Federally recognized tribal organizations were invited by letter and email to participate in the Scoping and Alternatives public meetings. In addition, the federally recognized tribes with ancestral lands in Wayne County were formally invited to consult on the alternatives considered for each dam on December 3, 2021. These tribal organizations included: Absentee-Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Oklahoma, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Onondaga Nation, Shawnee Tribe, and Stockbridge-Munsee Community Band of Mohican Indians. Only two tribes responded to this outreach, the Delaware Tribe of Indians and the Stockbridge-Munsee Community Band of Mohican Indians.

  The Delaware Tribe of Indians expressed concerns relating to sensitivity of the project area for ancestral materials and treaty resources. They asked that undisturbed areas either have a Phase IB archaeological investigation completed or be protected during construction. They also asked that work be halted if archaeological materials are discovered during construction.

  The Stockbridge-Munsee Community Band of Mohican Indians concurred with the determination of No Effect on the four respective dam enhancement projects. They asked to be notified should the scope of work be altered and or anything unexpected be encountered.

  Copies of the tribal responses are included in Appendix A.

  Draft Plan-EA Interagency and Public Review
  The public and all interested parties including tribes, state and federal agencies, local paper, and the public library were notified by letter of the availability of the Draft Plan-EA or provided a copy the week of May 15, 2023, with comments to be received by June 30th. Details of this outreach are provided in the Reviewable Record.

  Interagency Review Comment Summary
  Four comments were received. One was from the Eastern Shawnee Tribe. It stated, "the project proposes NO Adverse Effect or endangerment to known sites of interest to the Eastern Shawnee Tribe. Please continue project as planned."

  The second comment was from a private individual who was opposed to all dams on Holbert Creek and its tributaries.

  The Pennsylvania Fish and Boat Commission sent a letter noting their concerns. The concerns consisted of stream flows, public use/access to the dams, and sediment downstream of the dam during construction. They recommended an instream construction restriction from October 1 through April 1 to protect the life stage activities of the wild trout population below the Martin Dam and Finkleday Dam.

  The United States Army Corps of Engineers also provided comments. Wetland mitigation was one of the focuses as well as permitting. They also suggested considering dry dams as an alternative. Another of their comments proposed implementing additional measures upstream for flood control.

NRCS prepared written responses to all parties.

The individual comments and responses are included in Appendix A.

THE PREFERRED ALTERNATIVE

RATIONALE FOR PLAN SELECTION

The selected plans are to rehabilitate each dam to meet current NRCS and PADEP safety and performance standards for high hazard potential dams. The selected plans meet the identified purpose and need for the project, and significantly reduce the potential risk to human life. The project Sponsors, local residents, and state and local government agencies all prefer the selected plan for each dam. Below are beneficial effects for each dam.

Garrett Dam

- Reduces the threat to loss of life to approximately 152 people who live, work, and/or drive in the breach zone.
- Increases dam breach protection for 8 residences, 40 commercial structures, numerous outbuildings (sheds, barns, etc.), 10 stream crossings (bridges), and 13 roadways downstream within the breach inundation zone.
- Increases dam breach protection for over 3,400 vehicles and their occupants who utilize the roads downstream of Garrett Dam daily (using an average of 2 people per vehicle results in about 6,800 motorists).
- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.
- Provides downstream flood protection on the same order as the existing dam for the residents in the area, as well as those working, recreating, or traversing within the downstream floodplains, for an additional 60 years.
- Eliminates the liability associated with continuing to operate a dam that does not meet current Pennsylvania and NRCS safety and performance standards.
- Retains the existing aquatic and terrestrial habitat in and around the dam.
- Will meet current Pennsylvania and NRCS safety and performance standards for a high hazard potential dam.

Varcoe Dam

- Reduces the threat to loss of life to approximately 33 people who live, work, and/or drive in the breach zone.
- Increases dam breach protection for 3 residences, 3 commercial structures, numerous outbuildings (sheds, barns, etc.), 3 stream crossings (bridges), and 6 roadways downstream within the breach inundation zone.
- Increases dam breach protection for over 3,400 vehicles and their occupants who utilize the roads downstream of Varcoe Dam daily (using an average of 2 people per vehicle results in about 6,800 motorists).
- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.
- Provides downstream flood protection on the same order as the existing dam for the residents in the area, as well as those working, recreating, or traversing within the downstream floodplains, for an additional 50 years.
- Eliminates the liability associated with continuing to operate a dam that does not meet current Pennsylvania and NRC safety and performance standards.

- Retains the existing aquatic and terrestrial habitat in and around the dam.
- Will meet current Pennsylvania and NRCS safety and performance standards for a high hazard potential dam.

