FINAL

Appendix D – Cost

For the Feasibility Study of Rebuild by Design Meadowlands Flood Protection Project

May 2021

Boroughs of Little Ferry, Moonachie, Carlstadt, and Teterboro and the Township of South Hackensack, Bergen County, New Jersey

REBUILD BY DESIGN
MEADOWLANDS

Prepared by AECOM for the State of New Jersey Department of Environmental Protection

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Acronyms and Abbreviations

BCUA	Bergen County Utilities Authority
CFR	Code of Federal Regulations
cfs	Cubic feet per second
HTRW	Hazardous, Toxic, Radioactive Waste
HUD	Department of Housing and Urban Development
LOP	Line of Protection
NAVD 88	North American Vertical Datum of 1988
NJDEP	New Jersey Department of Environmental Protection
O&M	Operations and Maintenance
OMRRR	Operation, Maintenance, Rehabilitation, Repair, and Replacement
PED	Pre-construction, Engineering, and Design
USACE	United States Army Corps of Engineers

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1.0 Introduction

This appendix outlines the cost of constructing the alternatives evaluated during the Feasibility Study of the Rebuild by Design Meadowlands Flood Protection Project (the Proposed Project). Funding for design and construction of the Proposed Project would be paid for by the Department of Housing and Urban Development (HUD). The 5,405-acre Project Area is bounded by the Hackensack River to the east; Paterson Plank Road (State Route 120) to the south; State Route 17 to the west; Interstate 80 to the north and includes the Boroughs of Little Ferry, Moonachie, Carlstadt, and Teterboro, as well as the Township of South Hackensack, all located in Bergen County, NJ (**Figure D-1**).

1.1 Evaluated Project Alternatives

1.1.1 Structural Flood Reduction - Alternative 1

Alternative 1 (see **Section 6.0** in the Feasibility Study Report) would analyze various structural, infrastructure-based solutions that would be constructed to provide protection from coastal storm surges. Under Alternative 1, a Line of Protection (LOP) would be constructed using of a range of grey infrastructure, including floodwalls, levees, berms, a tide gate and eight closure gates, and a surge barrier and pump station, designed to provide flood protection up to an elevation of 7 feet (North American Vertical Datum of 1988 (NAVD 88)). In addition to flood reduction infrastructure, this alternative would integrate open space features and green infrastructure into the design. This alternative would protect the Project Area from coastal flooding; however, chronic inland flooding from heavy or frequent precipitation events would continue to adversely affect the Project Area.

1.1.2 Stormwater Drainage Improvements - Alternative 2

Alternative 2 (see **Section 7.0** in the Feasibility Study Report) would include various grey and green infrastructure-based solutions, as well as new parks and improved open spaces, intended to improve stormwater management in key locations throughout the Project Area. Under Alternative 2, stormwater management would be improved through the installation of 41 green infrastructure systems (bioswales, storage/tree trenches, and rain gardens) along roadways, five new parks, improvements to five existing open spaces/public amenities, three new pump stations, two new force mains, and dredging of the lower reach of East Riser Ditch. This alternative would reduce chronic inland flooding from heavy or frequent precipitation events up to approximately the 100-year storm, but coastal flooding would continue to adversely affect the Project Area.

1.1.3 Hybrid Plan - Alternative 3 (*Build Plan* and *Future Plan*)

Alternative 3 (see **Section 8.0** in the Feasibility Study Report) would consist of a hybrid of coastal flood protection and stormwater drainage improvements. To achieve this, the majority of both Alternatives 1 and 2 would be implemented. However, due to funding and construction constraints associated with a project of this magnitude, the Alternative 3 features would be separated into two stages: a *Build Plan*, which includes all features to be constructed as part of the Proposed Project, and a *Future Plan*, which includes the remaining features that could be constructed over time by others as funding sources become available and construction feasibility permits. The Alternative 3 *Build Plan* would consist of all of the Alternative 2 components, with the exceptions of two new parks and a pump station and force main in Losen Slote. Additionally, the proposed improvements proposed for one of the parks under Alternative 2 would be altered under the Alternative 3 *Build Plan.* The Alternative 3 *Future Plan* would consist of all of the remaining features from Alternative 2, as well as all of the features from Alternative 1..

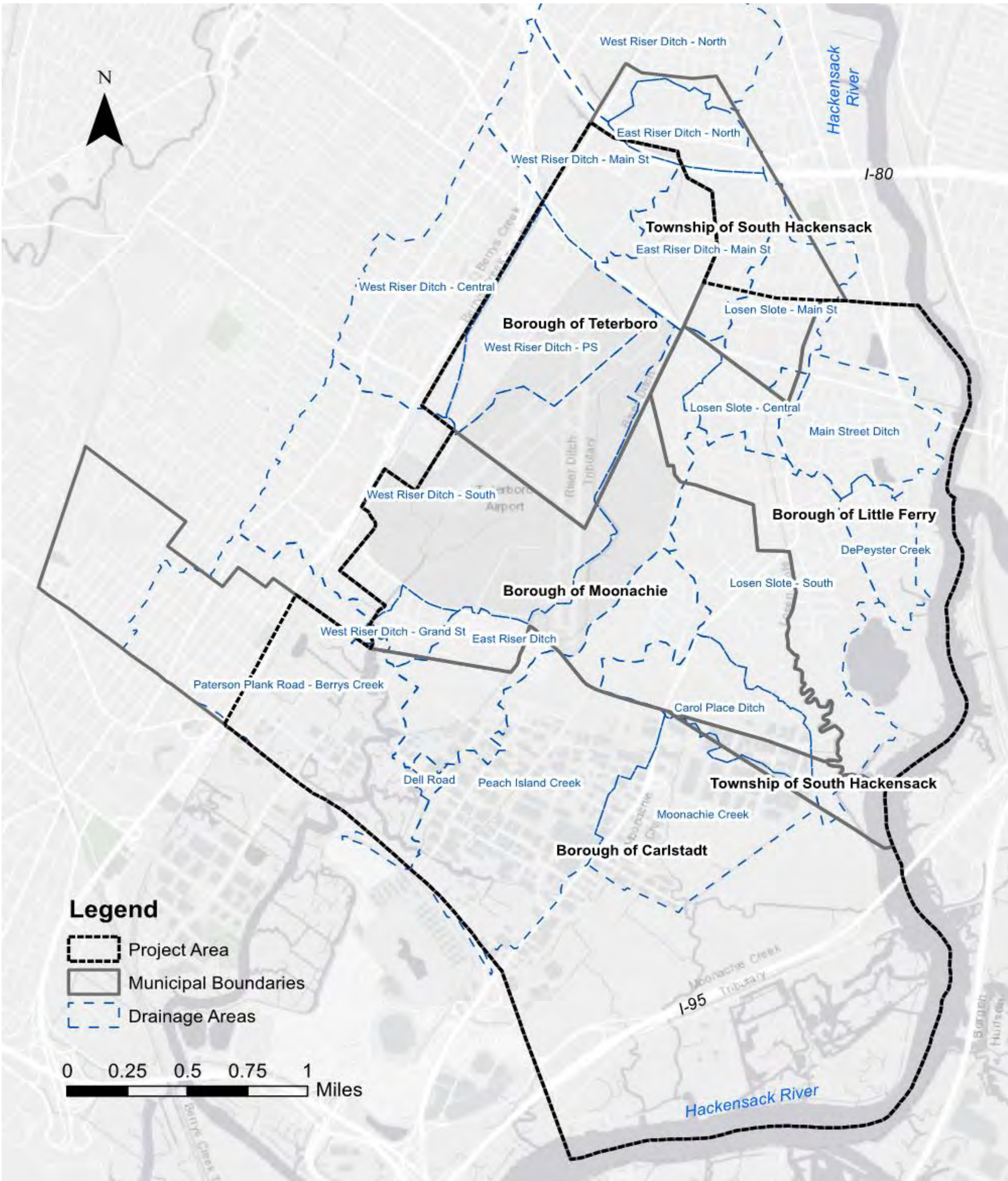

Figure D-1: Location Map

2.0 Detailed Cost Estimate

2.1 Quantity Estimate

For the detailed cost estimates, Proposed Project quantities were developed utilizing Microsoft Excel spreadsheets, along with assumptions based upon engineering experience such as floodwall reinforcing (80 pounds/cubic yard). The cost estimate was compiled using Microsoft Excel.

2.1.1 Quantity development

Quantity take-offs were performed for levee, floodwall, outlet structures, flap and tides gates, walkways, and open space areas.

The assumption that excess soil generated by the construction would be classified as non-hazardous ID27 solid waste and transported/disposed offsite at a cost of $85 per ton was used. The weight of the excavated material was conservatively estimated to be 2 tons per cubic yard. These costs may be reduced through a reduction in required disposal volume and/or identification of beneficial reuse of excavated materials.

Hazardous, Toxic, Radioactive Waste (HTRW) remediation was excluded from the estimate. If an isolated hot spot of HTRW is encountered, it can be addressed through contingency, implementing measures to reduce volume or possibly avoiding the area through relocation of planned Proposed Project features, such as rerouting of piping. If significant "hot spots" are encountered, there would be modifications to the design to minimize the need to remove HTRW material.

2.1.2 Fuel Rates

Fuel rates were not considered in the cost estimate.

2.1.3 Project Mark-ups:

Proposed Project mark-up, such as sales taxes, were not considered in the cost estimate.

2.2 Unit Cost

Unit Costs for the Proposed Project were developed primarily using RS Means 2017 price level for labor, material, and equipment with adjustment to local area cost using RS Means Area Factor of 114.4 for Hackensack, New Jersey. Additional costs were determined based upon quotes, allowances, and cost curves for undersigned items and engineering judgement.

2.3 Other Costs

2.3.1 Lands and Damages

For the purposes of the cost estimate, three types of easements were assumed to be required for the Proposed Project:

- Flood Protection Easements would be in locations where the construction, operation, maintenance, repair, and replacement of a LOP and equipment would be required;
- Drainage Easements would be needed at locations where a culvert/channel has been proposed; and
- Temporary Easements would allow access to the proposed construction.

2.3.2 Mitigation:

Mitigation costs were assumed for construction of wetlands to mitigate unavoidable impacts to existing wetlands that will not be offset by project features.

2.3.3 Interior

Due to limited design information on the pump stations, their respective construction costs were developed using cost-curves developed from pump station construction costs from similar sized projects to create a cost versus pump station size curve.

2.3.4 Closure Gates

2.3.4.1 Roller Gate

Roller gates were assumed to be structural steel, supported by a reinforced concrete monolith constructed on piles. Costs were derived from cost estimates prepared for roller gates ranging from 20 feet to 30 feet in width and between 2 feet to 9 feet in height. The four roller gates proposed range in height from 2 feet to 4 feet and have a width of between 25 feet and 30 feet. See Drawing Sheet CH-404 in Subappendix F4-1.

2.3.4.2 Swing Gate

Swing gates were also assumed to be structural steel, supported by a reinforced concrete pile foundation. Costs were derived from estimates prepared for gates ranging from 25 feet to 60 feet in width and between 2 feet to 8 feet in height. The two swing gates proposed range in height from 3 feet to 4 feet and have a width of between 25 to 30 feet. See Drawing Sheet CH-403 in Subappendix F4-1.

2.3.4.3 Stop Log Gate

No details, quantity, or cost estimates were prepared for the proposed aluminum stop log closure gates. An allowance of $100,000 was assumed for each of the 10 feet wide, 2 feet to 3 feet wide gates. See Drawing Sheet CH-402 in Subappendix F4-1.

2.3.5 Pre-construction Engineering & Design / Construction Administration:

Pre-construction, Engineering, and Design (PED) is 12 percent.

The construction administration of 4.3 percent was used for the cost estimation.

2.3.6 Contingencies

The contingency of 25 percent was used for the cost estimation.

2.3.7 Escalation

Computation was based on an Escalation to the construction mid-point in the year 2021, at 3.5 percent per year compounded.

2.4 First Cost

The components and cost of Alternatives 1, 2, and 3 are presented in **Section 2.4.1** through **Section 2.4.4**. Alternative 3 includes components and costs for the *Build Plan* plus the *Future Plan*, and for the *Build Plan* by itself. The cost summaries of these features exclude the General Requirements, Contingencies, and Escalation.

2.4.1 Structural Flood Reduction - Alternative 1

2.4.1.1 Line of Protection

The Alternative 1 LOP would be approximately five miles long including one mile of high ground and incorporates four new park areas. The eight major features which make up the proposed LOP including tide gates and drainage structures. For associated drawings refer to the Alternative 1 Plan Set included in the Feasibility Study Report.

- **Cantilevered Sheet Pile Floodwall with 16-foot Walkway**

This first segment of the LOP would begin approximately 1,000 linear feet south of Route 80 at Riverfront Shopping Center in the City of Hackensack and would be a cantilever sheet pile floodwall and 16 foot walkway that would extend approximately 3,877 feet to the south along the west bank of the Hackensack River through industrial and residential areas to an unnamed ditch (see Drawing Sheets CH-101 through CH-104 and LH-105).

The proposed walkway would provide a continuous 4 feet strip of planting along the back of the flood protection structure, and a 12 feet wide concrete pedestrian and emergency vehicle path in front. Amenities within the planting zone would include native grass, perennial and shrub plantings, and freestanding benches with intermittent canopies. A 7 feet high freestanding vertical trellis fence at the back edge of the structure would provide separation between the public realm and adjacent properties. The 12 feet wide pedestrian and emergency vehicle path would be free and clear of obstruction, other than a 3.5 feet walkway railing along the river edge of the structure (see Drawing Sheets S-406 and S-407 for details of the cantilever sheet pile floodwall). As shown in **Table D-1**, the cost of constructing the cantilever sheet pile floodwall would be approximately $15,383,200. The primary cost associated with this feature would be the installation of nearly 194,000 square feet of sheet pile at a cost of approximately $7,560,000.

- **Single Sheet Pile Floodwall with Concrete Cap**

The single sheet pile-floodwall would begin where the sheet pile floodwall ends and would follow the northern edge of the unnamed ditch for approximately 561 feet (with an average height 2 feet) to high ground (see Drawing Sheet LH-105). As shown in **Table D-2**, the cost of constructing the single sheet pile floodwall would be approximately $546,400.

- **Fluvial Park**

On the south side of the unnamed ditch, the creation of a new 3.8 acre park, which includes an upland area that acts as the LOP and a wetland that is integrated into a park setting, is proposed. The upland portion of the proposed park would contain a seating plaza/performance space (approximately 0.8 acre) and upland plantings (approximately 0.7 acre), while the portion of the park water ward of the LOP would include approximately 1.1 acres of newly created wetlands and 0.4 acre of riparian plantings. Additionally, a concrete path in the upland portion of the park and an elevated walkway through the wetlands and riparian areas would connect to access paths along the LOP on both sides of the park (see Drawing Sheets LH-105 and LH-107). The permanent easement required for this park would vary between 100 and 550 feet in width; the temporary easement would vary between 240 and 560 feet in width. As shown in **Table D** -3, the cost of constructing the proposed Fluvial Park is approximately $11,165,400. The primary cost of this feature would be the elevated walkway and proposed bridge connection to the northeast alignment, which is approximately $4,600,000.

Table D-1: Alternative 1 – Cantilevered Sheet Pile Floodwall with 16-foot Walkway

ALTERNATIVE 1 CONSTRUCTION COSTS – Cantilevered Sheet Pile Floodwall with 16-foot Walkway[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Clearing and Grubbing	Acre	$8,179.60	1.60	$13,087
Silt Fence	LF	$2.24	3,877	$8,684
Pavement Demolition	SY	$11.21	3,696	$41,432
Stripping	CY	$12.24	1,251	$15,312
Excavation (cuts along river bank)	CY	$11.50	5,506	$63,319
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	13,514	$1,148,690
Purchase/Drive/Cut-off AZ-13 Sheetpile @ 50' Long	SF	$39.00	193,850	$7,560,150
Backfill (behind floodwall)	CY	$17.33	4,281	$74,190
Precast Concrete "Eco-Panels"	SF	$28.60	35,862	$1,025,653
Riprap	CY	$74.36	1,939	$144,184
Drainage Ditch Excavation, incl Hauling & Disposal	CY	$40.00	1,508	$60,320
Drainage Ditch Concrete Lining	SY	$150.00	3,015	$452,250
Pavement Subbase, 6" thick	SY	$4.90	4,308	$21,109
Asphalt Pavement, 3" thick	SY	$17.16	4,308	$73,925
CIP CONCRETE CAP- Formwork	SF	$19.73	13,570	$267,736
CIP CONCRETE CAP- Rebar	LB	$2.00	236,850	$473,700
CIP CONCRETE CAP- Furnish & Place Concrete	CY	$209.92	1,579	$331,464
SPECIALTY FINISH 1-BROOM FINISH	SF	$0.98	8,527	$8,356
SPECIALTY FINISH 2-MASKED SANDBLAST	SF	$7.21	4,263	$30,736
RESIN BOUND AGGREGATE AT CANOPIES AND BENCHES	SF	$15.44	843	$13,016
CANOPY	SF	$175.00	256	$44,800

ALTERNATIVE 1 CONSTRUCTION COSTS – Cantilevered Sheet Pile Floodwall with 16-foot Walkway[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
STEEL GUARDRAIL AT RIVER	LF	$200.00	3,877	$775,400
GREENSCREEN FREESTANDING TRELLIS FENCE	LF	$97.00	3,877	$376,069
GATES WITHIN TRELLIS FENCE	EA	$750.00	4	$3,000
GABION (NON STANDARD SIZE) 1	CY	$204.78	23	$4,710
GABION (NON STANDARD SIZE) 2	CY	$204.78	25	$5,120
GABION BENCH TOP	EA	$500.00	27	$13,500
CONCRETE RAMP AT ENTRY POINTS	SY	$124.79	85	$10,607
LIGHTING FIXTURE/POLE - MARINE GRADE POWDER COAT	EA	$4,000.00	65	$260,000
PLANTING SOIL	CY	$75.00	18,000	$1,350,000
PRECAST CONCRETE PLANTER, 3'-4" x 6' x 4' D	EA	$2,087.80	185	$386,243
1.5 CAL SHRUBS	EA	$577.72	185	$106,878
1 GALLON PLANTS	EA	$25.17	5,149	$129,600
WETLAND PLANTS - LP50 PLUGS	EA	$4.40	20,444	$89,954
Area Subtotals – Total Construction Cost[2]				**$15,383,200**
Subtotal before General Requirements Contingency and Escalation				**$15,383,200**

1. The cantilevered sheet pile floodwall with 16-foot walkway is proposed to be located from Station 0+00 to Station 38+77.
2. Lands, damages, relocations, and soft costs are excluded.

Table D -2: Alternative 1 – Single Sheet Pile Floodwall with Concrete Cap

ALTERNATIVE 1 CONSTRUCTION COSTS – Single Sheet Pile Floodwall with Concrete Cap[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Clearing and Grubbing	AC	$8,179.60	0.11	$900
Silt Fence	LF	$2.24	493	$1,104
Pavement Demolition	SY	$11.21	274	$3,072
Excavation	CY	$11.50	73	$840
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	146	$12,410
AZ-12 Sheet Pile	SF	$38.00	7,398	$281,124
Structural Concrete - Form Work	SF	$11.78	5,916	$69,690
Reinforcement Steel for Structural Concrete	LBS	$2.00	32,879	$65,758
Structural Concrete - Placement & Finishing	CY	$209.92	219	$45,972
Drainage Ditch Excavation, incl Hauling & Disposal	CY	$40.00	192	$7,680
Drainage Ditch Concrete Lining	SY	$150.00	383	$57,450
Pavement Subbase, 6" thick	SY	$0.00	274	$0
Asphalt Pavement, 3" thick	SY	$0.00	274	$0
Seeding	MSF	$71.50	5	$358
Area Subtotals – Total Construction Cost[2]				**$546,400**
Subtotal before General Requirements Contingency and Escalation				**$546,400**

1. The single sheet pile floodwall with concrete cap is proposed to be located from Station 38+77 to Station 44+27.
2. Lands, damages, relocations, and soft costs are excluded.

Table D -3: Alternative 1 – Fluvial Park

ALTERNATIVE 1 CONSTRUCTION COSTS – Fluvial Park[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
EARTHWORK				
FILL	CY	$37.59	6,674	$250,876
EXCAVATION	CY	$11.50	6,479	$74,509
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	12,958	$1,101,430
STRUCTURE				
BRIDGE TO NE ALIGN	SF	$275.00	1,500	$412,500
ELEVATED WALKWAYS AND BRIDGE TO NE ALIGN	SF	$200.00	20,900	$4,180,000
PAVEMENT				
RUBBERIZED ACTIVITY/PLAY SURFACE	SF	$21.00	8,000	$168,000
WOOD DECK ON GRADE	SF	$180.00	18,300	$3,294,000
SYNTHETIC LAWN	SF	$24.50	6,000	$147,000
CONCRETE PAVEMENT	SF	$13.87	21,000	$291,270
UPLAND PLANTING AREA				
TREES (2.5-3" cal)	EA	$400.40	75	$30,030
SHRUBS (#5 CONT.)	EA	$44.62	645	$28,780
GRASSES AND HERBACEOUS (1 GAL)	EA	$25.17	9,822	$247,220
LAWN, SEEDED	SF	$0.07	14,000	$980
RIPARIAN PLANTING AREA				
SHRUBS (#5 CONT.)	EA	$44.62	182	$8,121
GRASSES AND HERBACEOUS (1 GAL)	EA	$25.17	11,550	$290,714
WETLAND PLANTING AREA				
WETLAND HERBACEOUS (LP50 PLUGS)	EA	$4.40	20,444	$89,954
FURNISHINGS				
PLAYGROUND EQUIP	SF	$17.50	8,000	$140,000
OUTDOOR EXERCISE EQUIP	SF	$17.50	8,000	$140,000
SEATING	LF	$375.00	400	$150,000
LIGHTING FIXTURE/POLE	EA	$5,000.00	24	$120,000
Area Subtotals – Total Construction Cost[2]				**$11,165,400**
Subtotal before General Requirements Contingency and Escalation				**$11,165,400**

1. Fluvial Park is proposed to be located from Station 56+52 to Station 65+63.
2. Lands, damages, relocations, and soft costs are excluded.

- **Sheet Pile Floodwall with and 10-foot Cantilevered Walkway and Transition Area**

At the southern limit of the proposed Fluvial Park, a 540 feet long cantilever sheet pile floodwall and 10-foot wide walkway (which would transition to 25 feet wide beginning at the proposed boat dock and kayak launch via a 271 feet long transition area) is proposed. The sheet pile (see Drawing Sheet LH-107 and CH-108 would be placed a minimum of 10 feet from the existing buildings to minimize structural impact on adjacent property. As shown in **Table D-4**, the cost of constructing this segment of floodwall and walkway would be approximately $2,679,100.

- **K–Town Park**

Located behind the walkway transition area, the proposed K-Town Park (see Drawing Sheet CH-108) would be approximately 1.4 acres and serves as the northern anchor for the cantilever system. The park would utilize vacant waterfront property to provide active recreation space that could be used for formal or informal pick-up games. As shown in **Table D-5**, the cost of constructing K-Town Park would be approximately $886,400.

