

TWDB State Flood Plan BCA Input Tool



INSTRUCTIONS FOR USE

Prepared by AECOM

INTRODUCTION

PURPOSE

- All projects in the Texas State Flood Plan must have a benefit-cost analysis (BCA) completed.
- Depending on the type and scope of the project, a BCA can be data-intensive and complex.
- In an effort to reduce the burden on small communities, TWDB has developed an Input Spreadsheet to work in conjunction with FEMA's BCA Toolkit 6.0.
- The Input Spreadsheet helps the community gather and organize the necessary data and calculate flood damages by recurrence interval.
- The flood damages by recurrence interval are input into FEMA's BCA Toolkit 6.0 to calculate project benefits.
- The purpose of this document is to guide the user through the Input Spreadsheet and the FEMA BCA Toolkit to produce a BCA for their project.

BASICS OF BENEFIT-COST ANALYSIS

- Benefits of Flood Risk Management Projects are derived from reduced flood damages.
- Flood damages are estimated under the Baseline (without-project/before mitigation) condition and the Project condition (with-project/after mitigation) for one or more recurrence intervals.
- Flood damages can include direct structural and content damages as well as increased costs of detours around flooded streets, delays to emergency services, costs of utility outages, and other impacts.
- Once the flood damages under each scenario are summed, they are multiplied by the probability that a storm would occur in each year of the analysis period and discounted to the present day.
- The discounted benefits are compared to the discounted costs to determine the Benefit-Cost Ratio (BCR). A $BCR > 1.0$ indicates that the project is cost-effective.

IMPORTANT TERMINOLOGY

- **Recurrence Interval**
The average time between events, based on the probability that a given event will be equaled or exceeded in a given year.
- **Baseline**
The condition that will exist if the Project is not constructed; in many (most) cases, this is the Existing Condition.
- **Analysis Period**
The period of time over which the Project is expected to be functional.
- **Discounting**
An adjustment made to account for the time value of money, which allows for benefits, which accrue over many years into the future, to be compared to costs, which are incurred in the present.
- **Hydrology & Hydraulics (H&H)**
An H&H Study is conducted to determine the volume and rate of flow of water as it moves through a watershed, basin, channel, or structure.
- **Capital Costs**
The costs necessary to make the project function and produce benefits, including construction, design, right-of-way, utility relocations, permitting, and other support costs that are necessary for project completion.
- **O&M Costs**
Ongoing costs required to maintain the project and keep it functioning over its lifecycle.

DATA NEEDS

- Project information such as Capital and O&M costs.
- Types of Project impacts, such as reduction in structure flooding, reduction in street flooding, etc.
- Knowledge of the Project area, such as number of residential and commercial structures, daily traffic levels, etc.
- Flood level (H&H) data that reflects the Baseline and Project conditions for up to three recurrence intervals; one recurrence interval must be the 100-year storm event.

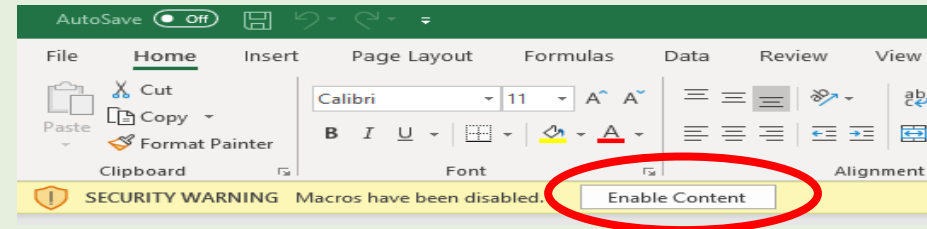
SELECTED MODEL ASSUMPTIONS AND DEFAULT DATA

- 7% Discount Rate
- Annual inflation is ~2%
- Each residence houses 3 people (including 2 workers)
- Per diem for displaced residents is \$240/day per household (1 hotel room and meals for 3 people)
- Residential square footage:
 - Small – 1,000
 - Average – 2,500
 - Large – 5,000
- Each commercial building employs 10 people
- Commercial property value is \$100/square foot

USING THE BCA INPUT SPREADSHEET & FEMA BCA TOOLKIT

DOWNLOADS

- The TWDB BCA Input Spreadsheet can be found [here](#).
 - The Input Spreadsheet is a Microsoft Excel file that was created in Microsoft Excel for Office 365.
 - It is important to enable macros for the spreadsheet to function correctly.



- FEMA's BCA Toolkit 6.0 and installation instructions can be found [here](#).
 - BCA Toolkit 6.0 may be used in the desktop version of Excel (Excel 2013 or later) or in Excel Online. If your organization does not permit individual acquisition of add-ins, you may use the BCA Toolkit in Excel Online.
- It is recommended that you save a blank version of each spreadsheet. Copy and paste a new version for each Project to ensure the appropriate data is included with the corresponding Project.

