

# ALLENTOWN WATER SYSTEM

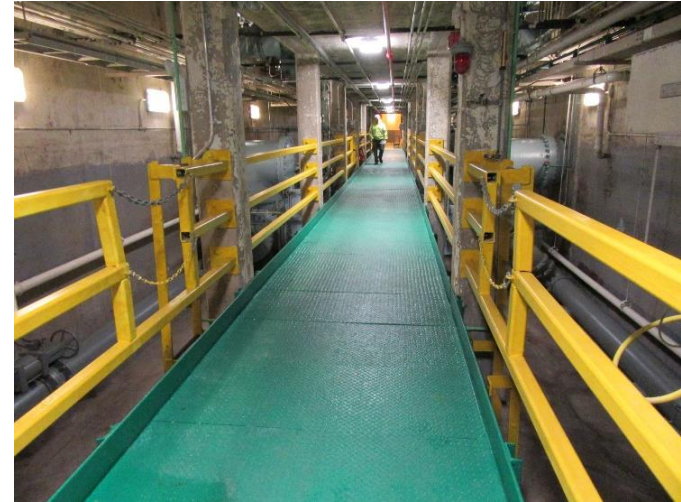
## Master Plan

9/11/17



# Agenda

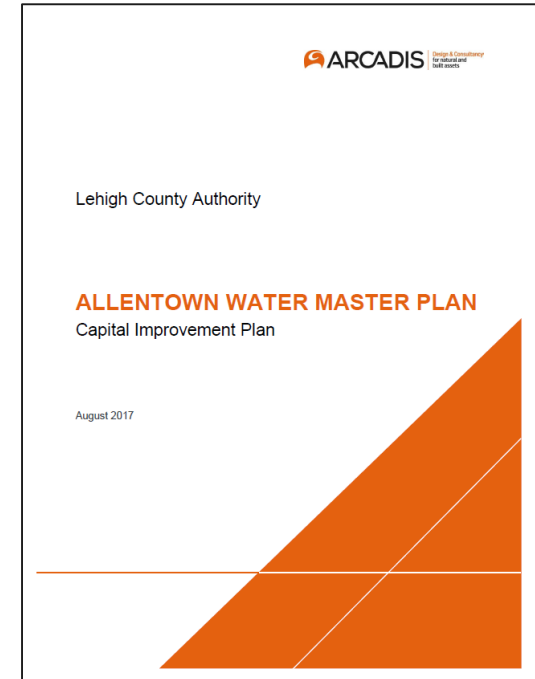
- Master Plan Scope
- Key Findings
- Questions and Answer



# Scope

# Allentown Water System Master Plan

- Assess current condition and remaining useful life of the water system infrastructure (excluding distribution system piping)
- Identify prioritized projects that reduce risk, improve reliability, and enhance operations
- Develop capital improvement plan (CIP) that encompasses 50-year planning period and addresses short and long term needs



# Methodology

## Condition Assessment

- Baseline Condition
- Remaining Useful Life
- Criticality
- Risk

## Process Optimization

- Unit Process Evaluation
- Performance Limiting Factors
- Regulatory Requirements

## CIP

- Prioritized Projects
- Project Descriptions
- Opinions of Probable Cost

# CIP Methodology

- Identified improvements grouped into projects and prioritized
  - Near Term (0-5 and 5-10 Yrs)
  - Mid Term (10-25 Yrs)
  - Long Term (25-50 Yrs)
- Developed opinions of probable project cost
  - AACE Class 5 cost estimate
  - Includes design, bidding, inspection, and legal/financial/admin (unless otherwise noted)