- **Concrete Floodwall and 25-foot Cantilever Walkway (Cantilever Riverwalk)**

The cantilever riverwalk begins at the south end of the proposed K-Town Park. The proposed cantilever riverwalk is an elevated 25 feet wide cantilever sheet pile floodwall (see Drawing Sheets CH-107 and CH-108) that sits on top of a concrete floodwall. This segment would be approximately 1,024 feet long and between 1 foot and 4 feet high. The proposed structure would utilize a concrete encased sheet pile wall as a means of flood-protection (flood side) with a retaining wall on the protected side. A concrete slab between the sheet pile wall and retaining wall would form the concrete walkway.

This plan would include pedestrian access to the K-Town industrial property; permanent easement of between 40 feet and 55 feet in width; temporary easement between 50 feet and 65 feet in width; and a proposed boat dock/kayak launch that would be built in the Hackensack River to allow recreational access to the water. As shown in **Table D-6**, the cost of constructing the 25-foot wide cantilever walkway would be approximately $4,447,700. The primary cost associated with this feature would be the installation of nearly 36,200 square feet of sheet pile at a cost of approximately $1,375,000.

- **Riverside Park**

Riverside Park (see Drawing Sheet C-109) would be constructed at the southern end of the proposed cantilever located along Riverside Avenue and Washington Avenue. This approximately 2.2-acre park would be the southern anchor of the cantilever system, which would incorporate passive recreational space that could include bocce ball, volleyball, and badminton courts, with sculptural landforms that would allow for remarkable views of the Hackensack River. A network of public access pathways lined with native plantings would connect with various entrance points along the cantilever system. As shown in **Table D-7**, the cost of constructing Riverside Park would be approximately $1,003,700.

Table D-4: Alternative 1 – Sheet Pile Floodwall with 10-foot Cantilever Walkway & Transition to 25-feet

ALTERNATIVE 1 CONSTRUCTION COSTS – Sheet Pile Floodwall with 10-foot Cantilever Walkway & Transition to 25-feet [1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
AZ-26 Sheet Pile	SF	$46.00	37,753	$1,736,638
AZ-12 Sheet Pile	SF	$38.00	985	$37,430
HP14x73 Bearing Pile	LF	$75.00	-	$0
W10x30 Wales	LF	$35.00	1,079	$37,765
C3x6 Struts	LF	$15.00	450	$6,750
Temporary Sheeting	SF	$30.89	-	$0
Excavation	CY	$11.50	207	$2,381
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	414	$35,190
Structural Concrete Encasement - Form Work	SF	$11.78	10,361	$122,052
Reinforcement Steel for Structural Concrete Encasement	LBS	$2.00	54,300	$108,600
Structural Concrete Encasement- Placement & Finishing	CY	$209.92	362	$75,991
Structural Concrete Footing & Wall - Form Work	SF	$11.78	418	$4,919
Reinforcement Steel for Structural Concrete Footing & Wall	LBS	$2.00	2,550	$5,100
Structural Concrete Footing & Wall - Placement & Finishing	CY	$209.92	17	$3,569
Sand Fill for Cell Interior	CY	$38.32	521	$19,965
CIP CONCRETE CAP- Formwork	SF	$19.73	1,144	$22,571
CIP CONCRETE CAP- Rebar	LB	$2.00	28,650	$57,300
CIP CONCRETE CAP- Furnish & Place Concrete	CY	$209.92	191	$40,095
STEEL GUARDRAILS	LF	$200.00	1,144	$228,800
Riprap	CY	$74.36	286	$21,267
Drainage Ditch Excavation, incl Hauling & Disposal	CY	$40.00	223	$8,920
Drainage Ditch Concrete Lining	SY	$150.00	445	$66,750
Pavement Subbase, 6" thick	SY	$8.39	4,344	$36,446
Asphalt Pavement, 3" thick	SY	$0.00	4,344	$0
Seeding	MSF	$71.50	8	$572
Area Subtotals – Total Construction Cost[2]				**$2,679,100**
Subtotal before General Requirements Contingency and Escalation				**$2,679,100**

1. The sheet pile floodwall with 10-foot cantilever walkway and transition to 25-feet is proposed to be located from Station 67+05 to Station 72+78.
2. Lands, damages, relocations, and soft costs are excluded.

Table D-5: Alternative 1 – K-Town Park

ALTERNATIVE 1 CONSTRUCTION COSTS – K-Town Park[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CANTILEVER WALWAY 25' W (CW25)				
CONCRETE PAVERS	SF	$23.60	960	$22,656
CUSTOM CONCRETE BENCHES	LF	$150.00	39	$5,850
LIGHTING FIXTURE/POLE	EA	$5,000.00	2	$10,000
CANTILEVER WALKWAY 10' W (CW10)				
CONCRETE PAVERS	SF	$23.60	686	$16,190
LIGHTING FIXTURE/POLE	EA	$5,000.00	1	$5,000
CANTILEVER WALKWAY TRANSITION (CWT)				
CONCRETE PAVERS	SF	$23.60	870	$20,532
LIGHTING FIXTURE/POLE	EA	$5,000.00	1	$5,000
DOCK STRUCTURE AT EL 5 (DS)				
Sustainable hardwood deck on Steel frame structure	SF	$180.00	1,287	$231,660
DECK WALKWAY AT EL 8 (DW)				
Sustainable hardwood deck on Steel frame structure	SF	$180.00	1,367	$246,060
GUARDRAIL	LF	$200.00	203	$40,600
LIGHTING FIXTURE/POLE	EA	$5,000.00	1	$5,000
CONCRETE PEDESTRIAN RAMP 1 (CR1)				
RAMP	SY	$124.79	21	$2,621
LANDING 1	SY	$124.79	24	$2,995
LANDING 2	SY	$124.79	17	$2,121
GUARDRAIL	LF	$200.00	53	$10,600
CONCRETE PEDESTRIAN RAMP 2 (CR2)				
RAMP	SY	$124.79	32	$3,993
LANDING	SY	$124.79	17	$2,121
GUARDRAIL	LF	$200.00	73	$14,600
CONCRETE STEPS (CS)				
CONCRETE STAIRS	SY	$250.00	20	$5,000
LANDING	SY	$124.79	8	$998
GUARDRAIL	LF	$200.00	30	$6,000
CONCRETE VEHICLE RAMP (CRV)				
RAMP	SY	$124.79	53	$6,614
LANDING 1	SY	$124.79	38	$4,742
LANDING 2	SY	$124.79	18	$2,246
GUARDRAIL	LF	$200.00	82	$16,400
CONCRETE BOAT LANDING RAMP (CBL)				
RAMP (pricing includes allowance for cofferdam & pumping)	SY	$500.00	108	$54,000
LANDING	SY	$124.79	49	$6,115
GUARDRAIL	LF	$200.00	72	$14,400
ADDITIONAL VEHICLE ZONE (AV)				
CONCRETE ON GRADE	SY	$124.79	333	$41,555

ALTERNATIVE 1 CONSTRUCTION COSTS – K-Town Park[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
PLANTS (CANTILEVER)				
PLANTERS (25'Lx4'Wx3'H custom concrete planter)	EA	$12,000.00	3	$36,000
SHRUBS (#5 CONT.)	EA	$44.62	27	$1,205
GRASSES AND HERBACEOUS (1 GAL)	EA	$25.17	55	$1,384
YARD DRAIN	EA	$600.00	3	$1,800
PLANTS (ON GRADE BUFFER)				
TREES (2.5-3" cal)	EA	$400.40	10	$4,004
SHRUBS (#5 CONT.)	EA	$44.62	90	$4,016
GRASSES AND HERBACEOUS (1 GAL)	EA	$25.17	1,284	$32,318
Area Subtotals – Total Construction Cost[2]				**$886,400**
Subtotal before General Requirements Contingency and Escalation				**$886,400**

1. The proposed K-Town Park location is not applicable to specific Station(s).
2. Lands, damages, relocations, and soft costs are excluded.

Table D-6: Alternative 1 – Concrete Floodwall and 25-foot wide Walkway (Cantilever Riverwalk)

ALTERNATIVE 1 CONSTRUCTION COSTS – Concrete Floodwall and 25-foot wide Walkway (Cantilever Riverwalk)[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
AZ-26 Sheet Pile	SF	$46.00	-	$0
AZ-12 Sheet Pile	SF	$38.00	36,176	$1,374,688
HP14x73 Bearing Pile	LF	$75.00	1,440	$108,000
W10x30 Wales	LF	$35.00	-	$0
C3x6 Struts	LF	$15.00	-	$0
Temporary Sheeting	SF	$30.89	4,900	$151,361
Excavation	CY	$11.50	2,242	$25,783
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	4,484	$381,140
Structural Concrete Encasement - Form Work	SF	$11.78	8,438	$99,395
Reinforcement Steel for Structural Concrete Encasement	LBS	$2.00	55,500	$111,000
Structural Concrete Encasement-Placement & Finishing	CY	$209.92	370	$77,670
Structural Concrete Footing & Wall - Form Work	SF	$11.78	17,530	$206,501
Reinforcement Steel for Structural Concrete Footing & Wall	LBS	$2.00	115,650	$231,300
Structural Concrete Footing & Wall - Placement & Finishing	CY	$209.92	771	$161,848
Sand Fill for Cell Interior	CY	$38.32	4,347	$166,577
CIP CONCRETE CAP- Formwork	SF	$19.73	4,632	$91,381
CIP CONCRETE CAP- Rebar	LB	$2.00	155,700	$311,400
CIP CONCRETE CAP- Furnish & Place Concrete	CY	$209.92	1,038	$217,897
STEEL GUARDRAILS	LF	$200.00	2,524	$504,800
Riprap	CY	$74.36	631	$46,921
Drainage Ditch Excavation, incl Hauling & Disposal	CY	$40.00	491	$19,640
Drainage Ditch Concrete Lining	SY	$150.00	982	$147,300
Pavement Subbase, 6" thick	SY	$8.39	1,403	$11,771
Asphalt Pavement, 3" thick	SY	$0.00	1,403	$0
Seeding	MSF	$71.50	18	$1,287
Area Subtotals – Total Construction Cost[2]				**$4,447,700**
Subtotal before General Requirements Contingency and Escalation				**$4,447,700**

1. The cantilever riverwalk is proposed to be located from Station 72+78 to Station 85+40.
2. Lands, damages, relocations, and soft costs are excluded.

Table D-7: Alternative 1 – Riverside Park

ALTERNATIVE 1 CONSTRUCTION COSTS – Riverside Park[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
LANDFORM				
IMPORTED FILL	CY	$37.59	1,750	$65,783
STRUCTURE				
RAMP	SY	$124.79	26	$3,245
CONCRETE STAIRS	SY	$250.00	25	$6,250
PAVEMENT				
CONCRETE PAVERS	SF	$23.60	10,100	$238,360
RESIN BOUND AGGREGATE	SF	$15.44	1,600	$24,704
PLAY SURFACE	SF	$21.00	2,000	$42,000
FURNISHINGS				
CONCRETE SEAT WALL	LF	$150.00	200	$30,000
WOOD SLAT SEAT TOP AT CONCRETE SEAT WALL	LF	$200.00	80	$16,000
LIGHTING FIXTURE/POLE	EA	$5,000.00	18	$90,000
GUARDRAIL	LF	$200.00	30	$6,000
BOCCE BALL COURTS	SF	$28.00	5,200	$145,600
PLAY EQUIPMENT	EA	$75,000.00	1	$75,000
PLANTS (FOR ALL SECTIONS)				
TREES (2.5-3" cal)	EA	$400.40	22	$8,809
TREES (BOCCE BOSQUE, 2" cal)	EA	$377.52	40	$15,101
SHRUBS(#5 CONT.)	EA	$44.62	200	$8,924
GRASSES AND HERBACEOUS (1 GAL)	EA	$25.17	9,000	$226,530
LAWN, SEEDED	SF	$0.07	20,000	$ 1,400
Area Subtotals – Total Construction Cost[2]				**$1,003,700**
Subtotal before General Requirements Contingency and Escalation				**$1,003,700**

1. The proposed Riverside Park location is not applicable to specific Station(s).
2. Lands, damages, relocations, and soft costs are excluded.

- **Concrete Floodwall (T-Wall)**

South of the cantilever riverwalk, the LOP would transition to a concrete floodwall (T-Wall) that would be constructed primarily following the Hackensack River until reaching high ground approximately 300 feet upstream of DePeyster Creek. This portion of the LOP would be approximately 2,168 feet long and include two stop log gates and a roller gate (see Drawing Sheets CH-109 through CH-112). Another section of floodwall (see Drawing Sheet CH-112) would be constructed on both sides of the existing tide gate located at DePeyster Creek. The approximate length of floodwall in this section would be 310 feet and the height would range from one to five feet above existing grade. As shown in **Table 2-8**, the cost of constructing these segments of floodwall would be approximately $3,321,900. The primary cost associated with this feature would be the disposal of nearly 16,530 cubic yards of regulated soil at a cost of approximately $1,405,000.

Table 2-8: Alternative 1 – Concrete T-Wall

ALTERNATIVE 1 CONSTRUCTION COSTS – Concrete T-Wall[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CAST-IN-PLACE CONCRETE WALLS				**$2,849,367**
Clearing and Grubbing	Acre	$8,179.60	2	$16,359
Sidewalk Repair (at 4-ft wide)	LF	$27.36		$0
Silt Fence	LF	$2.24	4,955	$11,099
Pavement Demolition	SY	$11.21	60	$673
Stripping	CY	$12.24	689	$8,433
Excavation	CY	$11.50	6,199	$71,289
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	13,776	$1,170,960
Mud Section	CY	$514.80	153	$78,764
Structural Concrete - Placement & Finishing	CY	$209.92	1,026	$215,378
Structural Concrete - Form Work	SF	$11.78	26,587	$313,195
Reinforcement Steel for Structural Concrete	LBS	$2.00	82,042	$164,084
Anti-Graffiti Coating	SF	$3.23	23,616	$76,280
Structural Backfill	CY	$17.33	2,727	$47,259
Filter Fabric	SY	$2.69	2,610	$7,021
6" thick Articulated Concrete Block	SY	$115.00	2,610	$300,150
Stripping/Excavation	CY	$12.24	1,377	$16,854
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	2,754	$234,090
12" Stone Bedding	CY	$46.54	389	$18,104
Top Soil (6" thick)	SY	$7.38	12,390	$91,438
Seeding	MSF	$71.50	111	$7,937
E) Stop Log Gate Station 90+53	LS	$100,000.00	1	$100,000
F) Stop Log Gate Station 96+31	LS	$100,000.00	1	$100,000
G) Roller Gate Station 103+55	LS	$272,557.00	1	$272,557
Area Subtotals – Total Construction Cost[2]				**$3,321,900**
Subtotal before General Requirements Contingency and Escalation				**$3,321,900**

1. The concrete T-wall is proposed to be located from Station 85+40 to Station 125+40.
2. Lands, damages, relocations, and soft costs are excluded.

- **DePeyster Creek Park**

The proposed 0.6-acre DePeyster Creek Park (see Drawing Sheet CH-113) would be located immediately west of the existing DePeyster Creek tide gate. This park would comprise an isolated component of the LOP, as it would tie into existing high ground on either side along DePeyster Creek. The proposed park would incorporate passive recreational space that could include open lawn, picnic tables, chairs, and a birdwatching platform. A new drainage swale would surround the park on the northern and western sides, and the proposed floodwall ranging from 1.6 feet to 3 feet in height would surround the park on the southern and eastern sides. The proposed floodwall would tie into the existing tide gate to the north and into existing high ground to the south. As shown in **Table D-9**, the cost of constructing DePeyster Creek Park would be approximately $338,800.

Table D-9: Alternative 1 – DePeyster Creek Park

ALTERNATIVE 1 CONSTRUCTION COSTS – DePeyster Creek Park[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
IMPORTED FILL	CY	$37.59	20	$752
PAVEMENT				
CONCRETE PAVERS	SF	$23.60	10,100	$238,360
FURNISHINGS				
WOOD PICNIC TABLES	EA	$2,500.00	8	$20,000
PARK GAME TABLES	EA	$4,000.00	8	$32,000
PLANTS (ON GRADE BUFFER)				
TREES (2.5-3" cal)	EA	$400.40	19	$7,608
SHRUBS(#5 CONT.)	EA	$44.62	166	$7,407
GRASSES AND HERBACEOUS (1 GAL)	EA	$25.17	1,284	$32,318
LAWN, SEEDED	SF	$0.07	4,500	$315
Area Subtotals – Total Construction Cost[2]				**$338,800**
Subtotal before General Requirements Contingency and Escalation				**$338,800**

1. The proposed DePeyster Creek Park location is not applicable to specific Station(s).
2. Lands, damages, relocations, and soft costs are excluded.

- **Single and Double Sheet Pile Floodwall**

The final section of the LOP (see Drawing Sheets CH-114 through CH-124) would begin approximately 500 linear feet downstream of DePeyster Creek where it would follow the Hackensack River south to high ground at Utility Road. From Utility Road the LOP would follow existing trails, infrastructure, and wetlands up to Commercial Boulevard where it would run adjacent to the south side of Commercial Boulevard to Moonachie Creek. This section would include 10,989 linear feet of single sheet that would range in height from 1 foot to 5 feet and 1,989 linear feet of double sheet pile floodwall that would rang in height from 5.5 feet to 7 feet. It would tie into the proposed Bergen County Utilities Authority (BCUA) tide gate, existing Losen Slote Creek tide gate, and proposed flap gate. This segment of the LOP would also include two roller gates and a swing gate. The closure gates would remain open under normal circumstances, but would be closed prior to flood events to seal the LOP. As shown in **Table D-10**, the cost of constructing the single and double sheet pile wall would be approximately $17,601,500. This cost does not include replacement of the BCUA tide gate, nor the proposed outlet structures.

- **BCUA Tide Gate Structure**

Based on the known geology of the Project Area, it was assumed that the proposed BCUA tide gate would be constructed on a pile foundation. As shown in **Table 2-11**, the cost of constructing the BCUA tide gate would be approximately $1,689,800.

- **Drainage Outlet Structures**

Drainage outlet structure quantities were determined based on the height of the proposed structure (LOP minus interior elevation plus 4 feet below grade) assuming a two-foot diameter pipe utilizing the details shown on Drawing Sheet CH-401. The cost of constructing 53 drainage structures would be approximately $6,489,700, as shown in **Table D-12**.

Table D-10: Alternative 1 – Single and Double Sheet Pile Floodwall

ALTERNATIVE 1 CONSTRUCTION COSTS – Single and Double Sheet Pile Floodwall[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
SHEET PILE I - WALL W/CONCRETE CAP				**$8,834,042**
Clearing and Grubbing	AC	$8,179.60	6	$49,078
Silt Fence	LF	$2.24	12,500	$28,000
Pavement Demolition	SY	$11.21	100	$1,121
Excavation	CY	$11.50	300	$3,450
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	600	$51,000
AZ-12 Sheet Pile	SF	$38.00	143,860	$5,466,680
Structural Concrete - Form Work	SF	$11.78	85,462	$1,006,742
Reinforcement Steel for Structural Concrete	LBS	$2.00	567,960	$1,135,920
Structural Concrete - Placement & Finishing	CY	$209.92	4,733	$993,551
Drainage Ditch Excavation, incl Hauling & Disposal	CY	$40.00	300	$12,000
Drainage Ditch Concrete Lining	SY	$150.00	100	$15,000
Pavement Subbase, 6" thick	SY	$0.00	50	-
Asphalt Pavement, 3" thick	SY	$0.00	50	-
Seeding	MSF	$71.50	1,000	$71,500
DOUBLE SHEET PILE WALL				**$8,140,692**
Clearing and Grubbing	AC	$8,179.60		
Silt Fence	LF	$2.24	2.00	$4
Pavement Demolition	SY	$11.21	1,500.00	$16,815
Excavation	CY	$11.50	200.00	$2,300
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	400.00	$34,000
AZ-26 Sheet Pile	SF	$46.00	109,332.00	$5,029,272
W10x30 Wales	LF	$35.00	3,854.00	$134,890
C3x6 Struts	LF	$15.00	1,140.00	$17,100
Sand Fill for Cell Interior	CY	$38.32	65,439.00	$2,507,622
Drainage Ditch Excavation, incl Hauling & Disposal	CY	$40.00	502.22	$20,089
Seeding	MSF	$71.50	62.40	$4,462
Sidewalk Repair	SF	$6.84	7,200	$49,248
Curb Removal & Replacement	LF	$50.00	2,785	$139,250
Pavement Removal/Replacement	SY	$60.00	3,094	$185,640
CLOSURE & TIDE GATES				
Excavation - Gate Structure	CY	$11.50	67	$771
Dewatering Pumps	EA*DAY	$292.86	30	$8,786
Structural Concrete - Building foundation & elevated slab (complete	CY	$1,258.40	52	$65,437

ALTERNATIVE 1 CONSTRUCTION COSTS – Single and Double Sheet Pile Floodwall[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
w/ formwork, rebar, placement & finish)				
Deep Foundations, H-Piling - Pipe Supports	LF	$57.77	480	$27,730
Sheetpile, cutoff wall	SF	$50.34	1,200	$60,408
Swing Gate Station 140+95	LS	$101,093.00	1	$101,093
Roller Gate, Station 165+85	LS	$60,000.00	1	$60,000
Roller Gate Station 185+85	LS	$272,557.00	1	$272,557
Flap Gate (5x4ft)	EA	$15,000.00	2	$30,000
Area Subtotals – Total Construction Cost[2]				**$17,601,500**
Subtotal before General Requirements Contingency and Escalation				**$17,601,500**

1. The single and double sheet pile floodwall is proposed to be located from Station 140+52 to Station 266+21.
2. Lands, damages, relocations, and soft costs are excluded.

Table 2-11: Alternative 1 – BCUA Tide Gate Structure

ALTERNATIVE 1 CONSTRUCTION COSTS – BCUA Tide Gate Structure[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Crane/pile driving rig mobilization & demobilization, including sectional barge hauling/rental/assembly/ disassembly	-	$179,000.00	1	$179,000
Cut fillet welds between W-section and Sheet Pile top plate. Remove /salvage walkway structure above top plate.	LS	$20,000.00	1	$20,000
Sheet Pile - PZ-22 Misc. Steel	LBS	$1.50	7,392	$11,088
Waler - W12x26	LBS	$3.00	2,184	$6,552
Struts - W12x26	LBS	$3.00	585	$1,755
Piles - 20"x½" Pipe	LBS	$2.50	185,901	$464,753
1/2" Top Plate	LBS	$3.00	305,870	$917,610
Misc. Steel	LBS	$3.00	11,347	$34,041
Static Pile Load Test	EA	$35,000.00	1	$35,000
Reinstall salvaged walkway structure	LS	$20,000.00	1	$20,000
Area Subtotals – Total Construction Cost[2]				**$1,689,800**
Subtotal before General Requirements Contingency and Escalation				**$1,689,800**

1. The BUCA tide gate structure is proposed to be located from Station 180+33 to Station 180+80.
2. Lands, damages, relocations, and soft costs are excluded.