PROJECT INFORMATION

- Input Project information in the green cells. Add recurrence intervals in decreasing order of frequency (i.e., more frequent events first).

| | | |
|--|--------------------------------|------------|
| Project Name | Example 1 | Clear Data |
| Project Region | Region 11 | |
| Project Type | Floodwater Diversion & Storage | |
| Start Construction Year | 2021 | |
| End Construction Year | 2022 | |
| Input up to 3 Recurrence Intervals for which you have water level (H&H) data. | | |
| At least 1 Recurrence Interval must be the 100-year storm. | | |
| Recurrence Intervals must be input in decreasing order of likelihood (i.e., 50-year storm before 100-year storm). | | |
| Recurrence Interval 1 | 50 year storm | |
| Recurrence Interval 2 | 100 year storm | |
| Recurrence Interval 3 | 500 year storm | |

- Select "Yes" for the types of project impacts expected for your Project.

Types of Project Impacts

| | |
|---|----|
| Residential Structure Damage Reduction | No |
| Commercial Structure Damage Reduction | No |
| Critical Facility (Police, Fire, Hospital) Loss of Function Reduction | No |
| Reduction in Street Flooding | No |
| Utility Outage Reduction | No |
| Agricultural Damage Reduction | No |
| Water Supply Benefits | No |
| Recreation Benefits | No |
| Does this project include Green Infrastructure elements? | No |
| Does this project replace a low-water crossing? | No |

PROJECT COSTS

- Input Project costs.

Clear Data

| | |
|---|-----|
| Capital Cost | |
| Right-of-Way | |
| Utility Relocation | |
| Construction | |
| Total Capital Cost | \$0 |
| Operations & Maintenance (O&M) | |
| Baseline Annual O&M | |
| Project Annual O&M | |
| Increased Annual O&M | \$0 |
| Project Lifespan (years) | |

Project Lifespan
Most projects should have a project lifespan of 30 years. None should have a lifespan longer than 100 years.

- Construction costs should include all necessary engineering and design costs.
- For projects involving the construction of new infrastructure, total Operations & Maintenance (O&M) costs will generally be positive, reflecting ongoing expenditures needed to maintain the new asset.
- For projects intended to replace, reconstruct, or rehabilitate existing infrastructure, the net change in O&M costs under the proposed project may be negative, as newer infrastructure may require less frequent and less costly maintenance compared to an aging, deteriorating asset.

RESIDENTIAL STRUCTURES

- Input cells are highlighted Green.
- Residential structures can be classified as "Small Home," "Average Home," or "Large Home."¹

| Structure Information | | | 100 - year storm | | | |
|-----------------------|---|----------------------|----------------------|------------------|---------------------|-----------------|
| Location | Structure Type | Number of Structures | Baseline Flood Depth | Baseline Damages | Project Flood Depth | Project Damages |
| 1 | <input type="text" value=""/> <div style="border: 1px solid black; padding: 2px; width: fit-content;"> Small Home Average Home Large Home </div> | | | | | |
| | | | | | | |
| | | | | | | |

- An error message will appear if the Project Flood Depth is greater than the Baseline Flood Depth.

ERROR: CHECK FLOOD DEPTHS

| Structure Information | | | 100 - year storm | | | |
|-----------------------|----------------|----------------------|----------------------|------------------|---------------------|-----------------|
| Location | Structure Type | Number of Structures | Baseline Flood Depth | Baseline Damages | Project Flood Depth | Project Damages |
| 1 | Neighborhood 1 | Average Home | 5 | 6" | \$270,517 | \$305,394 |
| 2 | | | | | | |
| | | | | | | |

- Repeat for all recurrence intervals. An error message will appear if flood depths are higher for more-frequent storms than less-frequent storms.

¹Source: https://www.floodsmart.gov/sites/default/files/flood-loss-potential_jul19.pdf

COMMERCIAL STRUCTURES

- Input structure information for any commercial structures that are expected to benefit from the Project.
- Use the drop-down list to select the type of commercial structure.
- Select whether you want to calculate damages based on square footage or structure value.
- An error message will appear if the Project Flood Depth is greater than the Baseline Flood Depth.
- Repeat for all recurrence intervals. An error message will appear if flood depths are higher for more-frequent storms than less-frequent storms.

| Address or Business Name | Structure Type | Square Footage | Bas |
|--------------------------|---|----------------|-----|
| 1 | <div style="border: 1px solid black; padding: 2px;"> Apartment Recreation Schools Convenience Store Grocery Medical Office Fast Food Non-Fast Food </div> | | |

| Address or Business Name | Structure Type | Basis of Value | Struc |
|--------------------------|----------------|---|-------|
| 1 | Grocery Store | Grocery | |
| 2 | | <div style="border: 1px solid black; padding: 2px;"> Structure Value Square Footage </div> | |

| Address or Business Name | Structure Type | Basis of Value | Structure Value | Square Footage | 100 - year storm | | | |
|--------------------------|----------------|----------------|-----------------|----------------|----------------------|------------------|---------------------|-----------------|
| | | | | | Baseline Flood Depth | Baseline Damages | Project Flood Depth | Project Damages |
| 1 | Grocery Store | Grocery | Square Footage | 5,000 | 8" | \$41,479 | 0 | |
| 2 | | | | | | | | |

