REBUILD BY DESIGN HUDSON RIVER: RESIST DELAY = STORE = DISCHARGE = ALTERNATIVES ANALYSIS MATRIX (07.28.16) Dewberry Department of Environmental Protection (
Category	Criteria		ALT-1 Option 1	ALT-1 Option 2	ALT-2 Option 1	ALT-2 Option 2	ALT-3 Option 1	ALT-3 Option 2	No Action Alternative (Baseline)
Purpose and Need (P&N)		Meets P&N (Y/N)	Y	Y	Y	Y	Y	Y	N
Flood Risk Reduction	Coastal Storm Surge	Percentage of Population in Floodplain Receiving Risk Reduction (2010 Census)	98 86 85			5	0		
	Risk Reduction for Residents	Percentage of Study Area in Floodplain Receiving Flood Risk Reduction	83	82	74	73	73	72	0
	Critical Facilities NOT Receiving Coastal Flood Risk Reduction		None		One (Fire Station, 1313 Washington Street)		One (Fire Station, 1313 Washington Street)		One Hospital (308 Willow Avenue) Four Fire Stations (201 Jefferson St, 43 Madison St, 801 Clinton St, 1313 Washington St) NHSA Water Treatment Plant (1600 Adams St.)
	Potential to Adapt to Higher Coastal Flood Events		Yes						No
	Potential Runoff to be Managed by DSD Components				0				
Socioeconomics and Built Environment	Environmental Justice Populations Receiving Flood Reduction Benefits		Rainfall: 2,053 Hispanic individuals, 1,883 Minority individuals, and 968 Households below poverty level Coastal Surge: 2,785 Hispanic individuals, 2,251 Minority individuals, 309 over 75 individuals, and 520 Households below poverty						Environmental Justice communities would remain exposed to flood risks
	Public Health Benefits (acreage no longer flooding during 5 Year rainfall events)		48.1 acres with reduction in flooding severity, including 35.5 acres no longer flooding						No benefit to Public Health. Flood events will continue to represent an adverse impact to Public Health
	Possible Potential Viewshed Impacts	Residential Impacts	1 st/2nd floor of properties on N. side of 15th St from Garden St to Sinatra Dr. N, and first floor of properties along Sinatra Dr. N.1 st floor residential properties fronting 15th St from Garden to Washington and along Washington St. from 15th to 13th St.Residential properties alo Washington St. from 15th 13th St.			operties along t. from 15th to ı St.	None		
		Recreational Impacts	1600 Park ballfields, Shipyard Park, and Hudson River walkway from Weehawken Cove to Sinatra Dr. N to 11th St		k Ballfields	1600 Park Ballfields		None	
		Retail/Dining Impacts	1st floor businesses: Shops at Lincoln Harbor. 1st floor businesses along Sinatra Dr. N. and Sinatra Dr. (south) Businesses along Washington St. from 15th to 13th St.		ng Washington h to 13th St.	Businesses along Washington St. from 15th to 13th St.		None	
	Acres	f New or Improved Park Space	13.85		0CI		150		0
		Number of Parking Spaces Impacted	2	0	15	13	9	7	0
	Connectivity and Circulation	Number of Gate Closures during Storm Conditions	29	31	21	25	19	23	0
	Benefits for Resist (in millions)		\$1,448M		\$1,417M		\$1,416M		
Benefit Cost Analysis	Estimated Resist Cost (in millions)		\$440-\$482	\$451-\$492	\$201-\$224	\$212-\$232	\$189-\$210	\$200-\$225	-
	Estimated Resist Cost Contingency (in millions)		\$96-\$107	\$99-\$110	\$43-\$49	\$45-\$50	\$40-\$45	\$43-\$49	
	Total Resist Cost (in millions)		\$537-\$589	\$550-\$602	\$243-\$273	\$258-\$282	\$230-\$255	\$243-\$274	
	Resist Benefit/Cost Ratio		2.24		4.74		4.95		•
	Total Project Benefit/Cost Ratio (includes Resist and DSD)		2.:	21	3.	83	3.	94	-
	Constructability	Potential Litility Relocation (linear feet)	4 860	4 600	2 300	2 060	1 280	1 030	0
Construction / Maintenance and	Constructability	Potential Utility Crossings	87	86	69	69	64	64	0
Operations	Temporary Construction Impacts (acres)		29.4	29.3	30.1	30.2	29.8	29.9	None
	Estimated Annual Maintenance Cost (millions)		\$3.6-5.4	\$3.7-5.5	\$1.5-2.4	\$1.6-2.6	\$1.4-2.3	\$1.5-2.4	
		Number of PEC Properties Affected	49		. 45	40		40	0
Environmental	Recognized Environmental	Estimate of hazardous soils requiring off-site	43	40	10 601	10 556	19.466	49	0
	Conditions (RECs)	disposal (tons)	22,200	22,102	13,021	10,000	13,400	13,407	
		Estimate of non-hazardous soils requiring off- site disposal (tons)	128,738	128,163	118,829	118,583	118,246	118,024	0