Martin Dam

- Reduces the threat to loss of life to approximately 85 people who live, work, and/or drive in the breach zone.
- Increases dam breach protection for ~~Protects~~ 5 residences, 11 commercial structures, 2 public properties, numerous outbuildings (sheds, barns, etc.), 8 stream crossings (bridges), and 13 roadways downstream within the breach inundation zone.
- Increases dam breach protection for over 5,200 vehicles and their occupants who utilize the roads downstream of Martin Dam daily (using an average of 2 people per vehicle results in about 10,400 motorists).
- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.
- Provides downstream flood protection on the same order as the existing dam for the residents in the area, as well as those working, recreating, or traversing within the downstream floodplains, for an additional 100 years.
- Eliminates the liability associated with continuing to operate a dam that does not meet current Pennsylvania and NRC safety and performance standards.
- Retains the existing aquatic and terrestrial habitat in and around the dam.
- Will meet current Pennsylvania and NRCS safety and performance standards for a high hazard potential dam.

Finkleday Dam

- Reduces the threat to loss of life to approximately 58 people who live, work, and/or drive in the breach zone.
- Increases dam breach protection for 4 residences, 8 commercial structures, numerous outbuildings (sheds, barns, etc.), 4 stream crossings (bridges), and 9 roadways downstream within the breach inundation zone.
- Increases dam breach protection for over 4,800 vehicles and their occupants who utilize the roads downstream of Finkleday Dam daily (using an average of 2 people per vehicle results in about 9,600 motorists).
- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.
- Provides downstream flood protection on the same order as the existing dam for the residents in the area, as well as those working, recreating, or traversing within the downstream floodplains, for an additional 100 years.
- Eliminates the liability associated with continuing to operate a dam that does not meet current Pennsylvania and NRC safety and performance standards.
- Retains the existing aquatic and terrestrial habitat in and around the dam.
- Will meet current Pennsylvania and NRCS safety and performance standards for a high hazard potential dam.

The preferred alternatives meet the Sponsors' objectives of bringing each dam into compliance with current dam design and safety criteria, providing the needed level of flood protection for downstream properties, and addressing resource concerns identified by the public. The selected plans are the NEE Alternatives. Each plan reasonably meets the following four criteria: completeness, effectiveness, efficiency, and acceptability. NRCS and the Sponsors agree on the selected plans.

MEASURES TO BE INSTALLED

Garrett Dam (NEE – Alternative 1)

- Armoring the 100-foot-wide auxiliary spillway with RCC covered with topsoil.
- Constructing a RCC cutoff wall at the downstream end of the RCC spillway
- Dam crest raised to EL 1207.9.
- Downstream slope will be flattened to 3H:1V.
- Non-standard principal spillway riser replaced.
- The leaking pipe joint of the existing 30-inch diameter reinforced concrete principal spillway conduit will be repaired.
- Principal spillway conduit extended.
- New impact basin will be constructed.
- Filter diaphragm constructed near the downstream slope around the existing principal spillway conduit.
- Existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout.
- New plastic toe drainpipes will be installed with a multi-stage filter.

Varcoe Dam (NEE - Alternative 1)

- Armoring the 50-foot-wide auxiliary spillway with articulated concrete blocks.
- A reinforced concrete starter wall will be constructed at the upstream end of the ACB spillway along with a reinforced concrete cantilever cutoff wall at the downstream end of the ACB spillway.
- Dam crest will be graded and raised where needed to EL 1277.6 ft.
- Downstream slope will be flattened to 3H:1V slope.
- Principal spillway low stage orifice will be modified to increase the normal pool by 0.14 to accommodate the required sediment storage.
- Footbridge will be installed for access to the riser.
- Principal spillway riser trash rack and existing gate will be repaired or replaced.
- Concrete sealant will be applied to the worn concrete surfaces in the conduit.
- Principal spillway conduit will be extended.
- New impact basin will be constructed.
- Filter diaphragm constructed near the downstream slope around the existing principal spillway conduit.
- New plastic pipe toe drains will be near the toe of the dam slope.
- Existing bituminous coated corrugated metal pipe auxiliary spillway drains will be removed and replaced with plastic pipe. There will be no change in the current levels of flood protection downstream as a result of project activity.

Martin Dam (NEE – Alternative 1)

- Armoring the 40-foot-wide auxiliary spillway with RCC.
- Constructing a reinforced concrete end sill and cutoff wall at the downstream end of the RCC spillway.
- Dam crest will be raised 2.1 feet to EL 1281.4 ft.
- Downstream slopes will be flattened to 3H:1V.
- A stability berm will be constructed on the upstream slope with a 3H:1V slope.
- Principal spillway riser will be replaced and moved upstream by extending the conduit.
- Flattening of the downstream slope of the dam.
- Footbridge will be installed for access to the riser.
- A concrete sealant will be applied to the worn concrete surfaces in the conduit.
- At the downstream end, the principal spillway conduit will also be extended and a new impact basin will be constructed
- Filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit.
- The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout.
- New plastic pipe toe drains will be installed.

