FEMA Benefit-Cost Calculator

V.6.0 (Build 20230103.1822 | Release Notes)

Benefit-Cost Analysis

Project Name: Driving Branch Mitigation Project

				Using 7% Discount Rate			Using 3% Discount Rate (For FY22 BRIC and FMA only)		
Map Marker ▲	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)	Benefits (B)	Costs (C)	BCR (B/C)
1	Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504		DFA - Riverine Flood	$ 441,502	$ 387,972	1.14	$ 823,124	$ 399,901	2.06
2	Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504		DFA - Riverine Flood	$ 292,623	$ 896,649	0.33	$ 545,559	$ 906,431	0.60
3	Drainage Improvement @ N Market St, Benson, North Carolina, 27504		DFA - Riverine Flood	$ 1,019,682	$ 1,148,413	0.89	$ 1,901,069	$ 1,363,136	1.39
4	Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504		DFA - Riverine Flood	$ 473,945	$ 568,424	0.83	$ 883,611	$ 638,806	1.38
5	Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504		DFA - Riverine Flood	$ 115,195	$ 84,168	1.37	$ 214,766	$ 87,770	2.45

Map Marker ▲	Mitigation Title	Property Type	Hazard	Using 7% Discount Rate Benefits (B)	Costs (C)	BCR (B/C)	Using 3% Discount Rate (For FY22 BRIC and FMA only) Benefits (B)	Costs (C)	BCR (B/C)
TOTAL (SELECTED)				$ 2,342,947	$ 3,085,626	0.76	$ 4,368,129	$ 3,396,044	1.29
TOTAL				$ 2,342,947	$ 3,085,626	0.76	$ 4,368,129	$ 3,396,044	1.29

Property Configuration

Property Title:	Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504
Property Location:	27504, Johnston, North Carolina
Property Coordinates:	35.3810099956491, -78.54653499487159
Hazard Type:	Riverine Flood
Mitigation Action Type:	Floodplain and Stream Restoration
Property Type:	Other
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

Project Useful Life (years):	50
Project Cost:	$374,171
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$1,000

Comments

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Project Useful Life:
Based on the input from the Town on-call team (P.E. that specializes in ecological restoration), useful life of 50 years was assumed for the stream restoration components of this project. Ideally, once a stream restoration project is complete, it is considered "maintenance free" due to the fact that it is intended to function as a natural system and not a utility such as a water line or a sewer main.

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Mitigation Project Cost:
375 linear feet x $750/linear foot restoration is $281,250 + $82,175 water line relocation + $10,746 demolition and removal of two structures = $374,171/375 ft = $997.79 per linear foot - $750/linear foot for this stream restoration work is based on past experience with similar site conditions, as per the ecological restoration P.E. - Based on input from the ecological restoration P.E., stream restoration will include: excavation of an appropriately sized floodplain bench to provide stability to the stream system, much needed flood flow storage and retention, and stream and riparian habitat that is currently non-existent with the current piped condition; re-align the stream to have an appropriate pattern and profile for its hydrologic regime; create riffles and pools in the channel to significantly improve the sediment transport capacity, hydraulics, and in-channel habitat; in-stream structures such as log vanes, log-rock riffles, and log cross vanes to provide channel bed stability and create a diversity of aquatic habitat. After the channel has been re-graded to a natural and stable form, the banks and riparian areas will be vegetated with native species to provide long term bank stability and riparian habitat. - Additional costs included in the average are 1) water line relocation at $82,175 (865' of water line relocation at $95/linear ft) and 2) demolition/removal of two structures at $10,746. Demolition cost includes 1) 2 equipment operators at $29.25/hr x 8 hrs x 15 days = $3510 + 2) 3 PW staff at $26/hr x 8 hrs x 15 days = $3,120 + 3) PW Superintendent at $41.16 for 100 hours = $4,116

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Annual Maintenance Cost:
Based on input from the ecological restoration P.E., it is not uncommon to expect minor repairs during the first 5 years after construction for a stream restoration project. Therefore, stream restoration projects are typically monitored for a period of 3-5 years to ensure that the project is progressing towards a state of dynamic equilibrium. Walk through field observation will be conducted on an annual basis for the first five years. It is anticipated that staff time for the site walk through will be $1,000 per year ($5,000) with repair/replacement of vegetation at $5,000 in years 3 and 5 ($10,000). Walk-throughs will be conducted every-other year for the rest of the life of the project ($22,500). Even though it is not anticipated, $2,500 in repair/replacement costs will be budgeted for maintenance every ten years ($12,500). This totals $50,000 for the life of the project with an annual average of $1,000.