	Freshwater Wetlands	Freshwater Wetlands Within Footprint (Square Feet)	230					0	
	Threatened and Endangered Species/ Essential Fish Habitat	Impacts to T&E and Essential Fish Habitat	Potential for minor impacts due to in-water work along waterfront. Negligible impacts from new outfalls		Negligible in-water impacts from new outfalls		Negligible in-water impacts from new outfalls		None
Impacts	State and Federal Environmental Permitting	NJDEP Flood Hazard Act (NJAC 7:13) Permit			Individu	al Permit			None
		Acreage of Floodplain Disturbance	7.54 ac Permanent 27.61 ac Temporary	7.57 ac Permanent 27.84 ac Temporary	5.81 ac Permanent 27.87 ac Temporary	5.85 ac Permanent 28.22 ac Temporary	5.76 ac Permanent 27.41 ac Temporary	5.80 ac Permanent 27.77 ac Temporary	None
		Number of Properties (by owner) Potentially Impacted (pursuant to NJAC 7:13), both Public and Private	2 properties potentially impacted (pursuant to NJAC 7:13)		5 properties potentially impacted (pursuant to NJAC 7:13)		5 properties potentially impacted (pursuant to NJAC 7:13)		None
		NJDEP Wetlands Permitting (NJAC 7:7A)	Individual Permits (for in-water work associated with bulkhead replacement)		General Permit (for proposed outfalls and work in wetlands)		General Permit (for proposed outfalls and work in wetlands)		None
		USACE Sections 10 and 404 Permitting	Individual Permit (for in-water work associated with bulkhead replacement)		Nationwide Permit (for proposed outfalls)		Nationwide Permit (for proposed outfalls)		None
	Historic Properties	Number of historic properties or districts with adverse effect	45	45	61	61	60	60	0
	Archaeological Resources	Acres of potential archaeological resources affected by the alternative	16.64	16.60	15.42	15.54	14.40	14.52	0
	Noise	Number of Noise Receptors during Construction	Schools - 4 Parks - 13 Places of Worship - 3	Schools - 4 Parks - 13 Places of Worship - 3	Schools - 0 Parks - 4 Places of Worship - 2	Schools - 0 Parks - 4 Places of Worship - 2	Schools - 0 Parks - 4 Places of Worship - 2	Schools - 0 Parks - 4 Places of Worship - 2	0

ALTERNATIVES ANALYSIS MATRIX DEFINITIONS (07.28.16)

Bewberry Department of Environmental Protection

Category	Criteria		Definition of Criteria and Metrics					
Purpose and Need (P&N)	Meets P&N		The purpose of the Project is to reduce the flood risk to flooding areas within the Study Area. The Project intends to minimize the impacts from surge and rainfall flood events on the community, including adverse impacts to public health, while providing benefits that will enhance the urban condition, recognizing the unique challenges that exist within a highly developed urban area. This criterion measures whether each alternative meets the P&N.					
Flood Risk Reduction	Coastal Storm Surge Risk Reduction for	Percentage of Population in Floodplain Receiving Risk Reduction (2010 Census)	This criterion measures the percentage of the population within the Study Area within FEMA 2015 preliminary 100-year floodplain that receives coastal storm surge flood risk reduction benefits from the Resist feature. Larger percentage of the Study Area population protected is considered better.					
	Residents	Percentage of Study Area in Floodplain Receiving Flood Risk Reduction	This criterion measures the percentage of the Study Area within the FEMA 2015 preliminary 100-year floodplain that receives coastal stor surge flood risk reduction benefits. Larger area of Study Area protected is considered better.					
	Critical Facilities NOT Receiving Coastal Flood Risk Reduction		FEMA has identified a list of critical facilities (hospitals, fire stations, police stations and facilities that store critical records). The North Hudson Sewerage Authority (NHSA) Treatment Plant is also considered a critical facility by the community. This criterion identifies critical facilities within the FEMA 2015 preliminary 100-year floodplain that would NOT receive coastal storm flood reduction benefits for each alternative. Fewer critical facilities left unprotected is considered better.					