Finkleday Dam (NEE – Alternative 2)

- Armoring the 60-foot-wide auxiliary spillway with articulated concrete blocks
- Constructing a secant pile cutoff wall at the downstream end of the ACB spillway.
- Dam crest will be leveled at existing EL 1281 ft.
- Downstream slope will be flattened to 3H:1V slope.
- Principal spillway riser trash rack and existing gate will be repaired or replaced.
- Footbridge will be installed for access to the riser.
- A concrete sealant will be applied to the worn concrete surfaces in the riser and conduit.
- Principal spillway conduit will be extended.
- New impact basin will be constructed to stabilize the outlet.
- Filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit.
- The existing bituminous coated corrugated metal pipe toe drains will be left in-place and filled with grout.
- New plastic pipe toe drains will be installed.
- The existing springhouse will be removed.
- Existing drainage will be improved to stabilize the area

After the implementation of these planned works of improvement, the dams included in this plan will meet all current NRCS and PADEP safety and performance standards. These rehabilitation projects do not introduce any additional hazards to the affected area.

Detailed structural data for the proposed rehabilitated dams can be found in Table 3.

COSTS

As indicated in Table 1, the total installation costs of the selected plans are $21,109,300. Of this amount, PL83-566 funds will bear $15,985,300 and nonfederal funds will bear $5,124,000. Table 2 shows details of the costs and cost-share amounts by category for each dam. Total annualized costs are shown in Table 4 along with the estimated costs for operation, maintenance, and repair. Table 5 displays the average annual flood damage reduction benefits by flood damage categories and other benefits, and Table 6 displays a comparison of annual costs and benefits, resulting in a benefit/cost ratio. A 2021 price base was used and amortized at 2.25 percent interest over the period of analysis for each dam. The period of analysis included a design and installation period of four years per dam, and an expected useful life (project life) of 60, 50, 100, and 100 years for Garrett, Varcoe, Martin, and Finkleday dams, respectively.

The cost projections for the proposed rehabilitation measures are estimated costs only for planning purposes. The fact that these costs are included in this plan does not infer that they are final costs. Detailed structural designs and construction cost estimates will be prepared prior to contracting for the work to be performed. Final construction costs will be those costs incurred by the contractor performing the work, including the cost of any necessary contract modifications.

RESPONSIBILITIES

The Sponsors will be responsible for the following:

- Secure all needed environmental permits, easements, and rights for the installation, operation, and maintenance of each rehabilitated structure.
- Prepare an updated Emergency Action Plan for each dam prior to the initiation of construction.
- Execute a Memorandum of Understanding with the NRCS to provide a framework for crediting in-kind services.
- Execute a new Operation and Maintenance Agreement with NRCS for each dam. This agreement will be based on the NRCS National Operation and Maintenance Manual.
- Provide nonfederal funds for cost-sharing of the project at a rate equal to, or greater than, 35% of the total eligible project costs.
- Participate in and comply with applicable Federal floodplain management and flood insurance programs.
- Prohibit future construction of habitable dwellings upstream of the dam below the top of dam elevation, Garrett Dam 1207.9 ft., Varcoe Dam 1277.6 ft., Martin Dam 1281.4 ft., and Finkleday Dam 1281.0 ft.
- Implement controls that limit improvements within the breach inundation area such that the hazard class does not increase during the evaluated project life.
- Enforce all associated easements and rights-of-way for the safe operation of the dam.

Easements and Landrights

Landrights will be attained upstream of the dam to the top of the dam elevation for each dam (the maximum water surface elevation for a PMF). For Garrett Dam landrights will be required for about 19.31 acres; for Varcoe Dam about 48.22 acres; for Martin Dam about 1.0 acre; and for Finkleday Dam, about 1.34 acres. There are no buildings upstream of the dam currently below the top of dam elevation for any of the dams. All land rights will be identified by metes and bounds surveys conducted by a professional land surveyor. There are no buildings downstream of the dam that would receive induced flooding from the auxiliary spillway during the passage of the design storm event.

Operation, Maintenance, and Replacement

Measures installed as part of this plan, and previously installed measures, will be operated and maintained by the sponsor with technical assistance from federal, state, and local agencies in accordance with their delegated authority. The terms of the new Operation and Maintenance (O&M) agreements will be developed for the following four dams within the watershed: Garrett Dam – 60 years following the completion of construction, Varcoe Dam – 50 years following the completion of construction, Martin Dam – 100 years following the completion of construction, and Finkleday Dam – 100 years following the completion of construction. The O&M agreements will be executed between the Sponsors and the NRCS prior to construction. The agreements will specify responsibilities of the Sponsors and include detailed provisions for retention, use, and disposal of property acquired or improved with PL 83-566 cost sharing. Provisions will be made for free access of state and federal representatives to inspect all structural measures and their appurtenances at any time.

