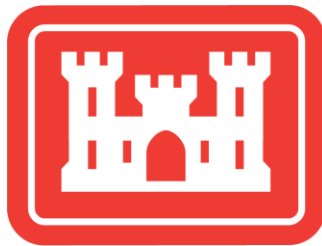


HUDSON RIVER HABITAT RESTORATION

**ECOSYSTEM RESTORATION
FINAL INTEGRATED FEASIBILITY REPORT AND
ENVIRONMENTAL ASSESSMENT**

Appendix E: Cost Engineering



**U.S. ARMY CORPS OF ENGINEERS
NEW YORK DISTRICT**
November 2020

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Attachment A – MII Reports

Attachment B – Cost and Schedule Risk Analysis

Attachment C – Cost Certification (FY20 PL)

Attachment D – Updated Cost Certification (FY21 PL)

Acronyms and Abbreviations

ALT	Alternative
AOP	Aquatic Organism Passage
ARA	Abbreviated Risk Analysis
CSRA	Cost Schedule Risk Analysis
HRHR	Hudson River Habitat Restoration
MCACES	Micro-Computer Aided Cost Estimating System
OMRR&R	Operation, Maintenance, Repair, Replacement, and Rehabilitation
PED	Pre-construction Engineering and Design
USACE	United States Army Corps of Engineer

Chapter 1: Introduction

This Appendix presents cost estimates that have been assembled for proposed restoration at the final array of sites evaluated as part of the Hudson River Habitat Restoration (HRHR) Ecosystem Restoration Feasibility Study. This includes both first costs for the alternatives phase and revised costs for the five project alternatives that were chosen to be progressed as recommended plans. A site-specific discussion regarding cost, schedule and risk is included within this appendix. What follows is a discussion regarding the methodology used to develop the first cost estimate package for each of the six sites and the revised costs for the five recommended and optimized plans.

The original 6 sites and restoration type included (Table 1-1):

- Binnen Kill: Mosaic Habitat – Wetlands and Side Channels; Wetland restoration and invasive species management
- Schodack Island – Mosaic Habitat: Wetlands and Side Channels; Wetland restoration and invasive species management
- Henry Hudson Park – Shoreline Restoration; Wetland Restoration and shoreline stabilization
- Charles Rider Park – Shoreline Restoration; Wetland Restoration and shoreline stabilization
- Moodna Creek – Aquatic Organism Passage; Dam Removal, Dam Breaching/Notching, Fishway, Fish Ladder
- Rondout Creek – Aquatic Organism Passage; Dam Removal, Dam Breaching/Notching, Fishway, Fish Ladder

Table 1-1: Alternatives Cost Estimates (FY2019 Price Level)

Site	Alt	Sub-Total Project Cost	Monitoring & Adaptive Management Costs	Project Total First Cost ¹	Average Annual Economic Cost ²	Total OMRR&R ³
Binnen Kill	North - 1	\$27,710,994	\$1,217,560	\$28,928,554	\$1,233,669	\$118,211
	North - 2	\$34,181,905	\$1,537,356	\$35,719,261	\$1,534,710	\$148,049
	North - 3	\$26,217,075	\$1,179,806	\$27,396,881	\$1,167,621	\$111,326
	North - 4	\$33,689,273	\$1,504,379	\$35,193,652	\$1,512,712	\$145,896
	South - 1	\$19,376,614	\$742,325	\$20,118,939	\$853,720	\$77,552
	South - 2	\$21,404,501	\$732,445	\$22,136,946	\$945,843	\$85,556
Schodack Island	North - 1	\$12,976,252	\$481,323	\$13,457,575	\$568,677	\$45,836
	North - 2	\$19,088,519	\$168,278	\$19,256,797	\$822,106	73,638
	South - 1	\$7,494,791	\$341,039	\$7,835,830	\$323,161	\$21,062
	South - 2	\$9,547,175	\$168,278	\$9,715,453	\$405,123	\$30,278
	South Pocket Wetlands	\$9,011,167	\$61,455	\$9,072,622	\$376,249	\$30,727
Henry Hudson Park	1	\$8,750,137	\$123,072	\$8,873,209	\$368,870	29,783
	2	\$15,095,892	\$125,619	\$15,221,511	\$638,516	\$59,173
Charles Rider Park	1	\$3,424,283	\$161,168	\$3,585,451	\$146,099	\$9,830
Moodna Creek	AOP1 - 1 – Barrier Removal	\$1,609,785	\$85,846	\$1,695,631	\$69,227	\$5,000*
	AOP1 - 2 – Rock Ramp	\$1,766,331	\$92,363	\$1,858,694	\$75,409	\$5,000*
	AOP2 - 1 – Dam Removal	\$3,511,137	\$110,846	\$5,317,614 (\$3,621,983)	\$214,789 (\$145,562)	\$7,664
	AOP2 - 2 – Fishway	\$3,480,602	\$568,793	\$5,745,026 (\$4,049,395)	\$246,779 (\$177,552)	\$25,000*
	AOP3 - 1 – Dam Removal	\$4,107,200	\$172,730	\$9,597,544 (\$4,279,930)	\$387,122 (\$172,333)	\$9,523
	AOP3 - 2 – Dam Breach	\$3,271,685	\$403,975	\$8,993,274 (\$3,675,660)	\$363,771 (\$148,982)	\$10,000*
Rondout Creek	1 – Fishway	\$3,652,287	\$568,793	\$4,221,080	\$183,602	\$25,000*
	2 – Dam Removal	\$3,821,542	\$110,846	\$3,932,388	\$157,659	\$8,429
	3 – Dam Notching	\$4,392,403	\$242,267	\$4,634,670	\$188,411	\$12,882

- ¹ Total First Cost for Moodna AOPs 2 and 3 Alternatives include costs for barrier removal at AOP 1 (costs in parentheses represent cost for the AOP Alternative action only.)
- ² Total Average Annual Cost for AOPs 2 and 3 Alternatives include average annual cost for barrier removal at AOP 1 (costs in parentheses represent cost for the AOP Alternative action only.)
- ³ Total OMRR&R Cost: Operations and Maintenance Repair and Rehabilitation also included in Total Average Annual Cost and NOT included in Total Project Cost. Costs are 100% non-federal funds for up to 10 years after ecological success has been determined.

The costs outlined in Table 1-1 for 23 alternatives were used to identify the Tentatively Selected Plan through Cost Effectiveness and Incremental Cost Analysis (CE/ICA). Following the release of the Draft Integrated Feasibility Report and Environmental Assessment (FR/EA), two sites (Binnen Kill and Rondout Creek) were removed from the recommendation due to public comment and opposition following consultation with the non-federal sponsor. Table 1-2 presents the recommended plan alternatives that were further optimized and cost updated.

Table 1-2: Selected Alternatives Cost Estimate Packages

Cost Estimate Package	Eco-Restoration Type	Site Name and Alternative
Schodack Island	Mosaic Habitat: Wetlands and side channels; Wetland restoration and invasive species management; Creation of waterways	Schodack Island North Alternative 2
Henry Hudson Park	Shoreline Restoration: Wetland restoration and shoreline stabilization	Henry Hudson Alternative 1
Moodna Creek	Aquatic Organism Passage: Barrier removal; Dam removal; Dam breaching/notching	Moodna AOP1 Alternative 1 – Barrier Removal
		Moodna AOP2 Alternative 1 – Dam Removal
		Moodna AOP3 Alternative 2 – Dam Breach

For all sites, the following cost accounts apply:

Price Levels: Costs were presented as current year (October 2019/FY2020) dollar values without escalation.

Real Estate (Account 01): Site-specific real estate costs were developed for each component/site. Fee title and temporary easements will be acquired (no permanent easements will be acquired) per ER 1105-2-100 Sec. 3-5(b)(9) and ER 405-1-12. Real estate costs include land acquisition and incidental (i.e., appraisals, land surveys, title services, etc.) costs. Details related to the real estate costs can be found in the Real Estate Plan (Appendix I).

Cultural Resource Surveys and Mitigation (Account 18): In accordance with the National Environmental Policy Act and the National Historic Preservation Act (54 USC 306108) federal agencies are to avoid, preserve, protect, minimize or compensate for impacts to National Register of Historic Places eligible or listed sites where an undertaking will result in adverse effect to the resource. Cultural Resources mitigation costs were developed for each alternative at each site in the final array in accordance with ER 1105-2-100. Survey and mitigation estimates include archaeological investigations, architectural surveys, and data recovery. Estimates were developed using existing information and assumptions about the level of mitigation required at each site depending on the scale of the undertaking proposed in each alternative as well as the presence of historic properties and potential for buried archaeological sites within a given area, refer to the Cultural Resources Appendix for a detailed discussion of potential cultural resources impacts at each site (See Appendix G5).

All costs incurred by the government for actions associated with historic preservation, including, but not limited to, the identification and treatment of historic properties, and the mitigation of adverse effects, will be included in construction costs. These costs, not including the costs for data recovery, are cost-shared in accordance with other project costs. Data recovery refers to the intensive excavation of an archaeological site to retrieve information from the site to mitigate for adverse effects to that archaeological site. Data recovery costs are a full federal cost and are not cost-shared and are subject to a cap of 1% of the total federal project cost. Data recovery costs in excess of 1% are subject to review and a waiver in accordance with ER 1105-2-100. Based upon current estimates, data recovery costs for this project will not exceed the 1% cap.

Table 1-3: Account 18 – Cultural Resources Preservation Costs (without contingency)

Site	Account 18a: Survey and Mitigation (not Data-recovery)	Account 18b: Mitigation (Data- recovery)	Total
Schodack Island	\$175,000	\$25,000	\$200,000
Henry Hudson Park	\$50,000	\$25,000	\$75,000
Moodna Creek			
AOP 1- Utility Crossing	\$0	\$0	\$0
AOP 2 – Firth Cliff	\$150,000	\$0	\$150,000
AOP 3 – Orr’s Mill Dam	\$200,000	\$0	\$200,000
Total	\$575,000	\$50,000	\$625,000

Planning Engineering and Design (Account 30): Planning, Engineering and Design account includes costs for the Pre-construction Engineering and Design (PED) Phase. Costs were developed for each site-specific alternative including costs related to regulatory compliance, field data collection, and preparation of design plans, documentation, and specifications for all alternatives and engineering support during

construction through project completion. It includes all the in-house labor based upon work-hour requirements, material and facility costs, travel, and overhead.

Construction Management (Account 31): Costs were developed for all construction management activities from pre-award requirements through final contract closeout. This cost includes in-house labor based upon work-hour requirements, materials, facility costs, support contracts, travel, and overhead. The cost was developed based on input from the construction division in accordance with Civil Works Breakdown Structure and includes, but is not limited to, anticipated items such as the salaries of the resident engineer and staff, surveyors, inspectors, drafters, clerical, and custodial personnel; operation, maintenance, and fixed charges for transportation and for other field equipment; field supplies; construction management, general construction supervision; and project office administration, distributive cost of area office, and general overhead charged to the project. The costs in this account also includes costs for engineering support during construction.

Monitoring: Monitoring costs are required by ER 1105-2-100 Sec. 3-5.b. (8). Implementation Guidance issued August 31, 2009 for Section 2039 of Water Resource Development Act (WRDA) 2007 (as amended by Section 1161 of WRDA 2016) directs the Secretary of the Army to ensure, when conducting a feasibility study for a project (or component of a project) under the U.S. Army Corps of Engineers (USACE) ecosystem restoration mission that the decision document include a monitoring plan to measure the success of the ecosystem restoration. Monitoring the success of a restoration project can be complex as restored wetlands can take a myriad of growing seasons to reach dynamic equilibrium conditions; therefore, the initial monitoring period of five years will ensure the site is on a trajectory toward ecological success. A detailed breakdown of the monitoring efforts required for each project site is provided in the Monitoring and Adaptive Management Plan (Appendix H).

Adaptive Management: Section 2039 of WRDA 2007 directs USACE to develop an adaptive management plan for all ecosystem restoration projects. A detailed breakdown of the assumed adaptive management efforts required for each project site is provided in the Monitoring and Adaptive Management Plan (Appendix H).

Construction Contingencies: As stated in ER 1110-2-1302, the goal in contingency development is to identify the uncertainty associated with an item of work or task to an acceptable degree of confidence. Consideration must be given to the detail available at each stage of planning, design, or construction for which a cost estimate is being prepared. Contingency may vary throughout the cost estimate and could constitute a significant portion of the overall costs when data or design details are unavailable.

Final contingency development and assessment are included in the cost estimate. The contingency development and assessment for potential project and cost growth was completed using Cost Schedule Risk Analysis (CSRA). The construction contingencies developed per CSRA for each site is shown in Table 1-4.

Table 1-4: Construction Contingency Factors used for Each Recommended Site

Cost Estimate Package	Construction Contingency Factor
1. Schodack Island North Alt 2	26%
2. Henry Hudson Park Alt 1	22%
3. Moodna Creek AOP#1 (Utility Crossing) – Removal	25%
4. Moodna Creek AOP#2 (Firth Cliff Dam) – Removal	25%
5. Moodna Creek AOP#3 (Orr's Mill Dam) – Breach	25%

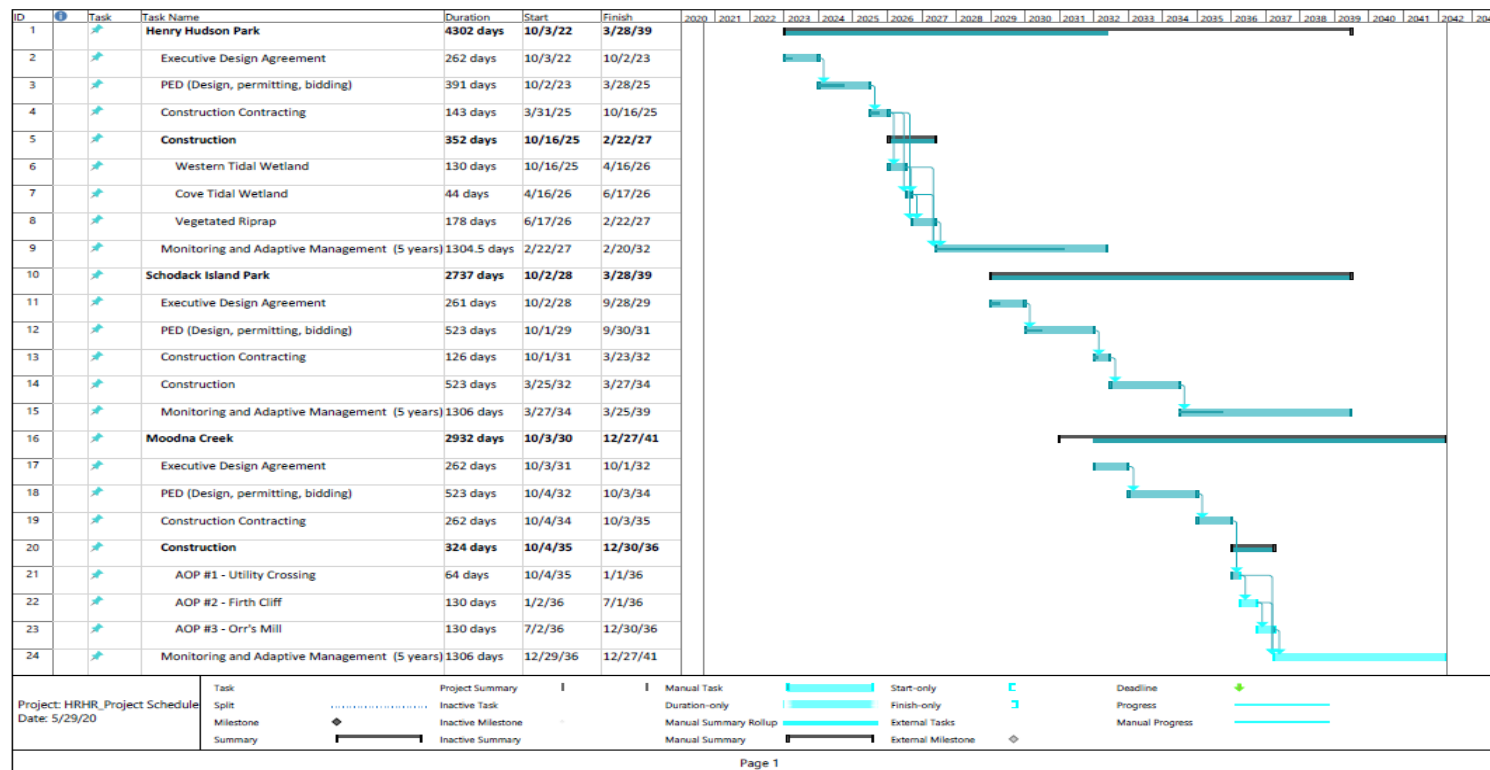
The contingency was applied to 18 - Cultural Resource Preservation, 30 - Planning, Engineering and Design (PED), and 31 - Construction Management.