Table D-12: Alternative 1 – Drainage Outlet Structures

ALTERNATIVE 1 CONSTRUCTION COSTS – Drainage Outlet Structures[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Drainage Outlet Structures				
Form Work, Misc Structures	SF	$40.00	14,850	$594,000
Reinforcing, Misc Structures	LBS	$2.00	237,120	$474,240
Concrete Placement, Misc Structures	CY	$500.00	295	$147,500
Access Ladders	VLF	$80.00	720	$57,600
Sluice Gates, 24"	EA	$12,000.00	54	$648,000
Rising Stem 24" Sluice Gate	VLF	$150.00	603	$90,450
Tide Flex Valves, 24"	EA	$16,000.00	54	$864,000
Heavy Duty Hinged Hatch Cover 2.5'x4'	EA	$8,000.00	54	$432,000
Aluminum Safety Rails	LF	$75.00	1,242	$93,150
Aluminum Safety Rail Gates	EA	$600.00	108	$64,800
Drainage Pipe, 24"	LF	$62.00	610	$37,820
Drainage Inlet Structures				
Concrete	CY	$500.00	179	$89,500
# 6 Rebar (80#/cy)	LBS	$2.00	152,080	$304,160
formwork	SF	$40.00	9,504	$380,160
temporary sheeting	SF	$30.89		$0
Ladder Rungs	EA	$60.00	162	$9,720
Excavation	CY	$48.60	423	$20,558
Backfill	CY	$17.33	45	$780
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	846	$71,910
Headwalls				
Concrete	CY	$500.00	270	$135,000
# 6 Rebar (80#/cy)	LBS	$2.00	231,200	$462,400
formwork	SF	$40.00	23,801	$952,040
temporary sheeting	SF	$30.89	13,600	$420,104
Excavation	CY	$48.60	415	$20,169
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	830	$70,550
G) Scour Holes				
Filter Fabric	SY	$2.69	669	$1,800
Rip Rap subbase	CY	$54.34	104	$5,651
Riprap	CY	$74.36	560	$41,642
Area Subtotals – Total Construction Cost[2]				**$6,489,700**
Subtotal before General Requirements Contingency and Escalation				**$6,489,700**

1. The drainage outlet structures are proposed to be located from Station 0+00 to Station 266+21.
2. Lands, damages, relocations, and soft costs are excluded.

2.4.1.2 Berry's Creek Line of Protection

- **Berry's Creek Surge Barrier**

The proposed surge barrier would be constructed to an elevation of 10 feet NAVD 88 and is approximately 118 feet wide and would be placed on Berry's Creek just to the south of Paterson Plank Road (see Drawing Sheet CB-130). The barrier would include the installation of two gates to prevent flooding of Berry's Creek during large storm events, a 1,000 cubic feet per second (cfs) pump station on the west bank, and levees tying off to high ground on both banks. In addition, two backup diesel generators with above ground storage tanks capable of maintaining operation for at least 3 days would be required, along with a permanent easement for the parcel containing the pump station. As shown in **Table D-13**, the cost of constructing the Berry's Creek Surge Barrier, closure gates, generators/fuel tanks, and pump station would be approximately $17,625,500.

In addition to the surge barrier, several small flood protection elements would be necessary to obtain a complete LOP of elevation 7 feet NAVD 88 in the Berry's Creek watershed (see Sheets CB-130, CB-147 and CB-148). These additional features would include the following:

- A single sheet pile floodwall approximately 382 feet long and 2.1 feet in average height along the Road A Plaza exit ramp from Paterson Plank Road to just east of the proposed surge barrier;
- Floodwall and flap gate structure (approximately 60 linear feet) located across an unnamed creek;
- Raising sections of Paterson Plank Road (approximately 177 linear feet) and Murray Hill Parkway (approximately 100 linear feet) northwest of the surge barrier; and
- Regrading/construction of a small segment of levee (approximately 245 linear feet) near the railroad tracks just east of the Rutherford Commons shopping center, as well as a closure gate over the railroad tracks (approximately 60 linear feet).

As shown in **Table D-14**, the cost of constructing these other features would be approximately $624,600.

Table D-13: Alternative 1 – Berry's Creek Surge Barrier, Closure Gates & Pump Station

ALTERNATIVE 1 CONSTRUCTION COSTS – Berry's Creek Surge Barrier, Closure Gates & Pump Station[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Earthwork				
Excavation - Intake Basin	CY	$11.50	8,600	$98,900
Excavation - Gate Structure	CY	$11.50	4,400	$50,600
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON		26,000	$2,210,000
Fill - Placed to EL 8	CY	$17.33	3,000	$51,990
Riprap, 24"	CY	$74.36	370	$27,513
Dewatering Pumps	EA*DAY	$292.86	31	$9,079
Pump Station, 1000cfs - Electric				
Structural Concrete - Intake channel base slab (complete w/ formwork, rebar, placement & finish)	CY	$514.80	480	$247,104
Structural Concrete - Intake channel walls (complete w/ formwork, rebar, placement & finish)	CY	$926.64	210	$194,594
Deep Foundations, H-Piling - Intake Channel	LF	$57.77	3,000	$173,310
Structural Concrete - Intake basin base slab (complete w/ formwork, rebar, placement & finish)	CY	$514.80	660	$339,768
Structural Concrete - Intake basin walls (complete w/ formwork, rebar, placement & finish)	CY	$926.64	1,000	$926,640
Deep Foundations, H-Piling - Intake Basin	LF	$57.77	10,125	$584,921
Structural Concrete - Building foundation & elevated slab (complete w/ formwork, rebar, placement & finish)	CY	$1,258.40	350	$440,440
Pre-Engineered metal building (45' eave height w/ standing seam metal roof)	SF	$65.42	5,000	$327,100
Trash racks	EA	$19,500.00	3	$58,500
Diesel generator w/ exhaust system (size TBD)	EA	$250,000.00	1	$250,000
Electric controls	LS	$50,000.00	1	$50,000
Exhaust Fans	EA	$2,831.40	3	$8,494
Vertical pumps/electric motors (size TBD)	EA	$1,000,000.00	3	$3,000,000
Discharge Pipes, φ7' x 3/4" wall, bell intake, coal tar epoxy	LF	$1,650.00	600	$990,000
Pipe Saddles, 2 pile support	EA	$8,000.00	25	$200,000
Deep Foundations, H-Piling - Pipe Supports	LF	$57.77	3,750	$216,638
Dewatering	DAY	$292.86	70	$20,500
Fuel Storage & Containment				

ALTERNATIVE 1 CONSTRUCTION COSTS – Berry's Creek Surge Barrier, Closure Gates & Pump Station[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Structural Concrete - Base Slab (complete w/ formwork, rebar, placement & finish)	CY	$514.80	63	$32,432
Structural Concrete - Containment walls (complete w/ formwork, rebar, placement & finish)	CY	$926.64	13	$12,046
Structural Concrete - Tank support (complete w/ formwork, rebar, placement & finish)	CY	$926.64	5	$4,633
Diesel fuel tanks, steel, 8' diameter, 10,000 Gal	EA	$47,933.60	2	$95,867
Deep Foundations, H-Piling - Tank Support	LF	$57.77	1,125	$64,991
Gate Structure				
Structural Concrete - Gate structure base slab (complete w/ formwork, rebar, placement & finish)	CY	$514.80	1,480	$761,904
Structural Concrete - Gate structure piers (complete w/ formwork, rebar, placement & finish)	CY	$926.64	1,130	$1,047,103
Deep Foundations, H-Piling - Gate Structure	LF	$57.77	45,000	$2,599,650
50' W x 20' H Tainter Gates	LBS	$3.00	200,000	$600,000
Hydraulic drive system- power unit & hyd. Hoists	EA	$75,000.00	2	$150,000
Electric controls	LS	$50,000.00	1	$50,000
W21x50 girders, W10x12 beams @ 5' OC	LBS	$2.50	20,000	$50,000
1-1/2"x 1/8" serrated grating	SF	$36.61	1,000	$36,610
OSHA approved handrail system, 1-1/2"φ x 42" H	LF	$56.06	260	$14,576
Prestressed-Concrete AASHTO bridge girders	LF	$340.00	324	$110,160
Precast concrete bridge deck	SF	$106.66	1,888	$201,374
Stop log system	LS	$120,000.00	1	$120,000
Trunnion Assembly	EA	$25,000.00	3	$75,000
Dewatering Pumps	EA*DAY	$292.86	133	$38,950
Retaining Walls				
Sheetpile, cutoff wall	SF	$50.34	1,760	$88,598
Sheetpile, retaining walls	SF	$50.34	5,000	$251,700
Sheetpile, tie-in walls	SF	$50.34	1,250	$62,925
Braced Excavations				
Sheet Pile - Intake Basin Phase 1	SF	$30.89	10,820	$334,230
Walers - Intake Basin Phase 1	LF	$41.61	541	$22,511
Pipe struts - Intake Basin Phase 1	LF	$41.61	2,000	$83,220

ALTERNATIVE 1 CONSTRUCTION COSTS – Berry's Creek Surge Barrier, Closure Gates & Pump Station[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Sheet Pile - Gate Structure Phase 2	SF	$30.89	6,400	$197,696
Walers - Gate Structure Phase 2	LF	$41.61	320	$13,315
Pipe struts - Gate Structure Phase 2	LF	$41.61	720	$29,959
Area Subtotals – Total Construction Cost[2]				**$17,625,500**
Subtotal before General Requirements Contingency and Escalation				**$17,625,500**

1. The proposed Berry's Creek Surge Barrier location is not applicable to specific Station(s).It would be generally located at the Guillen Trucking Property, 288 Paterson Plank Rd, East Rutherford, NJ.
2. Lands, damages, relocations, and soft costs are excluded.

Table D-14: Alternative 1 – Berry's Creek Floodwall, Flap Gate, Levee, and Roadway Raising

ALTERNATIVE 1 CONSTRUCTION COSTS – Berry's Creek Floodwall, Flap Gate, Levee, and Roadway Raising[1]				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
LEVEE				
Clearing and Grubbing	Acre	$8,179.60	0.50	$4,090
Silt Fence	LF	$2.24	380	$851
Stripping	CY	$12.24	246	$3,011
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	492	$41,820
Embankment	CY	$17.33	844	$14,627
Top Soil	SY	$7.38	247	$1,823
Seeding	MSF	$71.50	15	$1,073
Regrading				
HMA Pavement	TONS	$125.00	130	$16,250
Tack Coat	SY	$1.50	723	$1,085
Milling	SY	$6.00	723	$4,338
RAILROAD CLOSURE GATE	LS	$500,000.00	1	$500,000
SHEET PILE I - WALL W/CONCRETE CAP				
Clearing and Grubbing	AC	$8,179.60	0.07	$573
Silt Fence	LF	$2.24	130	$291
AZ-12 Sheet Pile	SF	$38.00	650	$24,700
Structural Concrete - Form Work	SF	$11.78	390	$4,594
Reinforcement Steel for Structural Concrete	LBS	$2.00	1,160	$2,320
Structural Concrete - Placement & Finishing	CY	$209.92	15	$3,149
Area Subtotals – Total Construction Cost[2]				**$624,600**
Subtotal before General Requirements Contingency and Escalation				**$624,600**

1. The proposed Berry's Creek floodwall, flap gate, levee, and roadway raising location are not applicable to specific Station(s).
2. Lands, damages, relocations, and soft costs are excluded.

2.4.2 Stormwater Drainage Improvements - Alternative 2

Alternative 2 would provide drainage improvements, including construction of a 500 cfs pump station that would be located northwest of the existing East Riser Ditch tide gate and a forebay inlet upstream of Starke Road. Additional work would include improvement of flow to the East Riser Ditch, dredging of the East Riser Ditch to improve flow conveyance from the tide gate to Moonachie Avenue, and construction of a 50 cfs and 100 cfs pump stations and force mains at Losen Slote Creek. The major features that make up the drainage improvements and green infrastructure are presented in **Section 2.4.2.1** through **Section 2.4.2.5**. For associated drawings refer to the Alternative 2 Plan Set included in the Feasibility Study Report.

2.4.2.1 500 cfs Pump Station at East Riser Ditch

The proposed station would be pile-supported, and would include a screened intake bay built into the right bank (looking downstream), eight Archimedean screw pumps, and a discharge channel and energy dissipation structure downstream of the gate. The modified structure would allow positive flow through four flap gates when the pump station is not in operation and would receive direct discharge from the pump station discharge channel during pumping operations. The pump station would be installed in the open area immediately northwest of the existing East Riser Ditch tide gate.

The modified forebay inlet structure would allow positive flow through four flap gates when the pump station is not in operation and would receive direct discharge from the pump station discharge channel during pumping operations. The forebay would be rectangular and would extend 40 feet across the channel and 60 feet in the direction of flow and would tie into the culvert headwall on the upstream side. Flow discharged from the pump station would be conveyed through the existing culverts under Grand Street/Starke Road. Four flap gates would be installed on the upstream side to allow low flow through the forebay when the pump is not operational. The gates would be the same size as the existing tide gates. The forebay would be pile-supported. A cofferdam and temporary water diversion via pumps and discharge line would be installed to convey water approaching Starke Road from the north to the south side of the tide gate.

2.4.2.2 Losen Slote Creek Residential Pump Stations and Force Mains

Two new pump stations would be constructed to control interior drainage at Losen Slote Creek. The smaller 50 cfs capacity would discharge through a 3,260-linear-foot, 36-inch subsurface ductile iron pipe installed within the Liberty Avenue/Eckel Road right-of-way and the larger 100 cfs pump station would discharge through a 3,100-linear-foot, 36-inch subsurface ductile iron pipe installed along the East of Park Street right-of-way. Energy dissipation structures would also be provided in Losen Slote Creek at the discharge points.

As shown in **Table D-15**, the cost of constructing the East Rise Ditch and Losen Slote Creek pump stations, force mains, foundation, and associated features would be approximately $73,812,100.

Table D-15: Alternative 2 – Pump Stations and Force Mains

ALTERNATIVE 2 CONSTRUCTION COSTS – Pump Stations and Force Mains				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
NEW PUMP STATIONS	**LS**	**-**	**-**	**$48,750,268**
New Pump Station - 50 cfs (forcemain)	EA	$11,370,000	1	$11,370,000
New Pump Station - 100 cfs (forcemain)	EA	$20,650,000	1	$20,650,000
New Pump Station - 500 cfs (discharge channel), 8 Archimedean Screw Pumps	EA	$16,430,000	1	$16,430,000
Forebay (40ft x 60ft x 10ft) See Components Below	*EA*	-	-	-
Excavation - Forebay [assumed at 40'x60'x5' avg]	CY	$11.50	445	$5,118
T&D of ID-27 Regulated Soils (at 2 tons/bcy)	TON	$85.00	890	$75,650
Structural Concrete - Forebay base slab (complete w/ formwork, rebar, placement & finish)[assumed at 40'x60'x2.5']	CY	$514.80	225	$115,830
Structural Concrete - Forebay channel walls (complete w/ formwork, rebar, placement & finish) [assumed at 2 ea x 40'x2'x10']	CY	$926.64	60	$55,598
Asphalt Parking Area	SY	$64.44	746	$48,072
CHANNEL IMPROVEMENTS	**LS**	**-**	**-**	**$4,832,114**
Excavation (Soil)	CY	$9.84	20,202	$198,788
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	40,404	$3,434,340
Revegetation (Riparian Habitat)	AC	$124,634.00	4	$499,782
Top Soil and Hydro-Seeding (Non-Riparian Habitat)	SY	$12.31	7,213	$88,794
Paved Surface Restoration (outside proposed trench limits)	SY	$22.64	23,987	$543,066
6-inch thick gravel staging area	SY	$8.07	8,345	$67,344
FORCE MAINS	**LS**	**-**	**-**	**$15,647,829**
Excavation (Pavement Road Section)	CY	$80.08	2,473	$198,038
Excavation (Soil)	CY	$9.84	6,087	$59,896
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	17,120	$1,455,200
TEMPORARY EXCAVATION SUPPORT	SF	$48.62	146,960	$7,145,195
DEWATERING EQUIPMENT INSTALLATION, RENTAL & OPERATION	LF	$303.16	6,680	$2,025,109
DEWATERING DISCHARGE TESTING, STORAGE & DISPOSAL	LS	excluded	excluded	-
Pipe Bedding Material	CY	$48.33	4,203	$203,131
Force Main Installation - 36-in	LF	$442.36	6,360	$2,813,410

ALTERNATIVE 2 CONSTRUCTION COSTS – Pump Stations and Force Mains				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Force Main Installation, Restrained Joints - 36-in	LF	$518.65	320	$165,968
Air Release Valve in Manhole	EA	$12,000.00	13	$156,000
Paved Road Section (within proposed trench limits)	CY	$576.58	2,473	$1,425,882
PILING & CRADLES FOR SUPPORT OF PIPELINES, CULVERTS & PUMP STATION	**LS**	**-**	**-**	**$4,291,737**
Bearing Piles (Timber) for Support of Piping <48-in Dia	LF	$19.24	74,200	$1,427,608
Bearing Piles (Timber) for Support of Manholes & Catch Basins	LF	$19.24	1,950	$37,518
Bearing Piles (micropiles instead of Steel H-Pile) for Support of Box Culverts (two 20LF piles per 40 LF)	LF	$185.54	280	$51,951
Cradle Beams for Support of Piping <48-in Dia	EA	$572.25	742	$424,610
Piles for Pump Station (HP 16x141, 220 piles, 65 ft long)	**LF**	$105.00	19,300	$2,026,500
Piles for Forebay (HP 16x141, 40 piles, 65 ft long)	**LF**	$105.00	2,600	$273,000
Pile Caps for Support of Box Culverts	**LF**	$150.00	337	$50,550
ENERGY DISSIPATION STRUCTURES	**LS**	**-**	**-**	**$290,118**
Energy Dissipator for 50 CFS Pump Station - See Components Below	*EA*	*priced below*	*1*	-
Excavation	CY	$11.50	300	$3,450
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	600	$51,000
Baffled chute spillway (concrete)	CY	$1,500.00	10	$15,000
Rip-Rap	CY	$74.36	200	$14,872
Energy Dissipator for 100 CFS Pump Station - See Components Below	*EA*	*priced below*	*1*	-
Excavation	CY	$11.50	600	$6,900
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	1,200	$102,000
Baffled chute spillway (concrete)	CY	$1,500.00	20	$30,000
Rip-Rap	CY	$74.36	400	$29,744
Energy Dissipation below ERD Tide Gate (ACB mat 60" x 40'x 0.75)	SF	$15.48	2,400	$37,152
Area Subtotals – Total Construction Cost[1]				**$73,812,100**
Subtotal before General Requirements Contingency and Escalation				**$73,812,100**

1. Lands, damages, relocations, and soft costs are excluded.

2.4.2.3 East Riser Ditch Channel and Culvert Improvements

Alternative 2 includes the proposed removal and replacement of existing drainage from the East Riser Ditch with: (1) a 46-foot-long, 12 feet by 6 feet metal elliptical arch culvert (Station 27+50); (2) an 18 feet long (336 square feet) railroad bridge (Station 21+78); and (3) twin 60 feet long, 7.8 feet by 4.3 feet concrete elliptical culverts (Station 16+79). The structures would be removed and disposed. The elliptical arch culvert would be replaced with two 10-feet by 7 feet concrete box culverts, the railroad bridge would be replaced with a 450 square feet railroad bridge, and the concrete elliptical culverts would be replaced with two 12 feet by 5 feet concrete box culverts.

2.4.2.4 Channel Dredging

Approximately 20,020 in-place cubic yards of dredged material would be removed from the tide gate location to Moonachie Avenue to improve flow conveyance capacity in the ditch and disposed of off-site at a facility licensed to receive the dredged material. Channel boundaries and adjacent areas falling within the riparian zone (9.5 acres, which is equal to the Proposed Project limit of work in this location) would be re-vegetated with native plant species consistent with that habitat type in the Project Area (9.5 acres). A two-track, vegetated operations and maintenance (O&M) road with a minimum width of 10 feet would be provided on one side of the channel throughout the improved reach. Access would be tied into local residential roads where feasible, but, in some cases, it would tie into parking areas on private property. Easements would be acquired to establish access where needed. Gates and adjacent hurricane fencing would be installed at access points to the O&M corridors to limit access to authorized personnel. As shown in **Table D-16**, the cost of constructing the drainage and channel improvements would be approximately $1,416,200.

Table D-16: Alternative 2 – Local Drainage Improvements

ALTERNATIVE 2 CONSTRUCTION COSTS – Local Drainage Improvements				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Excavation (Pavement Road Section)	CY	$80.08	206	$16,496
Excavation (Soil)	CY	$9.84	1,416	$13,933
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	3,244	$275,740
TEMPORARY EXCAVATION SUPPORT	SF	$48.62	6,360	$309,223
DEWATERING EQUIPMENT INSTALLATION, RENTAL & OPERATION	LF	$303.16	212	$64,270
DEWATERING DISCHARGE TESTING, STORAGE & DISPOSAL	LS	excluded	excluded	-
Existing Elliptical Arch Removal, Metal, 12ft x 6ft	LF	$200.00	46	$9,200
Existing Double Track, Single Span 25-ft Open Deck, (6) W24x146 Rolled Steel Beams, Bridge Removal	SF	$65.00	450	$29,250
Existing Elliptical Concrete Pipe Removal and Disposal, 8.8ft x 4.3ft	**LF**	$150.00	120	$18,000
Box Culvert, 120-in L x 84-in H	LF	$786.50	92	$72,358
Box Culvert, 144-in L x 60-in H	LF	$1,144.00	120	$137,280
Double Track, Single Span Ballast Deck Steel Beam Bridge (approx. 35'), (6) W24x146 Rolled Steel Beams, Bridge Replacement	SF	$500.00	630	$315,000
Pipe Bedding Material	CY	$48.33	423	$20,444
Coarse Aggregate	CY	$48.33	335	$16,191
Paved Road Surface (within proposed trench limits)	CY	$576.58	206	$118,775
Area Subtotals – Total Construction Cost[1]				**$1,416,200**
Subtotal before General Requirements Contingency and Escalation				**$1,416,200**

1. Lands, damages, relocations, and soft costs are excluded.

2.4.2.5 Open Space Creation and Existing Park Improvements

- **Avanti Park**

Avanti Park would be a new 1-acre park on an existing open lot along Moonachie Road. The park would feature open space, passive and active recreation, native habitat, and stormwater filtration. The primary park element would be an approximately 19,000-square-foot constructed wetland that would collect and infiltrate stormwater from the site and the adjacent lot. Approximately 5,500 square feet of elevated walkway would traverse this wetland, creating a unique public space experience. The elevated walkway would connect back to approximately 5,000 square feet of additional permeable pavement at grade along Moonachie Road. Adjacent to the at-grade permeable pavement would be approximately 5,000 square feet of permeable play surface and play structure. Remaining park elements would include approximately 5,000 square feet of woodland to screen adjacent warehouses, approximately 10,000 square feet of native plantings to increase biodiversity and stormwater filtration, and approximately 1,000 square feet of rain gardens. As shown in **Table D** -17, the cost of constructing Avanti Park would be approximately $1,314,400.

- **Caesar Place Park**

Caesar Place Park would be a new 4-acre park that provides open space, nature play, passive recreation, native habitat, stormwater filtration, and wetland enhancement and expansion. This park would offer approximately 69,000 square feet of wooded wetland and 60,000 square feet of emergent wetland to improve and expand the existing wetland located on site. Approximately 19,000 square feet of open lawn and approximately 10,000 square feet of nature play areas are proposed in an existing upland area to provide recreation and play while minimizing environmental impacts. Additionally, approximately 9,500 square feet of elevated boardwalk would allow visitors to walk through emergent and wooded wetland habitat with outlooks and viewing platforms to gather and bird watch. Approximately 1,200 square feet of rain gardens would filter stormwater from Caesar Place Road, and additional native plantings would frame the park and provide transition with the surrounding context. As shown in **Table D** -18, the cost of constructing Caesar Place Park would be approximately $1,593,600.