Mitigation

These mitigation measures are applicable to all dam sites:

- To minimize impacts to wetlands abutting the impoundment and WOTUS, during construction, a cofferdam or similar structure will be installed to avoid the need to drain the entire impoundment to facilitate work.
- All disturbed areas post construction will be regraded, stabilized, and seeded.
- As final staging areas, ingress/egress areas, access roads, etc., are determined, archaeological testing will be completed as informed by consultation with PA SHPO and Tribes.
- During construction if a discovery of potential cultural resources or human remains occurs all construction will be stopped until the appropriate investigation is completed.
- Sediment and erosion controls, such as turbidity curtains, silt fences, and/or straw bales, or similar will be employed to avoid impacts to water quality.

<u>Garrett Dam</u>

There are anticipated to be approximately 0.17 acres of adverse permanent wetlands impacts from this alternative. Therefore, an equivalent acreage of new wetlands, with similar or elevated form and function, within the general vicinity of the project site will be created.

Martin Dam

There are anticipated to be approximately 0.22 acres of permanent wetlands impacts from this alternative. Therefore, an equivalent acreage of new wetlands within the general vicinity of the project site will be created.

Permits and Compliance

Prior to construction, the Sponsors will be responsible for obtaining all required permits. It is anticipated that the following natural resource related permit applications may be necessary depending on disturbance areas outlined during the design process:

- U.S. Army Corps of Engineers authorization under the Pennsylvania State Programmatic General Permit (PSPGP) – Section 404 of the Clean Water Act (CWA) of 1972 and Section 10 of the Rivers and Harbors Act (RHA) of 1899 (this permit is typically issued by the Pennsylvania Department of Environmental Protection [PADEP] as part of the Dam Construction Permit [see below]; a separate permit application is not required)
- PADEP Section 401 CWA Water Quality Certification (this permit is typically issued by PADEP as part of the Dam Construction Permit [see below]; a separate permit application is not required)
- PADEP Dam Safety and Encroachments Act, Chapter 105 Dam Construction Permit (approval under CWA Section 404, RHA Section 10, and CWA Section 401 is typically issued by PADEP as part of this permit).
- Erosion and Sediment Control Plan approval – Wayne Conservation District.
- Coverage under NPDES Construction General Permit (CGP) would be required for projects resulting in disturbance of one or more acres of land. The NPDES CGP would require the operator to implement a site-specific Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would outline the steps that an operator must take to comply with the permit, including water quality and quantity requirements to reduce pollutants in the stormwater runoff from the construction site. The SWPPP also specifies all potential pollutant sources that could enter stormwater leaving the construction site and covers methods used to reduce pollutants in stormwater runoff during and after construction.

Other state or local permits may be necessary, and this determination will be made during pre-permit application meetings with local, state, and federal regulatory agencies once designs have been sufficiently developed to facilitate conversations. These discussions will involve protection of utilities.

The National Flood Insurance Program regulations state: "*A community's base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, a community shall notify the Administrator of the changes by submitting technical or scientific data in accordance with this part. Such a submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and flood plain management requirements will be based upon current data.*" Implementation of the preferred alternative will have no impact on the 500-year and smaller floods; therefore, there will be no impact on the flooding conditions shown in the flood insurance studies or on the FIRMs; however, the local communities may choose to provide to FEMA the results of the hydraulic analyses developed for this project for consideration in revising the FIRMs.

Installation Sequence

The typical rehabilitation project will be completed in 1.5 to 2.0 years following the Natural Resource Conservation Service and Sponsor appropriating construction funds. With project designs and permits in hand the necessary construction permits can be attained.

Wayne County has taxing authority to raise project funding and the power of eminent domain to acquire any necessary land rights. Actual construction will occur over about 24 months. However, with time allowed for set-up and winter shutdown, the actual construction activities will occur over about 15 months. All required easements and permits will be secured before the solicitation of construction bids for the project.

The contractor will determine the installation sequence after a construction contract has been awarded. The actual sequence of construction may vary somewhat from the bulleted items below, but these are the basic steps expected for this rehabilitation project.

