# FEMA Benefit-Cost Analysis (BCA)

MEMA Building Resilient Infrastructure and Communities (BRIC) Program – FY20 BCA Overview

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# Objectives

1. Understand why BCAs are needed to complete a mitigation grant application
2. Know where to download FEMA BCA software and guidance documents
3. Identify what is categorized as a benefit
4. Learn how to appropriately document damages
5. Review best practices for BCAs

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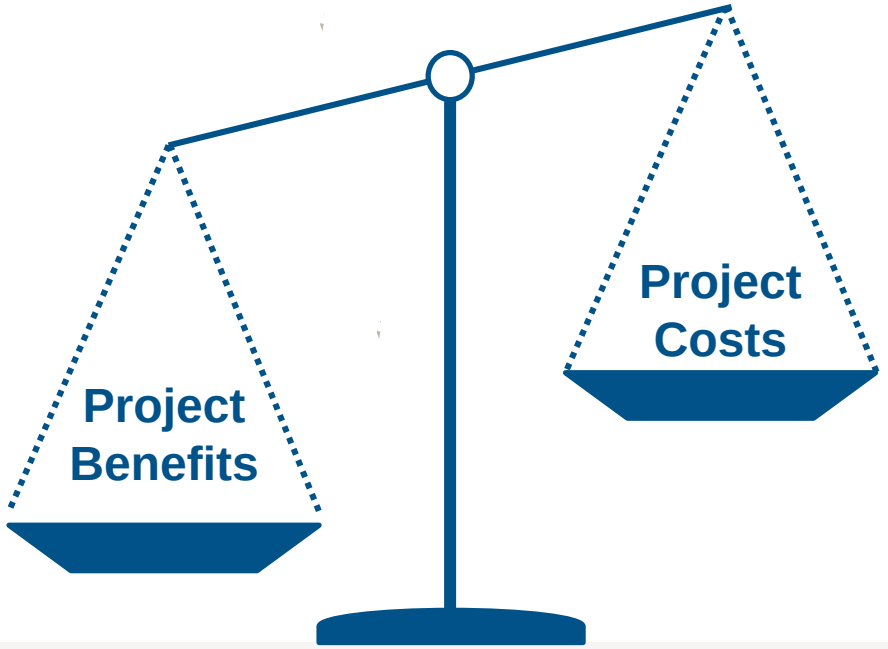
# What is a Benefit Cost Analysis (BCA) ?

- **Benefit-Cost Analysis (BCA**) is a method that quantifies the benefits of a mitigation project compared to its costs.
  - Goal: break the cycle of damage, reconstruction, and repeated damage

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# How do we use the BCA?

| We practice the concept of BCA everyday – it just may look a little different. | Examples: | What factors go into your decision? |
| --- | --- | --- |
| • Think about how you evaluate decisions | • Is a warehouse club membership worth it?<br>• Should I fix my leaky toilet or get a new one?<br>• Should I buy or rent a house? | • Cost<br>• Risk<br>• Convenience<br>• Timing |

# What is the purpose of a BCA?

Shows if project is cost-effective

If an action's benefits are greater than its costs, then it is considered **cost-effective**.

Once benefits for an action are added up, that value is divided by the costs, which produces the **Benefit-Cost Ratio (BCR)**.

$$\frac{\textbf{Benefits}}{\textbf{Costs}} = \textbf{BCR}$$

***If the BCR is greater than or equal to 1.0, then the action is cost-effective.***

# Are BCAs required?

YES!

*Should be the FIRST action completed to validate project's eligibility*

- Required component for HMA projects
- Required for some 406 (Public Assistance) mitigation projects

Bonus:

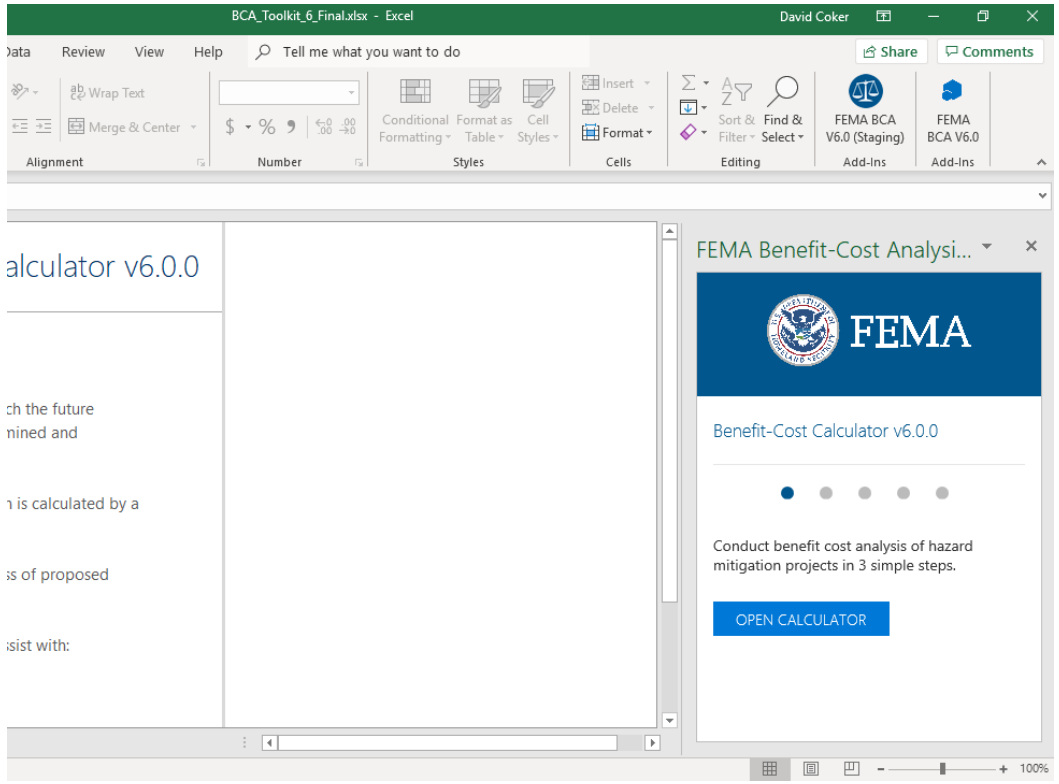
- Helps communities and sub-applicants make informed decisions about their risks and money and **prioritize projects**

# Why are BCAs required ?

- Demonstrate that a project is cost effective
- FEMA National Benefit Ratio:
  - For every $1 spent, $6 should be saved
- BCAs can help you set priorities among projects
- BCAs help you determine if a project is a good investment
- BCAs help “sell” good mitigation projects to the communities involved

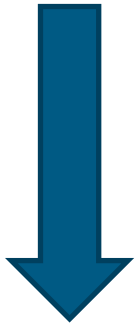
# Overview of Software: Where to Download

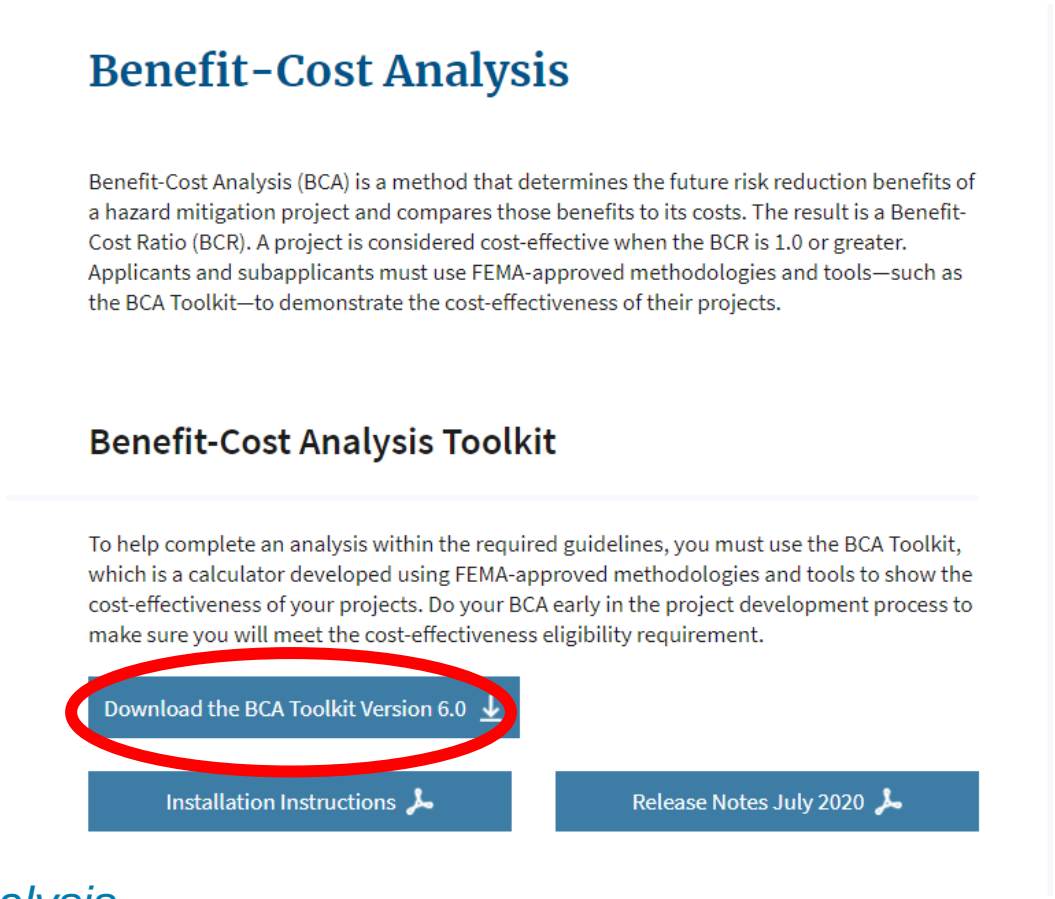
- FEMA has developed the BCA Toolkit.
- The BCA Toolkit is an Excel-based tool