Project	Near Term		Mid Term	Long Term
	Yrs 0-5 2020 Dollars	Yrs 5-10 2025 Dollars	Yrs 10-25 2035 Dollars	Yrs 25-50 2055 Dollars
Water Filtration Plant				
Filter Upgrades	\$ 12,000,000			\$ 16,000,000
Pretreatment/ Sedimentation		\$ 1,500,000	\$ 21,500,000	
High LR VFDs/Pumps	\$ 6,000,000			\$ 8,000,000
Elec Improvements/Pumps		\$ 7,000,000		\$ 8,000,000
Auxiliary Generator	\$ 2,500,000			\$ 3,000,000
Big Lehigh Screens and PAC	\$ 5,500,000			\$ 7,500,000
Little Lehigh Intake and Screens <sup>1</sup>	\$ 2,000,000	\$ 7,500,000		\$ 11,000,000
Ultraviolet Disinfection			\$ 12,000,000	
Security Improvements		\$ 500,000		
CO <sub>2</sub> Feed System <sup>2</sup>	\$ 300,000			
Concrete/Brick Repairs <sup>3</sup>	\$ 800,000			
SCADA Replacement <sup>7</sup>	\$ 750,000		\$ 1,000,000	\$ 2,000,000
Watershed Control Plan	\$ 100,000			
Pump Stations			\$ 7,500,000	\$ 6,000,000
Reservoirs and Tanks	\$ 3,000,000			\$ 48,000,000
Rehab-Buried Concrete Reservoirs			\$ 4,000,000	\$ 6,000,000
Rehab Tanks and Reservoirs				
Roof Replacements <sup>8</sup>	\$ 900,000		\$ 1,000,000	\$ 6,000,000
<b>Total</b>	<b>\$ 31,400,000</b>	<b>\$ 19,000,000</b>	<b>\$ 47,000,000</b>	<b>\$ 119,500,000</b>