- The contractor's schedule, Safety Plan, Quality Control Plan, Erosion and Sediment Control Plan, Water Control Plan and other necessary contract plans will be approved.
- A detailed survey and layout of the limits of disturbance, access routes, and major works of improvement will occur.
- The erosion and sediment control measures will be installed.
- The staging area will be cleared and grubbed. Gravel will be placed over geotextile fabric to limit ground disturbances within the staging area. Access routes will be established from the staging area to the work areas.
- Construction trailers will be set up and materials will begin to arrive onsite.
- The water control system and cofferdam will be installed. The sediment immediately adjacent to the riser will be removed. The riser and conduit will be dewatered to allow the concrete sealant to be applied to the worn concrete surfaces of the conduit and riser. After the sealant has cured, the existing pond drain gate will be removed along with the cofferdam.
- The existing bituminous coated corrugated metal pipe toe drains will be filled with grout. The new filter diaphragm will be constructed near the downstream slope around the existing principal spillway conduit and the plastic pipe toe drains and a filter trench will be installed closer to the toe of the dam slope.
- Simultaneously with the riser and conduit work, excavation of the auxiliary spillway will begin followed by construction of the reinforced concrete sidewalls.
- The concrete batch plant will be set up. The construction of the RCC stilling basin with riprap outlet protection will occur followed by the RCC chute. *(Applicable only to projects with RCC protection).*
- The auxiliary spillway will be completed.
- Earth fill may be placed to raise the top of dam. *(Applicable only to projects requiring dam raise)*.
- The dam downstream slope may be flattened. *(Applicable only to projects requiring slope flattening)*.
- The concrete batch plant will be removed.
- All disturbed areas, including the staging area, will be seeded and mulched.

Installation and Financing

This section is generally the same for all the dams associated with this plan. It is noted where slight deviations occur.

Each dam is planned for installation in about 48 months. During construction, equipment will not be allowed to operate when conditions are such that soil erosion and water, air, and noise pollution cannot be satisfactorily controlled.

NRCS will assist the Sponsors with the Lackawaxen Tributaries rehabilitation projects. NRCS will be responsible for the following:

- Execute a project agreement with the Sponsors before either party initiates work involving funds of the other party. Such agreements set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
- A collections/reimbursable agreement will also be needed for NRCS to perform the contracting.
- Execute a Memorandum of Understanding with the Sponsors to provide a framework within which cost-share funds are accredited.
- Execute a new Operation and Maintenance Agreement with the Sponsors that extends the O&M responsibilities for a specified time period: Garrett Dam - 60 years following construction; Varcoe Dam - 50 years following construction; Martin Dam - 100 years following construction; and Finkleday Dam - 100 years following construction. These agreements will be based on the NRCS National Operation and Maintenance Manual.
- Provide financial assistance equal to 65% of total eligible project costs, not to exceed 100% of actual construction costs.
- Verify that a current Emergency Action Plan is developed for each dam before construction is initiated.
- Provide consultative engineering support, technical assistance, and approval during the design and construction of the project.
- Provide contract administration technical assistance during construction of the project.
- Provide construction management technical assistance.
- Certify completion of all installed measures.

ECONOMIC AND STRUCTURAL TABLES

Table 1 – Estimated Installation Costs
Lackawaxen Tributaries Watershed, Pennsylvania
(Dollars)

Installation Cost Items	Estimated Costs		
	PL-83-566 Funds [1/]	Other Funds	Total
Garrett Dam	$4,627,400	$1,624,700	$6,252,100
Varcoe Dam	$3,337,900	$940,600	$4,278,500
Martin Dam	$4,353,200	$1,460,400	$5,813,600
Finkleday Dam	$3,666,800	$1,098,300	$4,765,100
Total Project:	**$15,985,300**	**$5,124,000**	**$21,109,300**

Price base: 2021 Prepared: July 2021

[1/] Paid by the USDA/NRCS – the Federal agency responsible for assisting in installation of improvements.

Table 2 – Estimated Cost Distribution – Structural Measures

Lackawaxen Tributaries Watershed, Pennsylvania

(Dollars)

Installation Cost Items	Installation Cost: PL-83-566 Funds[1/]					Installation Cost: Other Funds[2/]						Total Project Cost[3/]
	Construction Costs	Engineering Technical Assistance Costs	Geo-Technical Costs	Project Admin. Costs	Total PL-83-566 Costs	Construction Costs	Engineering Costs	Real Property Landrights	Permits	Project Admin. Costs	Total Other Funds	
Rehab. Garrett Dam	$3,003,400	$1,500,000	$80,000	$44,000	$4,627,400	$1,523,600	$5,000	$83,600	$7,500	$5,000	$1,624,700	$6,252,100
Rehab. Varcoe Dam	$1,732,900	$1,500,000	$80,000	$25,000	$3,337,900	$754,100	$5,000	$169,000	$7,500	$5,000	$940,600	$4,278,500
Rehab. Martin Dam	$2,698,200	$1,500,000	$115,000	$40,000	$4,353,200	$1,410,800	$5,000	$32,100	$7,500	$5,000	$1,460,400	$5,813,600
Rehab. Finkleday Dam	$2,025,800	$1,500,000	$110,000	$31,000	$3,666,800	$1,049,200	$5,000	$31,600	$7,500	$5,000	$1,098,300	$4,765,100
Totals:	**$9,460,300**	**$6,000,000**	**$385,000**	**$140,000**	**$15,985,300**	**$4,737,700**	**$20,000**	**$316,300**	**$30,000**	**$20,000**	**$5,124,000**	**$21,109,300**