Damage Analysis Parameters - Damage Frequency Assessment
Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

Year of Analysis was Conducted:	2018
Year Property was Built:	1962
Analysis Duration:	57 Use Default:Yes

Comments

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Analysis Year:

H&H Study is from 2018.

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Year Built:

The intersection of Market Street at the maintenance yard was built in approximately 1962. The maintenance yard was gifted to the Town and the exact year of construction is unknown. The building is visible in aerial photography from 1962.

Professional Expected Damages Before Mitigation
Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
100	0	0	0	0	0	0	0

Comments

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Damages Before Mitigation:

Only ecological benefits are included in this Element. All damages (pre and post mitigation) are included in Element 4 (Road Improvements, North Market Street).

Annualized Damages Before Mitigation
Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
100	0	0
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Professional Expected Damages After Mitigation
Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
100	0	0	0	0	0	0	0

Comments

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Damages After Mitigation:

Only ecological benefits are included in this Element. All damages (pre and post mitigation) are included in Element 4 (Road Improvements, North Market Street).

Annualized Damages After Mitigation
Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
100	0	0
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Standard Benefits - Ecosystem Services
Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

Total Project Area (acres):	0.86
Percentage of Urban Green Open Space:	0.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	100.00%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$31,991

Comments

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Percent Riparian:

Based on ecological restoration P.E., the restored acreage will create .86 acres of riparian ecosystem where there was none prior to restoration.

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Total Project Area:

375 linear feet long x 100 feet wide (state definition) = 37,500 sq ft = .8608 acres

Benefits-Costs Summary

Floodplain and Stream Restoration @ N Market St, Benson, North Carolina, 27504

Total Standard Mitigation Benefits:	$441,502
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$441,502
Total Mitigation Project Cost:	$387,972
Benefit Cost Ratio - Standard:	1.14
Benefit Cost Ratio - Standard + Social:	1.14

Property Configuration

Property Title:	Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504
Property Location:	27504, Johnston, North Carolina
Property Coordinates:	35.37978500145478, -78.54460501975595
Hazard Type:	Riverine Flood
Mitigation Action Type:	Floodplain and Stream Restoration
Property Type:	Other
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

Project Useful Life (years):	50
Project Cost:	$885,332
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$820

Comments

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Project Useful Life:

Based on the input from the Town on-call team (P.E. that specializes in ecological restoration), useful life of 50 years was assumed for the stream restoration components of this project. Ideally, once a stream restoration project is complete, it is considered "maintenance free" due to the fact that it is intended to function as a natural system and not a utility such as a water line or a sewer main.

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Mitigation Project Cost:

- 250 linear feet x $500/linear foot = $125,000 - $500/linear foot for this stream restoration work is based on past experience with similar site conditions, as per the ecological restoration P.E. Based on input from the ecological restoration P.E., stream restoration measures for this element will be implemented to: stabilize the channel within the vicinity of the culvert and utilities; reshape the channel; and creation of floodplain benches to create a dynamic equilibrium that will protect the integrity of the nearby infrastructure (and also improve the stream and riparian habitat). The stream restoration measures proposed include bank stabilization, the design and implementation of in-stream structures such as log vanes, log-rock riffles, and log cross vanes, and the restoration of riparian vegetation. Because of the culvert and utilities, low-growing vegetation will be utilized to ensure that maintenance of the utilities is still possible. - All non-construction costs for the project (from pre-award through close-out) were added to the project cost for this element ($760,332.16). - Stream restoration plus all non-construction costs for all elements = $885,332.16

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Annual Maintenance Cost:

Based on input from the ecological restoration P.E., it is not uncommon to expect minor repairs during the first 5 years after construction for a stream restoration project. Therefore, stream restoration projects are typically monitored for a period of 3-5 years to ensure that the project is progressing towards a state of dynamic equilibrium. Walk through field observation will be conducted on an annual basis for the first five years. It is anticipated that staff time for the site walk through will be $1,000 per year ($5,000) with repair/replacement of vegetation at $3,000 in years 3 and 5 ($6,000). Walk-throughs will be conducted every-other year for the rest of the life of the project ($22,500). Even though it is not anticipated, $1,500 in repair/replacement costs will be budgeted for maintenance every ten years ($7,500). This totals $41,000 for the life of the project with an annual average of $820.