- **DePeyster Creek Park**

DePeyster Creek Park would be a new 8-acre riverfront park with natural area. The park would transform approximately 360 linear feet of the Hackensack River into publicly accessible riverfront, with approximately 96,700 square feet of trails and plazas, providing opportunities for walking, running, picnicking, group assembly, and birdwatching along the river as well as through a newly created intertidal marshland. Disturbed successional shrubland and disturbed upland deciduous forest would be transformed into higher quality habitat, such as a protected shallow embayment with intertidal marsh, native shrub habitat, and native woodland with pollinator habitat. These improvements would be expected to provide significant ecological uplift for both upland and riparian species. As shown in **Table D-19**, the cost of constructing DePeyster Creek Park would be approximately $2,063,100.

- **Fluvial Park**

Fluvial Park would be a new 4-acre riverfront park that provides open space, passive and active recreation, native habitat, and stormwater filtration. The park would transform approximately 560 linear feet of riverfront into publicly accessible elevated walkways over constructed wetlands and native vegetation. Approximately 19,000 square feet of permeable play surface would be anchored with sports fields, such as basketball or tennis courts, adult exercise equipment, a kayak launch, and opportunities for fishing and birdwatching. An approximately 500-linear-foot access path would connect the park to the existing road from Bergen Turnpike. Stormwater would be filtered in an approximately 7,000-square-foot bioswale. Lawn areas would provide 45,000 square feet for picnicking, sunbathing, and informal games such as Frisbee and bocce ball. The ecological habitat and performance of the site would be improved with 25,000 square feet of a naturalized wetland river edge and 11,000 square feet of native woodland. As shown in **Table D-20**, the cost of constructing Fluvial Park would be approximately $3,170,200.

- **Riverside Park**

Riverside Park would be a new 2.5-acre riverfront park that transforms an existing boat dock area and parking lot into approximately 600 linear feet of accessible riverfront park with walking paths that would weave through approximately 30,000 square feet of native plantings and bioswales and 18,000 square feet of mowed lawn for informal recreation and gathering. A restored riparian wetland would create 5,700 square feet of new intertidal wetland habitat, and improved boat docks and a boat launch would create recreational opportunities for birdwatching, kayaking, and fishing. As shown in **Table D-21**, the cost of constructing Riverside Park would be approximately $1,562,700.

Table D -17: Alternative 2 – Avanti Park

ALTERNATIVE 2 CONSTRUCTION COSTS – Avanti Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	776	$9,498
SELECTIVE TREE REMOVAL	EA	$1,063.92	8	$8,511
EXCAVATION (NON-GI)	CY	$11.50	243	$2,795
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	486	$41,310
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$10,000.00	1	$10,000
FINE GRADING	SY	$5.40	4,654	$25,132
GEOTEXTILES	SY	$2.69	1,989	$5,350
PLANTING SOILS	CY	$69.21	444	$30,729
SEEDING - WET MEADOW MIX	SF	$0.40	5,100	$2,040
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	1,884	$8,290
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	6	$2,402
PLANTINGS - TREES, 2.5-IN CAL.	EA	$377.52	22	$8,305
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	28	$1,176
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	153	$6,827
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	2,553	$11,233
RAIN GARDEN #108 - STONE	CY	$54.34	460	$24,996
RAIN GARDEN #108 - RAIN GARDEN SOIL MIX	CY	$69.21	609	$42,149
RAIN GARDEN #108 - PLANTINGS & MULCHING	SF	$12.00	10,954	$131,448
STORM DRAINAGE INLET	EA	$4,500.00	2	$9,000
PERMEABLE PLAY SURFACE - MULCH, EWF, 12-IN DEEP	SF	$5.58	5,170	$28,849
PERMEABLE PAVING-CONCRETE	SF	$10.85	1,463	$15,874
PERMEABLE PAVING-WOOD DECK (PW), WOOD SLAT ON STEEL DECK	SF	$80.00	5,297	$423,760
PERMEABLE PAVING-PAVERS (PP), SAND SET	SF	$17.00	3,785	$64,345
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	77	$30,800
SITE FURNISHINGS-PLAY EQUIP.	SF	$350.00	500	$175,000
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	7	$35,000
Area Subtotals – Total Construction Cost[1]				**$1,314,400**
Subtotal before General Requirements Contingency and Escalation				**$1,314,400**

1. Lands, damages, relocations, and soft costs are excluded.

Table D -18: Alternative 2 – Caesar Place Park

ALTERNATIVE 2 CONSTRUCTION COSTS – Caesar Place Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	4	$32,718
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	3,220	$39,413
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$15,000.00	1	$15,000
EXCAVATION (NON-GI)	CY	$11.50	254	$2,921
PLACE EMBANKMENT USING EXCAVATED SOILS	CY	$17.33	232	$4,021
FINE GRADING	SY	$5.40	14,683	$79,288
GEOTEXTILES	SY	$2.69	6,956	$18,712
PLANTING SOILS	CY	$69.21	2,060	$142,573
SEEDING - WET MEADOW MIX	SF	$0.40	42,483	$16,993
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	13,587	$59,783
PLANTINGS - TREES, 2.5-IN CAL.	EA	$377.52	245	$92,492
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	180	$8,032
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	32	$12,813
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	277	$11,634
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	863	$38,507
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	2,997	$13,187
SEEDING - TURF	SF	$0.07	19,728	$1,381
RAIN GARDEN #110 - STONE	CY	$54.34	25	$1,359
RAIN GARDEN #110 - RAIN GARDEN SOIL MIX	CY	$69.21	27	$1,869
RAIN GARDEN #110 - PLANTINGS & MULCHING	SF	$12.00	489	$5,868
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
RAIN GARDEN #111 - STONE	CY	$54.34	20	$1,087
RAIN GARDEN #111 - RAIN GARDEN SOIL MIX	CY	$69.21	21	$1,453
RAIN GARDEN #111 - PLANTINGS & MULCHING	SF	$12.00	375	$4,500
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
PERMEABLE PAVING - WOOD DECK (PW) WOOD SLAT ON PILE SUPPORTS	SF	$80.00	9,523	$761,840
SITE FURNISHINGS - PLAY EQUIP	LS	$50,000.00	1	$50,000
PERMEABLE PAVING-CONCRETE (PC)	SF	$10.85	2,562	$27,798
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	161	$64,400
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	15	$75,000
Area Subtotals – Total Construction Cost[1]				**$1,593,600**
Subtotal before General Requirements Contingency and Escalation				**$1,593,600**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-19: Alternative 2 – DePeyster Creek Park

ALTERNATIVE 2 CONSTRUCTION COSTS – DePeyster Creek Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	8	$65,437
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	6,484	$79,364
EXCAVATION (NON-GI)	CY	$11.50	1,177	$13,536
PLACE EMBANKMENT USING EXCAVATED SOILS	CY	$17.33	1,086	$18,820
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	182	$15,470
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$10,000.00	1	$10,000
FINE GRADING	SY	$5.40	38,904	$210,082
GEOTEXTILES	SY	$2.69	3,176	$8,543
PLANTING SOILS	CY	$69.21	5,655	$391,383
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	27,547	$121,207
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	74	$29,630
PLANTINGS - TREES, 2.5-IN CAL.	EA	$377.52	365	$137,795
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	439	$18,438
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	1,794	$80,048
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	67,010	$294,844
PERMEABLE PAVING - WOOD DECK (PW) WOOD SLAT ON STEEL DECK	SF	$180.00	1,643	$295,740
PERMEABLE PAVING-RESIN BOUND AGGREGATE (PR)	SF	$2.61	26,942	$70,319
SITE FURNISHINGS-SHADE STRUCTURE	LS	$50,000.00	1	$50,000
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	381	$152,400
Area Subtotals – Total Construction Cost[1]				**$2,063,100**
Subtotal before General Requirements Contingency and Escalation				**$2,063,100**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-20: Alternative 2 – Fluvial Park

ALTERNATIVE 2 CONSTRUCTION COSTS – Fluvial Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	4	$33,536
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	3,282	$40,172
EXCAVATION (NON-GI)	CY	$11.50	573	$6,590
PLACE EMBANKMENT USING EXCAVATED SOILS	CY	$17.33	321	$5,563
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	504	$42,840
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$10,000.00	1	$10,000
FINE GRADING	SY	$5.40	19,693	$106,342
GEOTEXTILES	SY	$2.69	8,965	$24,116
PLANTING SOILS	CY	$69.21	1,788	$123,747
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	6,850	$30,140
PLANTINGS - TREES, 2.5-IN CAL.	EA	$377.52	9	$3,398
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	33	$1,472
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	62	$24,825
PLANTINGS - TREES, 2.5-IN CAL.	EA	$377.52	51	$19,254
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	122	$5,124
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	126	$5,622
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	2,086	$9,178
SEEDING - TURF	SF	$0.07	50,852	$3,560
BIOSWALE #138 - GRADING, PLANTINGS & MULCH/STONE	SF	$12.00	3,484	$41,808
STORM DRAINAGE INLET	EA	$4,500.00	2	$9,000
BASKETBALL COURTS, INCLUDING PAVEMENT, MARKINGS & EQUIP	SF	$5.34	9,400	$50,196
PERMEABLE PAVING-WOOD DECK (PW), WOOD SLAT ON STEEL DECK	SF	$180.00	4,594	$826,920
PERMEABLE PAVING-PAVERS (PP), SAND SET	SF	$17.00	50,149	$852,533
PERMEABLE PLAY SURFACE 1 (PS) - RUBBERIZED EXERCISE AREA	SF	$21.00	4,000	$84,000
PERMEABLE PLAY SURFACE 2 (PS2) - SYNTHETIC LAWN	SF	$24.50	5,425	$132,913
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	856	$342,400
SITE FURNISHINGS-OUTDOOR EXERCISE EQUIP	SF	$35.00	4,000	$140,000
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	39	$195,000
Area Subtotals – Total Construction Cost[1]				**$3,170,200**
Subtotal before General Requirements Contingency and Escalation				**$3,170,200**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-21: Alternative 2 – Riverside Park

ALTERNATIVE 2 CONSTRUCTION COSTS – Riverside Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	2	$15,541
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	1,552	$18,996
PAVEMENT DEMOLITION	SY	$11.21	3,105	$34,807
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$2,000.00	1	$2,000
FINE GRADING	SY	$5.40	12,418	$67,057
GEOTEXTILES	SY	$2.69	4,051	$10,897
PLANTING SOILS	CY	$69.21	1,395	$96,548
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	422	$1,857
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	112	$44,845
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	112	$4,704
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	481	$21,462
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	7,980	$35,112
SEEDING - LOW MEADOW MIX	SF	$0.30	2,217	$665
SEEDING - TURF	SF	$0.07	17,966	$1,258
RAIN GARDEN #131 - STONE	CY	$54.34	30	$1,630
RAIN GARDEN #131 - RAIN GARDEN SOIL MIX	CY	$69.21	45	$3,114
RAIN GARDEN #131 - PLANTINGS & MULCHING	SF	$12.00	812	$9,744
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
RAIN GARDEN #132 - STONE	CY	$54.34	35	$1,902
RAIN GARDEN #132 - RAIN GARDEN SOIL MIX	CY	$69.21	53	$3,668
RAIN GARDEN #132 - PLANTINGS & MULCHING	SF	$12.00	956	$11,472
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
PERMEABLE PAVING-ASPHALT (PA)	SF	$7.16	5,287	$37,855
PERMEABLE PAVING-CONCRETE (PC)	SF	$10.85	11,515	$124,938
PERMEABLE PAVING-WOOD DECK (PW), WOOD SLAT ON STEEL DECK	SF	$180.00	875	$157,500
PERMEABLE PAVING-PAVERS (PP), SAND SET	SF	$17.00	17,013	$289,221
STRUCTURAL INSPECTION & REPAIR OF EXISTING DOCKS	SF	$75.00	2,825	$211,875
BOAT RAMP	LS	$250,000.00	1	$250,000
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	19	$95,000
Area Subtotals – Total Construction Cost[1]				**$1,562,700**
Subtotal before General Requirements Contingency and Escalation				**$1,562,700**

1. Lands, damages, relocations, and soft costs are excluded.

- **Little Ferry Municipal Improvements**

Little Ferry Municipal Improvements would include 1 acre of improved landscape and stormwater management for the Little Ferry Municipal Building and Little Ferry Library. The improvements to the Library would include approximately 2,000 square feet of native plantings and rain gardens, as well as permeable paving to the parking lot. The improvements to the Little Ferry Municipal Building would include upgrading the existing stormwater best management practice on site for improved stormwater quality with native plants and replacing the asphalt parking with permeable paving. As shown in **Table D-22**, the cost of constructing Little Ferry Municipal Improvements would be approximately $684,000.

- **Little Ferry Public Schools Improvements**

Schools in the Borough of Little Ferry would receive campus improvements, including open space, passive and active recreation, native habitat, and stormwater filtration. Approximately 17,000 square feet of an existing sports field would be improved, including an allowance for new bleachers and back stop, while approximately 42,000 square feet of existing turf would be converted to native vegetation (with trees) to increase stormwater filtration and biodiversity. Proposed rain gardens along Liberty Avenue would also collect and infiltrate stormwater. At Washington Elementary School, approximately 9,500 square feet of impervious pavement would be converted to permeable pavement. Existing active programming areas would remain, but, overall, stormwater filtration and conveyance would be improved on site. As shown in **Table D-23**, the cost of constructing Little Ferry Public Schools Improvements would be approximately $561,500.

- **Robert Craig Elementary School**

Robert Craig Elementary School is an existing elementary school campus with approximately 1.7 acres of proposed improvements. Improvements would include approximately 59,000 square feet of new sports field at an existing baseball diamond and open lawn, approximately 13,000 square feet of permeable play surface at an existing impermeable play surface, and an approximately 2,500-square-foot rain garden at an existing open lawn. Stormwater filtration and conveyance would be improved on site while existing active programming would be unchanged. As shown in **Table D-24**, the cost of constructing Robert Craig Elementary School Improvements would be approximately $247,600.

- **St. Joseph Park**

Saint Joseph Park is an existing public park with basketball courts, sports courts, lawn, soccer fields, tennis courts, and a gazebo. Under Alternative 2, landscape improvements would be made to 0.80 acres of the park through the planting of native vegetation. Bioswales are also proposed to improve stormwater filtration. An existing parking lot would receive treatment to improve its permeability and ability to filter stormwater. As shown in **Table D-25**, the cost of constructing Saint Joseph Park would be approximately $273,800.

- **Willow Lake Park**

Willow Lake Park is an existing 7-acre public park that would be improved for pedestrian circulation and ecological benefit. Existing pedestrian trails would be expanded to connect the northern and southern areas of the park. These trails would be approximately 0.5 miles and would be woven through dynamic earthwork mounds supporting 11,400 square feet of native vegetation and 3,200 square feet of low meadow with scattered trees that provide habitat for pollinators and birds. Bioswales of 1,500 square feet would filter stormwater from Pickens Street and a large expanse of 100,000 square feet of open lawn would allow for informal active play. As shown in **Table D-26**, the cost of constructing Willow Lake Park would be approximately $1,708,000.

Table D-22: Alternative 2 – Little Ferry Municipal Improvements

ALTERNATIVE 2 CONSTRUCTION COSTS – Little Ferry Municipal Improvements				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	0	$2,454
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	644	$7,883
PAVEMENT DEMOLITION	SY	$11.21	28,224	$316,391
STORM DRAINAGE MODS & CONNECTIONS	LS	$8,000.00	1	$8,000
FINE GRADING	SY	$5.40	3,692	$19,937
GEOTEXTILES	SY	$2.69	3,741	$10,063
PLANTING SOILS	CY	$69.21	644	$44,571
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	-	$0
PLANTINGS- TREES, + STAKING/GUYING COST	EA	$42.00	-	$0
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	217	$9,683
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	3,612	$15,893
PLANTINGS (OR) - NATIVE PLANTS, 1 GAL	EA	$13.10	-	$0
SEEDING - LOW MEADOW MIX	SF	$0.30	-	$0
RAIN GARDEN #124 - STONE	CY	$54.34	10	$543
RAIN GARDEN #124 - RAIN GARDEN SOIL MIX	CY	$69.21	12	$831
RAIN GARDEN #124 - PLANTINGS & MULCHING	SF	$12.00	218	$2,616
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
RAIN GARDEN #125 - STONE	CY	$54.34	7	$380
RAIN GARDEN #125 - RAIN GARDEN SOIL MIX	CY	$69.21	8	$554
RAIN GARDEN #125 - PLANTINGS & MULCHING	SF	$12.00	148	$1,776
STORM DRAINAGE INLET	EA	$4,500.00	-	$0
RAIN GARDEN #128 - STONE	CY	$54.34	-	$0
RAIN GARDEN #128 - RAIN GARDEN SOIL MIX	CY	$69.21	-	$0
RAIN GARDEN #128 - PLANTINGS & MULCHING	SF	$12.00	-	$0
STORM DRAINAGE INLET	EA	$4,500.00	-	$0
RAIN GARDEN #129 - STONE	CY	$54.34	-	$0
RAIN GARDEN #129 - RAIN GARDEN SOIL MIX	CY	$69.21	-	$0
RAIN GARDEN #129 - PLANTINGS & MULCHING	SF	$12.00	-	$0
STORM DRAINAGE INLET	EA	$4,500.00	-	$0
PERMEABLE PAVING-ASPHALT (PA)	SF	$7.16	33,232	$237,941
PERMEABLE PAVING-CONCRETE (PC)	SF	$10.85	-	$0
PERMEABLE PAVING-PAVERS (PP), SAND SET	SF	$17.00	-	$0
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	-	$0
LIGHT FIXTURE/POLE-SS, AND SUPP INFRA	EA	$5,000.00	-	$0
Area Subtotals – Total Construction Cost[1]				**$684,000**
Subtotal before General Requirements Contingency and Escalation				**$684,000**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-23: Alternative 2 – Little Ferry Public Schools Improvements

ALTERNATIVE 2 CONSTRUCTION COSTS – Little Ferry Public Schools Improvements				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	1	$5,726
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	1,599	$19,572
PAVEMENT DEMOLITION	SY	$11.21	3,197	$35,838
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$20,000.00	1	$20,000
FINE GRADING	SY	$5.40	12,789	$69,061
GEOTEXTILES	SY	$2.69	818	$2,200
PLANTING SOILS	CY	$69.21	1,679	$116,204
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	33	$13,213
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	33	$1,386
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	795	$35,473
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	13,196	$58,062
SEEDING - TURF	SF	$0.07	8,439	$591
RAIN GARDEN #100 - STONE	CY	$54.34	28	$1,522
RAIN GARDEN #100 - RAIN GARDEN SOIL MIX	CY	$69.21	38	$2,630
RAIN GARDEN #100 - PLANTINGS & MULCHING	SF	$12.00	676	$8,112
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
RAIN GARDEN #101 - STONE	CY	$54.34	82	$4,456
RAIN GARDEN #101 - RAIN GARDEN SOIL MIX	CY	$69.21	116	$8,028
RAIN GARDEN #101 - PLANTINGS & MULCHING	SF	$12.00	2,080	$24,960
RAIN GARDEN #102 - STONE	CY	$54.34	43	$2,337
RAIN GARDEN #102 - RAIN GARDEN SOIL MIX	CY	$69.21	56	$3,876
RAIN GARDEN #102 - PLANTINGS & MULCHING	SF	$12.00	1,005	$12,060
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
RAIN GARDEN #103 - STONE	CY	$54.34	19	$1,032
RAIN GARDEN #103 - RAIN GARDEN SOIL MIX	CY	$69.21	23	$1,592
RAIN GARDEN #103 - PLANTINGS & MULCHING	SF	$12.00	419	$5,028
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
RAIN GARDEN #104 - STONE	CY	$54.34	14	$761
RAIN GARDEN #104 - RAIN GARDEN SOIL MIX	CY	$69.21	17	$1,177
RAIN GARDEN #104 - PLANTINGS & MULCHING	SF	$12.00	306	$3,672
RAIN GARDEN #106 - STONE	CY	$54.34	5	$272
RAIN GARDEN #106 - RAIN GARDEN SOIL MIX	CY	$69.21	7	$484
RAIN GARDEN #106 - PLANTINGS & MULCHING	SF	$12.00	120	$1,440
SPORTS FIELD-IMPROVED - TURF REPAIR & OVERSEEDING	SF	$0.21	17,052	$3,581
SPORTS FIELD-NEW - ALLOWANCE FOR	FIELDS	$15,000.00	1	$15,000

ALTERNATIVE 2 CONSTRUCTION COSTS – Little Ferry Public Schools Improvements				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
BLEACHERS & BACKSTOPS				
PERMEABLE PAVING-ASPHALT (PA)	SF	$7.16	9,585	$68,629
Area Subtotals – Total Construction Cost[1]				**$561,500**
Subtotal before General Requirements Contingency and Escalation				**$561,500**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-24: Alternative 2 – Robert Craig Elementry School

ALTERNATIVE 2 CONSTRUCTION COSTS – Robert Craig Elementary School				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
SELECTIVE TREE REMOVAL	EA	$1,063.92	1	$1,064
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	1,036	$12,681
PAVEMENT DEMOLITION	SY	$11.21	1,443	$16,176
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$2,000.00	1	$2,000
FINE GRADING	SY	$5.40	8,290	$44,766
GEOTEXTILES	SY	$2.69	1,711	$4,603
PLANTING SOILS	CY	$69.21	25	$1,730
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	2	$801
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	2	$84
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	10	$446
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	53	$233
RAIN GARDEN #130 - STONE	CY	$54.34	93	$5,054
RAIN GARDEN #130 - RAIN GARDEN SOIL MIX	CY	$69.21	140	$9,689
RAIN GARDEN #130 - PLANTINGS & MULCHING	SF	$12.00	2,519	$30,228
STORM DRAINAGE INLET	EA	$4,500.00	2	$9,000
PERMEABLE PAVING-ASPHALT (PA)	SF	$7.16	12,990	$93,008
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	40	$16,000
Area Subtotals – Total Construction Cost[1]				**$247,600**
Subtotal before General Requirements Contingency and Escalation				**$247,600**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-25: Alternative 2 – Saint Joseph Park

ALTERNATIVE 2 CONSTRUCTION COSTS – St. Joseph Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	350	$4,284
PAVEMENT DEMOLITION	SY	$11.21	2,142	$24,012
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$8,000.00	1	$8,000
FINE GRADING	SY	$5.40	4,201	$22,685
GEOTEXTILES	SY	$2.69	2,293	$6,168
PLANTING SOILS	CY	$69.21	318	$22,009
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	6	$2,402
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	6	$252
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	152	$6,782
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	2,520	$11,088
RAIN GARDEN #135 - STONE	CY	$54.34	46	$2,500
RAIN GARDEN #135 - RAIN GARDEN SOIL MIX	CY	$69.21	69	$4,775
RAIN GARDEN #135 - PLANTINGS & MULCHING	SF	$12.00	1,250	$15,000
RAIN GARDEN #137 - STONE	CY	$54.34	12	$652
RAIN GARDEN #137 - RAIN GARDEN SOIL MIX	CY	$69.21	18	$1,246
RAIN GARDEN #137 - PLANTINGS & MULCHING	SF	$12.00	324	$3,888
STORM DRAINAGE INLET	EA	$4,500.00	-	$0
PERMEABLE PAVING-ASPHALT (PA)	SF	$7.16	19,276	$138,016
Area Subtotals – Total Construction Cost[1]				**$273,800**
Subtotal before General Requirements Contingency and Escalation				**$273,800**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-26: Alternative 2 – Willow Lake Park

ALTERNATIVE 2 CONSTRUCTION COSTS – Willow Lake Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	1	$11,451
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	5,080	$62,179
PAVEMENT DEMOLITION	SY	$11.21	1,690	$18,945
PLACE EMBANKMENT USING IMPORTED SOILS	CY	$25.57	2,220	$56,765
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$2,000.00	1	$2,000
FINE GRADING	SY	$5.40	33,859	$182,839
GEOTEXTILES	SY	$2.69	3,327	$8,950
PLANTING SOILS	CY	$69.21	5,089	$352,210
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	164	$65,666
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	164	$6,888
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	1,645	$73,400
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	27,293	$120,089
SEEDING - LOW MEADOW MIX	SF	$0.30	85,786	$25,736
SEEDING - TURF	SF	$0.07	109,716	$7,680
RAIN GARDEN #134 - STONE	CY	$54.34	17	$924
RAIN GARDEN #134 - RAIN GARDEN SOIL MIX	CY	$69.21	28	$1,938
RAIN GARDEN #134 - PLANTINGS & MULCHING	SF	$12.00	507	$6,084
STORM DRAINAGE INLET	EA	$4,500.00	2	$9,000
RAIN GARDEN #133 - STONE	CY	$54.34	26	$1,413
RAIN GARDEN #133 - RAIN GARDEN SOIL MIX	CY	$69.21	37	$2,561
RAIN GARDEN #133 - PLANTINGS & MULCHING	SF	$12.00	657	$7,884
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
PERMEABLE PAVING-CONCRETE (PC)	SF	$10.85	28,670	$311,070
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	382	$152,800
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	43	$215,000
Area Subtotals – Total Construction Cost[1]				**$1,708,000**
Subtotal before General Requirements Contingency and Escalation				**$1,708,000**

1. Lands, damages, relocations, and soft costs are excluded.

- **Streetside Green Infrastructure**

Green infrastructure retrofits within the public right-of-way would be designed to capture stormwater runoff from streets and sidewalks, treat water quality, and enhance the streetscapes with permanent vegetation or new porous paving. Each green infrastructure system would be sized to capture and treat runoff from the New Jersey Department of Environmental Protection (NJDEP) Water Quality Design Storm, which is 1.25 inches of rainfall in 2 hours. Larger storms would bypass the green infrastructure systems and be conveyed by the existing storm sewer system. The green infrastructure retrofit opportunities identified for the right-of-way based on site constraints would include bioswales, rain gardens, storage trenches, and tree trenches. As shown in **Table D-27**, the cost of constructing the streetside green infrastructure would be approximately $838,400.