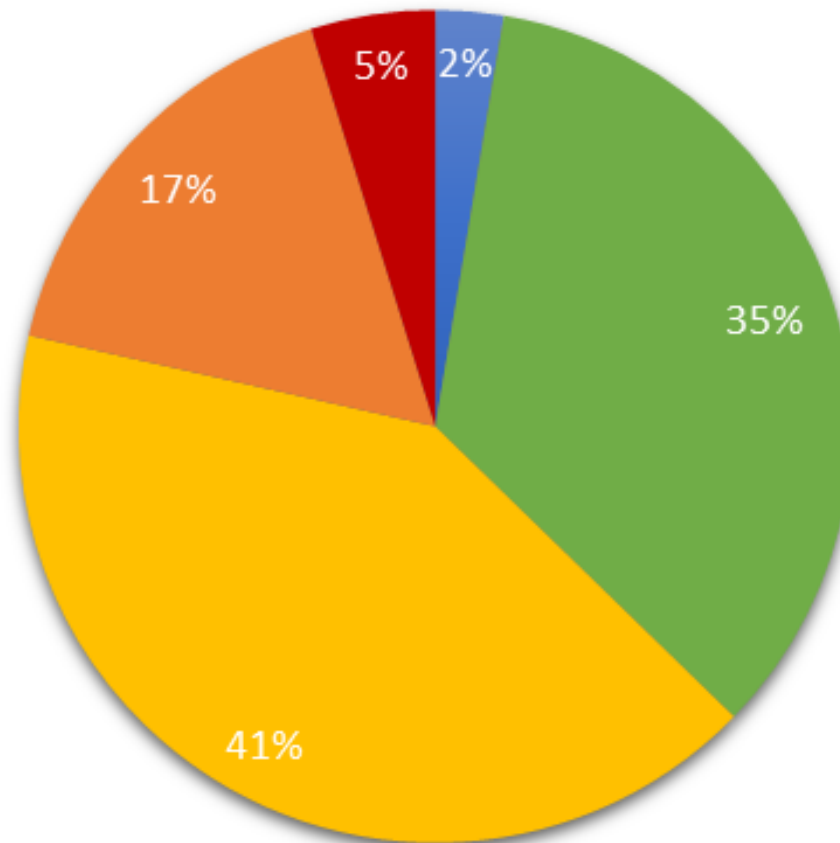


# Key Findings





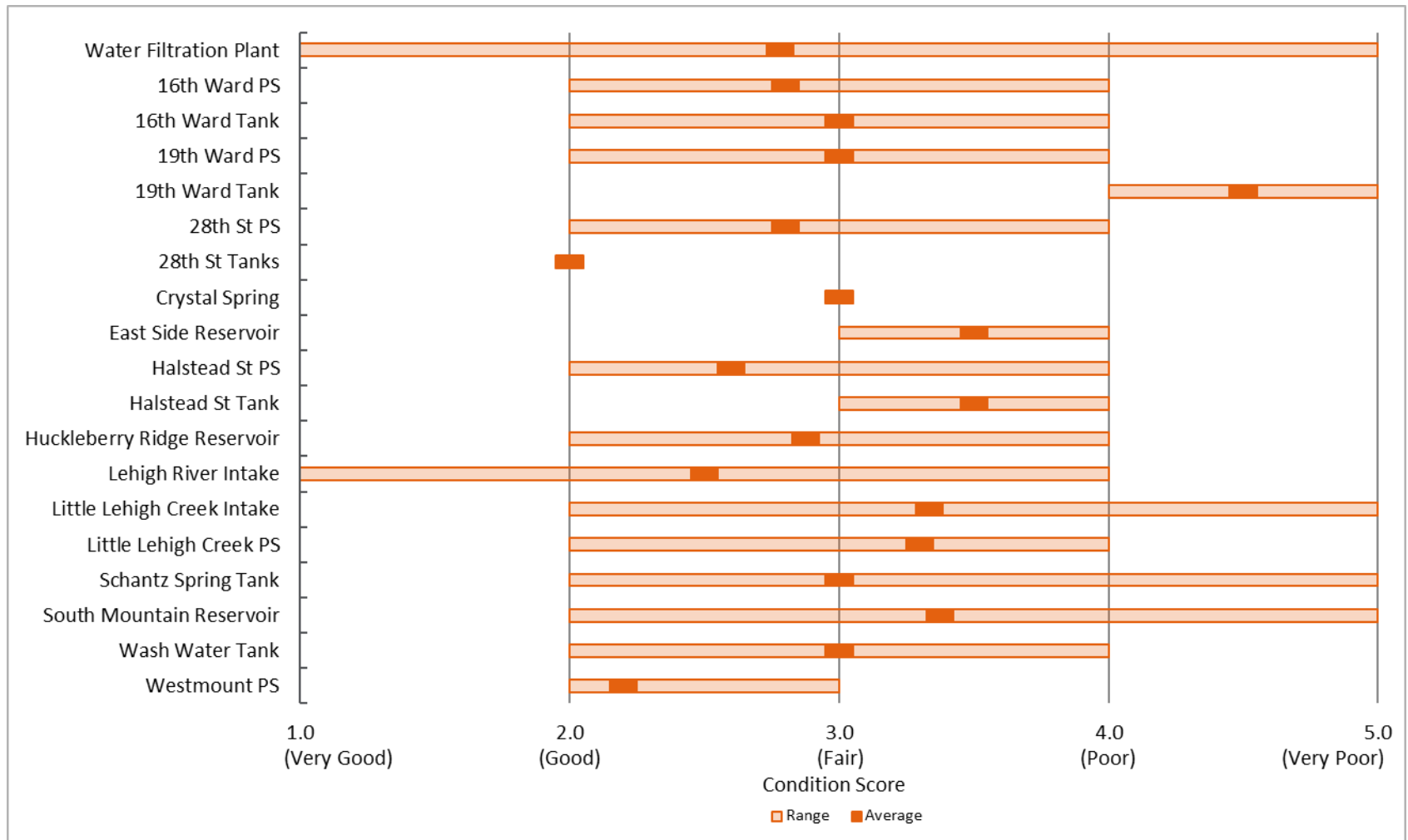
# Overall Condition Score Distribution



■ 1 (Very Good) ■ 2 (Good) ■ 3 (Fair) ■ 4 (Poor) ■ 5 (Very Poor)