Damage Analysis Parameters - Damage Frequency Assessment

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

Year of Analysis was Conducted:	2018	
Year Property was Built:	1938	
Analysis Duration:	81	Use Default:Yes

Comments

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Analysis Year:

H&H Study is from 2018.

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Year Built:

The year the road was built is assumed to be 1938, based on historical NCDOT maps. No maps dated prior to 1938 showing North Johnson Street extending across Driving Branch have been found.

Professional Expected Damages Before Mitigation

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
0	0	0	0	0	0	0	0

Comments

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Damages Before Mitigation:

Only ecological benefits are included in this Element. All damages (pre and post mitigation) are included in Element 5 (Road Improvements, North Johnson Street).

Annualized Damages Before Mitigation

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Professional Expected Damages After Mitigation

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
0	0	0	0	0	0	0	0

Comments

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Damages After Mitigation:

Only ecological benefits are included in this Element. All damages (pre and post mitigation) are included in Element 5 (Road Improvements, North Johnson Street).

Annualized Damages After Mitigation

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Standard Benefits - Ecosystem Services

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

Total Project Area (acres):	0.57
Percentage of Urban Green Open Space:	0.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	100.00%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$21,203

Comments

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Percent Riparian:

Based on ecological restoration P.E., the restored acreage will create .57 acres of riparian ecosystem where there was none prior to restoration.

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Total Project Area:

250 linear feet long x 100 feet wide (state definition) = 25,000 sq ft = .5739 acres

Benefits-Costs Summary

Floodplain and Stream Restoration @ N Johnson St, Benson, North Carolina, 27504

Total Standard Mitigation Benefits:	$292,623
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$292,623
Total Mitigation Project Cost:	$896,649
Benefit Cost Ratio - Standard:	0.33
Benefit Cost Ratio - Standard + Social:	0.33

Property Configuration

Property Title:	Drainage Improvement @ N Market St, Benson, North Carolina, 27504
Property Location:	27504, Johnston, North Carolina
Property Coordinates:	35.3810099956491, -78.54653499487159
Hazard Type:	Riverine Flood
Mitigation Action Type:	Drainage Improvement
Property Type:	Roads & Bridges
Analysis Method Type:	Professional Expected Damages

Cost Estimation
Drainage Improvement @ N Market St, Benson, North Carolina, 27504

Project Useful Life (years):	50
Project Cost:	$900,000
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$18,000

Comments

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Project Useful Life:

As per PUL Summary Table.

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Mitigation Project Cost:

Cost estimate is Town's on-call engineering firm estimate based on similar work done in the past.

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Annual Maintenance Cost:

Cost estimate is Town's on-call engineering firm estimate based on similar work done in the past. Assumption is that the road would need to be resurfaced every 10 years. Costs were calculated based on the area of pavement within the project. The costs came from a recent cost estimate that was prepared by NCDOT with an assumed increase of 3% a year.

Damage Analysis Parameters - Damage Frequency Assessment
Drainage Improvement @ N Market St, Benson, North Carolina, 27504

Year of Analysis was Conducted:	2018
Year Property was Built:	1962
Analysis Duration:	57 Use Default:Yes

Comments

-

Analysis Year:

H&H Study is from 2018.

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Year Built:

The intersection of Market Street at the maintenance yard was built in approximately 1962. The maintenance yard was gifted to the Town and the exact year of construction is unknown. The building is visible in aerial photography from 1962.

Roads and Bridges Properties

Drainage Improvement @ N Market St, Benson, North Carolina, 27504

Estimated Number of One-Way Traffic Detour Trips per Day:	0
Additional Time per One-Way Detour Trip (minutes):	0
Number of Additional Miles:	0
Federal Rate ($):	0.625 Use Default:Yes
Economic Loss Per Day of Loss of Function ($):	0

Professional Expected Damages Before Mitigation

Drainage Improvement @ N Market St, Benson, North Carolina, 27504

	ROADS AND BRIDGES	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	PW1230 & 1537	Crusher Fines	Cleanup/Facility Loss	Number of Volunteers	Number of Days	Damages ($)
100	7	84,946	18,192.84	150,995.84	0	0	254,135
1	0	0	12,332.19	8,103.84	0	0	20,436

Comments

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Damages Before Mitigation:

- Past Public Work Director confirmed 100-year recurrence interval resulted in road closure for seven days (damages from Hurricane Matthew in 2016). He also confirmed that during that time, the public works facility was completely blocked for four days, and Town staff were unable to gain access due to flooding. In addition, the facility operated at reduced capacity for several months due to the damages. - PW1230 - Flood water unearthed and damaged 60 ft x 60" corrugated metal pipe in the Public Works Yard, pipe bedding and fill materials (5 ft x 5ft 60ft), 3" of gravel. Engineering, survey/design and as built, mobilization, construction, erosion control = $45,292. - PW1537 - Flood water and high wind caused damages to Excavator Bays 1 and 2 in the interior of the Public Works Department. In addition, two vehicles were submerged and inoperable. The total for repair of the Bays and two vehicles (1997 Johnston Street sweeper and 1998 ford dump truck) will be $39,654. - Based on the Public Works Superintendent and Town Project Manager there were $141,881 in costs associated with the damages to the Public Works Facility (staff time $8,190 + equipment $133,446 + contractor time $245). Upon initial review, it appears that none of these costs were included in the PWs. During Phase 1 detailed analysis, these costs will be analyzed in detail for confirmation. Labor to relocate equipment from the lower yard at 7 people for 36 hours each at $32.50 per hour ($25x130%) = $8,190. Equipment costs at $133,446: replace supervisor trucks at $23,500; generator repair at $43,500; tow employee personal property at $8,900; damages to equipment at $5,000; damages to shed at $5,675; 97 Ford F 150 at $9,600.00; 2004 Chevy Silverado at $5,350.00; 1993 Chevy Truck at $4,788.00; 2000 Ram 2500 at $6,097.00; 1997 Chevy 2500 at $7,572.00; equipment lost at Public Works at $13,464.00. A contractor was hired at $10 per hour for 24.5 hours to clean-up and repair Market Street = $245. - Based on the Public Works Superintendent and Town Manager estimates, there was $9,114.84 expended by Town staff outside the Public Works Department in response to Hurricane Matthew. Three staff from the Electrical Department and two staff from the Wastewater Department spent 4.5 days clearing debris, maintaining storm drain capacity, and similar clean-up. The Electrical Superintendent and Wastewater Superintendent spent 36 hours at time-and-a-half for $3,375 ($31.25 per hour for 36 hours at 1.5 for two people). Two electrical crew members spent 36 hours at time-and-a-half for $2,700 ($25 per hour for 36 hours at 1.5 for two people). Two wastewater crew members spent 36 hours at time-and-a-half for $2,363.04 ($21.88 per hour for 36 hours at 1.5 for two people). In addition, a bucket truck was utilized for 18 hours at $37.60 per hour (based on insurance claim) to equal $676.80. This work totals $9,114.84 ($3,375 Superintendents, $2,700 Electric Department staff, $2,363.04 Wastewater Department staff, $676.80 bucket truck). - Clean-up/Facility Loss Optional Damages are $141,881 plus $9,114.84 at $150,995.84 - 250 tons of crusher fines were installed on Market Street in 2016 after Hurricane Matthew at $6,625 ($26.50 per ton). The cost for a Dump Truck (FEMA Cost Code 8723) was $7,544.64 ($78.59 per hour for six dump trucks for two days at eight hours per day) and for a bull dozer (FEMA Cost Code 8252) was $1,527.20 ($95.45 per hour for one bull dozer for two days at eight hours per day). Labor was four staff for two days at $39 per hour was $2,496. The cost for laying the crusher fines after Hurricane Matthew was $18,192.84 ($6,625 material, $7,544.64 dump truck, $1,527.20 bull dozer, and $2,496 personnel). - Additional crusher fines had to be installed to maintain access to the Public Works Facility on Market Street each year since 2016. From