Chapter 2: Construction Sequencing and Item Descriptions

2.1 Project Schedule

The remaining phases of the project from contracting through adaptive management is shown below. Included in this schedule in figure 2-1 is the sequencing of the three projects to stagger the implementation. The general construction for the recommended plan on the three projects (Schodack Island, Henry Hudson, and Moodna) is estimated to be 2 years, 16 months, and 15 months respectively.

Figure 2-1: Project Schedule



Chapter 3: Operation, Maintenance, Repair, Replacement, and Rehabilitation

Costs were developed for activities associated with operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) efforts. Operation and maintenance costs were developed for the first 10 years following the Monitoring and Adaptive Management period. Repair, replacement, and rehabilitation costs were also developed for 50 years following the Monitoring and Adaptive Management period. This account includes in-house labor based upon work-hour requirements, material and facility costs, travel, and overhead. It was determined that no OMRR&R efforts would be necessary beyond the monitoring and adaptive management period for AOP sites as the sites would generally be stabilized by the end of this period.

Table 3-1: OMRR&R Costs

Site Name and Alternative	Cost
Schodack Island North Alternative 2	\$155,210
Henry Hudson Park Alternative 1	\$190,422
Moodna Creek AOP1 Alternative 1 – Barrier Removal	\$0
Moodna Creek AOP2 Alternative 1 – Dam Removal	\$0
Moodna Creek AOP3 Alternative 2 – Dam Breach	\$0

Chapter 4: Total First Costs

The construction cost estimate was developed based on the current estimated quantities based on the optimized design plans (Engineering Appendix). The cost estimate was developed from these quantities using cost resources such as RSMeans, historical data from similar construction features, and MII Cost Libraries (Attachment A). The contingencies were developed based on input to the CSRA (template provided by the Cost Mandatory Center of Expertise, MCX, Walla Walla District) (Attachment B). These contingencies were applied to the construction cost estimate to develop the Total Project First Cost. The first cost in October 2019 / FY2020 price level for each recommended project site is presented from Table 4-1 thru Table 4-6.

Table 4-1: Schodack Island First Costs

Hudson River Habitat Restoration

Schodack Island

October 2019 Price Level

Feat. Acct.	Description	Subtotal	Cont. %	Cont \$\$	Total Cost
01	Lands & Damages	\$ 477,875	25%	\$ 119,469	\$ 597,344
	Total Lands & Damages	\$ 477,875		\$ 119,469	\$ 597,344
06	Fish & Wildlife Facilities	\$ 11,245,246	26%	\$ 2,923,764	\$ 14,169,010
	Total Fish & Wildlife Facilities	\$ 11,245,246		\$ 2,923,764	\$ 14,169,010
18	Cultural Resource	\$ 200,000	26%	\$ 52,000	\$ 252,000
	Total Cultural Resource	\$ 200,000		\$ 52,000	\$ 252,000
30	Planning, Engineering & Design	\$ 1,845,000	26%	\$ 479,700	\$ 2,324,700
31	Construction Management	\$ 1,200,000	26%	\$ 312,000	\$ 1,512,000
	Sub-Total First Cost	\$ 14,968,121		\$ 3,886,933	\$ 18,855,054
	Monitoring	\$ 242,099	26%	\$ 62,946	\$ 305,045
	Adaptive Management	\$ 546,725	26%	\$ 142,149	\$ 688,874
	Total First Cost	\$ 15,756,945		\$ 4,092,027	\$ 19,848,972

Table 4-2: Henry Hudson First Costs

Hudson River Habitat Restoration

Henry Hudson Park

October 2019 Price Level

Feat. Acct.	Description	Subtotal	Cont. %	Cont \$	Total Cost
01	Lands & Damages	\$ 271,317	25%	\$ 67,829	\$ 339,146
	Total Lands & Damages	\$ 271,317		\$ 67,829	\$ 339,146
16	Bank Stabilization	\$ 6,237,135	22%	\$ 1,372,170	\$ 7,609,305
	Total Bank Stabilization	\$ 6,237,135		\$ 1,372,170	\$ 7,609,305
18	Cultural Resource	\$ 75,000	22%	\$ 16,500	\$ 91,500
	Total Cultural Resource	\$ 75,000		\$ 16,500	\$ 91,500
30	Planning, Engineering & Design	\$ 1,490,000	22%	\$ 327,800	\$ 1,817,800
31	Construction Management	\$ 870,000	22%	\$ 191,400	\$ 1,061,400
Sub-Total First Cost		\$ 8,943,452		\$ 1,975,699	\$ 10,919,151
	Monitoring	\$ 114,067	22%	\$ 25,095	\$ 139,162
	Adaptive Management	\$ 139,124	22%	\$ 30,607	\$ 169,731
Total First Cost		\$ 9,196,643		\$ 2,031,401	\$ 11,228,044

Table 4-3: Moodna AOP 1 First Costs

Hudson River Habitat Restoration

Moodna - Utility Crossing AOP#1

October 2019 Price Level

Feat. Acct.	Description	Subtotal	Cont. %	Cont \$	Total Cost
01	Lands & Damages	\$ 258,274	30%	\$ 77,482	\$ 335,756
	Total Lands & Damages	\$ 258,274		\$ 77,482	\$ 335,756
04	Dams	\$ 525,400	25%	\$ 131,350	\$ 656,750
	Total Dams	\$ 525,400		\$ 131,350	\$ 656,750
18	Cultural Resource	\$ -	25%	\$ -	\$ -
	Total Cultural Resource	\$ -		\$ -	\$ -
30	Planning, Engineering & Design	\$ 660,000	25%	\$ 165,000	\$ 825,000
31	Construction Management	\$ 250,000	25%	\$ 62,500	\$ 312,500
Sub-Total First Cost		\$ 1,693,674		\$ 436,332	\$ 2,130,006
	Monitoring	\$ 32,008	25%	\$ 8,002	\$ 40,010
	Adaptive Management	\$ 25,799	25%	\$ 6,450	\$ 32,249
Total First Cost		\$ 1,751,481		\$ 450,784	\$ 2,202,265

Table 4-4: Moodna AOP 2 First Costs

Hudson River Habitat Restoration

Moodna - Firth Cliff Dam AOP#2

October 2019 Price Level

Feat. Acct.	Description	Subtotal	Cont. %	Cont \$	Total Cost
01	Lands & Damages	\$ 121,283	30%	\$ 36,385	\$ 157,668
	Total Lands & Damages	\$ 121,283		\$ 36,385	\$ 157,668
04	Dams	\$ 1,972,514	25%	\$ 493,129	\$ 2,465,643
	Total Dams	\$ 1,972,514		\$ 493,129	\$ 2,465,643
18	Cultural Resource	\$ 150,000	25%	\$ 37,500	\$ 187,500
	Total Cultural Resource	\$ 150,000		\$ 37,500	\$ 187,500
30	Planning, Engineering & Design	\$ 815,000	25%	\$ 203,750	\$ 1,018,750
31	Construction Management	\$ 500,000	25%	\$ 125,000	\$ 625,000
	Sub-Total First Cost	\$ 3,558,797		\$ 895,763	\$ 4,454,560
	Monitoring	\$ 32,008	25%	\$ 8,002	\$ 40,010
	Adaptive Management	\$ 25,799	25%	\$ 6,450	\$ 32,249
	Total First Cost	\$ 3,616,604		\$ 910,215	\$ 4,526,819

Table 4-5: Moodna Creek AOP 3 First Costs

Hudson River Habitat Restoration

Moodna - Orr's Mill Dam AOP#3

October 2019 Price Level

Feat. Acct.	Description	Subtotal	Cont. %	Cont \$	Total Cost
01	Lands & Damages	\$ 132,586	30%	\$ 39,776	\$ 172,362
	Total Lands & Damages	\$ 132,586		\$ 39,776	\$ 172,362
04	Dams	\$ 2,378,871	25%	\$ 594,718	\$ 2,973,589
	Total Dams	\$ 2,378,871		\$ 594,718	\$ 2,973,589
18	Cultural Resource	\$ 200,000	25%	\$ 50,000	\$ 250,000
	Total Cultural Resource	\$ 200,000		\$ 50,000	\$ 250,000
30	Planning, Engineering & Design	\$ 815,000	25%	\$ 203,750	\$ 1,018,750
31	Construction Management	\$ 500,000	25%	\$ 125,000	\$ 625,000
	Sub-Total First Cost	\$ 4,026,457		\$ 1,013,244	\$ 5,039,701
	Monitoring	\$ 192,047	25%	\$ 48,012	\$ 240,059
	Adaptive Management	\$ 45,598	25%	\$ 11,400	\$ 56,998
	Total First Cost	\$ 4,264,102		\$ 1,072,655	\$ 5,336,757

Table 4-6: Moodna Creek AOPs First Costs

Hudson River Habitat Restoration

Moodna - All Sites

October 2019 Price Level

Feat. Acct.	Description	Subtotal	Cont. %	Cont \$\$	Total Cost
01	Lands & Damages	\$ 512,143	30%	\$ 153,643	\$ 665,786
	Total Lands & Damages	\$ 512,143		\$ 153,643	\$ 665,786
04	Dams	\$ 4,876,785	25%	\$ 1,219,196	\$ 6,095,981
	Total Dams	\$ 4,876,785		\$ 1,219,196	\$ 6,095,981
18	Cultural Resource	\$ 350,000	25%	\$ 87,500	\$ 437,500
	Total Cultural Resource	\$ 350,000		\$ 87,500	\$ 437,500
30	Planning, Engineering & Design	\$ 2,290,000	25%	\$ 572,500	\$ 2,862,500
31	Construction Management	\$ 1,250,000	25%	\$ 312,500	\$ 1,562,500
	Sub-Total First Cost	\$ 9,278,928		\$ 2,345,339	\$ 11,624,267
	Monitoring	\$ 256,063	25%	\$ 64,016	\$ 320,079
	Adaptive Management	\$ 97,196	25%	\$ 24,299	\$ 121,495
	Total First Cost	\$ 9,632,187		\$ 2,433,654	\$ 12,065,841

Chapter 5: Cost Summary

The recommended plan has an estimated project first cost of \$43,142,857 which includes monitoring cost of \$764,285 and adaptive management cost of \$980,100 (October 2019/FY2020 price level). The Total Fully Funded Project cost is \$60,093,000 excluding the Monitoring and Adaptive Management cost of \$1,179,000 and \$1,512,000, respectively (for a total of \$62,784,000). The fully funded total project cost for the entire HRHR Recommended Plan is presented in Table 5-1. The costs for each recommended restoration project site are presented in Table 5-2 thru Table 5-7.

In October 2020, the cost was updated to October 2020 / FY2021 price level with the project first cost of \$44,638,000 which includes monitoring cost of \$799,000 and adaptive management cost of \$1,025,000. The Total Fully Funded Project cost is \$62,016,000 excluding the Monitoring and Adaptive Management cost of \$1,225,000 and 1,569,000, respectively (for a total of \$64,810,000). The certified FY2021 cost is presented in Attachment D.

Table 5-1: Total Project Cost Summary

PROJECT: Hudson River Habitat Restoration
PROJECT I/P2 xxxxxx
LOCATION: Hudson River, New York

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

This Estimate reflects the scope and schedule in report: Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): Effective Price Level Date:				2020 1 OCT 19					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Spent Thru: 1-Oct-19 (\$K)	TOTAL FIRST COST (\$K)	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
04	DAMS	\$4,877	\$1,219	25.0%	\$6,096	0.0%	\$4,877	\$1,219	\$6,096	\$0	\$6,096	58.1%	\$7,708	\$1,927	\$9,635
06	FISH & WILDLIFE FACILITIES	\$11,245	\$2,924	26.0%	\$14,169	0.0%	\$11,245	\$2,924	\$14,169	\$0	\$14,169	45.1%	\$16,313	\$4,242	\$20,555
16	BANK STABILIZATION	\$6,237	\$1,372	22.0%	\$7,609	0.0%	\$6,237	\$1,372	\$7,609	\$0	\$7,609	20.5%	\$7,516	\$1,653	\$9,169
18	CULTURAL RESOURCE PRESERVATION	\$625	\$156	25.0%	\$781	0.0%	\$625	\$156	\$781	\$0	\$781	44.1%	\$900	\$225	\$1,125
CONSTRUCTION ESTIMATE TOTALS:		\$22,984	\$5,671		\$28,655	0.0%	\$22,984	\$5,671	\$28,655	\$0	\$28,655	41.3%	\$32,438	\$8,047	\$40,485
01	LANDS AND DAMAGES	\$1,261	\$341	27.0%	\$1,602	0.0%	\$1,261	\$341	\$1,602	\$0	\$1,602	45.3%	\$1,830	\$498	\$2,328
30	PLANNING, ENGINEERING & DESIGN	\$5,625	\$1,380	24.5%	\$7,005	0.0%	\$5,625	\$1,380	\$7,005	\$0	\$7,005	51.1%	\$8,488	\$2,096	\$10,584
31	CONSTRUCTION MANAGEMENT	\$3,320	\$816	24.6%	\$4,136	0.0%	\$3,320	\$816	\$4,136	\$0	\$4,136	61.9%	\$5,368	\$1,328	\$6,696
PROJECT COST SUB-TOTALS:		\$33,191	\$8,208		\$41,398		\$33,191	\$8,208	\$41,398	\$0	\$41,398		\$48,124	\$11,969	\$60,093
MONITORING		\$612	\$152		\$764		\$612	\$152	\$764		\$764		\$945	\$235	\$1,179
ADAPTATIVE MANGEMENT		\$783	\$197		\$980		\$783	\$197	\$980		\$980		\$1,208	\$304	\$1,512
PROJECT COST TOTALS:		\$34,586	\$8,557		\$43,143		\$34,586	\$8,557	\$43,143		\$43,143		\$50,277	\$12,508	\$62,784

CHIEF, COST ENGINEERING, Mukesh Kumar

PROJECT MANAGER, Lisa Baron

CHIEF, REAL ESTATE, Lydia Williams

ESTIMATED TOTAL PROJECT COST: \$62,784
ESTIMATED TOTAL MONITORING COST: \$1,179
ESTIMATED TOTAL ADAPTIVE MANAGEMENT COST: \$1,512

