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NORTHEASTERN NEW JERSEY

APPENDIX B – CALCULATION OF COSTS AND BENEFITS

VERSION 2022.1

CONTENTS

- Cost estimating classes
- Cost estimation methodology for projects that address coastal flooding
- Cost estimation methodology for projects that address stormwater flooding
- Cost estimation methodology for non-capital projects

ADDITIONAL ATTACHMENTS:

- Appendix B.1 Coastal cost estimation and losses avoided calculations
- Appendix B.2 Losses avoided calculation mapping
- Appendix B.3 Stormwater cost estimation calculations
- Appendix B.4 Non-physical actions cost estimation

COST ESTIMATING CLASSES

As described in the AACE International's Total Cost Management Framework for cost engineering, the class designation system defines the maturity of the estimate, considering the extent and types of input information available to the estimating process. A Class 5 estimate is based upon the lowest level of project definition and a Class 1 estimate is closest to a fully defined project.

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Estimate class	Name	Purpose	Project definition level
Class 5	Order of magnitude	Screening or feasibility	0% to 2%
Class 4	Intermediate	Concept study or feasibility	1% to 15%
Class 3	Preliminary	Budget, authorization, or control	10% to 40%
Class 2	Substantive	Control or bid/tender	30% to 70%
Class 1	Definitive	Check estimate or bid/tender	50% to 100%

Note: There are broad ranges of certainty within each cost estimate class. Estimates generated for this planning project are at a late class 5 to early class 4. Costs can change dramatically as you progress along classes, as the concepts/goals/existing conditions are clarified. As such, the final costs may land outside of ranges provided through this effort.

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COSTS AND LOSSES AVOIDED

ESTIMATION FOR PROJECTS THAT ADDRESS COASTAL FLOODING

COST AND LOSS AVOIDANCE ESTIMATION FOR COASTAL PROJECTS

PROJECT ACTIONS INCLUDED

01 Add physical flood barriers to ease flooding and protect communities

02 Raise existing infrastructure to act as barriers and protect communities

03 Integrate flood protection into walkways & boardwalks

04 Provide flood protection at the site and building scale

05 Take action to restore the coastal environment

METHODOLOGY

- Projects are each assigned a unique Project ID (PID_*) and may comprise one or many subcomponents, called Elements, each with a unique Element ID (EID_*).
- Initial costs are based on GIS overlay of Elements, based on the length or area of the proposed improvement
- Unit costs are based on recently constructed projects and engineering guidance available from USACE
- Costs are adjusted for the region with allowance and contingency assumptions.
- Additional information about unit costs and contingency assumptions can be found in the *NENJ Coastal Cost and Losses Avoided Workbook (Appendix B.1)*.
- Each project is assigned to a “Losses Avoided Group” based on flood pathways estimated for the Sandy high water marks + 2.4 feet for 2070 sea level rise (2070 Sandy floodplain), each with a unique Group ID (GID_*). Groups can be viewed in *Appendix B.2.* Losses avoided estimated based on methodologies outlined in the Flood Impact Assessment. *Note: Each project may provide individual losses avoided for lower magnitude events, but an estimation of project-specific losses avoided is not available for lower magnitude events at this time.*

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COST DEVELOPMENT ASSUMPTIONS

CAPITAL PROJECTS THAT ADDRESS COASTAL FLOODING

Unit Costs

Unit Name	Unit Cost	Unit
Building Demolition	$6.43	SF
Building Replacement Value	Variable by Building	
Elevated Harborwalk on Existing Seawall	$5,800	LF
Elevated Harborwalk on New Seawall	$9,175	LF
Floodproofing	$120	SF
Floodwall Six Feet or Greater	$10,000	LF
Land Acquisition	$280,129	Acre
Living Shoreline	$1,200	LF
Living Shoreline Acreage	$321,543	Acre
Road Elevation	$7,000	LF
Roadway and Pedestrian Gate	$40,000	LF
Slab Demolition	$250,854	Acre
Structural Engineering Assessment	$8,682	Each
Upgrading Existing Bulkhead	$4,500	LF
Wetland Enhancement/Restoration	$160,772	Acre
Wetland Seeding	$32,154	Acre

Allowances and Contingencies**

Item	Cost Type	Percentage
Drainage	Site-Specific Allowances	15%
Public Amenity	Site-Specific Allowances	15%
Utility	Site-Specific Allowances	15%
Site Work	Site-Specific Allowances	10%
Maintenance and Protection of Traffic	Site-Specific Allowances	4%
Demolition	Site-Specific Allowances	5%
Mobilization/Demobilization	General Construction Allowances	7%
General Conditions	General Construction Allowances	15%
Contractor Overhead and Profit	General Construction Allowances	20%
Insurance and Bonding	General Construction Allowances	4%
Construction Management	Soft Cost	10%
Planning, Engineering, and Design	Soft Cost	20%
Contingency (high)	Contingency	50%

Note: Site-specific allowances, general construction allowances and soft costs are incorporated into unit costs for stormwater system improvements, restoration, and some site-specific actions.