FLOODED STREETS

- Input information into the green cells if the Project will reduce the length (mileage) and/or duration of street flooding.
- Streets are considered impassable if flooding is >6 inches.
- Note that EMS response time during a storm event should be \geq normal EMS response time.

| | 100 - year storm | |
|--|------------------|---------|
| | Baseline | Project |
| How many miles of roadway is flooded >6"? | | |
| How long are the roadways impassable (hours)? | | |
| What is the daily traffic (vehicle count) on the affected roadways? | | |
| How much mileage does the detour add to the route? (Difference between direct route and detour) | | |
| How much time (minutes) does the detour add to the route? (Difference between direct route and detour) | | |
| Normal Emergency Medical Services (EMS) response time (minutes) | | |
| EMS response time during storm event | | |
| Number of households impacted by EMS delay due to flooded streets | | |
| Number of commercial buildings impacted by EMS delay due to flooded streets | | |

Clear Data

LOW WATER CROSSING

- Input data into the green cells if the Project includes replacing a Low Water Crossing.
- The model estimates potential injuries, loss of life, and emergency response costs from motorists attempting to cross a flooded street.
- As the depth of flooding increases, the likelihood that a motorist would attempt to cross decreases, but the probability of a successful crossing also decreases.

| Input | 100 - year storm | |
|---|------------------|---------|
| | Baseline | Project |
| Depth of flooding over roadway | | |
| Duration of flooding (hours) | | |
| Daily Traffic | | |
| What is the length of the detour (minutes)? | | |

Clear Data

RECREATION

- Recreation benefits are calculated using the “Unit Day Value” methodology.
- Follow the instructions in the workbook closely. This worksheet includes multiple drop-down selections and informational popups. Input cells are highlighted green.
- The number of points assigned for each Criteria determine the overall quality of recreational experience and the “Unit Day Value” of the recreational aspect of the Project.
- Person-days are calculated by multiplying the number of people who will use the recreational aspect of the Project by the number of days they will use it.
- If 30 people are expected to use the Project every weekend, then the person-days is $30 \times 52 = 1,560$.

This spreadsheet uses the "Unit Day Value" methodology, which relies on expert or informed opinion and judgment to approximate the average willingness-to-pay of users of public recreation resources.
[More information about this methodology can be found here.](#)

Type of recreational experience
 Hunting & Fishing?

Use the following table as a guide to determine the quality of recreational experience provided by the Project. Select the option for each criteria that best describes the Project. Assign points within the Point Range for the selected option. The number of points leads to a higher Unit Day Value.

| Criteria | Options | Point Range | Points Assigned |
|-----------------------------|--------------------------------------|-------------|-----------------|
| Recreation Experience | <input type="text" value="General"/> | | |
| Availability of Opportunity | <input type="text" value=""/> | | |
| Carrying Capacity | <input type="text" value=""/> | | |
| Accessibility | <input type="text" value=""/> | | |
| Aesthetic Quality | <input type="text" value=""/> | | |

Quality of Recreational Experience
 Unit Day Value

How many people will use the Project each year? (Person-days)

Annual Recreational Value

RECREATION


- Select the Evaluation Factor that best describes the Project recreation features.
- The Point Range is determined by the Evaluation Factor that is selected.
- Assign points within the Point Range – if the Point Range is 5-10, then the Points Assigned should be between 5 and 10.
- If the Points Assigned is higher than the Point Range, a “Check Value” error message will appear.

| Criteria | Evaluation Factors | Point Range | Points Assigned |
|-----------------------------|---|-------------|-----------------|
| Recreation Experience | Several general activities | 5-10 | 8 |
| Availability of Opportunity | Several within 1 hour travel time; a few within 30 min. travel time | 0-3 | 2 |
| Carrying Capacity | Adequate facilities to conduct activity without deterioration of the | 6-8 | 6 |
| Accessibility | Good access, high standard road to site; good access within site | 15-18 | 16 |
| Aesthetic Quality | Above average aesthetic quality; and limiting factors can be reasonable | 7-10 | 12 CHECK VALUE |

- The spreadsheet will not allow the user to input more than the total number of points allowed for a specific Criteria.

| Criteria | Evaluation Factors | Point Range | Points Assigned |
|-----------------------------|---|-------------|-----------------|
| Recreation Experience | Several general activities | | |
| Availability of Opportunity | Several within 1 hour travel time; a few within 30 min. travel time | | |
| Carrying Capacity | Adequate facilities to conduct activity without deterioration of the | | |
| Accessibility | Good access, high standard road to site; good access within site | | |
| Aesthetic Quality | Above average aesthetic quality; and limiting factors can be reasonable | 7-10 | 30 |

Microsoft Excel

 This value doesn't match the data validation restrictions defined for this cell.

OTHER IMPACTS

- Other Impacts include Utility Outages, Water Supply, Agricultural Damages, and Green Infrastructure benefits.
- Select “Yes” for the types of impacts appropriate for your project.

****Note: These impacts will only be included in the Total Impacts if "Yes" is selected under "Types of Project Impacts" on the Project Information sheet.**

Does the project reduce utility outages?