	Potential to Adapt to Higher Coastal Flood Events		This criterion considers whether the north and south ends of the Resist feature ties into landforms which could be used to support construction of a resist barrier to handle a 500-year (0.2 percent annual chance) storm.					
	Potential Runoff to be Managed by Delay, Store, Discharge (DSD) Components		The DSD components of the project address rainfall flooding. This provides a measurement of the estimated total volume of runoff that the system is projected to be able to handle.					
	Environmental Justice Populations Receiving Flood Reduction Benefits		Federally-funded projects cannot disproportionately impact Environmental Justice communities - those that are made up primarily by low-moderate income households, minority populations, individuals over 75, and Hispanics. Instead of posing an impact, however, this project benefits these communities by reducing flood risk. This criterion provides a measurement of the estimated Environmental Justice population (based on Census data) that will receive rainfall flood risk reduction benefits from the Delay, Store, Discharge components during a 5-year rainfall event or during a 100-year coastal surge event.					
	Public Health Benefits (acreage no longer flooding during 5 Year rainfall events)		Rainfall-induced combined sewage overflows onto streets and inside buildings represents a public health risk. This criterion considers the area that currently floods during a 5-year rainfall event and compares it to the areas that 1) no longer floods and 2) may continue to flood but sees a reduction in that flooding due to the DSD features.					
Socioeconomics		Residential Impacts						
and Built Environment	Viewshed Impacts	Recreational Impacts	This criterion evaluates the changes in character and quality of views for residents, recreational users and businesses from representative viewpoints along the waterfront with the proposed project compared to existing conditions. Fewer viewshed impacts is considered better.					
		Retail/Dining Impacts						
	Length of Waterfront Access Impacted (feet)		I his criterion considers the linear length along the Hudson River shoreline where new Resist features would impact pedestrian access to the waterfront bulkhead. Within these locations, pedestrians would be required to access the new bulkhead by a series of steps or ramps. Shorter length of waterfront access impacted is considered better.					
	Acres of New or Improved Park Space		are located where a park already exists, such as portions of the Cove Park at Weehawken Cove. Greater acreage of new or improved park space is considered better.					
	Connectivity and Circulation	Number of Parking Spaces Impacted	This criterion provides a tally of the on-street parking spaces that would potentially be permanently impacted by the proposed Resist alignment. Fewer parking spaces impacted is considered better.					
		Number of Gate Closures during Storm Conditions	This considers the number of gate closures that would be required during storm surge events. This could potentially impact street and pedestrian access in the hours leading up to a storm event. Fewer number of gates is considered better.					
Benefit Cost Analysis	Benefits		This criterion considers the benefit of the Resist portion of the project, which includes the following: estimated value of avoided flood damages; avoided loss of function (residential displacement, non-residential business and/or service losses); socioeconomic benefits (mental stress and anxiety, lost productivity); and environmental benefits (open space). A higher benefit value is considered better.					
	Estimated Resist Cost		This is the estimated cost for the Resist feature. This includes final design, project management, engineering and construction costs. A lower cost is considered better.					
	Estimated Resist Cost Contingency		This criterion considers that based on the current design effort (feasibility stage) there are potential unforeseen costs for the next stage of the project. These costs are approximately 22% of the Resist construction cost.					
	Total Resist Cost		This criterion represents the overall cost of the Resist feature (including final design, project management, engineering, construction and project contingencies). A lower Resist cost is considered better.					
	Resist Benefit/Cost Ratio		This metric is a number which is calculated by dividing benefits by total Resist cost as described above. A Benefit Cost Ratio above one means the project's benefits outweigh its costs.					
	Total Project Benefit/Cost Ratio (includes Resist and DSD)		This metric is a number which is calculated by dividing benefits by Resist costs including DSD. A Benefit Cost Ratio above one means the project's benefits outweigh its costs.					
Construction / Maintenance		Number of Private Parcels Requiring Easements	The criterion considers three metrics. The first metric is the number of private parcels where temporary easements are required for construction access					
	Constructability	Potential Utility Relocation (linear feet)	or where permanent easements are required for installation of Resist features. The second metric is the estimated linear feet of utilities which could potentially require relocation to enable infrastructure construction. The third metric is the estimated number of utility crossing. Fewer number of private parcels requiring easements and fewer utility impacts are considered better.					