2017 to 2021, 100 tons were installed each year. In 2022 500 tons were installed. On average the cost per year from 2017 through 2022 was $12,332.19 ($7,521.50 for five years plus $36,385.68 for one year = $73,993.15/6 years). -- 100 tons of crusher fines were installed on Market Street in 2017 through 2021 at $2,650 ($26.50 per ton). The cost for a Dump Truck (FEMA Cost Code 8723) was $2,357 ($78.59 per hour for three dump trucks for one day at ten hours per day) and for a bull dozer (FEMA Cost Code 8252) was $954.50 ($95.45 per hour for one bull dozer at 10 hours per day). Labor was four staff for four days for ten hour days at $39 per hour was $1,560. The cost for laying the crusher fines each year from 2017 through 2021 was $7,521.50 ($2,650 material, $2,357 dump truck, $954.50 bull dozer, and $1,560 personnel). -- 500 tons of crusher fines were installed on Market Street in 2022 at $13,250 ($26.50 per ton). The cost for a Dump Truck (FEMA Cost Code 8723) was $15,089.28 ($78.59 per hour for six dump trucks for four days at eight hours per day) and for a bull dozer (FEMA Cost Code 8252) was $3,054.40 ($95.45 per hour for one bull dozer for four days at eight hours per day). Labor was four staff for four days at $39 per hour was $4,992. The cost for laying the crusher fines after Hurricane Matthew was $36,385.68 ($13,250 material, $15,089.28 dump truck, $3,054.40 bull dozer, and $4,992 personnel. - Based on the Public Works Superintendent and Town Manager estimates, annual clean-up costs continue until Market Street improvements are implemented. The cost of $8,103.84 per year is based on three staff at $26 per hour for four hours at five times each year ($1,560) plus a 4.5 cy excavator at $272.66 hour (FEMA Cost Code 8284) for three eight hour days ($6,543.84).

Annualized Damages Before Mitigation

Drainage Improvement @ N Market St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
1	20,436	71,345
100	254,135	2,541
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	274,571	73,886

Professional Expected Damages After Mitigation

Drainage Improvement @ N Market St, Benson, North Carolina, 27504

	ROADS AND BRIDGES	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	PW1230 & 1537	Crusher Fines	Cleanup/Facility Loss	Number of Volunteers	Number of Days	Damages ($)
100	0.5	0	0	0	0	0	0

Comments

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Damages After Mitigation:

- Post-mitigation expected damages are estimated to be half a day of closure in the 100-year recurrence interval storm. - Costs for re-surfacing is included in the maintenance figure of $18,000 per year.

Annualized Damages After Mitigation

Drainage Improvement @ N Market St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
100	0	0
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Standard Benefits - Ecosystem Services

Drainage Improvement @ N Market St, Benson, North Carolina, 27504

Total Project Area (acres):	0
Percentage of Urban Green Open Space:	0.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	0.00%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$0

Benefits-Costs Summary

Drainage Improvement @ N Market St, Benson, North Carolina, 27504

Total Standard Mitigation Benefits:	$1,019,682
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$1,019,682
Total Mitigation Project Cost:	$1,148,413
Benefit Cost Ratio - Standard:	0.89
Benefit Cost Ratio - Standard + Social:	0.89

Property Configuration

Property Title:	Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504
Property Location:	27504, Johnston, North Carolina
Property Coordinates:	35.37978500145478, -78.54460501975595
Hazard Type:	Riverine Flood
Mitigation Action Type:	Drainage Improvement
Property Type:	Roads & Bridges
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

Project Useful Life (years):	50
Project Cost:	$487,000
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$5,900

Comments

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Project Useful Life:

As per PUL Summary Table.

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Mitigation Project Cost:

Cost estimate is Town's on-call engineering firm estimate based on similar work done in the past. An additional $12,000 was added based on an estimate from the previous Public Works Director for replacement/relocation of two piers for the aerial sewer line.

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Annual Maintenance Cost:

-Cost estimate is Town's on-call engineering firm estimate based on similar work done in the past. Assumption is that the road would need to be resurfaced every 10 years. Costs were calculated based on the area of pavement within the project. The costs came from a recent cost estimate that was prepared by NCDOT with an assumed increase of 3% a year.

Damage Analysis Parameters - Damage Frequency Assessment
Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

Year of Analysis was Conducted:	2018
Year Property was Built:	1938
Analysis Duration:	81 Use Default:Yes

Comments

-

Analysis Year:

H&H Study is from 2018.

-

Year Built:

The year the road was built is assumed to be 1938, based on historical NCDOT maps. No maps dated prior to 1938 showing North Johnson Street extending across Driving Branch have been found.

Roads and Bridges Properties
Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

Estimated Number of One-Way Traffic Detour Trips per Day:	1,100
Additional Time per One-Way Detour Trip (minutes):	8
Number of Additional Miles:	2.3
Federal Rate ($):	0.625 Use Default:Yes
Economic Loss Per Day of Loss of Function ($):	6,802.58

Comments

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Number of Trips:

Estimated Number of One-Way Traffic Detour Trips per Day is 1,100 based on NC DOT 2021 AADT web map (https://ncdot.maps.arcgis.com/home/webmap/viewer.html?webmap=ff72d8f962bf40ac8973669fcdc63380).