No

Yes
No

Does the project increase water supply?

No

Does the project impact flooding on agricultural lands?

No

Does the project include any green infrastructure elements?

No

Clear Data

UTILITY OUTAGES

- Input the number of customers served by the affected utility and the number of days outages under the Baseline and Project conditions.

****Note: These impacts will only be included in the Total Impacts if "Yes" is selected under "Types of Project Impacts" on the Project Information sheet.**

Does the project reduce utility outages?

Clear Data

| Utility Type | No. of Customers |
|---------------|------------------|
| Electrical | |
| Potable Water | |
| Wastewater | |

| Number of Days Outage | 100 - year storm | |
|-----------------------|------------------|---------|
| | Baseline | Project |
| Utility Type | | |
| Electrical | | |
| Potable Water | | |
| Wastewater | | |

Does the project increase water supply?

Does the project impact flooding on agricultural lands?

Does the project include any green infrastructure elements?

WATER SUPPLY

- Input the increase in water supply provided by the Project and the price of water in your region.

| | |
|---|--------------------------------------|
| Does the project reduce utility outages? | <input type="radio"/> No |
| Does the project increase water supply? | <input checked="" type="radio"/> Yes |
| Amount of Increase (1,000 gallons) | <input type="text"/> |
| Average regional water price (\$/1,000 gallons) | <input type="text"/> |
| Does the project impact flooding on agricultural lands? | <input type="radio"/> No |
| Does the project include any green infrastructure elements? | <input type="radio"/> No |

AGRICULTURAL DAMAGES

- Input the damages per acre and the number of acres damaged under the Baseline and Project conditions.
- The model can calculate decreased damages for three types of agricultural land – pasture, low-value crops, and high-value crops.

| | | |
|---|-------------------------|----------------|
| Does the project impact flooding on agricultural lands? | Yes | |
| | 100 - year storm | |
| Acreage | Baseline | Project |
| Acres of pasture damaged | | |
| Acres of high-value crops damaged | | |
| Acres of low-value crops damaged | | |
| | | |
| Crop Type | Damage/Acre | |
| Pasture | | |
| High-Value Crops | | |
| Low-Value Crops | | |
| Does the project include any green infrastructure elements? | No | |

GREEN INFRASTRUCTURE

- Input the number of acres of habitat that will be created by the Project.

| | |
|---|--------------------------------------|
| Does the project reduce utility outages? | <input type="radio"/> No |
| Does the project increase water supply? | <input type="radio"/> No |
| Does the project impact flooding on agricultural lands? | <input type="radio"/> No |
| Does the project include any green infrastructure elements? | <input checked="" type="radio"/> Yes |
| Type of habitat | Acres |
| Green open space | <input type="text"/> |
| Riparian | <input type="text"/> |
| Wetlands | <input type="text"/> |
| Forests | <input type="text"/> |
| Marine & Estuary | <input type="text"/> |

Clear Data

TOTAL IMPACTS

- Review the damages and benefits on the Total Impacts tab.
- There are no inputs on this tab.

| Project Impacts by Recurrence Interval | 100 - year storm | |
|--|------------------|-----------|
| | Baseline | Project |
| Residential Structure Damage | \$551,838 | \$284,281 |
| Residential Loss of Function | \$389,964 | \$344,065 |
| Commercial Structure Damage | \$50,045 | \$0 |
| Commercial Loss of Function | \$8,423 | \$0 |
| Flooded Streets | - | - |
| Utility Impacts | \$781,371 | \$0 |
| Agricultural Losses | - | - |
| Low Water Crossing Damages | - | - |

| Flooded Structures by Recurrence Interval | 100 - year storm | |
|---|------------------|-----------|
| | Baseline | Project |
| Flooded residential structures | 10 | 10 |
| Impacted Residents | 30 | 30 |
| Flooded commercial structures | 1 | 0 |
| Impacted Employees | 10 | 0 |

| Other Project Impacts | Benefits |
|------------------------------|-----------|
| Water Supply Benefits | \$0 |
| Environmental Benefits | \$108,564 |
| Residual Value of Investment | \$0 |
| Recreational Benefits | \$130,827 |