****For additional information about how the allowances and contingencies were applied, please see the NENJ Coastal Cost and Losses Avoided Workbook.***

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COASTAL COST AND LOSSES AVOIDED

Workbook User Guide

A companion excel workbook (Appendix B.1) provides additional insight into the NENJ cost estimation process and methodology.

The excel workbook contains nine tabs:

- **Project Definition** – Defines the list of projects in each city and their associated Group IDs
- **Unit Costs** – Details the unit cost for different project components, or elements, for which cost estimates have been developed
- **Allowance Percentages** – Details the allowance and contingency cost types applied to projects in this region and how they were applied to determine the appropriate allowance and contingency factor
- **(Hidden) Allowance Scratch** – Contains notes on the application of allowances
- **Element Costs** – Estimates the baseline feature subtotal costs for each element, based on inputted quantities
- **Element Assignment** – Assigns each element to one or many projects
- **Project Subtotal** – Pivot table of data from the Element Assignment tab, used to summarize base construction costs by Project ID
- **Project Costs** – Applies Allowance Percentages to the feature subtotals to get final project costs
- **Losses Avoided by Group** – summarizes outputs from the Flood Impact Assessment, representing losses avoided for the buildings associated with each Group

COSTS AND LOSSES AVOIDED

ESTIMATION FOR PROJECTS THAT ADDRESS STORMWATER FLOODING

COST AND LOSS AVOIDANCE ESTIMATION FOR STORMWATER PROJECTS

PROJECT TYPES INCLUDED

01 Separate stormwater to safe, dedicated outfalls

02 Direct stormwater to deep storage and conveyance infrastructure

03 Improve natural drainage corridors

04 Reduce stormwater volume through stormwater management sites

METHODOLOGY

- Engineers estimated storage volumes required to manage the 5-year rainfall event over the project useful life (year 2000 baseline plus 10% increase to account for climate change) by drainage area by city using NJDEP models as the baseline
- Volumes were calculated by municipality and split between different areas in each municipality
- Volume assumed to be managed through either storage or conveyance approaches
- Unit costs developed on a volumetric basis using costs from example projects or guidance developed for the Long-term Control Plan projects
- Costs by region calculated by distributing the volume required to be managed across the four project types, aligning with the intent of the preferred scenario
- Costs developed for individual projects in the action plan based on typical project costs and best professional judgment, aligned with costs developed by municipality on a volumetric basis

UNIT COST ASSUMPTIONS

STORMWATER SOLUTIONS

- Unit costs based on review of available cost data from:
  - Long term control plans
  - NJ water bank projects
  - Unit price schedules
  - EPA reports
  - Academic reports
  - Arcadis cost data
  - Other cost estimating resources
- Cost data adjusted to 2022 dollars based on CPI data
- Units align with quantity analysis for quick application
- Markups to be added for contingency
- *Note: unit costs are not final*

Unit Costs			
Conveyance		Unit Cost	Unit
Pump Station	$	571,279.72	acre-ft
Sewer Separation	$	1,111,111.11	acre-ft
Storage		Unit Cost	Unit
Surface Storage	$	4,957,552	acre-ft
Underground storage	$	4,718,322	acre-ft

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STORMWATER COSTS AND LOSSES AVOIDED

Workbook User Guide

A companion excel workbook (Appendix B.3) provides additional insight into the NENJ cost estimation process and methodology.

The excel workbook contains six tabs:

- **NENJ Cost Summary** – Summarizes unit costs, potential scenarios, and calculated costs and benefits for each area for all municipalities
- **NENJ Drainage Areas** – Lists the model results for managing the five-year event for all regions, includes a map of regions and municipalities
- **(Hidden) Newark** – Contains initial calculations on potential stormwater volumes to manage, before modeling was conducted
- **(Hidden) Bayonne** – Contains initial calculations on potential stormwater volumes to manage, before modeling was conducted
- **(Hidden) Jersey City** – Contains initial calculations on potential stormwater volumes to manage, before modeling was conducted
- **(Hidden) Hoboken** – Contains initial calculations on potential stormwater volumes to manage, before modeling was conducted

COSTS
ESTIMATION FOR NON-CAPITAL PROJECTS

COST DEVELOPMENT ASSUMPTIONS

NON-PHYSICAL ACTION TYPES

- Policy and governance
- Service and program development
- Outreach, education, and capacity building
- Emergency management and preparedness

METHODOLOGY

- Costs for non-physical solutions have been estimated based on level of coordination and timeframes required and have been informed by the project team's experience with similar projects.
- Assumptions by action are captured in RNJ_NENJ_Appendix B.4_Costs for Non-Physical Actions

The Action Plan and Appendix A capture losses avoided and benefits for non-capital improvements through qualitative descriptions (losses avoided and benefits not quantified)

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