Table 5-2: Total Project Cost Summary – Schodack Island

PROJECT: Hudson River Habitat Restoration
 LOCATION: Hudson River, New York
 This Estimate reflects the scope and schedule in report: Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
 POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Schodack Island													
06	FISH & WILDLIFE FACILITIES	\$11,245	\$2,924	26.0%	\$14,169	0.0%	\$11,245	\$2,924	\$14,169	2033Q1	45.1%	\$16,313	\$4,242	\$20,555
18	CULTURAL RESOURCE PRESERVATION	\$200	\$52	26.0%	\$252	0.0%	\$200	\$52	\$252	2031Q1	37.0%	\$278	\$72	\$350
	(a) PED Activities	\$125	\$33	26.0%	\$158	0.0%	\$125	\$33	\$158	2031Q1	37.0%	\$171	\$45	\$216
	(a2) Construction Activities	\$50	\$13	26.0%	\$63	0.0%	\$50	\$13	\$63	2033Q1	45.1%	\$73	\$19	\$91
	(b) Mitigation with Data Recovery	\$25	\$7	26.0%	\$32	0.0%	\$25	\$7	\$32	2031Q1	37.0%	\$34	\$9	\$43
CONSTRUCTION ESTIMATE TOTALS:		\$11,445	\$2,976	26.0%	\$14,421		\$11,445	\$2,976	\$14,421			\$16,592	\$4,314	\$20,905
01	LANDS AND DAMAGES	\$478	\$119	25.0%	\$597	0.0%	\$478	\$119	\$597	2033Q1	45.1%	\$693	\$173	\$867
30	PLANNING, ENGINEERING & DESIGN	\$1,845	\$480	26.0%	\$2,325	0.0%	\$1,845	\$480	\$2,325	2031Q1	51.4%	\$2,793	\$726	\$3,520
31	CONSTRUCTION MANAGEMENT	\$1,200	\$312	26.0%	\$1,512	0.0%	\$1,200	\$312	\$1,512	2033Q1	63.4%	\$1,961	\$510	\$2,471
CONTRACT COST SUB-TOTALS:		\$14,968	\$3,887		\$18,855		\$14,968	\$3,887	\$18,855			\$22,039	\$5,723	\$27,762
	Monitoring	\$242	\$63	26.0%	\$305	0.0%	\$242	\$63	\$305	2031Q3	54.3%	\$374	\$97	\$471
	Adaptive Management	\$547	\$142	26.0%	\$689	0.0%	\$547	\$142	\$689	2031Q3	54.3%	\$844	\$219	\$1,063
CONTRACT COST TOTALS:		\$15,757	\$4,092		\$19,849		\$15,757	\$4,092	\$19,849			\$23,256	\$6,040	\$29,296

Table 5-3: Total Project Cost Summary – Henry Hudson

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

This Estimate reflects the scope and schedule in report: Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19								
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	RISK BASED				ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
		COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F									
	Henry Hudson													
16	BANK STABILIZATION	\$6,237	\$1,372	22.0%	\$7,609	0.0%	\$6,237	\$1,372	\$7,609	2026Q3	20.5%	\$7,516	\$1,653	\$9,169
18	CULTURAL RESOURCE PRESERVATION	\$75	\$17	22.0%	\$92	0.0%	\$75	\$17	\$92	2025Q1	15.4%	\$87	\$19	\$106
	(a) PED Activities	\$50	\$11	22.0%	\$61	0.0%	\$50	\$11	\$61	2025Q1	15.4%	\$58	\$13	\$70
	(a2) Construction Activities	\$0	\$0	22.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(b) Mitigation with Data Recovery	\$25	\$6	22.0%	\$31	0.0%	\$25	\$6	\$31	2025Q1	15.4%	\$29	\$6	\$35
CONSTRUCTION ESTIMATE TOTALS:		\$6,312	\$1,389	22.0%	\$7,701		\$6,312	\$1,389	\$7,701			\$7,602	\$1,673	\$9,275
01	LANDS AND DAMAGES	\$271	\$68	25.0%	\$339	0.0%	\$271	\$68	\$339	2026Q3	20.5%	\$327	\$82	\$409
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$1,490	\$328	22.0%	\$1,818	0.0%	\$1,490	\$328	\$1,818	2025Q1	21.3%	\$1,807	\$398	\$2,205
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$870	\$191	22.0%	\$1,061	0.0%	\$870	\$191	\$1,061	2026Q3	28.1%	\$1,114	\$245	\$1,360
CONTRACT COST SUB-TOTALS:		\$8,943	\$1,976		\$10,919		\$8,943	\$1,976	\$10,919			\$10,851	\$2,397	\$13,248
	Monitoring	\$114	\$25	22.0%	\$139	0.0%	\$114	\$25	\$139	2031Q3	54.3%	\$176	\$39	\$215
	Adaptive Management	\$139	\$31	22.0%	\$170	0.0%	\$139	\$31	\$170	2031Q3	54.3%	\$215	\$47	\$262
CONTRACT COST TOTALS:		\$9,197	\$2,031		\$11,228		\$9,197	\$2,031	\$11,228			\$11,242	\$2,483	\$13,725

Table 5-4: Total Project Cost Summary – Moodna AOP#1

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

This Estimate reflects the scope and schedule in report: Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:				Program Year (Budget EC): Effective Price Level Date:								
		8-May-20 1-Oct-19				2020 1 OCT 19								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Moodna - Utility Crossing AOP#1													
04	DAMS	\$525	\$131	25.0%	\$657	0.0%	\$525	\$131	\$657	2036Q1	58.1%	\$830	\$208	\$1,038
18	CULTURAL RESOURCE PRESERVATION	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(a) PED Activities	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(a2) Construction Activities	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$525	\$131	25.0%	\$657		\$525	\$131	\$657			\$830	\$208	\$1,038
01	LANDS AND DAMAGES	\$258	\$77	30.0%	\$336	0.0%	\$258	\$77	\$336	2036Q1	58.1%	\$408	\$122	\$531
30	PLANNING, ENGINEERING & DESIGN PLANNING, ENGINEERING & DESIGN	\$660	\$165	25.0%	\$825	0.0%	\$660	\$165	\$825	2034Q1	69.8%	\$1,120	\$280	\$1,401
31	CONSTRUCTION MANAGEMENT Construction Management	\$250	\$63	25.0%	\$313	0.0%	\$250	\$63	\$313	2036Q1	83.4%	\$459	\$115	\$573
CONTRACT COST SUB-TOTALS:		\$1,694	\$436		\$2,130		\$1,694	\$436	\$2,130			\$2,818	\$725	\$3,543
	Monitoring	\$32	\$8	25.0%	\$40	0.0%	\$32	\$8	\$40	2031Q3	54.3%	\$49	\$12	\$62
	Adaptive Management	\$26	\$6	25.0%	\$32	0.0%	\$26	\$6	\$32	2031Q3	54.3%	\$40	\$10	\$50
CONTRACT COST TOTALS:		\$1,751	\$451		\$2,202		\$1,751	\$451	\$2,202			\$2,907	\$747	\$3,654

Table 5-5: Total Project Cost Summary – Moodna AOP#2

PROJECT: Hudson River Habitat Restoration

DISTRICT: New York District

PREPARED: 6/18/2020

LOCATION: Hudson River, New York

POC: CHIEF, COST ENGINEERING, Mukesh Kumar

This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
04	Moodna - Firth Cliff AOP #2													
18	DAMS	\$1,973	\$493	25.0%	\$2,466	0.0%	\$1,973	\$493	\$2,466	2036Q1	58.1%	\$3,118	\$779	\$3,897
	CULTURAL RESOURCE PRESERVATION	\$150	\$38	25.0%	\$188	0.0%	\$150	\$38	\$188	2034Q1	49.3%	\$228	\$57	\$285
	(a) PED Activities	\$100	\$25	25.0%	\$125	0.0%	\$100	\$25	\$125	2034Q1	49.3%	\$149	\$37	\$187
	(a2) Construction Activities	\$50	\$13	25.0%	\$63	0.0%	\$50	\$13	\$63	2036Q1	58.1%	\$79	\$20	\$99
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$2,123	\$531	25.0%	\$2,653		\$2,123	\$531	\$2,653			\$3,346	\$837	\$4,183
01	LANDS AND DAMAGES	\$121	\$36	30.0%	\$158	0.0%	\$121	\$36	\$158	2036Q1	58.1%	\$192	\$58	\$249
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$815	\$204	25.0%	\$1,019	0.0%	\$815	\$204	\$1,019	2034Q1	69.8%	\$1,384	\$346	\$1,730
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$500	\$125	25.0%	\$625	0.0%	\$500	\$125	\$625	2036Q1	83.4%	\$917	\$229	\$1,146
CONTRACT COST SUB-TOTALS:		\$3,559	\$896		\$4,455		\$3,559	\$896	\$4,455			\$5,838	\$1,469	\$7,308
	Monitoring	\$32	\$8	25.0%	\$40	0.0%	\$32	\$8	\$40	2031Q3	54.3%	\$49	\$12	\$62
	Adaptive Management	\$26	\$6	25.0%	\$32	0.0%	\$26	\$6	\$32	2031Q3	54.3%	\$40	\$10	\$50
CONTRACT COST TOTALS:		\$3,617	\$910		\$4,527		\$3,617	\$910	\$4,527			\$5,928	\$1,491	\$7,419

Table 5-6: Total Project Cost Summary – Moodna AOP#3

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:				Program Year (Budget EC): Effective Price Level Date:				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Moodna - Orr's Mill AOP #3													
04	DAMS	\$2,379	\$595	25.0%	\$2,974	0.0%	\$2,379	\$595	\$2,974	2036Q1	58.1%	\$3,760	\$940	\$4,700
18	CULTURAL RESOURCE PRESERVATION	\$200	\$50	25.0%	\$250	0.0%	\$200	\$50	\$250	2034Q1	49.3%	\$307	\$77	\$384
	(a) PED Activities	\$100	\$25	25.0%	\$125	0.0%	\$100	\$25	\$125	2034Q1	49.3%	\$149	\$37	\$187
	(a2) Construction Activities	\$100	\$25	25.0%	\$125	0.0%	\$100	\$25	\$125	2036Q1	58.1%	\$158	\$40	\$198
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$2,579	\$645	25.0%	\$3,224		\$2,579	\$645	\$3,224			\$4,067	\$1,017	\$5,084
01	LANDS AND DAMAGES	\$133	\$40	30.0%	\$172	0.0%	\$133	\$40	\$172	2036Q1	58.1%	\$210	\$63	\$272
30	PLANNING, ENGINEERING & DESIGN PLANNING, ENGINEERING & DESIGN	\$815	\$204	25.0%	\$1,019	0.0%	\$815	\$204	\$1,019	2034Q1	69.8%	\$1,384	\$346	\$1,730
31	CONSTRUCTION MANAGEMENT Construction Management	\$500	\$125	25.0%	\$625	0.0%	\$500	\$125	\$625	2036Q1	83.4%	\$917	\$229	\$1,146
CONTRACT COST SUB-TOTALS:		\$4,026	\$1,013		\$5,040		\$4,026	\$1,013	\$5,040			\$6,578	\$1,655	\$8,233
	Monitoring	\$192	\$48	25.0%	\$240	0.0%	\$192	\$48	\$240	2031Q3	54.3%	\$296	\$74	\$370
	Adaptive Management	\$46	\$11	25.0%	\$57	0.0%	\$46	\$11	\$57	2031Q3	54.3%	\$70	\$18	\$88
CONTRACT COST TOTALS:		\$4,264	\$1,073		\$5,337		\$4,264	\$1,073	\$5,337			\$6,944	\$1,747	\$8,691

Table 5-7: Total Project Cost Summary – Moodna AOPs

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

This Estimate reflects the scope and schedule in report: Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2020 1 OCT 19		Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
		COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J					
	Moodna -AOPs													
04	DAMS	\$4,877	\$1,219	25.0%	\$6,096	0.0%	\$4,877	\$1,219	\$6,096	2036Q1	58.1%	\$7,708	\$1,927	\$9,635
18	CULTURAL RESOURCE PRESERVATION	\$350	\$88	25.0%	\$438	0.0%	\$350	\$88	\$438	2034Q1	49.3%	\$536	\$134	\$670
	(a) PED Activities	\$200	\$50	25.0%	\$250	0.0%	\$200	\$50	\$250	2034Q1	49.3%	\$299	\$75	\$373
	(a2) Construction Activities	\$150	\$38	25.0%	\$188	0.0%	\$150	\$38	\$188	2036Q1	58.1%	\$237	\$59	\$296
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$5,227	\$1,307	25.0%	\$6,533		\$5,227	\$1,307	\$6,533			\$8,244	\$2,061	\$10,305
01	LANDS AND DAMAGES	\$512	\$154	30.0%	\$666	0.0%	\$512	\$154	\$666	2036Q1	58.1%	\$809	\$243	\$1,052
30	PLANNING, ENGINEERING & DESIGN PLANNING, ENGINEERING & DESIGN	\$2,290	\$573	25.0%	\$2,863	0.0%	\$2,290	\$573	\$2,863	2034Q1	69.8%	\$3,888	\$972	\$4,860
31	CONSTRUCTION MANAGEMENT Construction Management	\$1,250	\$313	25.0%	\$1,563	0.0%	\$1,250	\$313	\$1,563	2036Q1	83.4%	\$2,293	\$573	\$2,866
CONTRACT COST SUB-TOTALS:		\$9,279	\$2,345		\$11,624		\$9,279	\$2,345	\$11,624			\$15,234	\$3,849	\$19,083
	Monitoring	\$256	\$64	25.0%	\$320	0.0%	\$256	\$64	\$320	2031Q3	54.3%	\$395	\$99	\$494
	Adaptive Management	\$97	\$24	25.0%	\$121	0.0%	\$97	\$24	\$121	2031Q3	54.3%	\$150	\$37	\$187
CONTRACT COST TOTALS:		\$9,632	\$2,434		\$12,066		\$9,632	\$2,434	\$12,066			\$15,779	\$3,985	\$19,764

ATTACHMENT A
MII Report

Description	Quantity	UOM	ProjectCost
Summary			11,445,245.99
Contract Cost Sub-Totals	1.0000	EA	11,445,245.99
Account 06-03 - Wildlife Facilities and Sanctuaries	1.0000	EA	11,245,245.99
Account 18 - Cultural Resources	1.0000	EA	200,000.00

Description	Quantity	UOM	ProjectCost
Summary			6,331,019.76
Contract Cost Sub-Total	1.0000	EA	6,331,019.76
Account 16 - Bank Stabilization	1.0000	EA	6,256,019.76
Account 18 - Cultural Resources	1.0000	EA	75,000.00

Description	Quantity	UOM	ProjectCost
Summary			5,226,784.55
Contract Cost Sub-Total	1.0000	EA	5,226,784.55
Account 4 - Dams/Construction	1.0000	EA	4,876,784.55
Account 18 - Cultural Resources	1.0000	EA	350,000.00

ATTACHMENT B

Cost and Schedule Risk Analysis Report



**US Army Corps
of Engineers®**

**Hudson River Habitat Restoration
Feasibility Study
New York, NY
Project Cost and Schedule Risk Analysis Report**

Prepared by/for:

U.S. Army Corps of Engineers,
Louisville District for New York District

June 2020

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EXECUTIVE SUMMARY

Under the auspices of the US Army Corps of Engineers (USACE), New York District, this report presents the current recommendation for the project cost and schedule contingencies for the Hudson River Habitat Restoration project in Hudson River, NY. In compliance with Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated 30 June 2016, a formal risk analysis study was conducted for the development of contingency on the project cost for the Tentatively Selected Plan. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated project cost. LRL Cost Engineering performed risk analysis using the *Monte Carlo* technique, producing the aforementioned contingencies and identifying key risk drivers.

The current estimated construction cost (base case at 2020 price level) is estimated at approximately \$40 Million. This includes all remaining real estate, construction costs, utility agreements, Engineering & Design and Construction Management costs to complete the project. The base remaining schedule (sum of construction by area) is 55 months. Based on the results of the analysis, LRL recommends a contingency amount of 25% on the remaining costs, or roughly \$8m, and 26 months on the base schedule. The contingency amounts shown are based on an 80% confidence level, as per USACE Civil Works guidance.