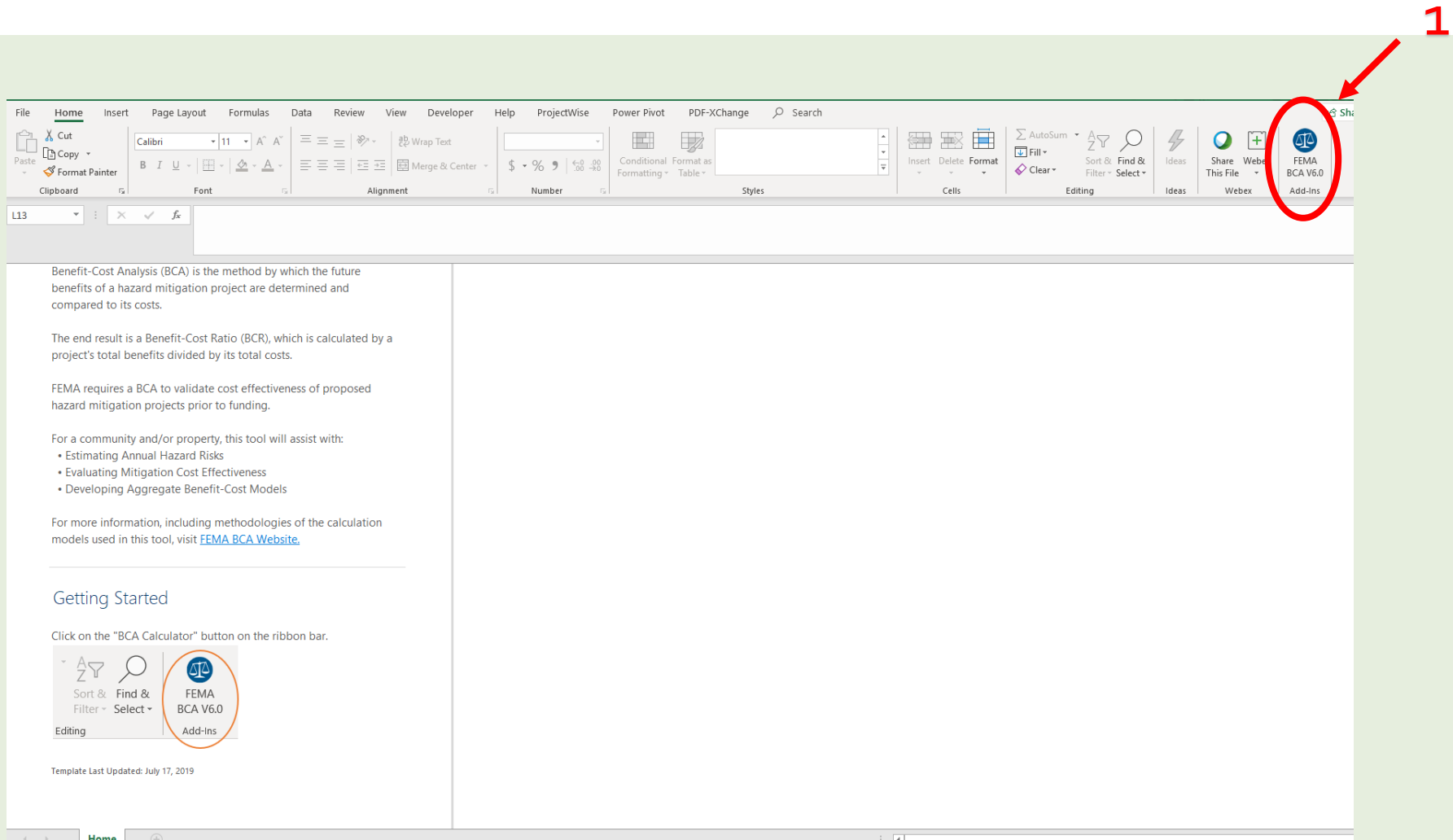
INPUTS INTO BCA TOOLKIT

- Total Baseline (Before Mitigation) and Project (After Mitigation) damages are collated by Recurrence Interval on the Results tab.
- These are the required inputs for the BCA Toolkit.

| Input Into BCA Toolkit | | |
|------------------------|-------------|-----------|
| Project Useful Life | 30 | |
| Event Damages | Baseline | Project |
| 100 - year storm | \$1,781,640 | \$628,346 |

- At this point in the analysis, open the BCA Toolkit 6.o. Installation instructions can be found [here](#).

OPEN BCA TOOLKIT 6.0



The screenshot shows the Microsoft Word ribbon with the 'FEMA BCA V6.0' add-in button circled in red. A red arrow labeled '1' points to this button. The ribbon includes tabs for File, Home, Insert, Page Layout, Formulas, Data, Review, View, Developer, Help, ProjectWise, PowerPivot, and PDF-XChange. The 'FEMA BCA V6.0' button is located in the 'Add-Ins' group on the right side of the ribbon.

Benefit-Cost Analysis (BCA) is the method by which the future benefits of a hazard mitigation project are determined and compared to its costs.

The end result is a Benefit-Cost Ratio (BCR), which is calculated by a project's total benefits divided by its total costs.

FEMA requires a BCA to validate cost effectiveness of proposed hazard mitigation projects prior to funding.