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Time per Trip:

Additional time is 8-minutes per one-way trip based on the detour map provided by the Town, speed limit, and number of stop lights as interpreted by the Town Project Manager. See attached map.

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Number of Miles:

Additional 2.3 miles per one-way trip based on the detour map provided by the Town as interpreted by the Town Project Manager. See attached map.

Professional Expected Damages Before Mitigation

Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

	ROADS AND BRIDGES	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	Electrical Service Loss	WastewaterServiceLoss	Cleanup/Traffic Control	Number of Volunteers	Number of Days	Damages ($)
100	14	0	0	0	0	0	95,236
100	0	581,672	85,180	20,451.6	0	0	687,304
1	0	0	0	8,103.84	0	0	8,104

Comments

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Damages Before Mitigation:

-Past Public Works Director confirmed that the 100-year recurrence interval resulted in road closure for 14 days (damages from Hurricane Matthew in 2016). -Electrical damages were calculated as a separate BCA Project to get the dollar value of the damages and are used as Optional Damages. The sub-station down for one day at this location on Johnson Street serves 1,158 meters. The calculation for number served is based on 2.76 people per household (Johnston County average from census data https://www.census.gov/quickfacts/fact/table/johnstoncountynorthcarolina,NC/HSD310221). 1158 x 2.76 = 3196 customers served. The Value of Unit of Service ($/person/day) that was automatically generated was $182. $182 x 3196 = $581,672. -Wastewater damages were calculated as a separate BCA Project to get the dollar value of the damages and are used as Optional Damages. This line has 65 connections, as per Town records. The calculation for number served is based on 2.76 people per household (Johnston County average from census data https://www.census.gov/quickfacts/fact/table/johnstoncountynorthcarolina,NC/HSD310221 . 65 x 2.76 = 179 customers served. The Value of Unit of Service ($/person/day) that was automatically generated was $179 x 60 = $10,740 x 7 days = $75,180 + $10,000 in clean-up costs. Past Public Work Director confirmed 10-year recurrence interval resulted in water line service interruption for seven days (damages from Hurricane Matthew in 2016). - The Police Department and Fire Department provided traffic control during the 14-day road closure at a cost of $11,051.60. Two patrol officers worked 12-hour shifts for 14 days at $8,576.96. ($21.88 per hour for eight hours straight time $175.04 plus $32.82 for 4 hours of time-and-a half at $131.28 = $306.32 per day for 14 days for two officers). Police Chief and Fire Chief worked for 4.5 days at $2,474.64 $34.37 per hour for 4.5 days at eight hours per day for two Chiefs). This work totals $11,051.60 ($8,576.96 Patrol Officers and $2,474.64 Chiefs). - North Carolina Department of Transportation identified $9,400 in cleanup costs for North Johnson Street after Hurricane Matthew. - Cleanup and traffic control are entered as Option Damages at $20,451.60 for the 100-year recurrence interval ($9,400 NCDOT cleanup plus $11,051.60 traffic control) -Annual clean-up costs continue until Johnson Street improvements are implemented. The cost of $8,103.84 per year is based on three staff at $26 per hour for four hours at five times each year ($1,560), a 4.5 cy excavator at $272.66 hour (FEMA Cost Code 8284) for three days ($6,543.84). - Annual traffic control costs when Johnson Street floods is $1,817.70. Three officers work for four hours for each of the five estimated floods per year at $1,560 ($26 per hour for four hours for five events for three officers). The Police Chief works 1.5 hours for each event at $257.77 ($34.37 per hour for 1.5 hours for five events). This work totals $1,817.70 ($1,560 officers and $257.77 Chief). - Cleanup and traffic control are entered as Option Damages at $9,921.54 annually ($8,103.84 annual clean up plus $1,817.70 traffic control)

Annualized Damages Before Mitigation

Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
1	8,104	27,503
100	95,236	0
100	687,304	6,873
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	790,644	34,376

Professional Expected Damages After Mitigation

Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

	ROADS AND BRIDGES	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	Electrical Service Loss	WastewaterServiceLoss	Cleanup/Traffic Control	Number of Volunteers	Number of Days	Damages ($)
100	0.5	0	0	0	0	0	3,401

Comments

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Damages After Mitigation:

- As stated in the Town Manager's Justification Letter, post-mitigation expected damages are estimated to be half a day of loss of service in the 100-year recurrence interval storm. - Costs for re-surfacing is included in the maintenance figure of $5,900 per year.