Table D-27: Alternative 2 – Streetside Green Infrastucture

ALTERNATIVE 2 CONSTRUCTION COSTS – Streetside Green Infrastructure				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
Demolish Existing Features	SY	$11.21	7,552	$84,658
Excavate	CY	$11.50	3,211	$36,927
Plantings & Mulching	SF	$12.00	14,663	$175,956
Soil Mix	CY	$69.21	815	$56,406
Stone	CY	$54.34	2,277	$123,732
8-in HDPE Piping	LF	$22.98	2,265	$52,050
STORM DRAINAGE INLET	EA	$4,500.00	63	$283,500
PLANTINGS- TREES, 3.0-IN CAL W/STAKING	EA	$442.40	57	$25,217
Area Subtotals – Total Construction Cost[1]				$838,400
Subtotal before General Requirements Contingency and Escalation				$838,400

1. Lands, damages, relocations, and soft costs are excluded.

2.4.3 Alternative 3 *Build Plan* Plus *Future Plan*

Alternative 3 (*Build Plan* plus *Future Plan*) is a combined or hybrid plan that would incorporate most of the elements and features proposed in Alternatives 1 and 2. In addition, the combined *Build Plan* and *Future Plan* of Alternative 3 would add channel and local improvements to the Middle and Upper section of the East Riser Ditch and would provide new concepts for DePeyster Creek Park, Riverside Park, and Willow Lake Park. For associated drawings, refer to the **Subappendix F4-3** Alternative 3 Plan Set included in the Feasibility Study Report.

The Proposed Project components related to Alternative 1 that would be constructed under the combined *Build Plan* and *Future Plan* for Alternative 3 includes the Hackensack River and Berry's Creek LOP and the proposed open space concepts at Fluvial Park, K-Town Park, and the southeast viewing platforms. This would include the allowance for wetlands and utilities. The cost of these features is presented in **Table D-1** through **Table D-14**. As shown in **Table D-28**, the cost of constructing these components would be approximately $92,062,900.

The Proposed Project components related to Alternative 2 that would be constructed under the combined *Build Plan* and *Future Plan* for Alternative 3 includes pump stations, channel, force main, energy dissipation, local drainage improvements, the proposed open space concepts at Avanti Park, Caesar Place Park, Little Ferry Municipal Park, Little Ferry Public Schools, Robert Craig School, and Saint Joseph Park, and the green features for street infrastructure. This would include the allowance for wetlands and utilities. The cost of these features is presented in **Table D-15** through **Table D-27**. As shown in **Table D-29**, the cost of constructing these components would be approximately $88,921,500.

- **Channel and Local Improvements for the Middle and Upper East Riser Ditch**

This Proposed Project element expands the local drainage improvements proposed under Alternative 2 by adding the middle and upper reaches of the East Riser Ditch. The cost of constructing this segment would be $21,803,067.

- **Modifications from Alternative 2 for DePeyster Creek Park, Riverside Park, and Willow Park**

This alternative would also provide modified concepts of the DePeyster Creek, Riverside, and Willow Lake Park plans. As shown in **Table D-30** through **Table D-32**, the costs of constructing these parks would be $1,806,500, $937,600, and $2,873,300, respectively.

Table D-28: Cost Summary of the Alternative 1 Features in Alternative 3 (*Build Plan* and *Future Plan*)

Feature	Estimated Cost Before Contingency & Escalation (2017$)
Line of Protection	**52,159,300**
CANTILEVERED SHEETPILE FLOODWALL (16' Wide)	$15,383,200
SHEET PILE I - WALL W/CONCRETE CAP	$546,400
CANTILEVERED WALKWAY SYSTEMS (10' Wide)	$2,679,100
CANTILEVERED WALKWAY SYSTEMS (25' Wide)	$4,447,700
CAST-IN-PLACE CONCRETE T-WALL	$3,321,900
SHEET PILE I - WALL W/CONCRETE CAP and DOUBLE SHEET PILE FLOODWALL	$17,601,500
BCUA TIDE GATE	$1,689,800
INTERIOR DRAINAGE ELEMENTS	$6,489,700
Berry's Creek	**$18,250,100**
BERRY'S CREEK SURGE BARRIER and PUMP STATION	$17,625,500
BERRY'S CREEK Misc - Levee and FW Tie Off, Railroad Closure, and Road Raising	$624,600
Green Infrastructure	**$12,183,500**
PARKS & OTHER PUBLIC REALM AMENTTIES	$12,183,500
Allowances	-
ALLOWANCES (WETLANDS & UTILITIES)	$9,470,000
TOTAL COST	**$92,062,900**

Table D-29: Cost Summary of the Alternative 2 Features in Alternative 3 (*Build Plan* and *Future Plan*)

Feature	Estimated Cost Before Contingency & Escalation (2017$)
GREY INFRASTRUCTURE FEATURES	**$75,228,226**
NEW PUMP STATIONS	$48,750,268
CHANNEL IMPROVEMENTS	$4,832,114
FORCE MAINS	$15,647,829
LOCAL DRAINAGE IMPROVEMENTS	$1,416,161
PILING & CRADLES FOR SUPPORT OF PIPELINES, CULVERTS & PUMP STATION	$4,291,737
ENERGY DISSIPATION STRUCTURES	$290,118
GREEN INFRASTRUCTURE FEATURES	**$7,845,100**
OPEN SPACE IMPROVEMENTS	
Revegetation (Riparian Habitat)	$159,532
AVANTI PARK (CONCEPT 7.3)	$1,154,868
CAESAR PLACE PARK (CONCEPT 12.1)	$1,593,600
FLUVIAL PARK (CONCEPT 1.5)	$3,170,200
LITTLE FERRY MUNICIPAL (CONCEPT 3.1)	$684,000
LITTLE FERRY PUBLIC SCHOOLS (CONCEPT 3.1)	$561,500
ROBERT CRAIG ELEMENTARY SCHOOL (CONCEPT 3.1)	$247,600
ST. JOSEPH PARK (CONCEPT 3.1)	$273,800
STREETSIDE GREEN INFRASTRUCTURE	
Bioswale, Rain Garden, Storage Trench, Bumpout and Median Plant Concept Areas	$838,400
ALLOWANCES	**$5,009,808**
TOTAL COST	**$88,921,500**

Table D-30: Alternative 3 (*Build Plan* and *Future Plan*) DePeyster Creek Park

ALTERNATIVE 3 (*Build Plan* and *Future Plan*) CONSTRUCTION COSTS – DePeyster Creek Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
IMPORTED FILL	CY	$37.59	20	$752
CONCRETE PAVERS	SF	$23.60	5,670	$133,812
WOOD PICNIC TABLES	EA	$2,500.00	8	$20,000
PARK GAME TABLES	EA	$4,000.00	8	$32,000
SEEDING - TURF	SF	$0.07	5,498	$385
CLEARING & GRUBBING	ACRES	$8,179.60	8	$65,437
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	6,484	$79,364
EXCAVATION (NON-GI)	CY	$11.50	1,177	$13,536
PLACE EMBANKMENT USING EXCAVATED SOILS	CY	$17.33	1,086	$ 18,820
T&D OF EXCESS EXCAVATION SPOILS (@ 2 tons/bcy)	TONS	$85.00	182	$15,470
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$10,000.00	1	$10,000
FINE GRADING	SY	$5.40	38,904	$210,082
GEOTEXTILES	SY	$2.69	3,176	$8,543
PLANTING SOILS	CY	$69.21	5,655	$391,383
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	27,637	$121,603
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	72	$28,829
PLANTINGS - TREES, 2.5-IN CAL.	EA	$377.52	326	$123,072
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	398	$16,716
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	1,804	$80,494
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	29,934	131,710
PLANTINGS (OR) - NATIVE PLANTS, 1 GAL CONTAINERS	EA	$13.10	-	-
PERMEABLE PAVING-RESIN BOUND AGGREGATE (PR)	SF	$2.61	28,227	$73,672
PERMEABLE PAVING - WOOD DECK (PW) WOOD SLAT ON STEEL DECK	SF	$180.00	-	-
SITE FURNISHINGS-SHADE STRUCTURE	LS	$50,000.00	1	$50,000
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	452	$180,800
Area Subtotals – Total Construction Cost[1]				**$1,806,500**
Subtotal before General Requirements Contingency and Escalation				**$1,806,500**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-31: Alternative 3 (*Build Plan* and *Future Plan*) Riverside Park

ALTERNATIVE 3 (*Build Plan* and *Future Plan*) CONSTRUCTION COSTS – Riverside Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	1.9	$15,541
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	1,552	$18,996
PAVEMENT DEMOLITION	SY	$11.21	3,105	$34,807
STORM DRAINAGE MODS & CONNECTIONS	LS	$2,000.00	1	$2,000
FINE GRADING	SY	$5.40	12,418	$67,057
GEOTEXTILES	SY	$2.69	4,051	$10,897
PLANTING SOILS	CY	$69.21	1,395	$96,548
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	0	-
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	98	$39,239
PLANTINGS - TREES, + STAKING/GUYING	EA	$42.00	98	$4,116
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	445	$19,856
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	7,387	$32,503
PLANTINGS (OR) - NATIVE PLANTS, 1 GAL	EA	$13.10	0	$-
SEEDING - LOW MEADOW MIX	SF	$0.30	0	$-
SEEDING - TURF	SF	$0.07	18,578	$1,300
RAIN GARDEN #131 - STONE	CY	$54.34	30	$1,630
RAIN GARDEN #131 - RAIN GARDEN SOIL MIX	CY	$69.21	45	$3,114
RAIN GARDEN #131 - PLANTINGS & MULCHING	SF	$12.00	812	$9,744
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
RAIN GARDEN #132 - STONE	CY	$54.34	35	$1,902
RAIN GARDEN #132 - RAIN GARDEN SOIL MIX	CY	$69.21	53	$3,668
RAIN GARDEN #132 - PLANTINGS & MULCHING	SF	$12.00	956	$11,472
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
PERMEABLE PAVING-ASPHALT (PA)	SF	$7.16	0	-
PERMEABLE PAVING-CONCRETE (PC)	SF	$10.85	0	-
PERMEABLE PAVING-WOOD DECK (PW), WOOD SLAT ON STEEL DECK	SF	$180.00	0	-
PERMEABLE PAVING-PAVERS (PP), SAND SET	SF	$17.00	22,305	$379,185
STRUCTURAL INSPECTION & REPAIR OF EXISTING DOCKS	SF	$75.00	0	-
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	19	$95,000
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	200	$80,000
Area Subtotals – Total Construction Cost[1]				**$937,577**
Subtotal before General Requirements Contingency and Escalation				**$937,577**

1. Lands, damages, relocations, and soft costs are excluded.

Table D-32: Alternative 3 (*Build Plan* and *Future Plan*) Willow Lake Park

ALTERNATIVE 3 (*Build Plan* and *Future Plan*) CONSTRUCTION COSTS – Willow Lake Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	1.4	$11,451
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	5,080	$62,179
PAVEMENT DEMOLITION	SY	$11.21	1,690	$18,945
PLACE EMBANKMENT USING IMPORTED SOILS	CY	$25.57	2,220	$56,765
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$2,000.00	1	$2,000
FINE GRADING	SY	$5.40	33,859	$182,839
GEOTEXTILES	SY	$2.69	10,024	$26,965
PLANTING SOILS	CY	$69.21	4,016	$277,947
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	258	$103,303
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	258	$10,836
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	395	$17,625
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	25,793	$113,489
PLANTINGS (OR) - NATIVE PLANTS, 1 GAL CONTAINERS	EA	$13.10	0	-
SEEDING - LOW MEADOW MIX	SF	$0.30	38,750	$11,625
SEEDING - TURF	SF	$0.07	113,918	$7,974
RAIN GARDEN #134 - STONE	CY	$54.34	17	$924
RAIN GARDEN #134 - RAIN GARDEN SOIL MIX	CY	$69.21	28	$1,938
RAIN GARDEN #134 - PLANTINGS & MULCHING	SF	$12.00	507	$6,084
STORM DRAINAGE INLET	EA	$4,500.00	2	$9,000
RAIN GARDEN #133 - STONE	CY	$54.34	26	$1,413
RAIN GARDEN #133 - RAIN GARDEN SOIL MIX	CY	$69.21	37	$2,561
RAIN GARDEN #133 - PLANTINGS & MULCHING	SF	$12.00	657	$7,884
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500
PERMEABLE PAVING-CONCRETE (PC)	SF	$10.85	56,408	$612,027
PERMEABLE PAVING-PAVERS (PP), SAND SET	SF	$17.00	15,058	$255,986
PERMEABLE PLAY SURFACE 1 (PS) - RUBBERIZED EXERCISE AREA	SF	$21.00	17,478	$367,038
SITE FURNISHINGS-PLAY EQUIP.	LS	$250,000.00	1	$250,000
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	500	$200,000
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	50	$250,000
Area Subtotals – Total Construction Cost[1]				**$2,873,300**
Subtotal before General Requirements Contingency and Escalation				**$2,873,300**

1. Lands, damages, relocations, and soft costs are excluded.

2.4.4 Alternative 3 *Build Plan*

The *Build Plan* of Alternative 3 would provide most of the drainage improvements proposed under Alternative 2 except for the 100 cfs Losen Slote Creek pump station and force main, Fluvial Park, and DePeyster Creek Park. This plan would also utilize the Willow Lake Park concept as shown in **Table D-32**. As shown in **Table D-33**, the cost of constructing Riverside Park would be $1,642,700 under the *Build Plan*. Refer to **Section 2.4.3** for the other Alternative 3 *Build Plan* costs.

Table D-33: Alternative 3 (*Build Plan*) - Riverside Park

ALTERNATIVE 3 (*Build Plan*) CONSTRUCTION COSTS –Riverside Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
CLEARING & GRUBBING	ACRES	$8,179.60	2	$15,541.24
STRIPING TOPSOIL, 6-IN DEEP	CY	$12.24	1,552	$18,996.48
PAVEMENT DEMOLITION	SY	$11.21	3,105	$34,807.05
STORM DRAINAGE MODIFICATIONS & CONNECTIONS	LS	$2,000.00	1	$2,000.00
FINE GRADING	SY	$5.40	12,418	$67,057.20
GEOTEXTILES	SY	$2.69	4,051	$10,897.19
PLANTING SOILS	CY	$69.21	1,395	$96,547.95
PLANTINGS - WETLAND GRASS PLUGS	EA	$4.40	422	$1,856.80
PLANTINGS - TREES, 3.0-IN CAL.	EA	$400.40	112	$44,844.80
PLANTINGS - TREES, ADDITIONAL COST FOR STAKING/GUYING	EA	$42.00	112	$4,704.00
PLANTINGS - SHRUBS, #5 CONTAINER	EA	$44.62	481	$21,462.22
PLANTINGS (EITHER) - NATIVE PLANT, PLUGS	EA	$4.40	7,980	$35,112.00
PLANTINGS (OR) - NATIVE PLANTS, 1 GAL CONTAINERS	EA	$13.10	-	$0.00
SEEDING - LOW MEADOW MIX	SF	$0.30	2,217	$665.10
SEEDING - TURF	SF	$0.07	17,966	$1,257.62
RAIN GARDEN #131 - STONE	CY	$54.34	30	$1,630.20
RAIN GARDEN #131 - RAIN GARDEN SOIL MIX	CY	$69.21	45	$3,114.45
RAIN GARDEN #131 - PLANTINGS & MULCHING	SF	$12.00	812	$9,744.00
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500.00
RAIN GARDEN #132 - STONE	CY	$54.34	35	$1,901.90
RAIN GARDEN #132 - RAIN GARDEN SOIL MIX	CY	$69.21	53	$3,668.13
RAIN GARDEN #132 - PLANTINGS & MULCHING	SF	$12.00	956	$11,472.00
STORM DRAINAGE INLET	EA	$4,500.00	1	$4,500.00
PERMEABLE PAVING-ASPHALT (PA)	SF	$7.16	5,287	$37,854.92
PERMEABLE PAVING-CONCRETE (PC)	SF	$10.85	11,515	$124,937.75
PERMEABLE PAVING-WOOD DECK (PW), WOOD SLAT ON STEEL DECK	SF	$180.00	875	$157,500.00
PERMEABLE PAVING-PAVERS (PP), SAND SET	SF	$17.00	17,013	$289,221.00
STRUCTURAL INSPECTION & REPAIR OF EXISTING DOCKS	SF	$75.00	2,825	$211,875.00

ALTERNATIVE 3 (*Build Plan*) CONSTRUCTION COSTS –Riverside Park				
Construction Activity	**Unit of Measure**	**Quantity**	**Estimated Cost per Unit**	**Total Cost**
BOAT RAMP	LS	$250,000.00	1	$250,000.00
SITE FURNISHINGS-SEATING, BENCHES	LF	$400.00	200	$80,000.00
LIGHT FIXTURE/POLE-SS, INCLG SUPPORTING INFRASTRUCTURE	EA	$5,000.00	19	$95,000.00
Area Subtotals – Total Construction Cost[1]				**$1,642,700**
Subtotal before General Requirements Contingency and Escalation				**$1,642,700**

1. Lands, damages, relocations, and soft costs are excluded.

2.5 Construction Cost

This section summarizes the cost of each of the alternatives that were considered. The costs shown exclude lands and damages, real estate, and soft costs. The construction cost of the proposed alternatives range from $114,500,000 to $309,404,000, as shown in **Table D-34** through **Table D-37**.