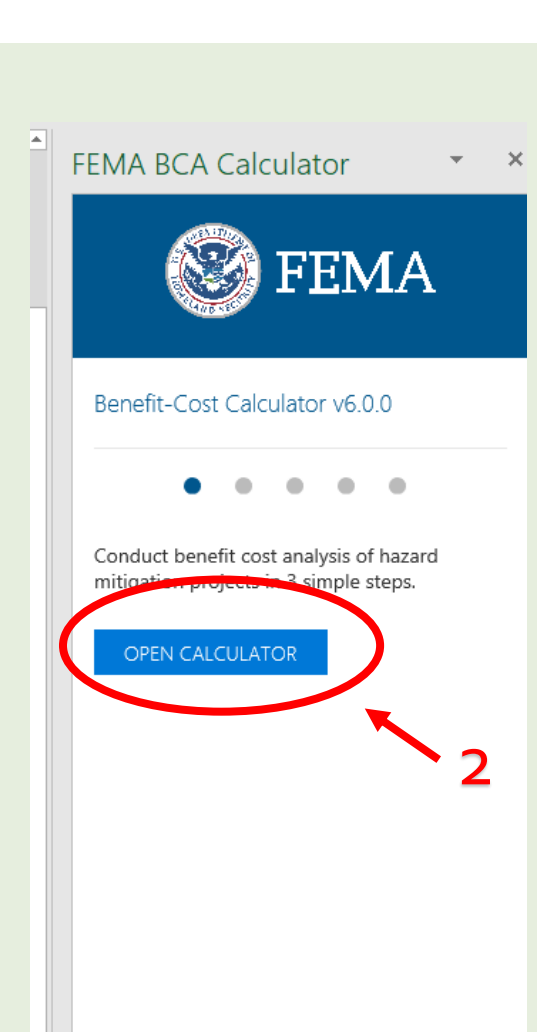
For a community and/or property, this tool will assist with:

- Estimating Annual Hazard Risks
- Evaluating Mitigation Cost Effectiveness
- Developing Aggregate Benefit-Cost Models

For more information, including methodologies of the calculation models used in this tool, visit [FEMA BCA Website](#).

Getting Started

Click on the "BCA Calculator" button on the ribbon bar.





The screenshot shows the FEMA BCA Calculator web application interface. The 'OPEN CALCULATOR' button is circled in red. A red arrow labeled '2' points to this button. The interface includes the FEMA logo, the title 'Benefit-Cost Calculator v6.0.0', and a section titled 'Conduct benefit cost analysis of hazard mitigation projects in 3 simple steps.'

ADD PROJECT



FEMA

Benefit-Cost Calculator
v6.0.0 (Build 20200506.2044)

+ Add Project  Delete Projects  Export Projects

SELECT PROJECT TITLE COUNTY, STATE

There are currently no projects in this file.

Totals

- Click "Add Project."
- Input Project information in the Project Configuration box.
- The Property Structure Type refers to the benefiting structures – NOT the Project structure itself.
- Unless the benefiting structure is a Critical Facility Building (Fire, Hospital, Police), select "Residential Building."

Project Configuration

| | | | | |
|---|--|---|-------------------------------------|--|
| Project Title | <input type="text" value="TWDB Example"/> | | | |
| Property Location | <input type="text" value="1600 Congress Ave, Austin, TX, 78701, USA"/> | | | Use Property Location? <input checked="" type="checkbox"/> Yes |
| | OR | | | |
| | Latitude | Longitude | | Use Decimal Degrees? <input type="checkbox"/> Yes |
| | <input type="text" value="30.278351"/> | <input type="text" value="-97.739702"/> | | |
| | <input type="text" value="78701"/> | <input type="text" value="Texas"/> | <input type="text" value="Travis"/> | |
| Property Structure Type | <input type="text" value="Select Structure Type..."/> | | | |
| Hazard Type | <input type="text" value="Select Structure Type..."/> | | | |
| Mitigation Action Type | <input type="text" value="Residential Building"/> | | | |
| Property Title | <input type="text" value="New Residential Building"/> | | | |
| Frequency and Damage Relationship based on: | <input type="text" value="Critical Facility Building"/> | | | |
| | <input type="text" value="Utilities"/> | | | |
| | <input type="text" value="Roads & Bridges"/> | | | |

Cost Estimation

PROJECT CONFIGURATION AND COSTS

- Select “Professional Expected Damages.”
- Input the Project Useful Life shown in the “Results” sheet of the BCA Input Spreadsheet. This will not be more than 30 years.
- Input Project Costs of \$1
- Click “Next.”

Project Configuration

Project Title: TWDB Example

Property Location: 1600 Congress Ave, Austin, TX, 78701, USA

Use Property Location? Yes

OR

Latitude: 30.278351 Longitude: -97.739702

Property Structure Type: Residential Building

Hazard Type: Riverine Flood

Mitigation Action Type: Floodwater Diversion and Storage

Property Title: Floodwater Diversion and Storage @ 1600 Congress Ave, Austin, Texas, 78701

Frequency and Damage Relationship based on: Modeled Damages Historical Damages Professional Expected Damages

Use Decimal Degrees? Yes

Cost Estimation

Enter the Project Useful Life: 30

Enter the Initial Project Costs (\$): 1.00

Enter the Number of Maintenance Years: 30

Enter the Annual Maintenance Costs (\$): 0.00

Total Mitigation Project Cost (\$): 1

Use Default? Yes

Next

DAMAGE ANALYSIS PARAMETERS

- Click the “Use Default?” button to select “No.”
- Input the Project Useful Life into the Analysis Duration (years) field.