Annualized Damages After Mitigation

Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
100	3,401	34
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	3,401	34

Standard Benefits - Ecosystem Services

Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

Total Project Area (acres):	0
Percentage of Urban Green Open Space:	0.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	0.00%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$0

Benefits-Costs Summary

Drainage Improvement @ N Johnson St, Benson, North Carolina, 27504

Total Standard Mitigation Benefits:	$473,945
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$473,945
Total Mitigation Project Cost:	$568,424
Benefit Cost Ratio - Standard:	0.83
Benefit Cost Ratio - Standard + Social:	0.83

Property Configuration

Property Title:	Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504
Property Location:	27504, Johnston, North Carolina
Property Coordinates:	35.37978500145478, -78.54460501975595
Hazard Type:	Riverine Flood
Mitigation Action Type:	Floodproofing Measures
Property Type:	Utilities
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

Project Useful Life (years):	50
Project Cost:	$80,000
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$302

Comments

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Project Useful Life:

As per PUL Summary Table.

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Mitigation Project Cost:

- 200′ of 6″ fusible PVC will be replaced. The section crossing the stream (approximately 40′) being placed in steel casing. The length of the line crossing the stream will be installed below the stream bed (currently the line is at the bed elevation). These measures will protect the line from being impacted as it crosses the creek. This element will also include mobilization, traffic control, and erosion control. - The cost for the water line is approximately $80,000 based on a generalized estimate from the current Public Works Superintendent and on-call engineer. The estimate is based on 200' of 6" fusible PVC plus 40' of steel casing ($60,000) and mobilization, traffic control, and erosion control ($20,000).

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Annual Maintenance Cost:

Annual maintenance costs are estimated to be $302 based on 1) Annual inspection will be $2,600 (Public Works Specialist at $26/hr x 2 hours x 50 years) + 2) anticipated repairs every ten years will be $12,500 ($2,500 in repairs x 5 times). These are generalized estimates from the current Public Works Superintendent.

Damage Analysis Parameters - Damage Frequency Assessment
Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

Year of Analysis was Conducted:	2018
Year Property was Built:	1972
Analysis Duration:	47 Use Default:Yes

Comments

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Analysis Year:

H&H Study is from 2018.

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Year Built:

The potable water line was built in 1972 based on town records.

Utilities Properties
Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

Type of Service:	Potable Water
Number of Customers Served:	1,104
Value of Unit of Service ($/person/day):	$116 Use Default:Yes
Total Value of Service Per Day ($/day):	$128,064

Comments

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Number of Customers Served:

This line has 400 connections, as per Town records. The calculation for number served is based on 2.76 people per household (Johnston County average from census data https://www.census.gov/quickfacts/fact/table/johnstoncountynorthcarolina,NC/HSD310221 . 400 x 2.76 = 1104 customers served. The Value of Unit of Service ($/person/day) that was automatically generated was $116. $116 x 1104 = $128,064.

Professional Expected Damages Before Mitigation
Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

	POTABLE WATER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	County Water Bill	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
100	7	2,272	0	0	0	0	898,720

Comments

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Damages Before Mitigation:

- Past Public Work Director confirmed 100-year recurrence interval resulted in water line service interruption for seven days (damages from Hurricane Matthew in 2016). - The Town was billed an additional $2,272 by the County for water during this period.

Annualized Damages Before Mitigation
Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
100	898,720	8,987
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	898,720	8,987

Professional Expected Damages After Mitigation
Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

	POTABLE WATER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	County Water Bill	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
100	0.5	0	0	0	0	0	64,032

Comments

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Damages After Mitigation:

As stated in the Town Manager's Justification Letter, post-mitigation expected damages are estimated to be half a day of loss of service in the 100-year recurrence interval storm.

Annualized Damages After Mitigation
Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
100	64,032	640
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	64,032	640

Benefits-Costs Summary

Floodproofing Measures @ N Johnson St, Benson, North Carolina, 27504

Total Standard Mitigation Benefits:	$115,195
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$115,195
Total Mitigation Project Cost:	$84,168
Benefit Cost Ratio - Standard:	1.37
Benefit Cost Ratio - Standard + Social:	1.37