# Overall Condition Scores by Facility



# CIP

Project	Near Term		Mid Term	Long Term
	Yrs 0-5	Yrs 5-10	Yrs 10-25	Yrs 25-50
	2020 Dollars	2025 Dollars	2035 Dollars	2055 Dollars
Water Filtration Plant				
Filter Upgrades	\$ 12,000,000			\$ 16,000,000
Pretreatment / Sedimentation		\$ 1,500,000	\$ 21,500,000	
High Lift VFDs/Pumps	\$ 6,000,000			\$ 8,000,000
Elec Improvements/Pumps		\$ 7,000,000		\$ 8,000,000
Auxiliary Generator		\$ 2,500,000		\$ 3,000,000
Big Lehigh Screens and PAC	\$ 5,500,000			\$ 7,500,000
Little Lehigh Intake and Screens <sup>4</sup>	\$ 2,000,000	\$ 7,500,000		\$ 11,000,000
Ultraviolet Disinfection			\$ 12,000,000	
Security Improvements		\$ 500,000		
CO <sub>2</sub> Feed System <sup>5</sup>	\$ 300,000			
Concrete/Brick Repairs <sup>6</sup>	\$ 800,000			
SCADA Replacement <sup>7</sup>	\$ 750,000		\$ 1,000,000	\$ 2,000,000
Watershed Control Plan	\$ 100,000			
Pump Stations			\$ 7,500,000	\$ 6,000,000
Reservoirs and Tanks	\$ 3,000,000			
Rehab Buried Concrete Reservoirs				\$ 46,000,000
Rehab Tanks and Reservoirs			\$ 4,000,000	\$ 6,000,000
Roof Replacements <sup>8</sup>	\$ 900,000		\$ 1,000,000	\$ 6,000,000
<b>Total</b>	<b>\$ 31,400,000</b>	<b>\$ 19,000,000</b>	<b>\$ 47,000,000</b>	<b>\$ 119,500,000</b>

# Near Term Recommendations

Project	Cost		Regulatory Compliance	Reliability	WQ Concerns	O&M
	0 – 5 Years (2020 Dollars)	5 -10 Years (2025 Dollars)				
Filters	\$12M		X	X	X	X
High Lift VFDs <sup>1</sup> / Pumps	\$6M			X		X
Electrical Improvements / Pumps		\$7M		X		X
Little Lehigh Intakes and Screens	\$2M	\$7.5M	X	X		X
Big Lehigh PAC <sup>2</sup> and Screens	\$5.5M			X	X	
Pretreatment / Sedimentation		\$1.5M		X	X	X
Auxiliary Generator		\$2.5M		X		
Security Improvements		\$0.5M		X		

# Near Term Recommendations

Project	Cost		Regulatory Compliance	Reliability	WQ Concerns	O&M
	0 – 5 Years (2020 Dollars)	5 -10 Years (2025 Dollars)				
CO <sub>2</sub> <sup>1</sup> Feed System	\$0.3M		X	X	X	
Concrete / Brick Repairs	\$0.8M			X		
SCADA Replacement	\$0.8M			X		
Watershed Control Plan	\$0.1M		X			
Reservoirs and Tanks	\$3M			X		X
Roof Replacements	\$0.9M			X		

# Near Term Recommendations

Project	Cost		Regulatory Compliance	Reliability	WQ Concerns	O&M
	0 – 5 Years (2020 Dollars)	5 -10 Years (2025 Dollars)				
<b>Filters</b>	\$12M		X	X	X	X
High Lift VFDs / Pumps	\$6M			X		X
Electrical Improvements / Pumps		\$7M		X		X
Little Lehigh Intakes and Screens	\$2M	\$7.5M	X	X		X
Big Lehigh PAC and Screens	\$5.5M			X	X	
Pretreatment / Sedimentation		\$1.5M		X	X	X
Auxiliary Generator		\$2.5M		X		
Security Improvements		\$0.5M		X		

# Filters

- Filters, underdrains, filter valves and control panels in poor condition
  - Underdrain inspection (2015) identified concerns
  - Difficulty obtaining spare parts (control panels, filter valves)
- Performance will become more critical for regulatory compliance<sup>1</sup>

Date of Install: 1953

Last Capital Project: ~1993

Remaining Useful Life: -12 to 11 years



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Reference: All Service Contracting Corp, 2015

<sup>1</sup> The Little Lehigh will be classified as a Bin 2 source which will require filtered water  $\leq 0.15$  NTU