Damage Analysis Parameters - Damage Frequency Assessment

| | | |
|-----------------------------|-----------------------------------|---|
| Year of Analysis Conducted: | <input type="text" value="2020"/> | |
| Year Property was Built: | <input type="text" value="0"/> | |
| Analysis Duration (years): | <input type="text" value="30"/> | Use Default? <input checked="" type="checkbox"/> No |

PROFESSIONAL EXPECTED DAMAGES

- You will input the damages calculated in the BCA Input Spreadsheet for Before Mitigation (Baseline) and After Mitigation (Project).
- Input the Recurrence Interval(s) used in the analysis. If there is more than 1 Recurrence Interval, use the “Add Row” button to add them.

Professional Expected Damages Before Mitigation

Damages Before Mitigation

+ Add Row Delete Row(s)

| SELECT | RECURRENCE INTERVAL (YEARS) | OTHER DAMAGES (\$) |
|--------------------------|-----------------------------|--------------------|
| <input type="checkbox"/> | 100.00 | 0.00 |

View Annualized Results

Professional Expected Damages After Mitigation

Damages After Mitigation

+ Add Row Delete Row(s)

| SELECT | RECURRENCE INTERVAL (YEARS) | OTHER DAMAGES (\$) |
|--------------------------|-----------------------------|--------------------|
| <input type="checkbox"/> | 100.00 | 0.00 |

View Annualized Results

PROFESSIONAL EXPECTED DAMAGES

- Input the Baseline damages into the Damages Before Mitigation field and the Project damages into the Damages After Mitigation field.

| Input Into BCA Toolkit | | |
|------------------------|-------------|-----------|
| Project Useful Life | 30 | |
| Event Damages | Baseline | Project |
| 100 - year storm | \$1,781,640 | \$628,346 |

Professional Expected Damages Before Mitigation

Damages Before Mitigation

+ Add Row - Delete Row(s)

| SELECT | RECURRENCE INTERVAL (YEARS) | OTHER DAMAGES (\$) | Ca |
|--------------------------|-----------------------------|--------------------|-----|
| <input type="checkbox"/> | 100 | 1,781,640.00 | 0.0 |

View Annualized Results

Professional Expected Damages After Mitigation

Damages After Mitigation



+ Add Row - Delete Row(s)

| SELECT | RECURRENCE INTERVAL (YEARS) | OTHER DAMAGES (\$) | Ca |
|--------------------------|-----------------------------|--------------------|-----|
| <input type="checkbox"/> | 100 | 628,346.00 | 0.0 |

View Annualized Results

BENEFIT-COST SUMMARY

- Do NOT input any Additional Benefits into the BCA Toolkit.
- Select "Finish."



| Benefit-Cost Summary | |  |  |
|--|------------|---|---|
| Total Standard Mitigation Benefits (\$): | \$ 143,113 | | |
| Total Social Benefits (\$): | \$ 0 | | |
| Total Mitigation Project Benefits (\$): | \$ 143,113 | | |
| Total Mitigation Project Cost (\$): | \$ 1 | | |
| Benefit Cost Ratio - Standard: | 143,113.00 | | |
| Benefit Cost Ratio - Standard + Social: | 143,113.00 | | |

FINISH

CRITICAL FACILITIES

- If the Project will decrease damages to Critical Facilities (Fire, Police, Hospital), these damages are input into the BCA Toolkit separately.
- Select "Add Mitigation Action."

Home **+ Add Mitigation Action** Delete Mitigation Actions View Report

| Select | Map Marker ▲ | Mitigation Title | Property Type | Hazard | Benefits (B) | Costs (C) | BCR (B/C) | Copy |
|-------------------------------------|--------------|--|---|----------------------|-------------------|-------------|-------------------|---|
| <input checked="" type="checkbox"/> | 1 | Floodwater Diversion and Storage @ 1600 Congress Ave, Austin, Texas, 78701 |  | DFA - Riverine Flood | \$ 143,113 | \$ 1 | 143,113.00 |  |
| TOTAL (SELECTED) | | | | | \$ 143,113 | \$ 1 | 143,113.00 | |
| TOTAL | | | | | \$ 143,113 | \$ 1 | 143,113.00 | |

CRITICAL FACILITIES - PROJECT CONFIGURATION

- Select “Critical Facility Building.” All other Project Configuration and Cost data remains the same. The Damage and Frequency Relationship is based on Professional Expected Damages.

Project Configuration

Project Title: TWDB Example

Property Location: 1600 Congress Ave, Austin, Texas, 78701

Use Property Location? Yes

OR

Latitude: 30.278351 Longitude: -97.739702

78701 Texas Travis

Use Decimal Degrees? Yes

Property Structure Type: Select Structure Type...

Hazard Type: Select Structure Type...

Mitigation Action Type: Residential Building

Property Title: Non-Residential Building

Damage and Frequency Relationship based on: **Critical Facility Building**

Utilities: Critical Facility Building

Roads & Bridges

Other

Cost Estimation

CRITICAL FACILITIES - DAMAGE ANALYSIS PARAMETERS


- Click the “Use Default?” button to select “No.”
- Input the Project Life in the Analysis Duration.