# Overview of Software: How to Access

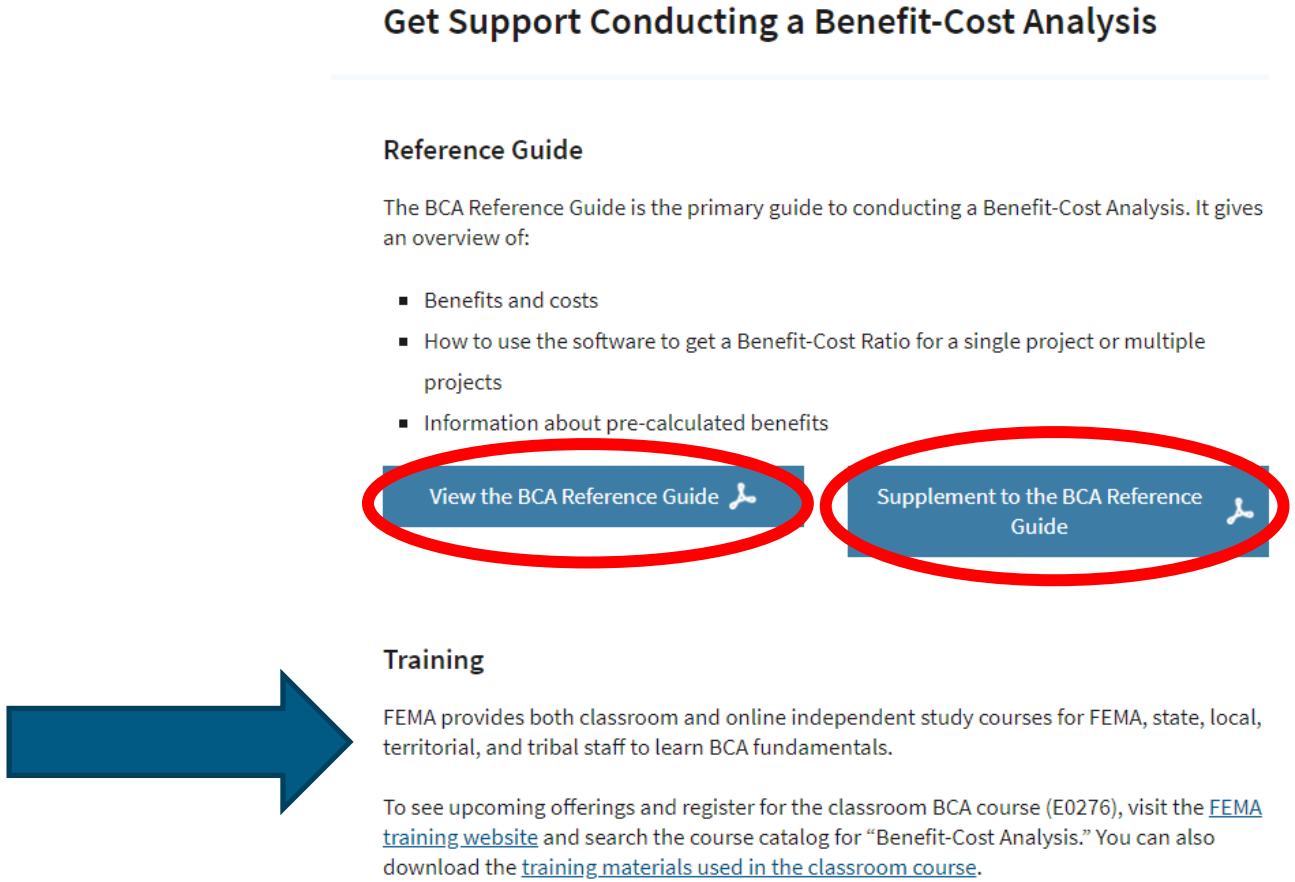
- Review Installation Instructions
- Download BCA Toolkit Version 6.0
- Open on desktop/laptop