The following table ES-1 portrays the total projected costs of the current project scope, including spent design costs. The costs shown are intended to portray the projected total cost of the project based on the feasibility report scope. The contingency amount is applied to the current costs, which are then inflated up to the assumed program year of FY20. To get the total project costs, the costs are inflated to the midpoint of construction (far right columns). The spent costs are added to this 'fully-funded' number to arrive at the estimated total project cost in bold type at the bottom of the table. Note all costs are shown in 1000s of dollars on the table below:

Table ES-1. Cost Summary

PROJECT: Hudson River Habitat Restoration PROJECT P2 xxxxxx LOCATION: Hudson River, New York										DISTRICT: New York District POC: CHIEF, COST ENGINEERING, Mukesh Kumar				PREPARED: 6/25/2020	
This Estimate reflects the scope and schedule in report: Integrated Feasibility Report & Environmental Assessment August 2020															
Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)					TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	Program Year (Budget EC): Effective Price Level Date:				Spent Thru: 1-Oct-19 (\$K)	TOTAL FIRST COST (\$K) K	INFLATED (%) L	COST (\$K) M	CNTG (%) N	FULL (\$K) O
						ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J						
04	DAMS	\$4,877	\$1,219	25.0%	\$6,096	0.0%	\$4,877	\$1,219	\$6,096	\$0	\$6,096	58.1%	\$7,708	\$1,927	\$9,635
06	FISH & WILDLIFE FACILITIES	\$11,245	\$2,924	26.0%	\$14,169	0.0%	\$11,245	\$2,924	\$14,169	\$0	\$14,169	45.1%	\$16,313	\$4,242	\$20,555
16	BANK STABILIZATION	\$6,237	\$1,372	22.0%	\$7,609	0.0%	\$6,237	\$1,372	\$7,609	\$0	\$7,609	20.5%	\$7,516	\$1,653	\$9,169
18	CULTURAL RESOURCE PRESERVATION	\$625	\$156	25.0%	\$781	0.0%	\$625	\$156	\$781	\$0	\$781	44.1%	\$900	\$225	\$1,125
CONSTRUCTION ESTIMATE TOTALS:		\$22,984	\$5,671		\$28,655	0.0%	\$22,984	\$5,671	\$28,655	\$0	\$28,655	41.3%	\$32,438	\$8,047	\$40,485
01	LANDS AND DAMAGES	\$262	\$66	25.0%	\$328	0.0%	\$262	\$66	\$328	\$0	\$328	44.9%	\$380	\$95	\$475
30	PLANNING, ENGINEERING & DESIGN	\$5,625	\$1,380	24.5%	\$7,005	0.0%	\$5,625	\$1,380	\$7,005	\$0	\$7,005	51.1%	\$8,488	\$2,096	\$10,584
31	CONSTRUCTION MANAGEMENT	\$3,320	\$816	24.6%	\$4,136	0.0%	\$3,320	\$816	\$4,136	\$0	\$4,136	61.9%	\$5,368	\$1,328	\$6,696
PROJECT COST SUB-TOTALS:		\$32,191	\$7,933		\$40,124		\$32,191	\$7,933	\$40,124	\$0	\$40,124		\$46,674	\$11,566	\$58,240
MONITORING		\$612	\$152		\$764		\$612	\$152	\$764		\$764		\$945	\$235	\$1,179
ADAPTATIVE MANGEMENT		\$782	\$197		\$979		\$782	\$197	\$979		\$979		\$1,207	\$304	\$1,510
PROJECT COST TOTALS:		\$33,586	\$8,281		\$41,867		\$33,586	\$8,281	\$41,867		\$41,867		\$48,825	\$12,104	\$60,930
CHIEF, COST ENGINEERING, Mukesh Kumar															
ESTIMATED TOTAL PROJECT COST: \$60,930															
PROJECT MANAGER, Lisa Baron															
ESTIMATED TOTAL MONITORING COST: \$1,179															
CHIEF, REAL ESTATE, Lydia Williams															
ESTIMATED TOTAL ADAPTIVE MANAGEMENT COST: \$1,510															

Notes:

- 1) Costs include the contingency determined by the CSRA, as well as escalation to the mid-point of construction.
- 2) Costs exclude O&M and Life Cycle Cost estimates.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The key cost risk drivers identified through sensitivity analysis for Henry Hudson were risks Acquisition Plan Not Established, Confidence in Scope/Quantities, and Acts of God, which together contribute an absolute value of 99 percent of the statistical cost variance. For Moodna Creek, Acquisition Plan Not Established, Confidence in Scope/Quantities, and Firth Cliff Dam/Orr's Mill Dam Removal, which contribute 93% of variance. For Schodack Island, Bid Risk, H&H Analysis not done during feasibility, and Confidence in Scope/Quantities, which contribute 82% of variance.

The key schedule risk drivers identified through sensitivity analysis for Henry Hudson were Endangered Species Possibly Present, Assumption that Timber Cribbing does not need replacement, and Historic change order or modification growth, which together contribute an absolute value of 94% of statistical schedule variance. For Moodna, they were Additional Cultural Resources Possibly Present, Endangered Species Possibly Present, and Differing Site Conditions, which together contribute an absolute value of 81 percent of the statistical schedule variance. For Schodack Island, they were Additional Cultural Resources Possibly Present, Endangered Species Possibly Present, and Differing Site Conditions, which together contribute an absolute value of 81 percent of the statistical schedule variance.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential

mitigation throughout the PED phase, and proactive monitoring and control of risk identified in this study.

MAIN REPORT

1.0 PURPOSE

Under the auspices of the US Army Corps of Engineers (USACE), Louisville District, this report presents a current recommendation for the project cost and schedule contingencies for the Hudson River Habitat Restoration project in Hudson River, NY.

2.0 BACKGROUND

The Hudson River Habitat Restoration project in Hudson River, NY ('HRHR') project consists of the construction of ecosystem restoration measures, including plantings, dam removals, grading, soil amendment, and clearing over several different geographic areas. Princeton Hydro provided the cost estimate, schedules, and supporting documents used as the basis for this exercise.

3.0 REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes, as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. Although this project is not bound by all regulations governing Civil Works projects, the process was desired to be used here due to its importance and size. The report presents the contingency results for cost risks for all project features. The risk analysis study and presentation does not include consideration for life cycle costs, though they are included in the accompanying total project cost summary sheets below the initial construction costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register. The analysis process evaluated the base case cost estimate and schedule using Crystal Ball software to conduct a *Monte Carlo* simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

The scope of this study addresses the identification of problems, needs, opportunities and potential solutions that are viable from an economic, environmental, and engineering viewpoint.

3.2 USACE Risk Analysis Process

The risk analysis process for this study follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Mandatory Center of Expertise ('Cost MCX'). The risk analysis process reflected within this report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analysis should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, this risk analysis was performed to meet the requirements and recommendations of the following documents and sources:

- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering MCX.
- Engineer Regulation (ER) 1110-2-1302 CIVIL WORKS COST ENGINEERING, dated 30 July 2016.
- Engineer Technical Letter (ETL) CONSTRUCTION COST ESTIMATING GUIDE FOR CIVIL WORKS, dated September 30, 2008.

4.0 METHODOLOGY / PROCESS

LRL Cost Engineering performed the Cost and Schedule Risk Analysis, relying on local New York District staff to provide expertise and information gathering for various project risks. The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence.

In simple terms, contingency is an amount added to an estimate to allow for items, conditions or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost MCX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is typically a risk averse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level. The selection of contingency at a particular confidence level is ultimately the decision and responsibility of the project's District and/or Division management.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results are provided in Section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative study using the Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

A PDT meeting was held for the purposes of identifying and assessing risk factors. The formal meeting conducted on May 21, 2020 included the following:

Cost and Schedule Risk Analysis

Hudson River Habitat Restoration

Risk Facilitator Taylor Canfield

Risk Register Meeting

Date: 5/21/2020

Attendance	Name	Office	Representing
Full	Lisa Baron	NAN	Project Management
Full	Mike Morgan	NAN	Technical Manager / Engineering
Full	Christie Pollack	Princeton Hydro	A/E
Full	Matthew Voisine	NAN	Planning
Full	Maya Dehner	NAN	Planning
Full	Taylor Canfield	LRL	Facilitator/Cost

This initial formal CSRA meeting focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Subsequent meetings focused primarily on risk factor assessment and quantification.

Additionally, informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were quantified using probability distributions (density functions) because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involved multiple project team disciplines and functions. However, the quantification process relied more extensively on collaboration between cost engineering and risk analysis team members with lesser inputs from other functions and disciplines. This process used an iterative approach to estimate the following elements of each risk factor:

- Maximum possible value for the risk factor
- Minimum possible value for the risk factor
- Most likely value (the statistical mode), if applicable

- Nature of the probability density function used to approximate risk factor uncertainty
- Mathematical correlations between risk factors
- Affected cost estimate and schedule elements

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT.

Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the baseline cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

5.0 PROJECT ASSUMPTIONS

The following data sources and assumptions were used in quantifying the costs associated with the HRHR project.

- a. The feasibility cost estimates for the different sites were provided in native MII format by Princeton Hydro (AE firm). The risk analysis focused on each individual contract/area as its own Forecast for cost and schedule, so the results are tailored by area rather than as an overall project contingency so that they could be applied in the TPCS summary sheets.

- b. The cost estimates were roughly class 3 cost estimates, with good detail and notes, that appeared to capture all known scope.
- c. The preliminary schedule with construction durations for each contract was used for schedule input into the CSRA for each area.
- d. The Cost MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk averse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to capture actual project costs.
- e. Only high and moderate risk level impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Low level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list”, with the exception of a few low risk items which were able to have quantifiable costs that would likely be incurred.

6.0 RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The actual risk register is provided in Appendix A. The complete risk register includes low level risks, as well as additional information regarding the nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context

of project controls.

- Communicating risk management issues.
- Providing a mechanism for eliciting feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

6.2 Cost Contingency and Sensitivity Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project cost at intervals of confidence (probability).

Table 1 provides the construction cost contingencies calculated for the P80 confidence level and rounded to the nearest thousand. The construction cost contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes only.

Project contingency was quantified as approximately \$8 Million at the P80 confidence level (25% of base estimate).

Table 1. Project Cost Contingency Summary

Base Case Estimate	\$32,004,166	
Confidence Level	Contingency Value	Contingency
0%	989,808	4%
10%	2,971,393	10%
20%	3,933,411	13%
30%	4,749,777	15%
40%	5,215,471	17%
50%	5,535,513	18%
60%	6,174,649	20%
70%	7,334,114	23%
80%	7,886,530	25%
90%	8,816,972	28%
100%	18,936,656	60%

Notes:

1) A P100 confidence level is an abstract concept for illustration only, as the nature of risk and uncertainty (specifically the presence of "unknown unknowns") makes 100% confidence a theoretical impossibility.

2) Real Estate accounts not included

3) Project First Costs shown

4) Summary of each individual contingency for each area

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to project cost.

Figure 1 presents a sensitivity analysis for cost growth risk from the high level cost risks identified in the risk register. Likewise, Figure 2 presents a sensitivity analysis for schedule growth risk from the high level schedule risks identified in the risk register.

6.3 Schedule and Contingency Risk Analysis

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall project duration at intervals of confidence (probability).

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 28 months based on the P80 level of confidence. These contingencies were used to calculate the projected residual fixed cost impact of project delays that are included in the Table 1 presentation of total cost contingency. The schedule contingencies were calculated by applying the high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks. Schedule contingency impacts presented in this analysis are based on projected residual fixed costs.

Table 2. Schedule Duration Contingency Summary

Contingency Analysis		
Base Case Schedule	55.0 Months	
Confidence Level	Contingency Value	Contingency
0%	9 Months	17%
10%	17 Months	31%
20%	19 Months	35%
30%	20 Months	38%
40%	22 Months	40%
50%	23 Months	43%
60%	25 Months	45%
70%	26 Months	48%
80%	28 Months	52%
90%	31 Months	57%
100%	63 Months	114%

Notes:

1) A P100 confidence level is an abstract concept for illustration only, as the nature of risk and uncertainty (specifically the presence of “unknown unknowns”) makes 100% confidence a theoretical impossibility.

Figure 1. Cost Sensitivity Analysis

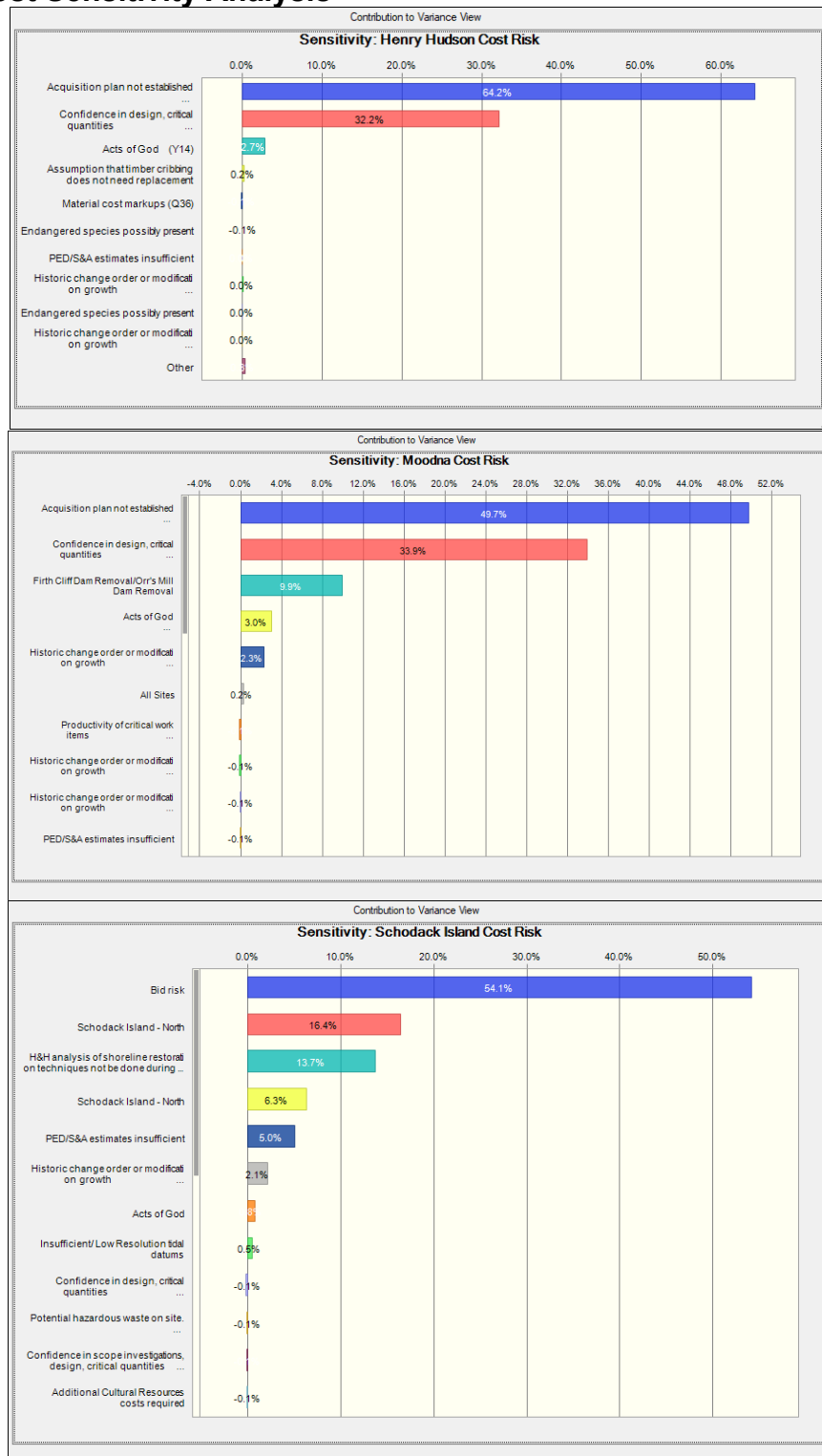
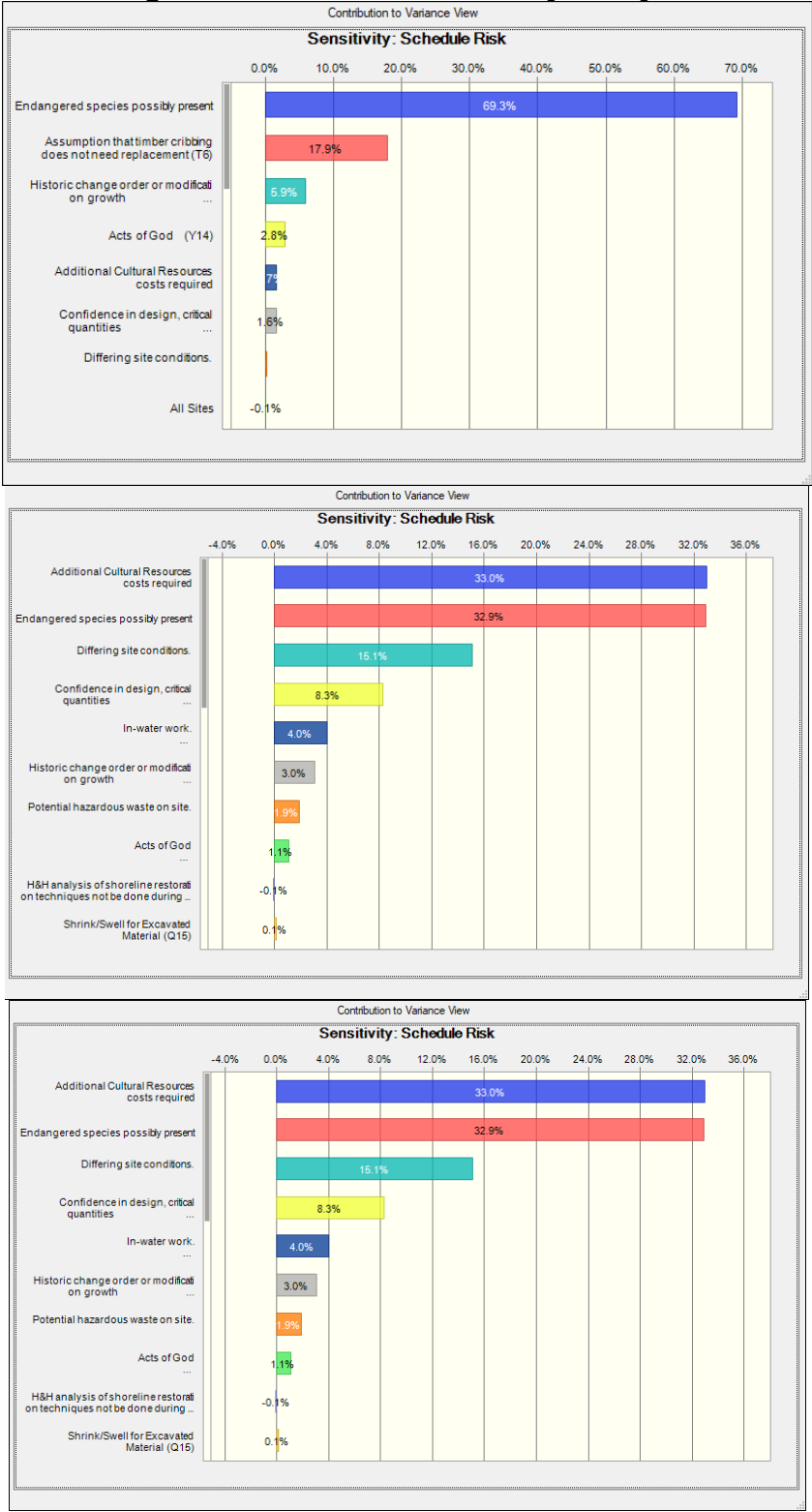