Price base: 2021 Prepared: July 2021

1/ Federal Engineering, Geo-Technical, and Project Administration costs (Garrett Dam: $1,624,000; Varcoe Dam: $1,605,000; Martin Dam: $1,655,000; Finkleday Dam: $1,641,000) are not included when calculating federal cost share for the rehabilitation project. Sponsors' total permitting costs ($30,000) are not eligible for cost share either. Therefore, federal cost share (65%) is based on total eligible project cost of $14,611,300. The actual federal cost/share cannot exceed 100% of the construction cost.

2/ 35% of total eligible project cost, excluding permits cost.

3/ As per the NRCS National Watershed Manual, Part 508.44, the actual federal cost/share amount will be calculated based on a total eligible project cost that excludes federal technical assistance costs, water, mineral and other resource rights, and all federal, state, and local permits. However, for the purpose of planning, all of these costs are included in the benefit/cost analysis and are displayed as part of the public record of this analysis.

Table 3 – Structural Data for Rehabilitated Dams

Lackawaxen Tributaries Watershed, Pennsylvania

Item	Unit	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam
Class of structure		High Hazard Potential	High Hazard Potential	High Hazard Potential	High Hazard Potential
Uncontrolled drainage area	mi^2	1.59	0.82	0.53	0.63
Controlled drainage area	mi^2	N/A	N/A	N/A	N/A
Total drainage area	mi^2	1.59	0.82	0.53	0.63
Runoff curve number (ARC II)		80	76	79	76
Time of concentration (T_c);	hours	3.01	1.58	0.93	1.60
Top of dam elevation	feet	1207.9	1277.6	1281.4	1281.0
Elevation crest auxiliary spillway	feet	1202.2	1272.1	1273.7	1275.4
Elevation crest high stage inlet	feet	1188.7	1268.66	1260.91	1267.18
Elevation crest low stage inlet	feet	N/A	1264.8	1258.24	1264.68
Auxiliary spillway type		RCC covered with topsoil	ACBs	RCC	ACBs
Auxiliary spillway crest width	feet	100	50	40	60
Auxiliary spillway exit slope	percent	2.75	4	18	3
Maximum height of dam	feet	30	25	36	25
Volume of fill	yd^3	21200	5600	25500	13700
Total capacity		244.98	166.04	96.48	138.65
Sediment submerged	acre-feet	4.14	2.64	5.88	7.44
Sediment aerated	acre-feet	0.55	0.50	0.61	1.49
Beneficial use (M&I water)	acre-feet	N/A	N/A	N/A	N/A
Floodwater retarding	acre-feet	240.84	163.04	90.6	131.21
Between high and low stage	acre-feet	N/A	64.31	6.6	19.75
Surface area					
Sediment pool	acres	3.4	2.6	2.3	6.0
Beneficial use pool (M&I water)	acres	N/A	N/A	N/A	N/A
Floodwater retarding pool	acres	28.5	31.6	9.5	17.7
Principal spillway design					
Rainfall volume (1-day)	inches	6.7	6.7	6.7	6.7

Item	Unit	Garrett Dam	Varcoe Dam	Martin Dam	Finkleday Dam
Rainfall volume (10-day)	inches	10.8	10.8	10.8	10.8
Runoff volume (10-day)	inches	8.3	8.3	8.3	8.3
Capacity	ft^3/s	97	68	74	68
Dimensions of conduit	inches	30	24	24	24
Type of conduit		RCP	RCP	RCP	RCP
Frequency of operation-auxiliary spillway	percent chance	1-2	1	1	1
Auxiliary spillway hydrograph					
Rainfall volume	inches	9.8	9.8	9.8	9.8
Runoff volume	inches	7.33	6.82	7.2	6.82
Storm duration	hours	6	6	6	6
Velocity of flow (V_e)	feet/sec	11.3	8.3	10.9	6.2
Max. reservoir water surface elev.	feet	1207.9	1274.0	1276.07	1277.05
Freeboard hydrograph					
Rainfall volume	inches	20.81	23.87	21.50	21.31
Runoff volume	inches	18.08	20.46	18.61	17.94
Storm duration	hours	6	24	6	6
Max. reservoir water surface elev.	feet	1207.9	1277.5	1281.4	1280.31
Capacity equivalents					
Sediment volume	inches	0.055	0.072	0.24	0.26
Floodwater retarding volume	inches	2.84	3.73	3.20	3.91
Beneficial volume	inches	N/A	N/A	N/A	N/A