*https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis*

# Overview of Software: Reference Documents



## Get Support Conducting a Benefit-Cost Analysis

### Reference Guide

The BCA Reference Guide is the primary guide to conducting a Benefit-Cost Analysis. It gives an overview of:

- Benefits and costs
- How to use the software to get a Benefit-Cost Ratio for a single project or multiple projects
- Information about pre-calculated benefits

View the BCA Reference Guide

Supplement to the BCA Reference Guide

### Training

FEMA provides both classroom and online independent study courses for FEMA, state, local, territorial, and tribal staff to learn BCA fundamentals.

To see upcoming offerings and register for the classroom BCA course (E0276), visit the FEMA training website and search the course catalog for "Benefit-Cost Analysis." You can also download the training materials used in the classroom course.

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# Overview of Software: Advice

It is **extremely** important to keep in mind that the BCA Toolkit is a calculator, **not** a data validation or analysis tool.

***Garbage in = garbage out***

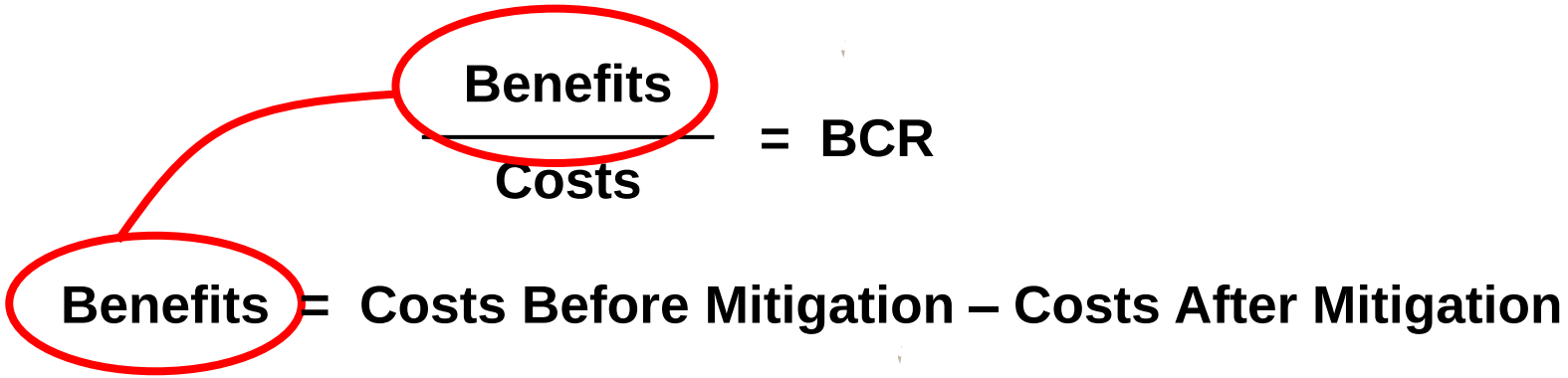
Properly sourced and documented data sources are **always** required as part of your project application!