Table D-34: Structural Flood Reduction – Alternative 1 Cost Summary

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
LINE OF PROTECTION	**$52,159,300**	-	**$13,039,825**	**-**	**$9,618,371**	**$74,817,496**
CANTILEVERED SHEETPILE FLOODWALL (16' Wide)	$15,383,200	**25%**	$3,845,800	**2021**	$2,836,720	$22,065,720
SHEET PILE I - WALL W/CONCRETE CAP	$546,400	**25%**	$136,600	**2021**	$100,758	$783,758
CANTILEVERED WALKWAY SYSTEMS (10' Wide)	$2,679,100	**25%**	$669,775	**2021**	$494,036	$3,842,911
CANTILEVERED WALKWAY SYSTEMS (25' Wide)	$4,447,700	**25%**	$1,111,925	**2021**	$820,173	$6,379,798
CAST-IN-PLACE CONCRETE T-WALL	$3,321,900	**25%**	$830,475	**2021**	$612,571	$4,764,946
SHEET PILE I - WALL W/CONCRETE CAP and DOUBLE SHEET PILE WALL	$17,601,500	**25%**	$4,400,375	**2021**	$3,245,783	$25,247,658
BCUA TIDE GATE	$1,689,800	**25%**	$422,450	**2021**	$311,605	$2,423,855
INTERIOR DRAINAGE ELEMENTS	$6,489,700	**25%**	$1,622,425	**2021**	$1,196,725	$9,308,850
BERRY'S CREEK	**$18,250,100**	**-**	**$4,562,525**	**-**	**$3,365,387**	**$26,178,012**
BERRY'S CREEK SURGE BARRIER and PUMP STATION	$17,625,500	**25%**	$4,406,375	**2021**	$3,250,208	$25,282,083
BERRY'S CREEK Misc - Levee and FW Tie Off, Railroad Closure and Road Raising	$624,600	**25%**	$156,150	**2021**	$115,179	$895,929

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
GREEN INFRASTRUCTURE	**$13,526,000**	**-**	**$3,381,500**	**-**	**$2,494,245**	**$19,401,745**
PARKS & OTHER PUBLIC REALM AMENTTIES	$13,526,000	**25%**	$3,381,500	**2021**	$2,494,245	$19,401,745
ALLOWANCES (WETLANDS & UTILITIES)	**$ 9,470,000**	**0%**	**-**	**2021**	**$1,397,043**	**$10,867,043**
GENERAL REQUIREMENTS	**$6,071,000**	**25%**	**$1,518,000**	**2021**	**$1,119,552**	**$8,708,552**
TOTAL CONSTRUCTION COSTS	**$99,476,000**	**-**	**$22,502,000**	**-**	**$17,995,000**	**$139,973,000**
REAL ESTATE	**-**	**-**	**-**	**-**	**-**	**-**
ENGINEERING AND DESIGN	**$11,937,000**	**25%**	**$2,984,250**	**2019**	**$1,062,766**	**$15,984,016**
CONSTRUCTION ADMINISTRATION	**$4,307,000**	**25%**	**$1,076,750**	**2021**	**$794,227**	**$6,177,977**
TOTAL COSTS	**$115,720,000**	**-**	**$26,563,000**	**-**	**$19,852,000**	**$162,135,000**

Estimate does NOT include Real Estate costs
Estimate includes 25% contingency for construction features and 12% for Engineering and Design.
Escalation based on assumed midpoint of construction in 2021, at 3.5% per year compounded.
Estimate assumes all excess soils generated by construction will be classified as non-hazardous ID27 solid waste that would be transported/disposed from the site at a cost of $85 per ton. The weight of the excavated material was conservatively estimated to be 2 tons per cubic yard.
Estimate assumes that "hot spots" of HTRW encountered can be addressed either through the project contingency or by implementing measures to reduce the volume. If significant "hot spots" are encountered, there would be modifications to the design to minimize the need to remove HTRW material.
Allowances provide for utility relocations/protection and for construction of wetlands to mitigate unavoidable impacts to existing wetlands that will not be offset by project features.
Estimate assumes deep foundation support will be needed for force mains, storm water piping & box culverts.
GENERAL REQUIREMENTS - includes 6.5% of construction cost for contractor PM and Supervision (3%), Mob/Demob (1%), Traffic Maintenance (2 %), and Erosion-sedimentation controls (0.5%)

Table D-35: Stormwater Drainage Improvements – Alternative 2 Cost Summary

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
GREY INFRASTRUCTURE	**$75,228,226**	**25%**	**$18,807,057**	**2021**	**$13,872,367**	**$107,908,000**
NEW PUMP STATIONS	$48,750,268	**25%**	$12,187,567	**2021**	$8,989,732	$69,927,567
CHANNEL IMPROVEMENTS	$4,832,114	**25%**	$1,208,028	**2021**	$891,060	$6,931,202
FORCE MAINS	$15,647,829	**25%**	$3,911,957	**2021**	$2,885,518	$22,445,304
LOCAL DRAINAGE IMPROVEMENTS	$1,416,161	**25%**	$354,040	**2021**	$261,145	$2,031,346
PILING & CRADLES FOR SUPPORT OF PIPELINES, CULVERTS & PUMP STATION	$4,291,737	**25%**	$1,072,934	**2021**	$791,412	$6,156,083
ENERGY DISSIPATION STRUCTURES	$290,118	**25%**	$72,530	**2021**	$53,499	$416,146
GREEN INFRASTRUCTURE	**$14,017,300**	**25%**	**$3,504,325**	**2021**	**$2,584,843**	**$20,106,000**
OPEN SPACE IMPROVEMENTS	-	**-**	-	**-**	-	-
Revegetation (Riparian Habitat)	$159,532	**25%**	$39,883	**2021**	$29,418	$228,833
AVANTI PARK (CONCEPT 7.3)	$1,154,868	**25%**	$288,717	**2021**	$212,962	$1,656,548
CAESAR PLACE PARK (CONCEPT 12.1)	$1,593,600	**25%**	$398,400	**2021**	$293,866	$2,285,866
DEPEYSTER SOUTH (CONCEPT 6.3)	$2,063,100	**25%**	$515,775	**2021**	$380,443	$2,959,318
FLUVIAL PARK (CONCEPT 1.5)	$3,170,200	**25%**	$792,550	**2021**	$584,597	$4,547,347
LITTLE FERRY MUNICIPAL (CONCEPT 3.1)	$684,000	**25%**	$171,000	**2021**	$126,132	$981,132
LITTLE FERRY PUBLIC SCHOOLS (CONCEPT 3.1)	$561,500	**25%**	$140,375	**2021**	$103,543	$805,418
RIVERSIDE PARK	$1,562,700	**25%**	$390,675	**2021**	$288,168	$2,241,543

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
(CONCEPT 1.5)						
ROBERT CRAIG ELEMENTARY SCHOOL (CONCEPT 3.1)	$247,600	**25%**	$61,900	**2021**	$45,658	$355,158
ST. JOSEPH PARK (CONCEPT 3.1)	$273,800	**25%**	$68,450	**2021**	$50,490	$392,740
WILLOW LAKE PARK (CONCEPT 1.5)	$1,708,000	**25%**	$427,000	**2021**	$314,962	$2,449,962
STREETSIDE GREEN INFRASTRUCTURE	-	**-**	-	**-**	-	-
Bioswale, Rain Garden, Storage Trench, Bumpout and Median Plant Concept Areas:	**$838,400**	**25%**	$209,600	**2021**	$154,604	$1,202,604
ALLOWANCES	**$5,010,000**	**0%**	**$0**	**2021**	**$739,090**	**$5,749,000**
Utilities	**$975,000**	**0%**	$0	**2021**	$143,835	$1,118,835
Wetlands	**$4,035,000**	**0%**	$0	**2021**	$595,255	$4,630,255
GENERAL REQUIREMENTS	**$6,127,000**	25%	**$1,531,750**	2021	**$1,129,842**	**$8,788,592**
TOTAL CONSTRUCTION COSTS	**$100,383,000**	23.8%	**$23,843,000**	-	**$18,326,000**	**$142,552,000**
REAL ESTATE	**$0**	25%	**$0**	**-**	**$0**	**$0**
ENGINEERING AND DESIGN	**$12,046,000**	25%	**$3,011,500**	2019	**$1,072,470**	**$16,129,970**
CONSTRUCTION ADMINISTRATION	**$4,347,000**	25%	**$1,086,750**	2021	**$801,603**	**$6,235,353**
TOTAL COSTS	**$116,776,000**	25%	**$27,941,000**	**-**	**$20,200,000**	**$164,917,000**

Estimate does NOT include Real Estate costs

Estimate includes 25% contingency for construction features and 12% for Engineering and Design.

Escalation based on assumed midpoint of construction in 2021, at 3.5% per year compounded.

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY	PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION

Estimate assumes all excess soils generated by construction will be classified as non-hazardous ID27 solid waste that would be transported/disposed from the site at a cost of $85 per ton. The weight of the excavated material was conservatively estimated to be 2 tons per cubic yard.
Estimate assumes that "hot spots" of HTRW encountered can be addressed either through the project contingency or by implementing measures to reduce the volume. If significant "hot spots" are encountered, there would be modifications to the design to minimize the need to remove HTRW material.
Allowances provide for utility relocations/protection and for construction of wetlands to mitigate unavoidable impacts to existing wetlands that will not be offset by project features.
Estimate assumes deep foundation support will be needed for force mains, storm water piping & box culverts.

GENERAL REQUIREMENTS - includes 6.5% of construction cost for contractor PM and Supervision (3%), Mob/Demob (1%), Traffic Maintenance (2 %), and Erosion-sedimentation controls (0.5%)

Table D-36: Alternative 3 (*Build Plan* Plus *Future Plan*) – Cost Summary

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		PERFOR MANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
Storm Surge Protection	**$70,409,000**	**25%**	**$17,602,000**	**2021**	**$12,983,000**	**$100,996,000**
LINE OF PROTECTION - HACKENSACK RIVER	**$42,880,000**	**25%**	**$10,720,000**	**2021**	**$7,907,000**	**$61,508,000**
CAST-IN-PLACE CONCRETE WALLS	$2,849,367	**25%**	$712,342	**2021**	$525,434	$4,087,142
SHEET PILE I - WALL W/CONCRETE CAP	$9,380,400	**25%**	$2,345,100	**2021**	$1,729,781	$13,455,281
DOUBLE SHEET PILE WALL	$8,140,692	**25%**	$2,035,173	**2021**	$1,501,174	$11,677,040
CANTILEVERED SHEETPILE FLOODWALL	$15,383,196	**25%**	$3,845,799	**2021**	$2,836,719	$22,065,714
CANTILEVERED WALKWAY SYSTEMS	$7,126,731	**25%**	$1,781,683	**2021**	$1,314,196	$10,222,609
CLOSURE GATES & TIDE GATES	**$2,789,000**	**25%**	**$697,250**	**2021**	**$514,302**	**$4,000,552**
INTERIOR DRAINAGE ELEMENTS	**$6,490,000**	**25%**	**$1,622,500**	**2021**	**$1,196,780**	**$9,309,280**
BERRY'S CREEK SURGE BARRIER AND PUMP STATION	**$18,250,000**	**25%**	**$4,562,500**	**2021**	**$3,365,368**	**$26,177,868**
Earthwork	$2,448,082	**25%**	$612,020	**2021**	$451,435	$3,511,538
Pump station (1000 cfs electric)	$8,237,980	**25%**	$2,059,495	**2021**	$1,519,114	$11,816,589
Tainter gate structure	$6,939,482	**25%**	$1,734,870	**2021**	$1,279,666	$9,954,019
Levee	$88,966	**25%**	$22,242	**2021**	$16,406	$127,614
Sheet Pile I-Wall with concrete cap	$35,627	**25%**	$8,907	**2021**	$6,570	$51,103
RR Closure Gate	$500,000	**25%**	$125,000	**2021**	$92,202	$717,202
GREY INFRASTRUCTURE	**$97,031,000**	**25%**	**$24,258,000**	**2021**	**$17,893,000**	**$139,182,000**
NEW PUMP STATIONS	$48,750,268	**25%**	$12,187,567	**2021**	$8,989,732	$69,927,567

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
CHANNEL IMPROVEMENTS	$14,665,754	**25%**	$3,666,438	**2021**	$2,704,420	$21,036,612
FORCE MAINS	$15,647,829	**25%**	$3,911,957	**2021**	$2,885,518	$22,445,304
LOCAL DRAINAGE IMPROVEMENTS	$13,385,587	**25%**	$3,346,397	**2021**	$2,468,352	$19,200,336
PILING & CRADLES FOR SUPPORT OF PIPELINES, CULVERTS & PUMP STATION	$4,291,737	**25%**	$1,072,934	**2021**	$791,412	$6,156,083
ENERGY DISSIPATION STRUCTURES	$290,118	**25%**	$72,530	**2021**	$53,499	$416,146
GREEN INFRASTRUCTURE	**$23,335,000**	**25%**	**$5,834,000**	**2021**	**$4,303,000**	**$33,472,000**
OPEN SPACE IMPROVEMENTS	-	**-**	-	**-**	-	-
Revegetation (Riparian Habitat)	$159,532	**25%**	$39,883	**2021**	$29,418	$228,833
Southeast Viewing Platform	$131,699	**25%**	$32,925	**2021**	$24,286	$188,910
AVANTI PARK (CONCEPT 7.3)	$1,154,868	**25%**	$288,717	**2021**	$212,962	$1,656,548
CAESAR PLACE PARK (CONCEPT 12.1)	$1,593,600	**25%**	$398,400	**2021**	$293,866	$2,285,866
DEPEYSTER SOUTH (CONCEPT 6.3)	$1,806,479	**25%**	$451,620	**2021**	$333,122	$2,591,220
FLUVIAL PARK (CONCEPT 1.5)	$11,185,993	**25%**	$2,796,498	**2021**	$2,062,739	$16,045,230
K-Town Park	$886,397	**25%**	$221,599	**2021**	$163,455	$1,271,451
LITTLE FERRY MUNICIPAL (CONCEPT 3.1)	$684,000	**25%**	$171,000	**2021**	$126,132	$981,132
LITTLE FERRY PUBLIC SCHOOLS (CONCEPT 3.1)	$561,500	**25%**	$140,375	**2021**	$103,543	$805,418
RIVERSIDE PARK (CONCEPT 1.5)	$937,577	**25%**	$234,394	**2021**	$172,893	$1,344,864

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		PERFOR MANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
ROBERT CRAIG ELEMNTARY SCHOOL (CONCEPT 3.1)	$247,600	**25%**	$61,900	**2021**	$45,658	$355,158
ST. JOSEPH PARK (CONCEPT 3.1)	$273,800	**25%**	$68,450	**2021**	$50,490	$392,740
WILLOW LAKE PARK (CONCEPT 1.5)	$2,873,298	**25%**	$718,325	**2021**	$529,847	$4,121,469
STREETSIDE GREEN INFRASTRUCTURE	-	**-**	-	**-**	-	-
Bioswale, Rain Garden, Storage Trench, Bumpout and Median Plant Concept Areas:	$838,400	**25%**	$209,600	**2021**	$155,000	$1,203,000
ALLOWANCES	**$14,480,000**	0%	**$0**	2021	**$2,136,000**	**$16,616,000**
GENERAL REQUIREMENTS	**$13,342,000**	25%	**$3,335,500**	2021	**$2,460,000**	**$19,138,000**
TOTAL CONSTRUCTION COSTS	**$218,597,000**	23.3%	**$51,030,000**	-	**$39,775,000**	**$309,404,000**
REAL ESTATE	**$0**	25%	**$0**	**-**	**$0**	**$0**
ENGINEERING AND DESIGN	**$26,232,000**	25%	**$6,558,000**	2019	**$2,335,468**	**$35,125,000**
CONSTRUCTION ADMINISTRATION	**$9,465,000**	25%	**$2,366,250**	2021	**$1,745,382**	**$13,577,000**
TOTAL COSTS	**$254,294,000**	25%	**$59,954,000**	-	**$43,856,000**	**$358,106,000**

Estimate does NOT include Real Estate costs

Estimate includes 25% contingency for construction features and 12% for Engineering and Design.

Escalation based on assumed midpoint of construction in 2021, at 3.5% per year compounded.

Estimate assumes all excess soils generated by construction will be classified as non-hazardous ID27 solid waste that would be transported/disposed from the site at a cost of $85 per ton. The weight of the excavated material was conservatively estimated to be 2 tons per cubic yard.

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY	PERFOR MANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION

Estimate assumes that "hot spots" of HTRW encountered can be addressed either through the project contingency or by implementing measures to reduce the volume. If significant "hot spots" are encountered, there would be modifications to the design to minimize the need to remove HTRW material.

Allowances provide for utility relocations/protection and for construction of wetlands to mitigate unavoidable impacts to existing wetlands that will not be offset by project features.

Estimate assumes deep foundation support will be needed for force mains, storm water piping & box culverts.

GENERAL REQUIREMENTS - includes 6.5% of construction cost for contractor PM and Supervision (3%), Mob/Demob (1%), Traffic Maintenance (2 %), and Erosion-sedimentation controls (0.5%)

Table D-37: Alternative 3 *Build Plan* – Cost Summary

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		ESTIMATED TOTAL W/ CONTINGENCY (2017$)	PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
GREY INFRASTRUCTURE	**$45,422,000**	**25%**	**$11,355,000**	**$56,777,000**	**2021**	**$8,376,000**	**$65,153,000**
NEW PUMP STATIONS	$28,100,268	**25%**	$7,025,067	$35,125,335	**2021**	$5,181,795	$40,307,130
CHANNEL IMPROVEMENTS	$4,832,114	**25%**	$1,208,028	$6,040,142	**2021**	$891,060	$6,931,202
FORCE MAINS	$7,866,146	**25%**	$1,966,537	$9,832,683	**2021**	$1,450,547	$11,283,229
LOCAL DRAINAGE IMPROVEMENTS	$1,416,161	**25%**	$354,040	$1,770,201	**2021**	$261,145	$2,031,346
PILING & CRADLES FOR SUPPORT OF PIPELINES, CULVERTS & PUMP STATION	$3,085,812	**25%**	$771,453	$3,857,265	**2021**	$569,035	$4,426,300
ENERGY DISSIPATION STRUCTURES	$121,477	**25%**	$30,369	$151,846	**2021**	$22,401	$174,247
GREEN INFRASTRUCTURE	**$10,029,000**	**25%**	**$2,507,000**	**$12,536,000**	**2021**	**$1,849,000**	**$14,385,000**
OPEN SPACE IMPROVEMENTS	-	**-**	-	-	**-**	-	-
Revegetation (Riparian Habitat)	$159,532	**25%**	$39,883	$199,414	**2021**	$29,418	$228,833
AVANTI PARK (CONCEPT 7.3)	$1,154,868	**25%**	$288,717	$1,443,586	**2021**	$212,962	$1,656,548
CAESAR PLACE PARK (CONCEPT 12.1)	$1,593,600	**25%**	$398,400	$1,992,000	**2021**	$293,866	$2,285,866
LITTLE FERRY MUNICIPAL (CONCEPT 3.1)	$684,000	**25%**	$171,000	$855,000	**2021**	$126,132	$981,132
LITTLE FERRY PUBLIC SCHOOLS (CONCEPT 3.1)	$561,500	**25%**	$140,375	$701,875	**2021**	$103,543	$805,418
RIVERSIDE PARK (CONCEPT 1.5)	$1,642,669	**25%**	$410,667	$2,053,336	**2021**	$302,914	$2,356,251
ROBERT CRAIG ELEMENTARY SCHOOL	$247,600	**25%**	$61,900	$309,500	**2021**	$45,658	$355,158

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY		ESTIMATED TOTAL W/ CONTINGENCY (2017$)	PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION
(CONCEPT 3.1)							
ST. JOSEPH PARK (CONCEPT 3.1)	$273,800	**25%**	$68,450	$342,250	**2021**	$50,490	$392,740
WILLOW LAKE PARK (CONCEPT 1.5)	$2,873,298	**25%**	$718,325	$3,591,623	**2021**	$529,847	$4,121,469
STREETSIDE GREEN INFRASTRUCTURE	-	**-**	-	-	**-**	-	-
Bioswale, Rain Garden, Storage Trench, Bumpout and Median Plant Concept Areas:	$838,400	**25%**	$209,000	$1,047,400	**2021**	$154,516	$1,201,916
ALLOWANCES	**$5,010,000**	**0%**	**$0**	**$5,010,000**	**2021**	**$739,090**	**$5,749,090**
GENERAL REQUIREMENTS	**$3,930,000**	**25%**	**$982,000**	**$4,912,000**	**2021**	**$724,633**	**$5,636,633**
TOTAL CONSTRUCTION COSTS	**$64,391,000**	**23.1%**	**$14,844,000**	**$79,235,000**		**$11,689,000**	**$90,924,000**
REAL ESTATE	**$10,300,000**	**25%**	**-**	**$10,300,000**		**-**	**$10,300,000**
ENGINEERING AND DESIGN	**$7,727,000**	**12%**	**$927,000**	**$8,654,000**	**2019**	**$616,381**	**$9,270,381**
CONSTRUCTION ADMINISTRATION	**$2,791,000**	**25%**	**$700,000**	**$3,491,000**	**2021**	**$515,003**	**$4,006,003**
TOTAL COSTS	**$85,209,000**	**25%**	**$ 16,471,000**	**$101,680,000**		**$12,820,000**	**$114,500,000**
OTHER COSTS	-	**-**	-	-	**-**	-	-
Feasibility Study/EIS	-	**-**	-	-	**-**	-	$20,500,000
NJDEP Program Administration	-	**-**	-	-	**-**	-	$15,000,000
TOTAL PROGRAM COSTS	**-**	**-**	**-**	**-**	**-**	**-**	**$150,000,000**

Estimate does NOT include Real Estate costs

Estimate includes 25% contingency for construction features and 12% for Engineering and Design.

Feature	ESTIMATED COST BEFORE CONTINGENCY & ESCALATION (2017$)	CONTINGENCY	ESTIMATED TOTAL W/ CONTINGENCY (2017$)	PERFORMANCE MID-POINT	ESCALATION @3.5%/Year	ESTIMATED TOTAL w/ CONTINGENCY & ESCALATION

Escalation based on assumed midpoint of construction in 2021, at 3.5% per year compounded.

Estimate assumes all excess soils generated by construction will be classified as non-hazardous ID27 solid waste that would be transported/disposed from the site at a cost of $85 per ton.
The weight of the excavated material was conservatively estimated to be 2 tons per cubic yard.

Estimate assumes that "hot spots" of HTRW encountered can be addressed either through the project contingency or by implementing measures to reduce the volume. If significant "hot spots" are encountered, there would be modifications to the design to minimize the need to remove HTRW material.
are encountered, there would be modifications.

Allowances provide for utility relocations/protection and for construction of wetlands to mitigate unavoidable impacts to existing wetlands that will not be offset by project features.
Estimate assumes deep foundation support will be needed for force mains, storm water piping & box culverts.

GENERAL REQUIREMENTS - includes 6.5% of construction cost for contractor PM and Supervision (3%), Mob/Demob (1%), Traffic Maintenance (2 %), and Erosion-sedimentation controls (0.5%)

3.0 Operations and Maintenance

3.1 General

The performance of the LOP would continue to meet its design intent if it is properly maintained during normal (non-storm) conditions and properly operated during times of nor'easters and hurricane flooding events. The need for proper maintenance of the LOP is critical given the potential damages to infrastructure in this area if deterioration or damage to structures due to lack of maintenance cause the system to fail during the storm event. The general O&M requirements are summarized in **Table D-38** and is discussed in greater detail in **Appendix C** and summarized below.

Table D-38: General O&M Assumptions

Action	Frequency
System Inspections	Once per year
Routine	Four per year (90 days intervals)
Flooding	Before and after one flood each year
Culvert/Ditch Cleaning	When necessary
Routine	Once per year
Flooding	Before and after one flood each year
Pipe System Cleaning	Once per 5 years
Routine	Once per year
Flooding	Before and after one flood each year
Ditch Dredging	Once per 5 years
Closed Circuit Television Inspection	Once per 5 years
Pump Station Inspections	Four times a year (90 day intervals)
Pump Station Maintenance	Twice per year

3.2 Emergency Operations

Emergency surveillance, communication, and chain of responsibility for the LOP structures and associated infrastructure would fall under existing protocols agreed upon by the NJDEP or local communities. Particular attention would be given to monitoring the performance of the LOP structures during storm events in the first few years of operation in order to ensure that they function as designed. Coordination with the United States Army Corps of Engineers (USACE), the National Weather Service and National Hurricane Center, and the NJDEP would be required during storm events to initiate standard flood risk management techniques. Typical emergency flood risk management techniques will include the following:

- Storm event patrolling and reporting of trouble spots;
- Scour hole repair – buried floodwall and levee;.
- Wave wash protection of eroded levee slopes;
- Topping of low or eroding spots on levee crown using sandbags;

- Flood barrier construction; and
- Sandbagging to control boils that are issuing sediment.

3.3 Maintenance

Maintenance under the Proposed Project would be the upkeep and repair of structures to maintain the function of the structure after construction is complete. Maintenance of specific Proposed Project features is described in the subsections below.

3.3.1 Floodwall

Maintenance of the concrete T-wall would be based on maintaining the integrity of the structure, which may be reduced due to loss of material at the toe of the structure and/or liquefaction of soil due to poor drainage. The pile foundation would provide support to prevent failure in the case of liquefaction. In addition, repair of the concrete would be performed to minimize corrosion of the reinforcing steel within the concrete.

3.3.2 Earthen Levee

Earthen levees would be maintained to remedy any adverse conditions threatening the integrity of the structure. Items or issues requiring maintenance include:

- Crown roadway and access ramps;
- Rodent activity;
- Vegetation management;
- Erosion control and repair;
- Seepage; and
- Cracking, settlement, and slips.

3.3.3 Pump Station and Sector Gates

The pump station and sector gates would be maintained in accordance with various equipment manufacturers' instructions. A detailed Operation, Maintenance, Rehabilitation, Repair, and Replacement (OMRRR) Plan would be developed during the construction phase.

3.3.4 Interior Drainage Facilities

Interior drainage facilities, including flap gates, sluice gates, trash racks, etc., would be maintained in accordance with the OMRRR Plan.