# Near Term Recommendations

Project	Cost		Regulatory Compliance	Reliability	WQ Concerns	O&M
	0 – 5 Years (2020 Dollars)	5 -10 Years (2025 Dollars)				
Filters	\$12M		X	X	X	X
High Lift VFDs / Pumps	\$6M			X		X
Electrical Improvements / Pumps		\$7M		X		X
Little Lehigh Intakes and Screens	\$2M	\$7.5M	X	X		X
Big Lehigh PAC and Screens	\$5.5M			X	X	
Pretreatment / Sedimentation		\$1.5M		X	X	X
Auxiliary Generator		\$2.5M		X		
Security Improvements		\$0.5M		X		



# High Lift Pumps & VFDs

- VFDs are no longer supported by manufacturer
- Motors may not meet current design requirements
- Existing pumps capacities do not align well with existing demands

Date of Install: 1953

Last Capital Project: ~1997, 2000

Remaining Useful Life: -12 – 20 years



# Near Term Recommendations

Project	Cost		Regulatory Compliance	Reliability	WQ Concerns	O&M
	0 – 5 Years (2020 Dollars)	5 -10 Years (2025 Dollars)				
Filters	\$12M		X	X	X	X
High Lift VFDs / Pumps	\$6M			X		X
<b>Electrical Improvements / Pumps</b>		\$7M		X		X
Little Lehigh Intakes and Screens	\$2M	\$7.5M	X	X		X
Big Lehigh PAC and Screens	\$5.5M			X	X	
Pretreatment / Sedimentation		\$1.5M		X	X	X
Auxiliary Generator		\$2.5M		X		
Security Improvements		\$0.5M		X		

# Electrical Improvements / Pumps

- Electrical equipment approaching end of useful life
- Difficulty obtaining spare parts
- Low lift pump capacities do not align well with existing demands

Date of Install: 1997

Last Capital Project: 1997

Remaining Useful Life: -5 – 17 years



# Near Term Recommendations

Project	Cost		Regulatory Compliance	Reliability	WQ Concerns	O&M
	0 – 5 Years (2020 Dollars)	5 -10 Years (2025 Dollars)				
Filters	\$12M		X	X	X	X
High Lift VFDs / Pumps	\$6M			X		X
Electrical Improvements / Pumps		\$7M		X		X
<b>Little Lehigh Intakes and Screens</b>	\$2M	\$7.5M	X	X		X
Big Lehigh PAC and Screens	\$5.5M			X	X	
Pretreatment / Sedimentation		\$1.5M		X	X	X
Auxiliary Generator		\$2.5M		X		
Security Improvements		\$0.5M		X		

# Little Lehigh Intakes

- Process mechanical equipment in poor/very poor condition
- Design velocity of the intake channel exceeds current design standards

Date of Install: 1928 / 1953

Last Capital Project: 1997 / 2015

Remaining Useful Life: -68 to 29 years





# Near Term Recommendations

Project	Cost		Regulatory Compliance	Reliability	WQ Concerns	O&M
	0 – 5 Years (2020 Dollars)	5 -10 Years (2025 Dollars)				
Filters	\$12M		X	X	X	X
High Lift VFDs / Pumps	\$6M			X		X
Electrical Improvements / Pumps		\$7M		X		X
Little Lehigh Intakes and Screens	\$2M	\$7.5M	X	X		X
<b>Big Lehigh PAC and Screens</b>	\$5.5M			X	X	
Pretreatment / Sedimentation		\$1.5M		X	X	X
Auxiliary Generator		\$2.5M		X		
Security Improvements		\$0.5M		X		

# Big Lehigh Screens and PAC

- Operation limited
  - Taste and odor complaints
  - Difficulty with cleaning and accessing screens
- Little Lehigh Intake construction may require more frequent use
- Increase resiliency of water supply

Date of Install: 1989

Last Capital Project: 1995 / 2014

Remaining Useful Life: -17 to 28 years





**Q + A**

# Add'l Slides

# Auxiliary Generator

- Findings
  - Regional and/or prolonged power outage could result in significant level of service and regulatory impacts
- Project Scope
  - Install auxiliary generator at the Water Filtration Plant to power the Schantz and Crystal high service pumps