			This criterion provides a measure of the temporary construction areas that may be impacted through the construction of the project. It considers					
7	Temporary Construction Impacts (acres)		The overall estimated Limits of Disturbance (LOD) for the Resist, Delay, Store and Discharge features of the project. A smaller area of temporary construction impacts is considered better.					
	Estimated Annual Maintenance Cost (millions)		maintenance cost are the overall size of the proposed structures/facilities and the number of gates associated with the Resist feature.					
Environmental	Recognized Environmen- tal Conditions (RECs)	Number of REC Properties Affected	This criterion provides a measurement of the number of potentially contaminated properties that would be encountered during construction of the project. It considers those sites that were determined by the Hazardous Waste investigation to be a REC to the project. These are sites that have unresolved soil and/or groundwater contamination issues. Fewer RECs impacted is considered better.					
		Estimate of Hazardous Soils Requiring Off-Site Disposal (tons)	This considers the amount of hazardous soils that will need to be disposed of off-site. Because subsurface investigations have not been cond it is assumed that 10% of the soils encountered may be considered above "hazardous" thresholds. A smaller volume of soils requiring dispos considered better.					
		Estimate of Non-Hazardous Soils Requiring Off- Site Disposal (tons)	This considers the amount of non-hazardous soils that will need to be disposed of off-site. Because subsurface investigations have not been conducted, it is assumed that 90% of the soils encountered may be considered non-hazardous. For these soils, it is possible that they can be re- used on-site under certain circumstances, reducing the need (and expense) to dispose of at an off-site facility. This has been reflected in the amounts identified on the matrix for this criterion. A smaller volume of soils requiring disposal is considered better.					
	Freshwater Wetlands	Freshwater Wetlands Within Footprint (square feet)	Freshwater wetlands were delineated as part of the project. This criterion identifies the area of freshwater wetlands that would fall within the footprint of proposed areas of disturbance.					
	Threatened and Endangered (T&E) Species/ Essential Fish Habitat	Impacts to T&E and Essential Fish Habitat	The metric for this criterion is a qualitative metric which considers the potential for impact on the Essential Fish Habitat for smooth dogfish, summer flounder, bluefish, and Atlantic butterfish as well as to the listed Atlantic and Shortnose sturgeons.					
	State and Federal Environmental Permitting	NJDEP Flood Hazard Act (NJAC 7:13) Permit	This criterion considers whether permitting would be required under NJAC 7:13 (New Jersey Flood Hazard Control Act). The type of permit is identified. An individual permit would require a more significant level of effort to obtain as compared to a general permit or permit-by-rule.					
J.		Acreage of Floodplain Disturbance (pursuant to NJAC 7:13)	This criterion considers the acreage of disturbance within the floodplain. This considers permanent impacts (which may include ar where new above-ground features are proposed) as well as temporary impacts (which may includes areas where below-grade features or areas where work is otherwise temporary in nature). A smaller acreage of floodplain impacts is considered better.					
		Number of Properties (by owner) Potentially Impacted (pursuant to NJAC 7:13), both Public and Private	NJAC 7:13 (New Jersey Flood Hazard Control Act) requires consideration of impacts from proposed actions within the floodplain. The number of properties that may experience additional flood depth of up to 1 inch greater than existing conditions was determined based on coastal modeling. Fewer properties potentially impacted is considered better.					
		NJDEP Wetlands Permitting (NJAC 7:7A)	This criterion considers whether permitting would be required under NJAC 7:7A (New Jersey Freshwater Wetlands Protection Act). The type of permit and the reason for the anticipated permit is identified. An individual permit would require a more significant level of effort to obtain as compared to a general permit.					
		USACE Sections 10 and 404 Permitting	This criterion considers whether permitting would be required under Sections 10 and/or 404 of the Clean Water Act. The type of permit and the reason for the anticipated permit is identified. An individual permit would require a more significant level of effort to obtain as compared to a nationwide permit.					
	Historic Properties Number of Historic Properties or Districts with Adverse Effect		The metric for this criterion is the number of properties or districts on or eligible for the National Register of Historic Places which may be adversely affected by an alternative. Fewer historic properties/districts affected is considered better.					
	Archaeological Acres of Potential Archaeological Resources Affected by the Alternative		The metric for this criterion is the square footage of potential archaeological sites which are on or eligible for the National Register of Historic Places which could be impacted by the Project. A smaller area of potential archaeological resources impacted is considered better.					
	Noise	Number of Noise Receptors During Construction	This considers the number of sensitive noise receptors that could be impacted during construction operations. Sensitive noise receptors include schools, parks, and places of worship. Fewer noise receptors impacted is considered better.					