Figure 2. Schedule Sensitivity Analysis



7.0 MAJOR FINDINGS/OBSERVATIONS/RECOMMENDATIONS

This section provides a summary of significant risk analysis results that are identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted.

7.1 Major Findings/Observations

Major findings and observations of the risk analysis are listed below.

1. The key cost risk drivers identified through sensitivity analysis for Henry Hudson were risks Acquisition Plan Not Established, Confidence in Scope/Quantities, and Acts of God, which together contribute an absolute value of 99 percent of the statistical cost variance. For Moodna Creek, Acquisition Plan Not Established, Confidence in Scope/Quantities, and Firth Cliff Dam/Orr's Mill Dam Removal, which contribute 93% of variance. For Schodack Island, Bid Risk, H&H Analysis not done during feasibility, and Confidence in Scope/Quantities, which contribute 82% of variance. key cost risk drivers identified through sensitivity analysis were Risks Es-11 (Modifications), Ex-2 (Stakeholders request late changes), and Ex-5 (Escalation/Inflation Underestimation), which together contribute an absolute value of 65 percent of the statistical cost variance.
2. The key schedule risk drivers identified through sensitivity analysis for Henry Hudson were Endangered Species Possibly Present, Assumption that Timber Cribbing does not need replacement, and Historic change order or modification growth, which together contribute an absolute value of 94% of statistical schedule variance. For Moodna, they were Additional Cultural Resources Possibly Present, Endangered Species Possibly Present, and Differing Site Conditions, which together contribute an absolute value of 81 percent of the statistical schedule variance. For Schodack Island, they were Additional Cultural Resources Possibly Present, Endangered Species Possibly Present, and Differing Site Conditions, which together contribute an absolute value of 81 percent of the statistical schedule variance.

7.2 Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 4th edition, states that "project risk management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project." Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The Cost and Schedule Risk Analysis (CSRA) produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

1. Key Cost Risk Drivers: The key cost risk drivers identified through sensitivity analysis for Henry Hudson were risks Acquisition Plan Not Established, Confidence in Scope/Quantities, and Acts of God, which together contribute an absolute value of 99 percent of the statistical cost variance. For Moodna Creek, Acquisition Plan Not Established, Confidence in Scope/Quantities, and Firth Cliff Dam/Orr's Mill Dam Removal, which contribute 93% of variance. For Schodack Island, Bid Risk, H&H Analysis not done during feasibility, and Confidence in Scope/Quantities, which contribute 82% of variance.

- a) Modifications: Modifications will happen on every project. Project leadership should attempt to manage design effectively to try and ensure quality of design in order to minimize changes during construction. Once change requirements are discovered, they should be expedited so that delays do not have a domino effect on the project schedule.
- b) Confidence in Scope/Quantities: Quantity increases could result in longer durations/more cost than originally anticipated, potentially having a domino effect on other areas of work. Project leadership and the design team should attempt to manage design to ensure that no discrepancies arise between drawings. The cost engineer should also attempt to reconcile quantity takeoffs with design team in order to flush out any inconsistencies. It is recommended that both the design team and the cost engineer perform takeoffs at each submittal and reconcile any differences so that cost increases (or decreases) are tracked accordingly.

- c) Acquisition Plan Not Established: Project leadership, in conjunction with the contracting, should attempt to define the acquisition strategy of the project so that any appropriate factors or pricing information can be included in the cost estimates. Generally moving from full and open to a MATOC or Small Business contract will have adverse effects on the project cost. The earlier that the acquisition plan can be developed, the more accurate the cost estimates can be at earlier phases.
- d) Firth's Cliff/Orr's Mill Dam Removal: Currently the plan is demolish these dams while controlling the upstream and downstream water with rock filters. Additional design and modeling should be done as soon as practical to ensure that this construction method does not set the project up for delays caused by seasonal water levels or environmental windows.
- e) Bid Risk: While the construction market is generally competitive for Corps contracts, certain market conditions can lead to increased pricing provided by bidding contractors. The cost engineer and the should keep the PDT and project leadership aware of any such situations as they arise so that appropriate steps may be taken, such as creating option items in the contract to ensure that the base bid is awardable with programmed funds.
- f) H&H Analysis Not Done During Feasibility: As soon as practical a proper H&H analysis should be done so that the design of areas that would be affected can proceed with as much certainty as possible. Any delays in modeling/analysis could potentially push out design changes that could have adverse effects on cost and/or schedule.

2. Key Schedule Risk Drivers: The key schedule risk drivers identified through sensitivity analysis for Henry Hudson were Endangered Species Possibly Present, Assumption that Timber Cribbing does not need replacement, and Historic change order or modification growth, which together contribute an absolute value of 94% of statistical schedule variance. For Moodna, they were Additional Cultural Resources Possibly Present, Endangered Species Possibly Present, and Differing Site Conditions, which together contribute an absolute value of 81 percent of the statistical schedule variance. For Schodack Island, they were Additional Cultural Resources Possibly Present, Endangered Species Possibly Present, and Differing Site Conditions, which together contribute an absolute value of 81 percent of the statistical schedule variance.

- a) Endangered Species Possibly Present: Sufficient Endangered Species surveys should be performed as soon as practical over the work areas. Any findings that will impact the schedule should be incorporated immediately. If alternate work windows are available as to not impact certain species present, those should be used to minimize the delays encountered.

- b) Assumption that Timber Cribbing Does Not Need Replacement: Specific to Henry Hudson, an investigation into the state of the cribbing should be done prior to the bulk of the design effort to see if any additional reinforcement or alternate design may be required. If the weakness of the cribbing is so far gone that replacement is required, alternate means to achieve stability that would not impact the design and/or construction schedule should be pursued, such as adding additional rock.
- c) Modifications: Modifications will happen on every project. Project leadership should attempt to manage design effectively to try and ensure quality of design in order to minimize changes during construction. Once change requirements are discovered, they should be expedited so that delays do not have a domino effect on the project schedule.
- d) Additional Cultural Resources Possibly Present: Similar to the Endangered Species mitigation strategy, a sufficient cultural resources survey at each site should be performed as soon as practical, so that any impacts can be incorporated into the project schedule. The longer the surveys are pushed out into the design schedule, the more severe the impacts will be.
- e) Differing Site Conditions: While it is likely that some differing site conditions cannot be avoided, Similar to the Endangered Species mitigation strategy, a sufficient cultural resources survey at each site should be performed as soon as practical, so that any impacts can be incorporated into the project schedule. The longer the surveys are pushed out into the design schedule, the more severe the impacts will be.