***Document, Document, Document***

# What is a benefit?

**Benefits** are any future costs or losses that can be avoided by completing a mitigation project

› The difference in the costs before mitigation and costs after mitigation




› *Future costs should be included: no matter who is responsible for the cost*

# What is a benefit?

Avoided Physical Damages

Avoided Loss of Function Costs

Avoided Casualties

Avoided Emergency Management Costs

MEMA BCA Resource Page

www.mass.gov/service-details/benefit-cost-analysis-bca

## What Is a Benefit?

The benefit of a mitigation project is simply the difference in expected damage and loss before and after the project is completed. Benefits of a proposed mitigation project can be sorted into four main categories:

| | |
|---|---|
| *Avoided Physical Damage* | Buildings<br>Contents<br>Infrastructure<br>Landscaping<br>Site Contamination<br>Vehicles<br>Equipment |
| *Avoided Loss-of-Function Costs* | Displacement costs for temporary quarters<br>Loss of rental income<br>Loss of business income<br>Lost wages<br>Disruption time for residents<br>Loss of public services<br>Economic impact of loss of utility services<br>Economic impact of road/bridge closures |
| *Avoided Casualties* | Deaths<br>Injuries<br>Illnesses |
| *Avoided Emergency Management Costs* | Emergency operations center costs<br>Evacuation or rescue costs<br>Security costs<br>Temporary protective measure costs<br>Debris removal and cleanup costs<br>Other management costs |

# How to Identify Benefits?

- Avoided future costs/losses can include:
  - *Physical damage*
  - *Loss of service/function*
  - *Injury or death*
  - *Displacement costs*
  - *Emergency management costs*
- What benefit might be the result of a mitigation plan in this area?

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# Benefits: Physical Damages

- Benefit: avoided physical damages
  - *Example: if mitigation project is an acquisition where the structure is being demolished, there is no longer any risk at that location*
- Physical damages can include:
  - Structural damage to buildings or infrastructure
  - Contents damage
  - Damage to historic/cultural resources
  - Site contamination

# Avoided physical damages: types

How do we quantify – express in numerical terms – avoided physical damages?

Use either:

- hazard-specific information; or
- past or expected damage data to estimate the amount of damage expected in the future.

# Avoided loss of service/function: type

Another major benefit of a hazard mitigation project can be avoided loss of service or function of the facility.

- This benefit is only applicable to public facilities, such as utilities, emergency operations facilities (i.e. police, fire), and infrastructure such as roads and bridges
- Examples include:
  - A generator project for a fire station can ensure the fire station remains operational even during a storm event
  - A bridge retrofit project can ensure the bridge remains functional during/after a hazard event

# Avoided loss of service/function: quantification

## How do we quantify this benefit?

- **Public/nonprofit sector buildings**:
  - Value of service: building becomes unusable due to a hazard event
- **Critical facilities** (i.e. fire/police stations, hospitals)
  - Value of service: service population and societal benefits of maintaining that facility in the aftermath of a disaster.
- **Roads and bridges**
  - Value of service: number of one-way trips, additional time/miles required for detour, the GSA mileage rate, and FEMA standard values.
- **Utilities**
  - Value of service: service population and FEMA standard values

# Avoided loss of service/function: values

| Loss of Service Type | FEMA Standard Value |
|---|---|
| Electrical power | $174/person/day |
| Potable water | $114/person/day |
| Wastewater | $58/person/day |

# Avoided displacement costs

- Displacement costs occur when occupants (of residential, commercial, or public buildings) are displaced to temporary quarters while damage is repaired
- These costs include rent and other monthly costs, such as furniture rental and utilities, and one-time costs, such as moving and utility hook-up fees
- They can also include loss of business income for commercial buildings

# Avoided emergency management costs

- Emergency management costs incurred by communities during and immediately after a disaster.
  - *These costs are much smaller than physical damages or loss of service impacts.*
- These costs can include debris removal and volunteer costs (i.e. sandbagging).

# Avoided NFIP administration costs

- Properties insured under the **National Flood Insurance Program (NFIP)** incur administrative fees to run the program.
- If a property is acquired and demolished, there is no longer an administrative cost to the government for that property; therefore, it is an avoided cost.

# Other Benefits

- In addition to avoided costs, hazard mitigation projects can have other benefits.
  - *Social benefits*
  - *Environmental benefits*

# Social benefits

- **Social benefits** capture the avoided costs associated with:
  - Mental stress & anxiety
  - Lost wages
- Only projects that protect residential structures
- Project must have a 0.75 BCR before social benefits can be applied

| Social Benefit | FEMA Standard Value |
|---|---|
| Mental stress & anxiety | $2,443/person |
| Lost productivity | $8,736/person |

# Environmental benefits

**Environmental benefits** are benefits resulting from an improved natural environment.

- These benefits are applicable to any project type that results in a preserved or improved natural environment,
- Applicable projects include acquisitions, relocations, and floodplain, stream, or coastal restoration