Damage Analysis Parameters - Damage Frequency Assessment









| | |
|-----------------------------|-----------------------------------|
| Year of Analysis Conducted: | <input type="text" value="2020"/> |
| Year Property was Built: | <input type="text" value="0"/> |
| Analysis Duration (years): | <input type="text" value="30"/> |

Use Default? No

CRITICAL FACILITIES PROPERTIES

- Input the Properties in the appropriate boxes. Click on the  icon to see more information about the required inputs.
- Critical Facilities are Fire Stations, Hospitals, and Police Stations.

Critical Facilities Properties 

| | | | |
|---|--|---|---|
| Critical Facility Type: | <input type="text" value="Fire Station"/> |  |  |
| How many people are served by this fire station? | <input type="text" value="0"/> | |  |
| Indicate the type of area served by this fire station | <input type="text" value="Select Type of Area"/> |  |  |
| What is the distance in miles between this fire station and the fire station that would provide fire protection for the geographical area normally served by this fire station? | <input type="text" value="0"/> | |  |
| Does the fire station provide Emergency Medical Services (EMS)? | <input type="text" value="No"/> |  |  |
| Total (\$/day) | <input type="text" value="0"/> | | |

CRITICAL FACILITIES DAMAGES

- Input the Recurrence Interval(s) and the number of days the Critical Facility will be impacted under the Baseline (Before Mitigation) and Project (After Mitigation).
- Select “Finish” at the bottom right of the screen.

Professional Expected Damages Before Mitigation

Damages Before Mitigation

+ Add Row Delete Row(s)

| SELECT | RECURRENCE INTERVAL (YEARS) | IMPACT (DAYS) | Category 1 (\$) |
|--------------------------|-----------------------------|---------------|-----------------|
| <input type="checkbox"/> | 100.00 | 1.00 | 0.00 |

View Annualized Results

Professional Expected Damages After Mitigation

Damages After Mitigation

+ Add Row Delete Row(s)

| SELECT | RECURRENCE INTERVAL (YEARS) | IMPACT (DAYS) | Category 1 (\$) |
|--------------------------|-----------------------------|---------------|-----------------|
| <input type="checkbox"/> | 100.00 | 0.00 | 0.00 |

View Annualized Results

TOTAL BENEFITS

- Input the Total Benefits from the BCA Toolkit into the green "Total Benefits from BCA Toolkit" field in the BCA Input Spreadsheet.

Home + Add Mitigation Action Delete Mitigation Actions View Report

| Select | Map Marker ▲ | Mitigation Title | Property Type | Hazard | Benefits (B) | Costs (C) | BCR (B/C) |
|-------------------------------------|--------------|--|---------------|----------------------|--------------|-----------|------------|
| <input checked="" type="checkbox"/> | 1 | Floodwater Diversion and Storage @ 1600 Congress Ave, Austin, Texas, 78701 | | DFA - Riverine Flood | \$ 143,113 | \$ 1 | 143,113.00 |
| <input checked="" type="checkbox"/> | 2 | Drainage Improvement @ 1600 Congress Ave, Austin, Texas, 78701 | | DFA - Riverine Flood | \$ 136 | \$ 1 | 136.00 |
| TOTAL (SELECTED) | | | | | \$ 143,249 | \$ 2 | 71,624.50 |
| TOTAL | | | | | \$ 143,249 | \$ 2 | 71,624.50 |

| Input Into BCA Toolkit | | |
|---------------------------------|-----------------|----------------|
| Project Useful Life | 30 | |
| Event Damages | Baseline | Project |
| 100 - year storm | \$1,781,640 | \$628,346 |
| Total Benefits from BCA Toolkit | \$143,249 | |
| Other Benefits (Not Recreation) | \$108,564 | |
| Recreation Benefits | \$130,827 | |
| Total Costs | \$96,729 | |

PROJECT BENEFIT-COST RATIOS

- The BCA Input Spreadsheet will calculate 2 Benefit-Cost Ratios for the Project: a Final BCR and a Final BCR with Recreation.
- Remember to SAVE the Input Spreadsheet and BCA Toolkit workbooks to retain your data.

| Input Into BCA Toolkit | | |
|----------------------------------|-------------|-----------|
| Project Useful Life | 30 | |
| Event Damages | Baseline | Project |
| 100 - year storm | \$1,781,640 | \$628,346 |
| Total Benefits from BCA Toolkit | \$143,249 | |
| Other Benefits (Not Recreation) | \$108,564 | |
| Recreation Benefits | \$130,827 | |
| Total Costs | \$96,729 | |
| Net Benefits | \$155,084 | |
| Net Benefits with Recreation | \$285,911 | |
| Final BCR | 2.6 | |
| Final BCR with Recreation | 4.0 | |

ITEMS TO CONSIDER

WHAT TO DO IF THE BCR IS <1.0?

- Ensure that all impacts are captured.
- Add more recurrence intervals.
 - A rule of thumb is that the 500-year water elevations are 1.25 times the 100-year water elevations.
- Determine if the default data included in the BCA Input Spreadsheet is appropriate for your project.
 - If the default data is not appropriate for your project, input data directly into the FEMA BCA Toolkit using the Modeled Damages option.