3. Risk Management: Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

4. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

Appendix A

				Project Cost		Project Schedule		Other Information		\$2,941,358		\$0		\$19,819,257		3 Months		6 Months		\$29,579		\$0		\$1,487,887					
CHRP	Risk/Opportunity Event	Risk Event Description	PDT Discussions on Impact and Likelihood	Project Cost		Project Schedule		Other Information		COST		Schedule Model		Cost From Schedule		TOTAL Cost		TOTAL Schedule											
				Likelihood (C)	Impact (C)	Risk Level (C)	Likelihood (S)	Impact (S)	Risk Level (S)	Cost Variance Distribution	Schedule Variance Distribution	Affected Project Component	Low Variance (Min)	Likely (C)	High Variance (80%ile)	Low Variance (S) (Min)	Likely (S)	High Variance (S) (80%ile)	Low Variance (CS) (Min)	Likely Added Cost (CS)	High Variance (CS) (80%ile)	Event Prob (P-C)	Simulated Cost (C) + (CS)	Event Prob (P-S)	Simulated Sched (S)				
Henry Hudson Park																							\$0			\$0			
Henry Hudson Park	Assumption that timber cutting does not need replacement	Following timber cutting, needed at or before post-construction period to allow vegetation establishment, would be more reinforcement than replacement of the entire canopy, require the full portion of the schedule (1-2 years). Further research may find endangered species present which could delay project. Still hasn't been surveyed, could potentially be some endangered species.	Over a bright nightingale 75% of the cutting, the top 1-2 ft would represent 1,500 to 2,000 sq ft of cutting face that would need to be reinforced. Assume replacement of cutting would be some form of stanchion steel (assume 80 months) 1,500 sq ft.	Possible	Moderate	Low	Unclear	Moderate	Low	Triangular	Triangular	Project Cost & Schedule	\$70,000	0%	\$146,000	0 Months	0 Months	0 Months	\$0	\$0	\$49,997	100%	\$0	100%	0 Mo				
Henry Hudson Park	Endangered species possibly present	Further research may find endangered species present which could delay project. Still hasn't been surveyed, could potentially be some endangered species.	Could potentially cause delays due to seasonal restrictions. Assume worst-case schedule delay of 6 months if multiple windows had to be adhered to during construction.	Unclear	Marginal	Medium	Unclear	Marginal	Medium	Triangular	Triangular	Project Cost & Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$99,794	100%	\$0	100%	0 Mo				
Henry Hudson Park	Historic change order or modification growth	Historic change order or modification growth	Change order and modification is common in all construction project. Anticipated changes are expected to be normal. Assume 5-10% for low/high cases, and 1-3 months of critical path delay.	Unclear	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$311,857	0%	\$623,714	0 Months	0 Months	0 Months	\$0	\$0	\$49,997	100%	\$0	100%	0 Mo				
Henry Hudson Park	Disposal locations and costs for excavated materials	Disposal locations and costs for excavated materials. Further analysis could lead to cost savings (if cheaping cost site is found) or increased costs based on tipping fees. Included tipping fees in estimates, could be increased by the time of construction. Restoration actions could cause adverse impacts to National Register Eligible or listed properties that will require coordination with SHPOs, tribes and interested parties. Any adverse impacts will require mitigation.	This risk will not be modeled, as the estimate assumes the worst-case and the best case scenario of finding another area to dispose of material is unlikely.	Unclear	Marginal	Low	Unclear	Marginal	Low	NA-Not Modeled	NA-Not Modeled	Project Schedule										100%	\$0	100%	0 Mo				
AD Sites	Additional Cultural Resources costs required	Market conditions on key materials by the time of construction. Restoration actions could cause adverse impacts to National Register Eligible or listed properties that will require coordination with SHPOs, tribes and interested parties. Any adverse impacts will require mitigation.	Cultural resources amounts were provided by the team member, but are early estimates and could increase should something like native american artifacts be found. Assume a range of 25% on the provided costs and up to 1 month of delay.	Unclear	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$18,750	0 Months	0 Months	0 Months	\$0	\$0	\$16,832	100%	\$0	100%	0 Mo				
Henry Hudson Park	Confidence in design, critical quantities	Designs advanced without hydrodynamic modeling. PED phase analysis may impact design and quantities. Design and quantities are contingent on available beneficial reused quantities.	Assume site could increase by up to 15% as this is early stage planning, and potentially adding 1 month to schedule.	Possible	Moderate	Medium	Possible	Significant	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$205,570	0 Months	0 Months	0 Months	\$0	\$0	\$16,832	100%	\$0	100%	0 Mo				
Henry Hudson Park	Acquisition plan not established	Currently one contract is planned, however the ASM has not been established.	It is possible that the contract could go to a small business, if that occurs, the markups on the contract will be higher than currently estimated (i.e. all work going to Prime right now). Assume Prime HCOH will be higher (assume 8% increase, from 4% to 12%) as well as amount subcontracted (assume up to 85%), PLUS sub markups of 25%. Assume a 30% increase in sales tax, currently 4% is shown. Value shown is overall contract cost difference between sales and 8%.	Possible	Moderate	Medium	Possible	Negligible	Low	Yes-No	NA-Not Modeled	Project Cost	\$1,431,423	0%	\$1,431,423				\$0	\$0		1%	\$0	33%	0 Mo				
Henry Hudson Park	Material cost markups	Some item have price quotes referenced, but no sales tax or costbook inflation included	Sales tax has been included in material design levels for estimates, and costbook material inflation should be included for anything without a price quote. Henry Hudson could have up to 8% sales tax, currently 4% is shown. Value shown is overall contract cost difference between sales and 8%.	Very Unclear	Marginal	Medium	Very Unclear	Marginal	Medium	NA-Not Modeled	NA-Not Modeled	Project Schedule	\$116,331	0%	\$115,331				\$0	\$0		1%	\$0	100%	0 Mo				
Henry Hudson Park	Acts of God	Severe weather may impact construction schedule	Severe weather impact is a norm in every construction project however the possibility is low with marginal impact.	Possible	Marginal	Low	Possible	Marginal	Low	Yes-No	Unclear	Project Cost & Schedule	\$1,118,368	0%	\$1,118,368	12 Months	0 Months	0 Months	\$0	\$0	\$169,588	1%	\$0	1%	0 Mo				
Henry Hudson Park	Shrink/Well for Excavated Material	Shrink/Well for Excavated Material	Conversion factor of roughly 1.2 for material going from ground into trucks.	Very Unclear	Marginal	Medium	Very Unclear	Marginal	Medium	NA-Not Modeled	NA-Not Modeled	Project Schedule	\$109,927	0%	\$109,927				\$0	\$0		1%	\$0	1%	0 Mo				
Henry Hudson Park	Estimate assumptions	Estimate assumptions	Crew productivity has been conservatively adjusted in key construction elements. Should be little risk in productivity.	Unclear	Marginal	Low	Unclear	Moderate	Low	NA-Not Modeled	NA-Not Modeled	Project Cost & Schedule										100%	\$0	100%	0 Mo				
Moodya Creek																							\$0			\$0			
AD Sites	Acquisition plan not established	Currently one contract is planned for Moodya, however the ASM has not been established.	It is very possible that the Moodya contract could go to a small business, if that occurs, the markups on the contract will be higher than currently estimated (i.e. all work going to Prime right now). Assume Prime HCOH will be higher (assume 8% increase, from 4% to 12%) as well as amount subcontracted (assume up to 85%), PLUS sub markups of 25%. Assume a 30% increase in sales tax, currently 4% is shown. Value shown is overall contract cost difference between sales and 8%.	Possible	Moderate	Medium	Possible	Negligible	Low	Yes-No	NA-Not Modeled	Project Cost	\$1,119,222	0%	\$1,119,222				\$0	\$0		1%	\$0	33%	0 Mo				
AD Sites	Material cost markups	Some item have price quotes referenced, but no sales tax or costbook inflation included	Sales tax has been included in material design levels for estimates, and costbook material inflation should be included for anything without a price quote. Moodya could have up to 8% sales tax, currently 4% is shown. Value shown is overall contract cost difference between sales and 8%.	Very Unclear	Marginal	Medium	Very Unclear	Marginal	Medium	NA-Not Modeled	NA-Not Modeled	Project Schedule	\$91,848	0%	\$91,848				\$0	\$0		1%	\$0	100%	0 Mo				
AD Sites	Acts of God	Severe weather may impact construction schedule	Severe weather impact is a norm in every construction project however the possibility is low with marginal impact.	Unclear	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$2,438,392	0%	\$2,438,392	0 Months	0 Months	0 Months	\$0	\$0	\$91,033	1%	\$0	1%	0 Mo				
AD Sites	Confidence in design, critical quantities	Designs advanced without hydrodynamic modeling. PED phase analysis may impact design and quantities. Design and quantities are contingent on available beneficial reused quantities.	Assume site could increase by up to 15%, adding 1.2 months to duration.	Unclear	Marginal	Medium	Unclear	Marginal	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$731,918	0 Months	0 Months	0 Months	\$0	\$0	\$16,907	100%	\$0	100%	0 Mo				
AD Sites	Historic change order or modification growth	Historic change order or modification growth	Change order and modification is common in all construction project. Anticipated changes are expected to be normal. Assume 5-10% for low/high cases.	Unclear	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$24,839	0%	\$487,878	1 Months	0 Months	0 Months	\$13,005	\$0	\$26,010	100%	\$0	100%	0 Mo				
AD Sites	Endangered species possibly present	Further research may find endangered species present which could delay project. Still hasn't been surveyed, could potentially be some endangered species.	Could potentially cause delays due to seasonal restrictions. Assume worst-case schedule delay of 3 months if multiple windows had to be adhered to during construction.	Unclear	Marginal	Medium	Unclear	Marginal	Medium	Triangular	Triangular	Project Cost & Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$39,014	100%	\$0	100%	0 Mo				
AD Sites	Potential hazardous waste on site	If HTRW is identified during PED, sponsors will take remedial action and thus causing delay in construction start.	If HTRW is identified during PED, sponsors will take remedial action prior to initiation of restoration, and thus causing delay in construction start. Assume 3 month worst case and 25% chance of occurrence.	Possible	Marginal	Low	Possible	Moderate	Medium	NA-Not Modeled	Triangular	Project Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$39,014	25%	\$0	25%	0 Mo				
AD Sites	Additional Cultural Resources costs required	Market conditions on key materials by the time of construction. Restoration actions could cause adverse impacts to National Register Eligible or listed properties that will require coordination with SHPOs, tribes and interested parties. Any adverse impacts will require mitigation.	Cultural resources amounts were provided by the team member, but are early estimates and could increase should something like native american artifacts be found. Assume a range of 25% on the provided costs and up to 3 months of delay.	Unclear	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$87,500	0 Months	0 Months	0 Months	\$0	\$0	\$39,014	100%	\$0	100%	0 Mo				
Fish Camp Dam Removal/OTR's MB Dam Removal	Offering site conditions.	Means and methods of dam removal	Current scope of removal is use a rock filter to block sediment from the work area (i.e. no cofferdams). Conversations with local officials had instructed us assume that in the wet removal should not be assumed for environmental reasons. As such, it's possible that a rock filter will not be sufficient in terms of water control to allow the full removal of the dam and will need a more expensive method to control the water. Assume a potential doubling of the cost of the current assumption for both dam sites as a worst case scenario, as well as a double profit share.	Unclear	Marginal	Medium	Unclear	Marginal	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$433,173	0 Months	0 Months	0 Months	\$0	\$0	\$23,207	100%	\$0	100%	0 Mo				
Fish Camp Dam Removal/OTR's MB Dam Removal	In-water work.	In-water work could reduce the productivity of placement and thus increase schedule.	In-water work requires placement of project elements during cooler seasons (spring), the water is not deep, this will likely increase the project schedule marginally.	Possible	Marginal	Low	Possible	Marginal	Low	NA-Not Modeled	Triangular	Project Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$11,804	100%	\$0	100%	0 Mo				
Fish Camp Dam Removal/OTR's MB Dam Removal	Detailed H&M analysis of Dam	Impacts of dam removal on sediment mobilization and downstream bank erosion may be underestimated, impacting implementation costs.	The current project is located at a site with sufficient stability, thus the presence of soft silty sediment is unlikely and no impact to cost and schedule is foreseen.	Unclear	High/Low	Low	Unclear	High/Low	Low	NA-Not Modeled	NA-Not Modeled	NA-Not Modeled				0 Months	0 Months	0 Months	\$0	\$0		100%	\$0	100%	0 Mo				
Schodack Island - North																							\$0			\$0			
Schodack Island - North	Design development stage, complete or preliminary	Design development stage is currently preliminary and it is possible that planned areas of restoration need to be adjusted.	PED schedule delay/quantity adjustment. Site is characterized by restoration of fragmented areas. The accuracy of these areas is questionable. While the variation in actual restored acreage is not expected to change significantly, the actual areas might. Assume a potential delay in the PED schedule of maybe 3 months with a 10% increase in cost for PED construction and restoration.	Unclear	Moderate	Medium	Unclear	Marginal	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$1,124,525	0 Months	0 Months	0 Months	\$0	\$0	\$99,962	100%	\$0	100%	0 Mo				
Schodack Island - North	Endangered species possibly present	Further research may find endangered species present which could delay project. Still hasn't been surveyed, could potentially be some endangered species.	Could potentially cause delays due to seasonal restrictions. Assume worst-case schedule delay of 6 months if multiple windows had to be adhered to during construction.	Unclear	Marginal	Medium	Unclear	Marginal	Medium	NA-Not Modeled	Triangular	Project Cost & Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$179,524	100%	\$0	100%	0 Mo				
Schodack Island - North	N&H analysis of shoreline restoration techniques not done during the feasibility stage	N&H analysis of shoreline restoration techniques not done during the feasibility stage	Assessments about best shoreline restoration techniques may not be accurate, impacting implementation costs. May change the measures selected, currently assumed middle of the road in terms of resiliency of measures. Assume a range of 5% to 10% construction cost in case measures are affected and need to be substituted.	Possible	Moderate	Medium	Possible	Moderate	Medium	Triangular	Triangular	Project Schedule	\$592,262	0%	\$1,124,525	0 Months	0 Months	0 Months	\$0	\$0	\$169,975	100%	\$0	100%	0 Mo				
Schodack Island - North	Insufficient Low Resolution tidal datums	Site conditions could differ than the designed assumptions. This will be mitigated during PED to reduce cost and schedule impact.	Reported short term observations of water level may not have sufficient coverage to accurately define critical tide datums. Similar to H&M analysis risk, could affect the excavation volume. The excavating/bulking portion of this area is over 80%, so even a 10% increase in excavation volume would result in a \$300,000 increase.	Unclear	Marginal	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$300,000	0 Months	0 Months	0 Months	\$0	\$0	\$99,962	100%	\$0	100%	0 Mo				
Schodack Island - North	Productivity of critical work items	Coordination with resources and availability of parties at proper time can impact critical work items.	Coordination with resources and availability of parties is needed for the type of work. However no impact to the cost is foreseen but will result in marginal schedule impact. Assume a 2 month delay at worst.	Possible	Marginal	Low	Possible	Marginal	Low	NA-Not Modeled	Triangular	Project Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$169,975	100%	\$0	100%	0 Mo				
Schodack Island - North	PED/ISA estimates insufficient	PED/ISA has been estimated on a percentage basis.	PED for this contract is only estimated at 10% - potential this could increase up to the other average levels of 20% based on other N&H projects estimates.	Possible	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Schedule	\$5	0%	\$686,311				\$0	\$0		10%	\$0	10%	0 Mo				
Schodack Island - North	Material cost markups	Some item have price quotes referenced, but no sales tax or costbook inflation included	Sales tax has been included in material design levels for estimates, and costbook material inflation should be included for anything without a price quote. Schodack could have up to 8% sales tax, currently 4% is shown. Value shown is overall contract cost difference between sales and 8%.	Very Unclear	Marginal	Medium	Very Unclear	Marginal	Medium	Triangular	Triangular	Project Schedule	\$212,581	0%	\$212,581				\$0	\$0		100%	\$0	100%	0 Mo				
Schodack Island - North	Confidence in scope investigations, design, critical quantities	No additional borings, soil sampling or testing will be obtained to develop the conceptual plan. Additional geotechnical investigation will be included in the future phases.	Assume site could increase by up to 10% as this is early stage planning, and potentially adding 1 month to schedule due to typos increase.	Possible	Moderate	Medium	Possible	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$1,686,787	0 Months	0 Months	0 Months	\$0	\$0	\$119,949	100%	\$0	100%	0 Mo				
Schodack Island - North	Known and unknown utility impacts	Only Preliminary data was used in the current design.	Utility surveys are needed during PED. However ecosystem restoration sites typically do not have a high density of utilities. Assume maybe 1 month of delays while utilities are incorporated into layout/site plans if needed at all.	Possible	Marginal	Low	Possible	Moderate	Medium	NA-Not Modeled	NA-Not Modeled	Project Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$29,987	100%	\$0	100%	0 Mo				
Schodack Island - North	Potential hazardous waste on site	If HTRW is identified during PED, sponsors will take remedial action and thus causing delay in construction start.	If HTRW is identified during PED, sponsors will take remedial action prior to initiation of restoration, and thus causing delay in construction start. Assume 3 month worst case and 25% chance of occurrence.	Possible	Marginal	Low	Possible	Moderate	Medium	NA-Not Modeled	Triangular	Project Schedule				0 Months	0 Months	0 Months	\$0	\$0	\$99,962	25%	\$0	25%	0 Mo				
Schodack Island - North	Historic change order or modification growth	Historic change order or modification growth	Change order and modification is common in all construction project. Anticipated changes are expected to be normal. Assume 5-10% for low/high cases, and a delay of 2-4 months for the 2 year duration.	Unclear	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$592,262	0%	\$1,124,525	0 Months	0 Months	0 Months	\$59,975	\$0	\$119,949	100%	\$0	100%	0 Mo				
Schodack Island - North	Bid risk	Construction market conditions/COVID may lead to higher bids	Included due to uncertainty surrounding bidding climate. Assume range of 10% lower to 20% higher	Unclear	Moderate	Medium	Unclear	Moderate	Medium	Triangular	Triangular	Project Schedule	\$1,124,525	0%	\$1,249,049				\$0	\$0		100%	\$0	100%	0 Mo				
Schodack Island - North	Acts of God	Severe weather may impact construction schedule	Severe weather impact is a norm in every construction project however the possibility is low with marginal impact. Assume 1% chance of occurrence with 50% impact to construction.	Possible	Moderate	Medium	Possible	Moderate	Medium	Triangular	Triangular	Project Cost & Schedule	\$5	0%	\$1,822,823	0 Months	0 Months	0 Months	\$0	\$0	\$169,848	1%	\$0	1%	0 Mo				
END																													

ATTACHMENT C
Cost MCX Certification

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 396168

NAN – Hudson River Habitat Restoration Feasibility Study

The Hudson River Habitat Restoration Feasibility Study, as presented by New York District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of July 14, 2020, the Cost MCX certifies the estimated total project cost:

FY20 Project First Cost: \$43,143,000
Fully Funded Amount: \$62,784,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through the period of Federal Participation.



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Michael P. Jacobs, PE, CCE
Chief, Cost Engineering MCX
Walla Walla District

****** TOTAL PROJECT COST SUMMARY ******

Printed:7/14/2020
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PROJECT: Hudson River Habitat Restoration
PROJECT # P2 396168
LOCATION: Hudson River, New York

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Spent Thru: 1-Oct-19 (\$K)	TOTAL FIRST COST (\$K)	INFLATEC (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
04	DAMS	\$4,877	\$1,219	25.0%	\$6,096	0.0%	\$4,877	\$1,219	\$6,096	\$0	\$6,096	58.1%	\$7,708	\$1,927	\$9,635
06	FISH & WILDLIFE FACILITIES	\$11,245	\$2,924	26.0%	\$14,169	0.0%	\$11,245	\$2,924	\$14,169	\$0	\$14,169	45.1%	\$16,313	\$4,242	\$20,555
16	BANK STABILIZATION	\$6,237	\$1,372	22.0%	\$7,609	0.0%	\$6,237	\$1,372	\$7,609	\$0	\$7,609	20.5%	\$7,516	\$1,653	\$9,169
18	CULTURAL RESOURCE PRESERVATION	\$625	\$156	25.0%	\$781	0.0%	\$625	\$156	\$781	\$0	\$781	44.1%	\$900	\$225	\$1,125
	CONSTRUCTION ESTIMATE TOTALS:	\$22,984	\$5,671		\$28,655	0.0%	\$22,984	\$5,671	\$28,655	\$0	\$28,655	41.3%	\$32,438	\$8,047	\$40,485
01	LANDS AND DAMAGES	\$1,261	\$341	27.0%	\$1,602	0.0%	\$1,261	\$341	\$1,602	\$0	\$1,602	45.3%	\$1,830	\$498	\$2,328
30	PLANNING, ENGINEERING & DESIGN	\$5,625	\$1,380	24.5%	\$7,005	0.0%	\$5,625	\$1,380	\$7,005	\$0	\$7,005	51.1%	\$8,488	\$2,096	\$10,584
31	CONSTRUCTION MANAGEMENT	\$3,320	\$816	24.6%	\$4,136	0.0%	\$3,320	\$816	\$4,136	\$0	\$4,136	61.9%	\$5,368	\$1,328	\$6,696
	PROJECT COST SUB-TOTALS:	\$33,191	\$8,208		\$41,398		\$33,191	\$8,208	\$41,398	\$0	\$41,398		\$48,124	\$11,969	\$60,093
	MONITORING	\$612	\$152		\$764		\$612	\$152	\$764		\$764		\$945	\$235	\$1,179
	ADAPTATIVE MANGEMENT	\$783	\$197		\$980		\$783	\$197	\$980		\$980		\$1,208	\$304	\$1,512
	PROJECT COST TOTALS:	\$34,586	\$8,557		\$43,143		\$34,586	\$8,557	\$43,143		\$43,143		\$50,277	\$12,508	\$62,784

CHIEF, COST ENGINEERING, Mukesh Kumar

PROJECT MANAGER, Lisa Baron

CHIEF, REAL ESTATE, Lydia Williams

ESTIMATED TOTAL PROJECT COST: \$62,784
ESTIMATED TOTAL MONTIORING COST: \$1,179
MATED TOTAL ADAPTIVE MANAGEMENT COST: \$1,512

**** TOTAL PROJECT COST SUMMARY ****

Printed:7/14/2020
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**** CONTRACT COST SUMMARY ****