# Pretreatment/Sedimentation

- Findings
  - Certain asset groups are approaching or beyond nominal useful life
  - Clarifiers perform poorly under certain conditions
  - Clarifier inlet channel does not meet current industry standards
- Project Scope
  - Flocculation channel improvements, replace/rehab chemical fill station, replace fluoride tanks and transfer pump (Years 5-10)
  - Pilot testing to evaluate alternative plate settlers.  
Rehab/replacement of process mechanical equipment and building facilities (Years 10-25)

# Concrete Tanks and Reservoirs

- Findings
  - Certain asset groups in poor condition and/or approaching or beyond their nominal useful life
- Project Scope
  - Rehabilitate concrete tank and reservoirs
    - Tank exterior repairs
    - Building structure, building facility, and process mechanical equipment





# South Mountain Reservoir



# Watershed Control Plan

- Findings
  - Little Lehigh will require additional 1-log *Cryptosporidium* inactivation removal (based on recent sampling)
- Project Scope
  - Develop watershed control plan to obtain 0.5-log *Cryptosporidium* removal credit
  - Credit provides back-up to the 0.5-log individual filter effluent (IFE) monitoring credit



# Ultraviolet Filtration

- Findings
  - Little Lehigh will require additional 1-log *Cryptosporidium* inactivation removal (based on recent sampling)
  - Current raw water chlorination practice leads to higher disinfection byproduct levels
  - Limitations on ability to meet Giardia inactivation at certain conditions
- Project Scope
  - New ultraviolet filtration facility recommended to address above process limitations and provide higher level of public health protection

# Near-Term CIP (0-10 Yrs)

Project	Estimated Cost	
	0-5 Yrs 2020 Dollars	5-10 Yrs 2025 Dollars
Water Filtration Plant		
Filter Upgrades	\$12,000,000	
Pretreatment/ Sedimentation		\$1,500,000
High Lift Pumps/ VFDs	\$6,000,000	
Electrical Improvements/ Pumps		\$7,000,000
Auxiliary Generator		\$2,500,000
Big Lehigh Screens and PAC	\$5,500,000	
Little Lehigh Intake	\$2,000,000	\$7,500,000

# Near-Term CIP (0-10 Yrs)

Project	Estimated Cost	
	0-5 Yrs 2020 Dollars	5-10 Yrs 2025 Dollars
Water Filtration Plant		
Security Improvements		\$500,000
CO <sub>2</sub> Feed System	\$300,000	
Concrete / Brick Repairs	\$800,000	
SCADA Replacement	\$750,000	
Watershed Control Plan	\$100,000	
Reservoirs and Tanks	\$3,000,000	
Roof Replacements	\$900,000	
<b>Total</b>	<b>\$31,400,000</b>	<b>\$19,000,000</b>

# Mid-Term CIP (10-25 Yrs)

Project	Estimated Cost
	10-25 Yrs 2035 Dollars
Water Filtration Plant	
Pretreatment/ Sedimentation	\$21,500,000
Ultraviolet Disinfection	\$12,000,000
SCADA Replacement	\$1,000,0000
Pump Stations	\$7,500,000
Tanks and Reservoirs	\$4,000,000
Roof Replacements	\$1,000,000
<b>Total</b>	<b>\$47,000,000</b>

# Long-Term CIP (25-50 Yrs)

Project	Estimated Cost
	25-50 Yrs 2055 Dollars
Water Filtration Plant	
Filter Upgrades	\$16,000,000
High Lift Pumps/VFDs	\$8,000,000
Electrical Improvements / Pumps	\$8,000,000
Auxiliary Generator	\$3,000,000
Big Lehigh Intake and Screens	\$7,500,000
Little Lehigh Intake and Screens	\$11,000,000
SCADA Replacement	\$2,000,000

# Long-Term CIP (25-50 Yrs)

Project	Estimated Cost
	25-50 Yrs 2055 Dollars
Pump Stations	\$6,000,000
Rehab Concrete Reservoirs	\$46,000,000
Rehab Tanks and Reservoirs	\$6,000,000
Roof Replacements	\$6,000,000
<b>Total</b>	<b>\$119,500,000</b>