Prepared: July 2021

Table 4 – Average Annual National Economic Efficiency (NEE) Costs
Lackawaxen Tributaries Watershed, Pennsylvania (Dollars[1/])

Item	Average Annual Equivalent Cost	Average Annual Equivalent O&M Costs	Total Average Annual Equivalent Cost
Rehabilitation of Garrett Dam	$293,000 [1/]	$6,000	$199,000
Rehabilitation of Varcoe Dam	$143,800 [2/]	$6,000	$149,800
Rehabilitation of Martin Dam	$151,200 [3/]	$6,300	$157,500
Rehabilitation of Finkleday Dam	$124,100 [3/]	$6,500	$130,600
Totals:	**$612,100**	**$24,800**	**$636,900**

Price base: 2021 Prepared: July 2021

[1/] Based on a 2.25% discount rate and a 64-year period of analysis (4 years for project design/installation and 60 years of expected useful life).
[2/] Based on a 2.25% discount rate and a 54-year period of analysis (4 years for project design/installation and 50 years of expected useful life).
[3/] Based on a 2.25% discount rate and a 104-year period of analysis (4 years for project design/installation and 100 years of expected useful life).

Table 5 – Estimated Average Annual Flood Damage Reduction Benefits

Lackawaxen Tributaries Watershed, Pennsylvania

(Dollars)

Item	Estimated Average Annual Equivalent Damages		Damage Reduction Benefits
	Without Federal Project	With Federal Project	Average Annual Equivalents
Garrett Dam			
Floodwater–Urban Area			
Residential	$299,300	$211,500	$87,800
Commercial	$336,900	$238,000	$98,900
Road and Bridge	$204,200	$173,600	$30,600
Floodwater–Ag Area			
Crop and Pasture	$1,000	$300	$700
Subtotal	*$841,400*	*$623,400*	*$218,000*
Sediment/Erosion	$1,300	$400	$900
Total, Garrett Dam	*$842,700*	*$623,800*	*$218,900*
Varcoe Dam			
Floodwater–Urban Area			
Residential	$287,400	$237,600	$49,800
Commercial	$323,400	$267,400	$56,000
Road and Bridge	$196,000	$177,800	$18,200
Floodwater–Ag Area			
Crop and Pasture	$600	$200	$400
Subtotal	*$807,400*	*$683,000*	*$124,400*
Sediment/Erosion	$700	$200	$500
Total, Varcoe Dam	*$808,100*	*$683,200*	*$124,900*

Table 5 – Estimated Average Annual Flood Damage Reduction Benefits (Continued)
Lackawaxen Tributaries Watershed, Pennsylvania
(Dollars)

Item	Estimated Average Annual Equivalent Damages		Damage Reduction Benefits
	Without Federal Project	With Federal Project	Average Annual Equivalents
Martin Dam			
Floodwater–Urban Area			
Residential	$130,800	$110,700	$20,100
Commercial	$276,700	$234,100	$42,600
Public	$600	$500	$100
Road and Bridge	$98,200	$74,200	$24,000
Floodwater–Ag Area			
Crop and Pasture	$400	$100	$300
Subtotal	*$506,700*	*$419,600*	*$87,100*
Sediment/Erosion	$500	$200	$300
Total, Martin Dam	*$507,200*	*$419,800*	*$87,400*
Finkleday Dam			
Floodwater–Urban Area			
Residential	$130,900	$114,600	$16,300
Commercial	$276,700	$242,300	$34,400
Public	$600	$500	$100
Road and Bridge	$98,200	$90,300	$7,900
Floodwater–Ag Area			
Crop and Pasture	$500	$100	$400
Subtotal	*$506,900*	*$447,800*	*$59,100*
Sediment/Erosion	$600	$200	$400
Total, Finkleday Dam	*$507,500*	*$448,000*	*$59,500*
Totals:	**$2,665,500**	**$2,174,800**	**$490,700**

Price base: 2021 Prepared: July 2021

Table 6 – Comparison of National Economic Efficiency (NEE) Benefits and Costs
Lackawaxen Tributaries Watershed, Pennsylvania
(Dollars)

Evaluation Unit	Average Annual Equivalents				Benefit/ Cost Ratios
	Damage Reduction Benefits [1/]	Total Average Annual Benefits	Average Annual Costs [3/]	Net Average Annual Benefits	
Garrett Dam	$218,900	$218,900	$199,000	$19,900	1.1 to 1.0
Varcoe Dam	$124,900	$124,900	$149,800	(-$24,900)	0.8 to 1.0
Martin Dam	$87,400	$87,400	$157,500	(-$70,100)	0.6 to 1.0
Finkleday Dam	$59,500	$59,500	$130,600	(-$71,100)	0.5 to 1.0
Totals:	**$490,700**	**$490,700**	**$636,900**	**(-$146,200)**	**0.8 to 1.0**

Price base: 2021 Prepared: July 2021
[1/] From Table 5.
[2/] From Table 4.