3.4 Operations & Maintenance (O&M) Costs

The estimated annual O&M costs for Alternative 1, Alternative 2, Alternative 3 *Build Plan*, and Alternative 3 *Build Plan* plus *Future Plan* are provided in **Table D-39** through **Table D-42**. Cost estimates for operating, inspecting, and maintaining the various grey infrastructure features associated with the drainage improvement and LOP features were developed in general accordance with Federal Flood Control Regulations (Title 33 of the Code of Federal Regulations (CFR), Section 208.10 (33 CFR 208.10). Those requirements include system inspections at 90-day intervals during the year and before and after flood events.

Table D-39: Annual O&M Cost Summary for Alternative 1

Annual Operation and Maintenance Costs	Description		Cost
Storm Surge Protection			
System Inspections	Includes annual inspection of levees (1200 linear feet) , floodwalls (22,000 linear feet), and ditches (28,700 linear feet); quarterly inspection of closure and tidal gates, drainage outlet structures)		$68,800
Levees and floodwalls	Includes mowing of levees and minor repairs to floodwalls		$44,100
Drainage Ditch/swales	Includes vegetation control, debris and sediment removal		$232,000
Closure and Tidal gates	Routine maintenance, scheduled and unscheduled maintenance 11 closure and tidal gates		$45,900
Drainage Outlet structures	Routine maintenance, scheduled and unscheduled maintenance of the 53 outlet structures		$48,000
Sub-total - Storm Surge Protection			**$438,800**
Green Features -Open Space (Does not include equipment and replacement of park features)			
	square feet	**unit cost**	
Fluvial Park	177,200	$0.81	$142,600
Riverside Park	111,800	$0.81	$90,000
DePeyster Creek Park	350,100	$0.81	$281,800
K-town Park	60,984	$0.81	$49,100
Southeast Viewing Platform	1,055	$0.36	$400
Sub-total - Green Features - Open Space			**$563,900**
TOTAL ANNUAL O&M COSTS:			**$1,002,700**
			SAY $1,350,000

Table D-40: Annual O&M Cost Summary for Alternative 2

Annual Operation and Maintenance Costs - Grey Features -	**East Riser Ditch (500 cfs pump station, discharge channel, modified forebay inlet to existing tide gate, culvert upgrades, ditch dredging)**	**Losen Slote and Carol Place (50 cfs and 100 cfs pump stations, force mains)**	**Total**
	Concept 12.1 D	Concept 13.2 D	
Grey Features -			
System Inspections	$12,000	$12,000	**$24,000**
Ditch/Culvert Cleaning	$31,500	$0	**$31,500**
Pipe System Cleaning	$0	$8,000	**$8,000**
Ditch Dredging	$39,000	0	**$39,000**
CCTV Inspections	$0	$6,300	**$6,300**
Pump Station Inspections	$800	$3,800	**$4,600**
O& M for Pumping Stations	$360,000	$130,000	**$490,000**
Sub-total - Grey Feature	**$443,300**	**$160,100**	**$603,400**
Green Features -Parks (not including equipment and replacement of park features)	**square feet**	**unit cost**	
Avanti Park	41,900	$0.81	**$33,700**
Caesar Place Park	173,900	$0.81	**$140,000**
Depeyster Creek Park	350,100	$0.81	**$281,800**
Fluvial Park	177,200	$0.81	**$142,600**
Little Ferry Municipal	59,900	$0.81	**$48,200**
Little Ferry Public Schools (Overall O&M estimated to be $92,700/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	115,100	$0.81	**$60,400**
Riverside Park	111,800	$0.81	**$90,000**
Robert Craig Elementary School (Overall O&M estimated to be $26500/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	74,600	$0.36	**$13,000**
St. Joseph Park (Overall O&M estimated to be $13,400/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	37,800	$0.36	**$6,700**

Annual Operation and Maintenance Costs - Grey Features -	East Riser Ditch (500 cfs pump station, discharge channel, modified forebay inlet to existing tide gate, culvert upgrades, ditch dredging)	Losen Slote and Carol Place (50 cfs and 100 cfs pump stations, force mains)	Total
Willow Lake Park* (Overall O&M estimated to be $108,200/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	304,700	$0.36	**$73,200**
Sub-total - Green Features _ Parks	**square feet**	**unit cost**	**$889,600**
Green Features - Streetside Green Infrastructure			
DePeyster Creek (Storage/Tree trench)	2,800	$0.28	**$800**
Carol Place (Bioswales)	8,900	$0.74	**$6,600**
West River Ditch (rain gardens)	2,900	$0.74	**$2,100**
Park St. (storage/tree trench)	3,100	$0.28	**$900**
Park St. (bioswales)	5,200	$0.74	**$3,800**
Main St (storage/Tree trench)	7,100	$0.28	**$2,000**
Main St (Bioswale)	2,300	$0.74	**$1,700**
Main St (Rain garden)	4,600	$0.74	**$3,400**
Sub-total - Green Features - Streetside			**$21,300**
TOTAL ANNUAL O&M COSTS:			**$1,514,300**
			say $1,500,000

Table D-41: Annual O&M Cost Summary for Alternative 3 *Build Plan*

Annual Operation and Maintenance Costs - Grey Features -	**East Riser Ditch (500 cfs pump station, discharge channel, modified forebay inlet to existing tide gate, culvert upgrades, ditch dredging)**	**Losen Slote and Carol Place (50 cfs pump stations, force mains)**	**Total**
Grey Features -			
System Inspections	$12,000	$12,000	**$24,000**
Ditch/Culvert Cleaning	$31,500	$0	**$31,500**
Pipe System Cleaning	$0	$5,500	**$5,500**
Ditch Dredging	$39,000	0	**$39,000**
CCTV Inspections	$0	$3,000	**$3,000**
Pump Station Inspections	$3,800	$1,900	**$5,700**
O& M for Pumping Stations	$360,000	$65,000	**$425,000**
Sub-total - Grey Feature	**$446,300**	**$87,400**	**$533,700**
Green Features -Open Space (not including equipment and replacement of park features)	**sq ft**	**unit cost**	
Avanti Park	41,900	$0.81	**$33,700**
Caesar Place Park	173,900	$0.81	**$140,000**
DePeyster Creek Park (Not included in the *Build Plan*)	-		**-**
Fluvial Park (Not included in the *Build Plan*)	-		**-**
Little Ferry Municipal	59,900	$0.81	**$48,200**
Little Ferry Public Schools (Overall O&M estimated to be $92,700/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	115,100	$0.81	**$51,800**
Riverside Park	111,800	$0.81	**$90,000**
Robert Craig Elementary School (Overall O&M estimated to be $26,500/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	74,600	$0.36	**$13,200**

Annual Operation and Maintenance Costs - Grey Features -	East Riser Ditch (500 cfs pump station, discharge channel, modified forebay inlet to existing tide gate, culvert upgrades, ditch dredging)	Losen Slote and Carol Place (50 cfs pump stations, force mains)	Total
St. Joseph Park (Overall O&M estimated to be $13,400/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	37,800	$0.36	**$6,700**
Willow Lake Park* (Overall O&M estimated to be $245,300/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	304,700	$0.81	**$137,100**
Sub-total - Green Features Open Space			**$520,700**
Green Features - Streetside Green Infrastructure			
DePeyster Creek (Storage/Tree trench)	2,800	$0.28	**$800**
Carol Place (Bioswales)	8,900	$0.74	**$6,600**
West River Ditch (rain gardens)	2,900	$0.74	**$2,100**
Park St. (storage/tree trench)	3,100	$0.28	**$900**
Park St. (Bioswales)	5,200	$0.74	**$3,800**
Main St (storage/Tree trench)	7,100	$0.28	**$2,000**
Main St (Bioswale)	2,300	$0.74	**$1,700**
Main St (Rain garden)	4,600	$0.74	**$3,400**
Sub-total - Green Features - Streetside			**$21,300**
TOTAL ANNUAL O&M COSTS:			**$1,075,700**
			say $1,100,000

Table D-42: Annual O&M Cost Summary for Alternative 3 *Build Plan* Plus *Future Plan*

Annual Operation and Maintenance Costs	Description		Total
Storm Surge Protection			
System Inspections	Includes annual inspection of levees (1200 linear feet) , floodwalls (22,000 linear feet), and ditches (28,700 linear feet); quarterly inspection of closure and tidal gates, drainage outlet structures)		$68,800
Levees and floodwalls	Includes mowing of levees and minor repairs to floodwalls		$44,100
Drainage Ditch/swales	Includes vegetation control, debris and sediment removal		$232,000
Closure and tidal gates	Routine maintenance, scheduled and unscheduled maintenance 11 closure and tidal gates		$45,900
Drainage outlet structures	Routine maintenance, scheduled and unscheduled maintenance of the 53 outlet structures		$48,000
Berry's Creek Tainter Gate/Pump Station	Includes routine maintenance, major repairs/replacement, power		$324,000
Sub-total - Storm Surge Protection			**$762,800**
Drainage/ Fluvial Flooding Improvement features (Grey features)	**East Riser Ditch (500 cfs pump station, discharge channel, modified forebay inlet to existing tide gate, culvert upgrades, ditch dredging)**	**Losen Slote and Carol Place (50 cfs and 100 cfs pump stations, force mains)**	**Total**
System Inspections	$12,000	$12,000	**$24,000**
Ditch/Culvert Cleaning (Lower East Riser ditch)	$31,500	$0	**$31,500**
Ditch/Culvert Cleaning (Upper East Riser ditch)	$63,000	$0	**$63,000**
Pipe System Cleaning	$0	$8,000	**$8,000**
Ditch Dredging	$39,000	0	**$39,000**
CCTV Inspections	$0	$6,300	**$6,300**
Pump Station Inspections	$800	$3,800	**$4,600**
O& M for Pumping Stations	$360,000	$130,000	**$490,000**
Sub-total - Grey Feature	**$506,300**	**$160,100**	**$666,400**
Green Features -Open Space (not including equipment and replacement of park features)	**square feet**	**unit cost**	
Avanti Park	41,900	$0.81	**$33,700**
Caesar Place Park	173,900	$0.81	**$140,000**
DePeyster Creek Park	350,100	$0.81	**$281,800**
Fluvial Park	177,200	$0.81	**$142,600**

K-town Park	60,984	$0.81	**$49,100**
Little Ferry Municipal	59,900	$0.81	**$48,200**
Little Ferry Public Schools (Overall O&M estimated to be $92,700/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	115,100	$0.81	**$51,800**
Riverside Park	111,800	$0.81	**$90,000**
Robert Craig Elementary School (Overall O&M estimated to be $26500/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	74,600	$0.36	**$13,200**
Southeast Viewing Platform	1,055	$0.36	**$400**
St. Joseph Park (Overall O&M estimated to be $13,400/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	37,800	$0.36	**$6,700**
Willow Lake (Overall O&M estimated to be $108,200/year). Shown in "Total" is estimated net increase in O&M over current estimated O&M)	304,700	$0.36	**$54,100**
Sub-total - Green Features - Open Space			**$911,600**
Green Features - Streetside Green Infrastructure			
DePeyster Creek (Storage/Tree trench)	2,800	$0.28	**$800**
Carol Place (Bioswales)	8,900	$0.74	**$6,600**
West River Ditch (rain gardens)	2,900	$0.74	**$2,100**
Park St. (storage/tree trench)	3,100	$0.28	**$900**
Park St. (Bioswales)	5,200	$0.74	**$3,800**
Main St (storage/Tree trench)	7,100	$0.28	**2,000**

Main St (Bioswale)	2,300	$0.74	**$1,700**
Main St (Rain garden)	4,600	$0.74	**$3,400**
Sub-total - Green Features - Streetside			**$21,300**
TOTAL ANNUAL O&M COSTS:			**$2,362,100**
			say $2,400,000

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4 ATTACHMENTS

Attachment 1	Estimating Excavation, Disposal, and Fill Requirements for Culverts & Bridges and Calculating Easements
Attachment 2	Estimating Impacts to Riparian and Wetland Habitat
Attachment 3	Operation and Maintenance Requirements for Alternatives 2 and 3

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Memo

Date:	Tuesday, November 07, 2017
Project:	RBDM
To:	Michael Vecchio
From:	Kim Hayden
Subject:	Estimating Excavation, Disposal and Fill Requirements for Culverts & Bridges and Calculating Easements

Project background: The New Jersey Department of Environmental Protection (NJDEP), as the Project sponsor, intends to complete Preliminary Planning and Design for the Rebuild by Design Meadowlands Flood Protection Project, which includes the Boroughs of Little Ferry, Moonachie, Carlstadt, and Teterboro, and the Township of South Hackensack, Bergen County, New Jersey.

The proposed project was developed as a concept through the Hurricane Sandy Rebuilding Task Force's RBD competition. This competition promoted the development of innovative resilience projects in the Sandy-affected region. The Proposed Project is a proposal for the New Jersey Meadowlands that aims to reduce flooding risks in the project area, with potential ancillary benefits.

The Phase 1 Pilot Area was selected by Housing and Urban Development (HUD) through the RBD competition, and HUD Community Development Block Grant – Disaster Recovery (CDBG-DR) funds, totaling $150M, have been allocated to it.

The State of New Jersey through New Jersey Department of Community Affairs (NJDCA) is the Grantee of HUD (CDBG–DR) funds that have been appropriated under the Disaster Relief Appropriations Act of 2013 (Pub. L. 113–2, approved January 29, 2013) related to disaster relief, long-term recovery, restoration of infrastructure and housing, and economic revitalization in the most impacted and distressed areas resulting from a major disaster that was declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974 (Stafford Act) in calendar year 2012 for Hurricane Sandy.

To complete the feasibility study for preparing the Environmental Impact Statement (EIS), the process was developed to perform 3 separate screenings. Screening 1 was a coarse screening to narrow down 30 design concepts to 7 design concepts. Screening 2 increased the level of detail of these 7 concepts which were screened down to a total of 6. These remaining 6 concepts were part of a feasibility study.

Pipe / Culvert Removal & Replacement Excavation Volumes

The *Excavation (Pavement Road Section)* quantity from the Cost Estimate represents the volume of base course aggregate and asphalt pavement to be removed in order to replace culverts or install new culverts and force mains. A conservative total pavement layer thickness of 1.5 feet was used, based on New Jersey Department of Transportation (NJDOT) Standard Construction Details (Roadway, Traffic, Bridges) dated 2016 and the New Jersey Asphalt Pavement Design Guide dated 2013, which typically requires 6 inches of graded aggregate base course, with a total minimum of 5 inches for the asphalt base and surface layers.

In instances where adequate cover over proposed pipes / culverts marginally could not be achieved due to geometric constraints (i.e., maintaining positive slope along the alignment in a relatively flat area), it is assumed that regrading within the construction limit is permissible in order to meet minimum requirements. Any additional regrading efforts are not included in the Cost Estimate and are expected to be covered by the contingency as needed. For this level of development, cover along the pipe alignment was only verified at manhole and catch basin locations (pipe segment ends). During the next phase of design, cover will be verified along the entire profile of the proposed system using a detailed topographic survey.

The excavation widths were calculated using a modified formula from the American Concrete Pipe Association:

$$Excavation\ trench\ width\ (ft) = \ Outer\ pipe\ diameter\ or\ width\ (ft)\ *\ 1.25\ +\ 1\ ft. + 1.5\ ft.$$

The 1.5 feet component of the above formula conservatively accounts for the trench box thickness that may be required given the depth of the excavation and soil type. Multiple trench box vendors recommend a minimum of 6 to 8 inches of separation between the outer diameter / width of the pipe and the box wall.

The *Excavation (Soil)* quantity represents the volume of soil to be removed in order to replace existing culverts or install new culverts or force mains. The depth of the excavation extends from the ground surface, if vegetated (i.e. outside of roadway or asphalted area), or from the bottom of the *Pavement Road Section* layer to the bottom of the proposed coarse aggregate layer beneath the installed pipe.

The proposed *Coarse Aggregate Material* layer thickness for a concrete circular pipe is 6 inches, per the NJDOT 2016 Standard Construction Details, or 2.0 feet below the bottom of a concrete box culvert, per Section 29.5.7 of the NJDOT 2016 Design Manual for Bridges and Structures. Refer to Figures 1 and 2 for a typical excavation trench cross section within a paved area for a box culvert and circular pipe, respectively.

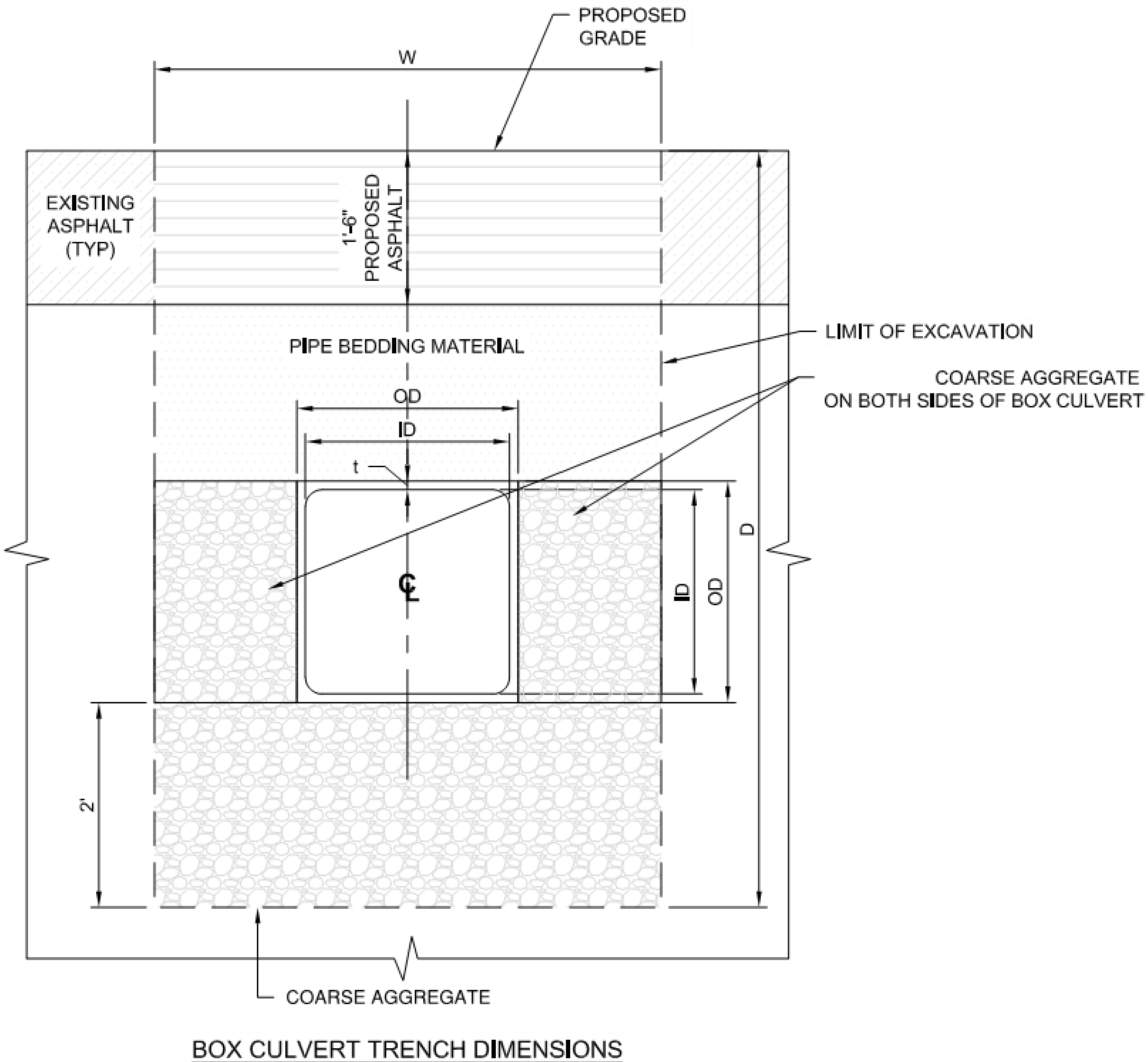

Figure 1 Cross Section of Excavation Trench – Concrete Box Culvert

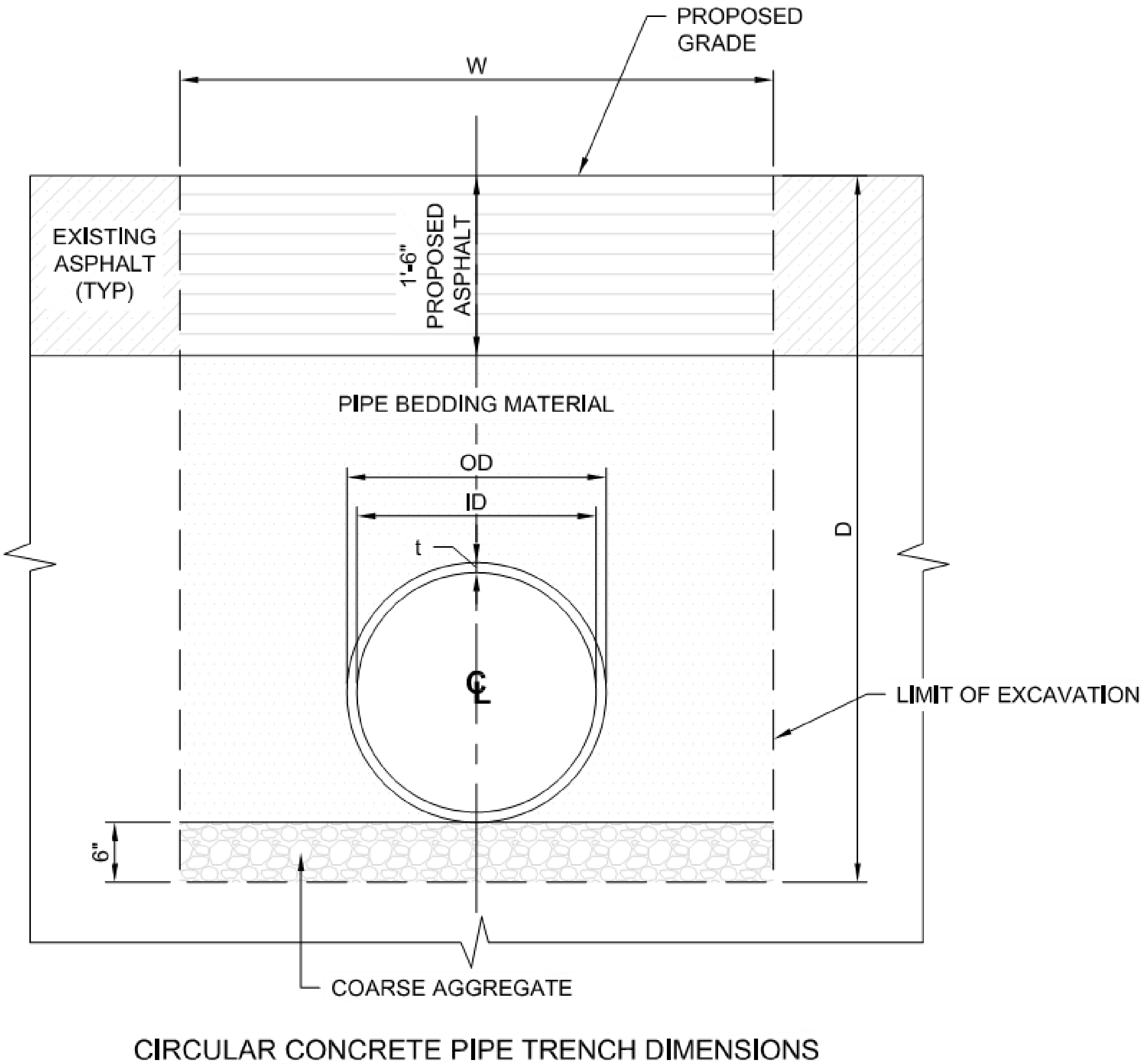

Figure 2 Cross Section of Excavation Trench – Circular Concrete Pipe

Per the NJDOT 2016 Design Manual for Bridges and Structures, box culverts also require a minimum of 1 foot of a *Coarse Aggregate Material* on both sides once the pipe is laid. *Pipe Bedding Material* accounts for the remainder of the excavation trench, as depicted in Figures 1 and 2 above,

Since no excavated pavement or soils are anticipated to be reused on site, the *Excavation* quantities are equal to the associated *Disposal* volumes. The removal and replacement of storm drainage manholes, inlets and pipe laterals affected by the proposed excavation / installation were accounted for under separate line items in the Cost Estimate.