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19								
		RISK BASEC												
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
16	Henry Hudson													
	BANK STABILIZATION	\$6,237	\$1,372	22.0%	\$7,609	0.0%	\$6,237	\$1,372	\$7,609	2026Q3	20.5%	\$7,516	\$1,653	\$9,169
18	CULTURAL RESOURCE PRESERVATION	\$75	\$17	22.0%	\$92	0.0%	\$75	\$17	\$92	2025Q1	15.4%	\$87	\$19	\$106
	(a) PED Activities	\$50	\$11	22.0%	\$61	0.0%	\$50	\$11	\$61	2025Q1	15.4%	\$58	\$13	\$70
	(a2) Construction Activities	\$0	\$0	22.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(b) Mitigation with Data Recovery	\$25	\$6	22.0%	\$31	0.0%	\$25	\$6	\$31	2025Q1	15.4%	\$29	\$6	\$35
	CONSTRUCTION ESTIMATE TOTALS:	\$6,312	\$1,389	22.0%	\$7,701		\$6,312	\$1,389	\$7,701			\$7,602	\$1,673	\$9,275
01	LANDS AND DAMAGES	\$271	\$68	25.0%	\$339	0.0%	\$271	\$68	\$339	2026Q3	20.5%	\$327	\$82	\$409
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$1,490	\$328	22.0%	\$1,818	0.0%	\$1,490	\$328	\$1,818	2025Q1	21.3%	\$1,807	\$398	\$2,205
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$870	\$191	22.0%	\$1,061	0.0%	\$870	\$191	\$1,061	2026Q3	28.1%	\$1,114	\$245	\$1,360
	CONTRACT COST SUB-TOTALS:	\$8,943	\$1,976		\$10,919		\$8,943	\$1,976	\$10,919			\$10,851	\$2,397	\$13,248
	Monitoring	\$114	\$25	22.0%	\$139	0.0%	\$114	\$25	\$139	2031Q3	54.3%	\$176	\$39	\$215
	Adaptive Management	\$139	\$31	22.0%	\$170	0.0%	\$139	\$31	\$170	2031Q3	54.3%	\$215	\$47	\$262
	CONTRACT COST TOTALS:	\$9,197	\$2,031		\$11,228		\$9,197	\$2,031	\$11,228			\$11,242	\$2,483	\$13,725

**** TOTAL PROJECT COST SUMMARY ****

Printed:7/14/2020
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**** CONTRACT COST SUMMARY ****

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2020 1 OCT 19						
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
Moodna -AOPs														
04	DAMS	\$4,877	\$1,219	25.0%	\$6,096	0.0%	\$4,877	\$1,219	\$6,096	2036Q1	58.1%	\$7,708	\$1,927	\$9,635
18	CULTURAL RESOURCE PRESERVATION	\$350	\$88	25.0%	\$438	0.0%	\$350	\$88	\$438	2034Q1	49.3%	\$536	\$134	\$670
	(a) PED Activities	\$200	\$50	25.0%	\$250	0.0%	\$200	\$50	\$250	2034Q1	49.3%	\$299	\$75	\$373
	(a2) Construction Activities	\$150	\$38	25.0%	\$188	0.0%	\$150	\$38	\$188	2036Q1	58.1%	\$237	\$59	\$296
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$5,227	\$1,307	25.0%	\$6,533		\$5,227	\$1,307	\$6,533			\$8,244	\$2,061	\$10,305
01	LANDS AND DAMAGES	\$512	\$154	30.0%	\$666	0.0%	\$512	\$154	\$666	2036Q1	58.1%	\$809	\$243	\$1,052
30	PLANNING, ENGINEERING & DESIGN	\$2,290	\$573	25.0%	\$2,863	0.0%	\$2,290	\$573	\$2,863	2034Q1	69.8%	\$3,888	\$972	\$4,860
31	CONSTRUCTION MANAGEMENT	\$1,250	\$313	25.0%	\$1,563	0.0%	\$1,250	\$313	\$1,563	2036Q1	83.4%	\$2,293	\$573	\$2,866
CONTRACT COST SUB-TOTALS:		\$9,279	\$2,345		\$11,624		\$9,279	\$2,345	\$11,624			\$15,234	\$3,849	\$19,083
	Monitoring	\$256	\$64	25.0%	\$320	0.0%	\$256	\$64	\$320	2031Q3	54.3%	\$395	\$99	\$494
	Adaptive Management	\$97	\$24	25.0%	\$121	0.0%	\$97	\$24	\$121	2031Q3	54.3%	\$150	\$37	\$187
CONTRACT COST TOTALS:		\$9,632	\$2,434		\$12,066		\$9,632	\$2,434	\$12,066			\$15,779	\$3,985	\$19,764

****** TOTAL PROJECT COST SUMMARY ******

Printed:7/14/2020
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****** CONTRACT COST SUMMARY ******

PROJECT: Hudson River Habitat Restoration

LOCATION: Hudson River, New York

This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District

POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2020 Effective Price Level Date: 1 OCT 19								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
04	Moodna - Utility Crossing AOP#1													
18	DAMS	\$525	\$131	25.0%	\$657	0.0%	\$525	\$131	\$657	2036Q1	58.1%	\$830	\$208	\$1,038
	CULTURAL RESOURCE PRESERVATION	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(a) PED Activities	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(a2) Construction Activities	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	CONSTRUCTION ESTIMATE TOTALS:	\$525	\$131	25.0%	\$657		\$525	\$131	\$657			\$830	\$208	\$1,038
01	LANDS AND DAMAGES	\$258	\$77	30.0%	\$336	0.0%	\$258	\$77	\$336	2036Q1	58.1%	\$408	\$122	\$531
30	PLANNING, ENGINEERING & DESIGN	\$660	\$165	25.0%	\$825	0.0%	\$660	\$165	\$825	2034Q1	69.8%	\$1,120	\$280	\$1,401
31	CONSTRUCTION MANAGEMENT	\$250	\$63	25.0%	\$313	0.0%	\$250	\$63	\$313	2036Q1	83.4%	\$459	\$115	\$573
	Construction Management													
	CONTRACT COST SUB-TOTALS:	\$1,694	\$436		\$2,130		\$1,694	\$436	\$2,130			\$2,818	\$725	\$3,543
	Monitoring	\$32	\$8	25.0%	\$40	0.0%	\$32	\$8	\$40	2031Q3	54.3%	\$49	\$12	\$62
	Adaptive Management	\$26	\$6	25.0%	\$32	0.0%	\$26	\$6	\$32	2031Q3	54.3%	\$40	\$10	\$50
	CONTRACT COST TOTALS:	\$1,751	\$451		\$2,202		\$1,751	\$451	\$2,202			\$2,907	\$747	\$3,654

****** TOTAL PROJECT COST SUMMARY ******

Printed:7/14/2020
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****** CONTRACT COST SUMMARY ******

PROJECT: Hudson River Habitat Restoration

DISTRICT: New York District

PREPARED: 6/18/2020

LOCATION: Hudson River, New York

POC: CHIEF, COST ENGINEERING, Mukesh Kumar

This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2020 1 OCT 19						
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
Moodna - Firth Cliff AOP #2														
04	DAMS	\$1,973	\$493	25.0%	\$2,466	0.0%	\$1,973	\$493	\$2,466	2036Q1	58.1%	\$3,118	\$779	\$3,897
18	CULTURAL RESOURCE PRESERVATION	\$150	\$38	25.0%	\$188	0.0%	\$150	\$38	\$188	2034Q1	49.3%	\$228	\$57	\$285
	(a) PED Activities	\$100	\$25	25.0%	\$125	0.0%	\$100	\$25	\$125	2034Q1	49.3%	\$149	\$37	\$187
	(a2) Construction Activities	\$50	\$13	25.0%	\$63	0.0%	\$50	\$13	\$63	2036Q1	58.1%	\$79	\$20	\$99
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	CONSTRUCTION ESTIMATE TOTALS:	\$2,123	\$531	25.0%	\$2,653		\$2,123	\$531	\$2,653			\$3,346	\$837	\$4,183
01	LANDS AND DAMAGES	\$121	\$36	30.0%	\$158	0.0%	\$121	\$36	\$158	2036Q1	58.1%	\$192	\$58	\$249
30	PLANNING, ENGINEERING & DESIGN	\$815	\$204	25.0%	\$1,019	0.0%	\$815	\$204	\$1,019	2034Q1	69.8%	\$1,384	\$346	\$1,730
31	CONSTRUCTION MANAGEMENT	\$500	\$125	25.0%	\$625	0.0%	\$500	\$125	\$625	2036Q1	83.4%	\$917	\$229	\$1,146
	Construction Management													
	CONTRACT COST SUB-TOTALS:	\$3,559	\$896		\$4,455		\$3,559	\$896	\$4,455			\$5,838	\$1,469	\$7,308
	Monitoring	\$32	\$8	25.0%	\$40	0.0%	\$32	\$8	\$40	2031Q3	54.3%	\$49	\$12	\$62
	Adaptive Management	\$26	\$6	25.0%	\$32	0.0%	\$26	\$6	\$32	2031Q3	54.3%	\$40	\$10	\$50
	CONTRACT COST TOTALS:	\$3,617	\$910		\$4,527		\$3,617	\$910	\$4,527			\$5,928	\$1,491	\$7,419

****** TOTAL PROJECT COST SUMMARY ******

Printed:7/14/2020
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****** CONTRACT COST SUMMARY ******

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2020 1 OCT 19		FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
04	Moodna - Orr's Mill AOP #3													
18	DAMS	\$2,379	\$595	25.0%	\$2,974	0.0%	\$2,379	\$595	\$2,974	2036Q1	58.1%	\$3,760	\$940	\$4,700
	CULTURAL RESOURCE PRESERVATION	\$200	\$50	25.0%	\$250	0.0%	\$200	\$50	\$250	2034Q1	49.3%	\$307	\$77	\$384
	(a) PED Activities	\$100	\$25	25.0%	\$125	0.0%	\$100	\$25	\$125	2034Q1	49.3%	\$149	\$37	\$187
	(a2) Construction Activities	\$100	\$25	25.0%	\$125	0.0%	\$100	\$25	\$125	2036Q1	58.1%	\$158	\$40	\$198
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	CONSTRUCTION ESTIMATE TOTALS:	\$2,579	\$645	25.0%	\$3,224		\$2,579	\$645	\$3,224			\$4,067	\$1,017	\$5,084
01	LANDS AND DAMAGES	\$133	\$40	30.0%	\$172	0.0%	\$133	\$40	\$172	2036Q1	58.1%	\$210	\$63	\$272
30	PLANNING, ENGINEERING & DESIGN	\$815	\$204	25.0%	\$1,019	0.0%	\$815	\$204	\$1,019	2034Q1	69.8%	\$1,384	\$346	\$1,730
31	CONSTRUCTION MANAGEMENT	\$500	\$125	25.0%	\$625	0.0%	\$500	\$125	\$625	2036Q1	83.4%	\$917	\$229	\$1,146
	Construction Management													
	CONTRACT COST SUB-TOTALS:	\$4,026	\$1,013		\$5,040		\$4,026	\$1,013	\$5,040			\$6,578	\$1,655	\$8,233
	Monitoring	\$192	\$48	25.0%	\$240	0.0%	\$192	\$48	\$240	2031Q3	54.3%	\$296	\$74	\$370
	Adaptive Management	\$46	\$11	25.0%	\$57	0.0%	\$46	\$11	\$57	2031Q3	54.3%	\$70	\$18	\$88
	CONTRACT COST TOTALS:	\$4,264	\$1,073		\$5,337		\$4,264	\$1,073	\$5,337			\$6,944	\$1,747	\$8,691

****** TOTAL PROJECT COST SUMMARY ******

Printed:7/14/2020
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****** CONTRACT COST SUMMARY ******

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 6/18/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2020 1 OCT 19		FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
06	Schodack Island													
	FISH & WILDLIFE FACILITIES	\$11,245	\$2,924	26.0%	\$14,169	0.0%	\$11,245	\$2,924	\$14,169	2033Q1	45.1%	\$16,313	\$4,242	\$20,555
18	CULTURAL RESOURCE PRESERVATION	\$200	\$52	26.0%	\$252	0.0%	\$200	\$52	\$252	2031Q1	37.0%	\$278	\$72	\$350
	(a) PED Activities	\$125	\$33	26.0%	\$158	0.0%	\$125	\$33	\$158	2031Q1	37.0%	\$171	\$45	\$216
	(a2) Construction Activities	\$50	\$13	26.0%	\$63	0.0%	\$50	\$13	\$63	2033Q1	45.1%	\$73	\$19	\$91
	(b) Mitigation with Data Recovery	\$25	\$7	26.0%	\$32	0.0%	\$25	\$7	\$32	2031Q1	37.0%	\$34	\$9	\$43
	CONSTRUCTION ESTIMATE TOTALS:	\$11,445	\$2,976	26.0%	\$14,421		\$11,445	\$2,976	\$14,421			\$16,592	\$4,314	\$20,905
01	LANDS AND DAMAGES	\$478	\$119	25.0%	\$597	0.0%	\$478	\$119	\$597	2033Q1	45.1%	\$693	\$173	\$867
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$1,845	\$480	26.0%	\$2,325	0.0%	\$1,845	\$480	\$2,325	2031Q1	51.4%	\$2,793	\$726	\$3,520
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$1,200	\$312	26.0%	\$1,512	0.0%	\$1,200	\$312	\$1,512	2033Q1	63.4%	\$1,961	\$510	\$2,471
	CONTRACT COST SUB-TOTALS:	\$14,968	\$3,887		\$18,855		\$14,968	\$3,887	\$18,855			\$22,039	\$5,723	\$27,762
	Monitoring	\$242	\$63	26.0%	\$305	0.0%	\$242	\$63	\$305	2031Q3	54.3%	\$374	\$97	\$471
	Adaptive Management	\$547	\$142	26.0%	\$689	0.0%	\$547	\$142	\$689	2031Q3	54.3%	\$844	\$219	\$1,063
	CONTRACT COST TOTALS:	\$15,757	\$4,092		\$19,849		\$15,757	\$4,092	\$19,849			\$23,256	\$6,040	\$29,296

ATTACHMENT D
Cost MCX Recertification- FY21

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 396168

NAN – Hudson River Habitat Restoration Feasibility Study

The Hudson River Habitat Restoration Feasibility Study, as presented by New York District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of October 13, 2020, the Cost MCX certifies the estimated total project cost:

FY21 Project First Cost: \$44,638,000

Fully Funded Amount: \$64,810,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through the period of Federal Participation.