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REPORT PREPARERS

The Lackawaxen Watershed Supplemental Plan and Environmental Assessment was prepared by Aterra - Schnabel Joint Venture with support from EA Engineering, Science, and Technology (EA), other consultants, and the NRCS staff, and Sponsors.

The following table identifies and lists the experience and qualifications of those individuals who were directly responsible for providing significant input to the preparation of the Supplemental Plan-EA.

Experience and Qualifications of Report Preparers					
Name	**Project Role**	**Professional Title**	**Education**	**Experience in Years**	**Other**
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Tim Ridley	Hydrologic & Hydraulic Engineer, WV State Office	Dam Safety Engineer (retired effective 12/31/2020)	B.S. Civil Engineering	40	P.E., P.S.
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Capital RC&D Council					
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Aterra Solutions					
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Paul Welle	Quality Assurance Enginering and Alternatives Task Leader		B.S. Agricultural Engineering	50	P.E. - PA, NJ
EA Engineering, Science, and Technology					
Sal DeCarli,	Scientist		M.S. Environmental Science and Policy B.A. Geography and Environmental	7	
Consultant					
James Featherston	Economist		M.S. Agricultural Economics B.S. Agricultural Economics	42	

DISTRIBUTION LIST

Comments were requested on the Draft Supplemental Plan – EA from the following agencies and organizations.

	Response Received on Draft Plan/EA
Federal Agencies	
Environmental Protection Agency Region III, Philadelphia, PA	No
U.S. Army Corps of Engineers Philadelphia, PA Clifton Township, PA	Yes
US Geological Survey Northern Appalachian Research Branch, Wellsboro, PA Pennsylvania Water Science Center, New Cumberland, PA	No
U.S. Department of the Interior Fish and Wildlife Service, PA Field Office, State College, PA	No
National Marine Fisheries Service Greater Atlantic Regional Fisheries Office, Gloucester, MA	No
Federal Emergency Management Agency Region III, Philadelphia, PA	No
National Oceanic and Atmospheric Administration Office of Legislative and Intergovernmental Affairs, Washington, DC	No
U.S. Department of Agriculture U.S. Forest Service Northeastern Area Office, Newtown Square, PA Farm Service Agency, Harrisburg, PA Rural Development, Harrisburg, PA	 No No No
Pennsylvania State Agencies	
Pennsylvania Historical and Museum Commission SHPO, Harrisburg, PA 17120	No
Pennsylvania Department of Environmental Protection Northeast Regional Office, Wilkes-Barre, PA	No
Pennsylvania Fish and Boat Commission	Yes

	Response Received on Draft Plan/EA
Harrisburg, PA Bellefonte, PA	
Pennsylvania Game Commission Harrisburg, PA Northeast Region, Dallas, PA	No
Pennsylvania Department of Environmental Protection Bureau of Waterways, Engineering and Wetlands, Division of Dam Safety, Harrisburg, PA	No
Pennsylvania Department of Agriculture Harrisburg, PA Region 3, Tunkhannock, PA	No
PA Department of Conservation and Natural Resources Bureau of Recreation and Conservation, Harrisburg, PA	No
Pennsylvania DCNR, Bureau of Forestry District Number 11 – Pinchot, North Abington, PA	No
Pennsylvania State Conservation Commission Harrisburg, PA	No
Pennsylvania Emergency Management Agency Harrisburg, PA	No
Pennsylvania Department of Transportation Lackawanna District 4, Dunmore, PA	No
Tribal Organizations	
Absentee-Shawnee Tribe of Oklahoma Shawnee, OK	No
Delaware Nation, Oklahoma Anadarko, OK	No
Delaware Tribe of Indians Bartlesville, OK Pennsylvania Office, Stroudsburg, PA	No
Eastern Shawnee Tribe of Oklahoma Wyandotte, OK Senaca, MO	 No No

	Response Received on Draft Plan/EA
Onondaga Nation Nedrow, NY	No
Shawnee Tribe Miami, OK	Yes
Stockbridge-Munsee Community Band of Mohican Indians Bowler, WI	No
Other	
Wayne Conservation District Honesdale, PA	No
Wayne County Board of County Commissioners Honesdale, PA	No
Wayne County Planning Department Honesdale PA	No
Wayne County Engineering Department Honesdale, PA	No
Wayne County Emergency Management Agency Honesdale, PA	No
Appalachian Regional Commission Washington, DC	No
Delaware River Basin Commission West Trenton, NJ	No
Hawley Borough Council Hawley, PA	No

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