<u>Bridge Removal & Replacement</u>

The cost to remove bridge structures within an open channel system were estimated using an average deck area, calculated by multiplying the existing width by the length of the deck. Proposed bridge structures were quantified by calculating the trench area required to install the new bridge decking, plus 1 foot on both sides of the deck to account for headwalls. This trench area was calculated using the same formula used for pipe / culvert installation, as discussed above. Additionally, notes were included in the Cost Estimate provided the type of bridge or bridge material, i.e., single span wooden footbridge, four span railroad bridge, etc.

Soil excavation and disposal quantities for bridge structures were captured in the total dredging volume calculated in AutoCAD Civil 3D for channel improvements. Due to modeling limitations, the soil excavation (dredging) quantity associated with the removal / replacement of one bridge on the East Riser Ditch was estimated by hand, and not in the Civil 3D model.

<u>Easements</u>

The real estate quantities for the grey infrastructure civil design are divided into two categories based on the duration of their demand: (1) *Temporary Easements* provide access for construction activities required to implement proposed concept design (i.e., to remove existing and install new pipe, channel widening, pump station construction, etc.). The *Temporary Easements* quantity includes the area within the construction limit boundary. The construction limit encompasses work zones, staging areas and Operations and Maintenance (O&M) access roads. (2) *Permanent Easements* secure necessary work areas to accommodate both routine and emergency repairs and maintenance which may include the use of heavy machinery (i.e., routine channel dredging, pipe repair and cleanout, etc.). The *Permanent Easements* quantity includes the footprint of the excavation trench (for culvert installation areas) and bank to bank extents of the proposed channel plus associated O&M corridors that would be used throughout the lifespan of the installed project.

The O&M corridors for all Feasibility Study concepts are a minimum of 10 feet in width to accommodate truck and vehicular access. Where there are no physical or zoning constraints, the corridors extend to 15 feet wide. The Main Street (1.5) concept corridors extend into the centerline of the roadway, encompassing one direction of traffic.

Both *Temporary* and *Permanent Easement* quantities were further divided between areas *within Tax Parcels* (private land) or *Public Right-of-Way* (ROW) for Alternative 3 only.

The CAD drawing files containing green infrastructure and landscape design linework were extracted from “Focus Group Data Share > Alternative 2 > Feasibility Study > CAD Models” folder on SharePoint, which were uploaded by AECOM on 29 September 2017. The *Temporary* and *Permanent Easements* were exported to GIS shapefiles, which were then merged with the civil grey infrastructure easements for all concepts. The *Temporary* and *Permanent Easement* boundaries represented on the Real Estate plan sheets encompass all civil grey, green and landscape linework.

Memo

Date: Tuesday, November 07, 2017

Project: RBDM

To: Michael Vecchio

From: Pratik Desai

Subject: Screening 2 – Estimating Impacts to Riparian and Wetland Habitat

Project background: The New Jersey Department of Environmental Protection (NJDEP), as the Project sponsor, intends to complete Preliminary Planning and Design for the Rebuild by Design (RBD) Meadowlands Flood Protection Project, which includes the Boroughs of Little Ferry, Moonachie, Carlstadt, and Teterboro, and the Township of South Hackensack, Bergen County, New Jersey.

The Proposed Project was developed as a concept through the Hurricane Sandy Rebuilding Task Force's RBD competition. This competition promoted the development of innovative resiliency projects in the Sandy-affected region. The Proposed Project is a proposal for the New Jersey Meadowlands that aims to reduce flooding risks in the project area, with potential ancillary benefits.

The Phase 1 Pilot Area was selected by Housing and Urban Development (HUD) through the RBD competition, and HUD Community Development Block Grant – Disaster Recovery (CDBG-DR) funds, totaling $150M, have been allocated to it.

The State of New Jersey through New Jersey Department of Community Affairs (NJDCA) is the Grantee of HUD (CDBG–DR) funds that have been appropriated under the Disaster Relief Appropriations Act of 2013 (Pub. L. 113–2, approved January 29, 2013) related to disaster relief, long-term recovery, restoration of infrastructure and housing, and economic revitalization in the most impacted and distressed areas resulting from a major disaster that was declared pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974 (Stafford Act) in calendar year 2012 for Hurricane Sandy.

To complete the feasibility study for preparing the Environmental Impact Statement (EIS), the process was developed to perform 3 separate screenings. Screening 1 was a coarse screening to narrow down 30 design concepts to 7 design concepts. Screening 2 increased the level of detail of these 7 concepts which were screened down to a total of 6. These remaining 6 concepts were part of a feasibility study.

Purpose: This technical memorandum documents the process used to quantify the impacts to riparian areas for several concepts to develop a high level cost estimate for the feasibility study.

Assumptions for Riparian Buffer: For all concepts, it was assumed that the riparian buffer area extends 50 feet from the existing channel banks.

Data/sources used to calculate the impact areas: Construction Limit: The Construction Limit boundary includes the grey/green infrastructure improvements, temporary construction access, temporary staging area and permanent operation and maintenance (O&M) access. This boundary was developed in CAD as a part of preparing screening exhibits by HDR and AECOM hydraulic modeling and civil design teams. This boundary was then exported to GIS database where the calculations of impact areas were performed.

Existing Channel Boundary: HDR modeling team defined this boundary as a part of existing conditions hydraulic HEC-RAS 1D/2D or InfoWorks models. This boundary was then exported to GIS database where the calculations of impact areas were performed.

Wetland boundary: 2012 NJDEP land use / land cover data (wetlands and water bodies attributes)

Impervious cover: Manually defined in ArcGIS based on 2015 NJDEP aerial imagery

Riparian vegetation area: 2012 NJDEP land use / land cover data and AECOM vegetated area surveys

Methodology to calculate impact areas: The following process was established to calculate the impacts to the riparian habitat for each concept due to construction of the proposed improvements and O&M access after the construction is completed.

1. The riparian area within the Construction Limit was determined for each concept using the data layers listed above.
2. The existing impervious areas, structures that are proposed for removal / replacement that are grass covered, temporary wetland impact areas, proposed pump station footprints and the existing channel bottom areas were deducted from the riparian area calculated in the first step. The existing channel bottom areas were calculated using average widths from the pre-simplified HEC-RAS models.

The impacts to the riparian habitat areas for the grey infrastructure component of each concept are summarized in the section below.

Riparian Area Re-vegetation Summary (Grey Infrastructure)				
Concept No.	**Concept Description**	**Riparian Re-vegetation Area (AC)**	**Unit Cost**	**Total re-vegetation Cost**
13.3	Losen Slote / Carol Place	0.02	$124,634.00	$2,492.68
6.3	Depeyster Creek	1.94	$124,634.00	$241,789.96
12.1	East Riser Ditch	14.87	$124,634.00	$1,853,307.58
13.4	Concept D: East Riser & Losen Slote combination	4.01	$124,634.00	$499,782.34
11.2	West Riser Ditch	8.37	$124,634.00	$1,043,186.58
1.5	Main Street	0	$124,634.00	$0.00

Basis of unit cost for riparian area restoration: The unit cost per acre of $124,634 was used based on construction bid pricing from other recent local projects. This unit cost included both restoration costs for temporary impacts and monitoring and maintenance costs to complete permit compliance. This unit cost does not include mobilization, clearing, grubbing, tree removal, grading activities, access road installation and removal, soil and erosion controls, permitting, and real estate costs. These items would be covered elsewhere. It also assumed that waterfowl fencing and capping or importation of clean fill was not required.

Memo

Date: Monday, December 18, 2017

Project: RBDM

Subject: Operation and Maintenance Requirements for Alternatives 2 and 3 (*WO 4, Task 9.2 and 9.3*)

Introduction

AECOM was awarded a contract by the New Jersey Department of Environmental Protection (NJDEP) to complete a feasibility study, environmental impact statement, project design and construction administration for the Rebuild By Design Meadowlands Flood Protection Project (the Proposed Project). That project was one of several award winners for a Rebuild By Design competition sponsored by the United States Department of Housing and Urban Development (HUD). Funds for the project are being provided to NJDEP by HUD. AECOM subsequently signed HDR to a subcontract to provide data management, engineering, and environmental sciences support throughout the project. Engineering support for the project included developed and screening of drainage improvement concepts.

The New Meadowlands drainage improvement concept development and screening process included evaluation of the operation and maintenance requirements. The requirements apply equally to Alternative 2 concepts and elements therein adopted as part of Alternative 3 concepts. The HDR design team defined requirements and associated costs for drainage system maintenance, periodic inspection and pump station operation and maintenance. Cost information was provided to the AECOM cost team for use as part of Screening 2.

Operation and Maintenance Requirements

Cost estimates for operating, inspecting and maintaining the various grey infrastructure features associated with the drainage improvement features were developed in general accordance with Federal Flood Control Regulations (Title 33 of the Code of Federal Regulations, Section 208.10 (33 CFR 208.10). Those requirements include system inspections at 90-day intervals during the year and before and after flood events. The required actions and associated frequencies are summarized in Table 1.

Cost estimates were based on man-hour and equipment estimates for system inspections, ditch and culvert cleaning (routine, and before and after flood events), pipe system cleaning, ditch dredging, closed circuit television pipe inspections, pump station inspections, and pumps station power and maintenance. A summary of Operation and Maintenance costs for the seven concepts evaluated as part of Screening 2 is contained in Table 2.

Table 1: General Operation and Maintenance Assumptions

Action	Frequency
System Inspections	
Routine	Four per year (90 days intervals)
Flooding	Before and after one flood each year
Culvert/Ditch Cleaning	
Routine	Once per year
Flooding	Before and after one flood each year
Pipe System Cleaning	
Routine	Once per year
Flooding	Before and after one flood each year
Ditch Dredging	Once per 5 years
Closed Circuit Television Inspection	Once per 5 years
Pump Station Inspections	Four times a year (90 day intervals)
Pump Station Maintenance	Twice per year

Table 2: Operation and Maintenance Costs for Alternative 2 Concepts

Concept	Annual Cost
1.5 Main Street	$215,300
6.3 Depeyster Creek	$83,599
7.3 Carol Place	$110,051
11.2 West Riser Ditch	$275,478
12.1 East Riser Ditch	$271,882
13.1 – East Riser Ditch-Main Street	$562,714
13.2 Losen Slote-Park Street	$271,882
Concept D (Losen Slote segment)	$160,125
Concept D (East Riser Ditch segment)	$476,963

Attachment A, Figures 1 – 9, contain detailed staffing and equipment-hour breakdowns supporting the costs reported in Table 2.

Attachment A

Staff and Equipment-Hour Operation and Maintenance Cost Breakdown

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Concept 1.5 - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/ day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	40	5	3	480	$50.00	$24,000.00	0	$1,500.00	$0.00	$24,000.00
Flood Event Inspection	2	40	5	3	240	$50.00	$12,000.00	0	$1,500.00	$0.00	$12,000.00
Ditch/Culvert Cleaning											
Routine Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Pipe System Cleaning											
Routine Cleaning	1	40	5	3	120	$50.00	$6,000.00	1	$1,500.00	$7,500.00	$13,500.00
Flood Event Cleaning	2	40	5	3	240	$50.00	$12,000.00	1	$1,500.00	$15,000.00	$27,000.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$0.00
CCTV Inspections											
Routine Inspections	0.2	200	25	4	160	$50.00	$8,000.00	2	$1,500.00	$15,000.00	$23,000.00
Flood Event Inspections	1	200	25	4	800	$50.00	$40,000.00	2	$1,500.00	$75,000.00	$115,000.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	0	$1,500.00	$0.00	$800.00
Total Annual O&M Cost											**$215,300.00**

Figure 1: Main Street Operation Costs

Concept 6.3 - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	16	2	1	64	$50.00	$3,200.00	0	$1,500.00	$0.00	$3,200.00
Flood Event Inspection	2	16	2	1	32	$50.00	$1,600.00	0	$1,500.00	$0.00	$1,600.00
Ditch/Culvert Cleaning											
Routine Cleaning	1	40	5	3	120	$50.00	$6,000.00	2	$1,500.00	$15,000.00	$21,000.00
Flood Event Cleaning	2	40	5	3	240	$50.00	$12,000.00	2	$1,500.00	$30,000.00	$42,000.00
Pipe System Cleaning											
Routine Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$14,998.66
CCTV Inspections											
Routine Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	0	$1,500.00	$0.00	$800.00
Total Annual O&M Cost											**$83,598.66**

Total volume excavated	4170 CY	
5-Year Dredging Volume	417 CY	**10% of the total excavated volume to be dredged every 5 years.**
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$74,993.28	
Total Annualized cost of dredging	$14,998.66	

Figure 2: Depeyster Creek Operation and Maintenance Costs

Concept 7.3 - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	16	2	3	192	$50.00	$9,600.00	0	$1,000.00	$0.00	$9,600.00
Flood Event Inspection	2	16	2	3	96	$50.00	$4,800.00	0	$1,000.00	$0.00	$4,800.00
Ditch/Culvert Cleaning											
Routine Cleaning	1	16	2	3	48	$50.00	$2,400.00	2	$1,500.00	$6,000.00	$8,400.00
Flood Event Cleaning	2	16	2	3	96	$50.00	$4,800.00	2	$1,500.00	$12,000.00	$16,800.00
Pipe System Cleaning											
Routine Cleaning	1	16	2	3	48	$50.00	$2,400.00	1	$1,000.00	$2,000.00	$4,400.00
Flood Event Cleaning	2	16	2	3	96	$50.00	$4,800.00	1	$1,000.00	$4,000.00	$8,800.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$13,250.61
CCTV Inspections											
Routine Inspections	0.2	80	10	4	64	$50.00	$3,200.00	2	$1,000.00	$4,000.00	$7,200.00
Flood Event Inspections	1	80	10	4	320	$50.00	$16,000.00	2	$1,000.00	$20,000.00	$36,000.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	0	$1,000.00	$0.00	$800.00
Total Annual O&M Cost											**$110,050.61**

Total volume excavated	3684	CY
5-Year Dredging Volume	368.4	CY
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$66,253.06	
Total Annualized cost of dredging	$13,250.61	

10% of the total excavated volume to be dredged every 5 years.

Figure 3: Carol Place Operation and Maintenance Costs

Concept 11.2 - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	40	5	1	160	$50.00	$8,000.00	0	$1,500.00	$0.00	$8,000.00
Flood Event Inspection	2	40	5	1	80	$50.00	$4,000.00	0	$1,500.00	$0.00	$4,000.00
Ditch/Culvert Cleaning											
Routine Cleaning	1	80	10	3	240	$50.00	$12,000.00	2	$1,500.00	$30,000.00	$42,000.00
Flood Event Cleaning	2	80	10	3	480	$50.00	$24,000.00	2	$1,500.00	$60,000.00	$84,000.00
Pipe System Cleaning											
Routine Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$136,678.40
CCTV Inspections											
Routine Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	0	$1,500.00	$0.00	$800.00
Total Annual O&M Cost											**$275,478.40**

Total volume excavated	38000 CY	
5-Year Dredging Volume	3800 CY	**10% of the total excavated volume to be dredged every 5 years.**
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$683,392.00	
Total Annualized cost of dredging	$136,678.40	

Figure 4: West Riser Ditch Operation and Maintenance Costs

Concept 12.1 - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	40	5	1	160	$50.00	$8,000.00	0	$1,500.00	$0.00	$8,000.00
Flood Event Inspection	2	40	5	1	80	$50.00	$4,000.00	0	$1,500.00	$0.00	$4,000.00
Ditch/Culvert Cleaning											
Routine Cleaning	1	80	10	3	240	$50.00	$12,000.00	2	$1,500.00	$30,000.00	$42,000.00
Flood Event Cleaning	2	80	10	3	480	$50.00	$24,000.00	2	$1,500.00	$60,000.00	$84,000.00
Pipe System Cleaning											
Routine Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$133,081.60
CCTV Inspections											
Routine Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	0	$1,500.00	$0.00	$800.00
Total Annual O&M Cost											**$271,881.60**

Total volume excavated	37000 CY	
5-Year Dredging Volume	3700 CY	**10% of the total excavated volume to be dredged every 5 years.**
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$665,408.00	
Total Annualized cost of dredging	$133,081.60	

Figure 5: East Riser Ditch Operation and Maintenance Costs

Concept 13.1 - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	40	5	4	640	$50.00	$32,000.00	0	$1,500.00	$0.00	$32,000.00
Flood Event Inspection	2	40	5	4	320	$50.00	$16,000.00	0	$1,500.00	$0.00	$16,000.00
Ditch/Culvert Cleaning											
Routine Cleaning	1	80	10	3	240	$50.00	$12,000.00	2	$1,500.00	$30,000.00	$42,000.00
Flood Event Cleaning	2	80	10	3	480	$50.00	$24,000.00	2	$1,500.00	$60,000.00	$84,000.00
Pipe System Cleaning											
Routine Cleaning	1	40	5	3	120	$50.00	$6,000.00	1	$1,500.00	$7,500.00	$13,500.00
Flood Event Cleaning	2	40	5	3	240	$50.00	$12,000.00	1	$1,500.00	$15,000.00	$27,000.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$208,614.40
CCTV Inspections											
Routine Inspections	0.2	200	25	4	160	$50.00	$8,000.00	2	$1,500.00	$15,000.00	$23,000.00
Flood Event Inspections	1	200	25	4	800	$50.00	$40,000.00	2	$1,500.00	$75,000.00	$115,000.00
Pump Station Inspections	1	16	2	2	32	$50.00	$1,600.00	0	$1,500.00	$0.00	$1,600.00
Total Annual O&M Cost											**$562,714.40**

Total volume excavated	58000 CY	
5-Year Dredging Volume	5800 CY	**10% of the total excavated volume to be dredged every 5 years.**
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$1,043,072.00	
Total Annualized cost of dredging	$208,614.40	

Figure 6: East Riser Ditch / Main Street Extension Operation and Maintenance Costs

Concept 13.2 - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	40	5	1	160	$50.00	$8,000.00	0	$1,500.00	$0.00	$8,000.00
Flood Event Inspection	2	40	5	1	80	$50.00	$4,000.00	0	$1,500.00	$0.00	$4,000.00
Ditch/Culvert Cleaning											
Routine Cleaning	1	80	10	3	240	$50.00	$12,000.00	2	$1,500.00	$30,000.00	$42,000.00
Flood Event Cleaning	2	80	10	3	480	$50.00	$24,000.00	2	$1,500.00	$60,000.00	$84,000.00
Pipe System Cleaning											
Routine Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$133,081.60
CCTV Inspections											
Routine Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	0	$1,500.00	$0.00	$800.00
Total Annual O&M Cost											**$271,881.60**

Total volume excavated	37000 CY	
5-Year Dredging Volume	3700 CY	**10% of the total excavated volume to be dredged every 5 years.**
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$665,408.00	
Total Annualized cost of dredging	$133,081.60	

Figure 7: Losen Slote – Park Street Operation and Maintenance Costs

Concept 13.2 Losen Slote Portion of Concept D - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost
System Inspections										
Quarterly Inspection	4	40	5	1	160	$50.00	$8,000.00	0	$1,500.00	$0.00
Flood Event Inspection	2	40	5	1	80	$50.00	$4,000.00	0	$1,500.00	$0.00
Ditch/Culvert Cleaning										
Routine Cleaning	0	80	10	3	0	$50.00	$0.00	2	$1,500.00	$0.00
Flood Event Cleaning	0	80	10	3	0	$50.00	$0.00	2	$1,500.00	$0.00
Pipe System Cleaning										
Routine Cleaning (once every two years)	0.5	10	5	2	10	$50.00	$500.00	1	$1,500.00	$3,750.00
Flood Event Cleaning (before and after a flood annully)	2	10	1.25	0	0	$50.00	$0.00	1	$1,500.00	$3,750.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00
CCTV Inspections										
Routine Inspections (once per 5 yrs)	0.2	10	1.25	2	4	$50.00	$200.00	1	$1,500.00	$375.00
Flood Event Inspections (before and after a flood annually)	2	10	1.25	2	40	$50.00	$2,000.00	1	$1,500.00	$3,750.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	1	$1,500.00	$3,000.00
Pump Station Power and Maintenance										
Total Annual O&M Cost										

Total volume excavated	0 CY	
5-Year Dredging Volume	0 CY	**10% of the total excavated volume to be dredged every 5 years.**
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$0.00	
Total Annualized cost of dredging	$0.00	

Figure 8: Losen Slote Segment of Concept D

Concept 12.1 East Riser Ditch Segment of Concept D - Annual Operation and Maintenance Costs

Action	No. of actions per year	No. of hours/staff/action	No. of days/action	No. of staff	Total staff hours	Avg. labor rate	Labor cost	No. of equipments	Unit cost of equipment/day	Equipment rental cost	Total Annual cost
System Inspections											
Quaterly Inspection	4	40	5	1	160	$50.00	$8,000.00	0	$1,500.00	$0.00	$8,000.00
Flood Event Inspection	2	40	5	1	80	$50.00	$4,000.00	0	$1,500.00	$0.00	$4,000.00
Ditch/Culvert Cleaning											
Routine Cleaning	1	20	2.5	3	60	$50.00	$3,000.00	2	$1,500.00	$7,500.00	$10,500.00
Flood Event Cleaning	2	20	2.5	3	120	$50.00	$6,000.00	2	$1,500.00	$15,000.00	$21,000.00
Pipe System Cleaning											
Routine Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Cleaning	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Ditch Dredging	0	0	0	0	0	$0.00	$0.00	0	$0.00	$0.00	$72,662.55
CCTV Inspections											
Routine Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Flood Event Inspections	0	0	0	0	0	$50.00	$0.00	0	$1,500.00	$0.00	$0.00
Pump Station Inspections	1	16	2	1	16	$50.00	$800.00	0	$1,500.00	$0.00	$800.00
Pump Station Power and Maintenance											$360,000.00
Total Annual O&M Cost											**$476,962.55**

East Riser Ditch Length (Tide Gate to US of HW 80)=	20100	**ft**
East Riser Ditch Length (Tide Gate to Moonachie Ave)=	4300	**ft**
Ratio	0.21	
Assumed Dredging Volumes		
Total volume excavated	20202	CY
5-Year Dredging Volume	2020.2	CY
Unit Cost of Dredging per CY	$9.84	
Unit cost of T & D per CY	$170.00	
Total unit cost of Dredging per CY	$179.84	
Total Cost of Dredging (every 5 years)	$363,312.77	
Total Annualized cost of dredging	$72,662.55	

10% of the total excavated volume to be dredged every 5 years.

Figure 9: East Riser Ditch of Concept D

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