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**FOR: Michael P. Jacobs, PE, CCE
Chief, Cost Engineering MCX
Walla Walla District**

****** TOTAL PROJECT COST SUMMARY ******

Printed:10/14/2020
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PROJECT: Hudson River Habitat Restoration
PROJECT NP2 xxxxxx
LOCATION: Hudson River, New York

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: #####

This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2021 Effective Price Level Date: 1 OCT 20									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Spent Thru: 1-Oct-19 (\$K)	TOTAL FIRST COST (\$K) K	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
04	DAMS	\$4,877	\$1,219	25.0%	\$6,096	3.0%	\$5,023	\$1,256	\$6,278	\$0	\$6,278	57.9%	\$7,932	\$1,983	\$9,915
06	FISH & WILDLIFE FACILITIES	\$11,245	\$2,924	26.0%	\$14,169	3.0%	\$11,582	\$3,011	\$14,593	\$0	\$14,593	44.9%	\$16,787	\$4,365	\$21,151
16	BANK STABILIZATION	\$6,237	\$1,372	22.0%	\$7,609	3.0%	\$6,424	\$1,413	\$7,837	\$0	\$7,837	20.4%	\$7,734	\$1,701	\$9,435
18	CULTURAL RESOURCE PRESERVATION	\$625	\$156	25.0%	\$781	3.0%	\$644	\$161	\$804	\$0	\$804	44.0%	\$926	\$232	\$1,158
CONSTRUCTION ESTIMATE TOTALS:		\$22,984	\$5,671		\$28,655	3.0%	\$23,672	\$5,841	\$29,512	\$0	\$29,512	41.2%	\$33,379	\$8,281	\$41,659
01	LANDS AND DAMAGES	\$1,261	\$341	27.0%	\$1,602	3.0%	\$1,299	\$351	\$1,650	\$0	\$1,650	45.9%	\$1,893	\$515	\$2,407
30	PLANNING, ENGINEERING & DESIGN	\$5,625	\$1,380	24.5%	\$7,005	4.6%	\$5,882	\$1,443	\$7,326	\$0	\$7,326	50.0%	\$8,815	\$2,177	\$10,992
31	CONSTRUCTION MANAGEMENT	\$3,320	\$816	24.6%	\$4,136	4.6%	\$3,472	\$853	\$4,325	\$0	\$4,325	60.9%	\$5,578	\$1,380	\$6,958
PROJECT COST SUB-TOTALS:		\$33,191	\$8,208		\$41,398		\$34,325	\$8,488	\$42,813	\$0	\$42,813		\$49,664	\$12,352	\$62,016
MONITORING		\$612	\$152		\$764		\$640	\$159	\$799		\$799		\$981	\$244	\$1,225
ADAPTATIVE MANGEMENT		\$783	\$197		\$980		\$819	\$206	\$1,025		\$1,025		\$1,254	\$316	\$1,569
PROJECT COST TOTALS:		\$34,586	\$8,557		\$43,143		\$35,784	\$8,853	\$44,638		\$44,638		\$51,899	\$12,911	\$64,810

CHIEF, COST ENGINEERING, Mukesh Kumar

PROJECT MANAGER, Lisa Baron

CHIEF, REAL ESTATE, Lydia Williams

ESTIMATED TOTAL PROJECT COST: \$64,810
ESTIMATED TOTAL MONTIORING COST: \$1,225
ESTIMATED TOTAL ADAPTIVE MANAGEMENT COST: \$1,569

****** TOTAL PROJECT COST SUMMARY ******

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****** CONTRACT COST SUMMARY ******

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report;

Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 10/7/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2021 Effective Price Level Date: 1 OCT 20								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
16	Henry Hudson													
	BANK STABILIZATION	\$6,237	\$1,372	22.0%	\$7,609	3.0%	\$6,424	\$1,413	\$7,837	2027Q3	20.4%	\$7,734	\$1,701	\$9,435
18	CULTURAL RESOURCE PRESERVATION	\$75	\$17	22.0%	\$92	3.0%	\$77	\$17	\$94	2026Q1	15.3%	\$89	\$20	\$109
	(a) PED Activities	\$50	\$11	22.0%	\$61	3.0%	\$51	\$11	\$63	2026Q1	15.3%	\$59	\$13	\$72
	(a2) Construction Activities	\$0	\$0	22.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(b) Mitigation with Data Recovery	\$25	\$6	22.0%	\$31	3.0%	\$26	\$6	\$31	2026Q1	15.3%	\$30	\$7	\$36
CONSTRUCTION ESTIMATE TOTALS:		\$6,312	\$1,389	22.0%	\$7,701		\$6,501	\$1,430	\$7,931			\$7,823	\$1,721	\$9,544
01	LANDS AND DAMAGES	\$271	\$68	25.0%	\$339	3.0%	\$279	\$70	\$349	2028Q3	23.9%	\$346	\$87	\$433
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$1,490	\$328	22.0%	\$1,818	4.6%	\$1,558	\$343	\$1,901	2026Q1	20.3%	\$1,874	\$412	\$2,287
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$870	\$191	22.0%	\$1,061	4.6%	\$910	\$200	\$1,110	2027Q3	27.1%	\$1,156	\$254	\$1,410
CONTRACT COST SUB-TOTALS:		\$8,943	\$1,976		\$10,919		\$9,248	\$2,043	\$11,291			\$11,199	\$2,474	\$13,674
Monitoring		\$114	\$25	22.0%	\$139	4.6%	\$119	\$26	\$146	2032Q3	53.3%	\$183	\$40	\$223
Adaptive Management		\$139	\$31	22.0%	\$170	4.6%	\$145	\$32	\$177	2032Q3	53.3%	\$223	\$49	\$272
CONTRACT COST TOTALS:		\$9,197	\$2,031		\$11,228		\$9,513	\$2,101	\$11,614			\$11,605	\$2,564	\$14,169

**** TOTAL PROJECT COST SUMMARY ****

Printed:10/14/2020
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**** CONTRACT COST SUMMARY ****

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report;

Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 10/7/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2021 Effective Price Level Date: 1 OCT 20								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
Moodna -AOPs														
04	DAMS	\$4,877	\$1,219	25.0%	\$6,096	3.0%	\$5,023	\$1,256	\$6,278	2037Q1	57.9%	\$7,932	\$1,983	\$9,915
18	CULTURAL RESOURCE PRESERVATION	\$350	\$88	25.0%	\$438	3.0%	\$360	\$90	\$451	2035Q1	49.1%	\$551	\$138	\$689
	(a) PED Activities	\$200	\$50	25.0%	\$250	3.0%	\$206	\$51	\$257	2035Q1	49.1%	\$307	\$77	\$384
	(a2) Construction Activities	\$150	\$38	25.0%	\$188	3.0%	\$154	\$39	\$193	2037Q1	57.9%	\$244	\$61	\$305
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$5,227	\$1,307	25.0%	\$6,533		\$5,383	\$1,346	\$6,729			\$8,483	\$2,121	\$10,604
01	LANDS AND DAMAGES	\$512	\$154	30.0%	\$666	3.0%	\$527	\$158	\$686	2037Q1	57.9%	\$833	\$250	\$1,083
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$2,290	\$573	25.0%	\$2,863	4.6%	\$2,395	\$599	\$2,993	2035Q1	68.7%	\$4,039	\$1,010	\$5,049
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$1,250	\$313	25.0%	\$1,563	4.6%	\$1,307	\$327	\$1,634	2037Q1	82.4%	\$2,384	\$596	\$2,980
CONTRACT COST SUB-TOTALS:		\$9,279	\$2,345		\$11,624		\$9,613	\$2,430	\$12,042			\$15,740	\$3,977	\$19,716
	Monitoring	\$256	\$64	25.0%	\$320	4.6%	\$268	\$67	\$335	2032Q3	53.3%	\$410	\$103	\$513
	Adaptive Management	\$97	\$24	25.0%	\$121	4.6%	\$102	\$25	\$127	2032Q2	51.8%	\$154	\$39	\$193
CONTRACT COST TOTALS:		\$9,632	\$2,434		\$12,066		\$9,982	\$2,522	\$12,504			\$16,304	\$4,118	\$20,422

**** TOTAL PROJECT COST SUMMARY ****

Printed:10/14/2020
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**** CONTRACT COST SUMMARY ****

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report;

Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 10/7/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 8-May-20 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2021 Effective Price Level Date: 1 OCT 20								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
04	Moodna - Utility Crossing AOP#1													
18	DAMS	\$525	\$131	25.0%	\$657	3.0%	\$541	\$135	\$676	2037Q1	57.9%	\$855	\$214	\$1,068
	CULTURAL RESOURCE PRESERVATION	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(a) PED Activities	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(a2) Construction Activities	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
	CONSTRUCTION ESTIMATE TOTALS:	\$525	\$131	25.0%	\$657		\$541	\$135	\$676			\$855	\$214	\$1,068
01	LANDS AND DAMAGES	\$258	\$77	30.0%	\$336	3.0%	\$266	\$80	\$346	2037Q1	57.9%	\$420	\$126	\$546
30	PLANNING, ENGINEERING & DESIGN	\$660	\$165	25.0%	\$825	4.6%	\$690	\$173	\$863	2035Q1	68.7%	\$1,164	\$291	\$1,455
31	CONSTRUCTION MANAGEMENT	\$250	\$63	25.0%	\$313	4.6%	\$261	\$65	\$327	2037Q1	82.4%	\$477	\$119	\$596
	Construction Management													
	CONTRACT COST SUB-TOTALS:	\$1,694	\$436		\$2,130		\$1,759	\$453	\$2,212			\$2,916	\$750	\$3,666
	Monitoring	\$32	\$8	25.0%	\$40	4.6%	\$33	\$8	\$42	2032Q3	53.3%	\$51	\$13	\$64
	Adaptive Management	\$26	\$6	25.0%	\$32	4.6%	\$27	\$7	\$34	2032Q2	51.8%	\$41	\$10	\$51
	CONTRACT COST TOTALS:	\$1,751	\$451		\$2,202		\$1,819	\$468	\$2,287			\$3,008	\$773	\$3,781

**** TOTAL PROJECT COST SUMMARY ****

Printed:10/14/2020
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**** CONTRACT COST SUMMARY ****

PROJECT: Hudson River Habitat Restoration

DISTRICT: New York District

PREPARED: 10/7/2020

LOCATION: Hudson River, New York

POC: CHIEF, COST ENGINEERING, Mukesh Kumar

This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2021 1 OCT 20						
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
Moodna - Firth Cliff AOP #2														
04	DAMS	\$1,973	\$493	25.0%	\$2,466	3.0%	\$2,032	\$508	\$2,539	2037Q1	57.9%	\$3,208	\$802	\$4,010
18	CULTURAL RESOURCE PRESERVATION	\$150	\$38	25.0%	\$188	3.0%	\$154	\$39	\$193	2035Q1	49.1%	\$235	\$59	\$294
	(a) PED Activities	\$100	\$25	25.0%	\$125	3.0%	\$103	\$26	\$129	2035Q1	49.1%	\$154	\$38	\$192
	(a2) Construction Activities	\$50	\$13	25.0%	\$63	3.0%	\$51	\$13	\$64	2037Q1	57.9%	\$81	\$20	\$102
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$2,123	\$531	25.0%	\$2,653		\$2,186	\$547	\$2,733			\$3,443	\$861	\$4,304
01	LANDS AND DAMAGES	\$121	\$36	30.0%	\$158	3.0%	\$125	\$37	\$162	2037Q1	57.9%	\$197	\$59	\$256
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$815	\$204	25.0%	\$1,019	4.6%	\$852	\$213	\$1,065	2035Q1	68.7%	\$1,438	\$359	\$1,797
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$500	\$125	25.0%	\$625	4.6%	\$523	\$131	\$654	2037Q1	82.4%	\$954	\$238	\$1,192
CONTRACT COST SUB-TOTALS:		\$3,559	\$896		\$4,455		\$3,686	\$928	\$4,614			\$6,032	\$1,518	\$7,549
	Monitoring	\$32	\$8	25.0%	\$40	4.6%	\$33	\$8	\$42	2032Q3	53.3%	\$51	\$13	\$64
	Adaptive Management	\$26	\$6	25.0%	\$32	4.6%	\$27	\$7	\$34	2032Q2	51.8%	\$41	\$10	\$51
CONTRACT COST TOTALS:		\$3,617	\$910		\$4,527		\$3,747	\$943	\$4,689			\$6,124	\$1,541	\$7,665

****** TOTAL PROJECT COST SUMMARY ******

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****** CONTRACT COST SUMMARY ******

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
This Estimate reflects the scope and schedule in report; Integrated Feasibility Report & Environmental Assessment August 2020

DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 10/7/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2021 1 OCT 20		FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
Moodna - Orr's Mill AOP #3														
04	DAMS	\$2,379	\$595	25.0%	\$2,974	3.0%	\$2,450	\$613	\$3,063	2037Q1	57.9%	\$3,869	\$967	\$4,836
18	CULTURAL RESOURCE PRESERVATION	\$200	\$50	25.0%	\$250	3.0%	\$206	\$51	\$257	2035Q1	49.1%	\$316	\$79	\$395
	(a) PED Activities	\$100	\$25	25.0%	\$125	3.0%	\$103	\$26	\$129	2035Q1	49.1%	\$154	\$38	\$192
	(a2) Construction Activities	\$100	\$25	25.0%	\$125	3.0%	\$103	\$26	\$129	2037Q1	57.9%	\$163	\$41	\$203
	(b) Mitigation with Data Recovery	\$0	\$0	25.0%	\$0	0.0%	\$0	\$0	\$0	0	0.0%	\$0	\$0	\$0
CONSTRUCTION ESTIMATE TOTALS:		\$2,579	\$645	25.0%	\$3,224		\$2,656	\$664	\$3,320			\$4,185	\$1,046	\$5,232
01	LANDS AND DAMAGES	\$133	\$40	30.0%	\$172	3.0%	\$137	\$41	\$178	2037Q1	57.9%	\$216	\$65	\$280
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$815	\$204	25.0%	\$1,019	4.6%	\$852	\$213	\$1,065	2035Q1	68.7%	\$1,438	\$359	\$1,797
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$500	\$125	25.0%	\$625	4.6%	\$523	\$131	\$654	2037Q1	82.4%	\$954	\$238	\$1,192
CONTRACT COST SUB-TOTALS:		\$4,026	\$1,013		\$5,040		\$4,168	\$1,049	\$5,216			\$6,792	\$1,709	\$8,501
	Monitoring	\$192	\$48	25.0%	\$240	4.6%	\$201	\$50	\$251	2032Q3	53.3%	\$308	\$77	\$385
	Adaptive Management	\$46	\$11	25.0%	\$57	4.6%	\$48	\$12	\$60	2032Q2	51.8%	\$72	\$18	\$90
CONTRACT COST TOTALS:		\$4,264	\$1,073		\$5,337		\$4,416	\$1,111	\$5,527			\$7,173	\$1,804	\$8,976

****** TOTAL PROJECT COST SUMMARY ******

Printed:10/14/2020
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****** CONTRACT COST SUMMARY ******

PROJECT: Hudson River Habitat Restoration
LOCATION: Hudson River, New York
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DISTRICT: New York District
POC: CHIEF, COST ENGINEERING, Mukesh Kumar

PREPARED: 10/7/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: Effective Price Level:		8-May-20 1-Oct-19		Program Year (Budget EC): Effective Price Level Date:		2021 1 OCT 20		FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J	Mid-Point Date P	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
Schodack Island														
06	FISH & WILDLIFE FACILITIES	\$11,245	\$2,924	26.0%	\$14,169	3.0%	\$11,582	\$3,011	\$14,593	2034Q1	44.9%	\$16,787	\$4,365	\$21,151
18	CULTURAL RESOURCE PRESERVATION	\$200	\$52	26.0%	\$252	3.0%	\$206	\$54	\$260	2032Q1	36.9%	\$286	\$74	\$360
	(a) PED Activities	\$125	\$33	26.0%	\$158	3.0%	\$129	\$33	\$162	2032Q1	36.9%	\$176	\$46	\$222
	(a2) Construction Activities	\$50	\$13	26.0%	\$63	3.0%	\$51	\$13	\$65	2034Q1	44.9%	\$75	\$19	\$94
	(b) Mitigation with Data Recovery	\$25	\$7	26.0%	\$32	3.0%	\$26	\$7	\$32	2032Q1	36.9%	\$35	\$9	\$44
	CONSTRUCTION ESTIMATE TOTALS:	\$11,445	\$2,976	26.0%	\$14,421		\$11,788	\$3,065	\$14,852			\$17,073	\$4,439	\$21,512
01	LANDS AND DAMAGES	\$478	\$119	25.0%	\$597	3.0%	\$492	\$123	\$615	2034Q1	44.9%	\$713	\$178	\$892
30	PLANNING, ENGINEERING & DESIGN													
	PLANNING, ENGINEERING & DESIGN	\$1,845	\$480	26.0%	\$2,325	4.6%	\$1,929	\$502	\$2,431	2032Q1	50.4%	\$2,902	\$754	\$3,656
31	CONSTRUCTION MANAGEMENT													
	Construction Management	\$1,200	\$312	26.0%	\$1,512	4.6%	\$1,255	\$326	\$1,581	2034Q1	62.3%	\$2,037	\$530	\$2,567
	CONTRACT COST SUB-TOTALS:	\$14,968	\$3,887		\$18,855		\$15,464	\$4,016	\$19,480			\$22,725	\$5,901	\$28,626
	Monitoring	\$242	\$63	26.0%	\$305	4.6%	\$253	\$66	\$319	2032Q3	53.3%	\$388	\$101	\$489
	Adaptive Management	\$547	\$142	26.0%	\$689	4.6%	\$572	\$149	\$720	2032Q3	53.3%	\$876	\$228	\$1,104
	CONTRACT COST TOTALS:	\$15,757	\$4,092		\$19,849		\$16,289	\$4,230	\$20,519			\$23,989	\$6,230	\$30,219