# Environmental benefits: values

| Type of space | FEMA Standard Value |
|---|---|
| Green open space | $8,308/acre/year |
| Riparian | $39,545/acre/year |
| Wetlands | $6010/acre/year |
| Forest | $554/acre/year |
| Marine & estuary | $1,799/acre/year |

# Pre-Calculated Benefits

- What are pre-calculated benefits?
  - FEMA **pre-calculated benefits** that provide pre-determined cost effectiveness values.
- Pre-calculated benefits eliminate requirements to conduct a separate BCA for eligible projects:
  - Acquisitions and Elevations in the Special Flood Hazard Area (SFHA)
  - Residential Hurricane Wind Retrofits
  - Non-Residential Hurricane Wind Retrofits
  - Residential Tornado Safe Rooms
  - Post-Wildfire Mitigation
- **Projects must still meet all other HMA application requirements**

**FEMA's BCA website**

# Pre-calculated benefits: values

| Project Type | Maximum Project Cost | Notes |
|---|---|---|
| Acquisitions in SFHA | $276,000/property | Property must be in SFHA. See memo for details. |
| Elevations in SFHA | $175,000/property | Property must be in SFHA. See memo for details. |
| Residential hurricane wind retrofits | Ranges from $13,153-$52,018/property | Only certain states and counties eligible. Maximum cost depends on type of work being performed; see Job Aid for details. |
| Non-residential hurricane wind retrofits | 10% of Building Replacement Value (BRV) | See memo for details. |
| Residential tornado safe rooms | Ranges from $3,936-$20,067/property | Maximum cost depends on state; see Job Aid for details. |
| Post-wildfire mitigation | $5,250/acre | See Policy Clarification for details. |

# What are NOT considered benefits?

- Anything that is **subjective** or **non-quantifiable**
  - Ease of project
  - Aesthetic value of project
- Anything not impacted by the proposed project
  - Definitive connection must be made between the project & benefits
- OMB Circular A-94 dictates that indirect benefits must not be considered in a BCA, such as:
  - Changes in gross regional economic product, incomes, or employment
  - Avoided criminal justice system costs for disaster-related crime

# Duplication of benefits and programs

It is important to include all possible quantifiable benefits when developing the project, *but benefits cant be double-counted or duplicate other programs*

- Duplication of benefits occurs when:
  - Counting the same benefits in two different projects or counting the same benefits on multiple structures in a project
  - Example: elevating a home in one project but then using the original elevation of that home in a separate drainage project
- Duplication of programs occurs when:
  - Project falls mainly under another federal program (e.g. certain levee projects are the domain of the U.S. Army Corps of Engineers).

# Project Useful Life (PUL)

- **Project Useful Life (PUL)** is the estimated amount of time (in years) that the mitigation action will be effective
  - *How long will this project last?*
  - *Is there documentation to support that length of time?*
- The PUL is important in the calculation of the BCR because it establishes the timeframe to calculate benefits

- **FEMA Default Values for PULs should be used**
  - *Unless acceptable documentation is applicable*

# Project Useful Life (PUL): example

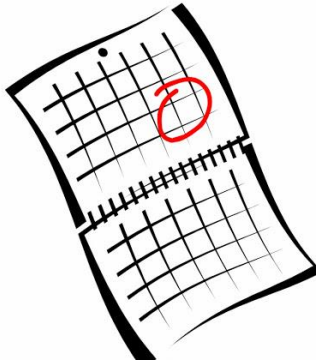
## Let’s think back to the example of the leaky toilet

- Let’s say I’ve have finally decided to replace the toilet
- My PUL is the amount of time I expect the new toilet to last, assuming proper maintenance (the costs of which I must include in my overall project cost)
- For this example, we will assume the PUL of the new toilet is 30 years.

# Recurrence interval (RI)

A **recurrence interval (RI)** is how often a hazard event of specific severity is likely to occur in a particular location.

- An RI is often talked about as the “X-year” or “Y% annual chance” event
  - For example, the “100-year flood” is the 1% annual chance flood, meaning that in any given year, there is a 1% chance it will occur



# Recurrence interval (RI): example

## Back to the leaky toilet example:

Perhaps, just as with hazard events, my toilet does not leak all the time. The RI is **how often** the toilet is leaking **at a particular severity**, averaged over the life of the toilet.

- Example:
  - Toilet: 20 years
  - Leaked: 5 times
    - *Flooded floor: 2 times*
  - RI: 2/20 = 10%

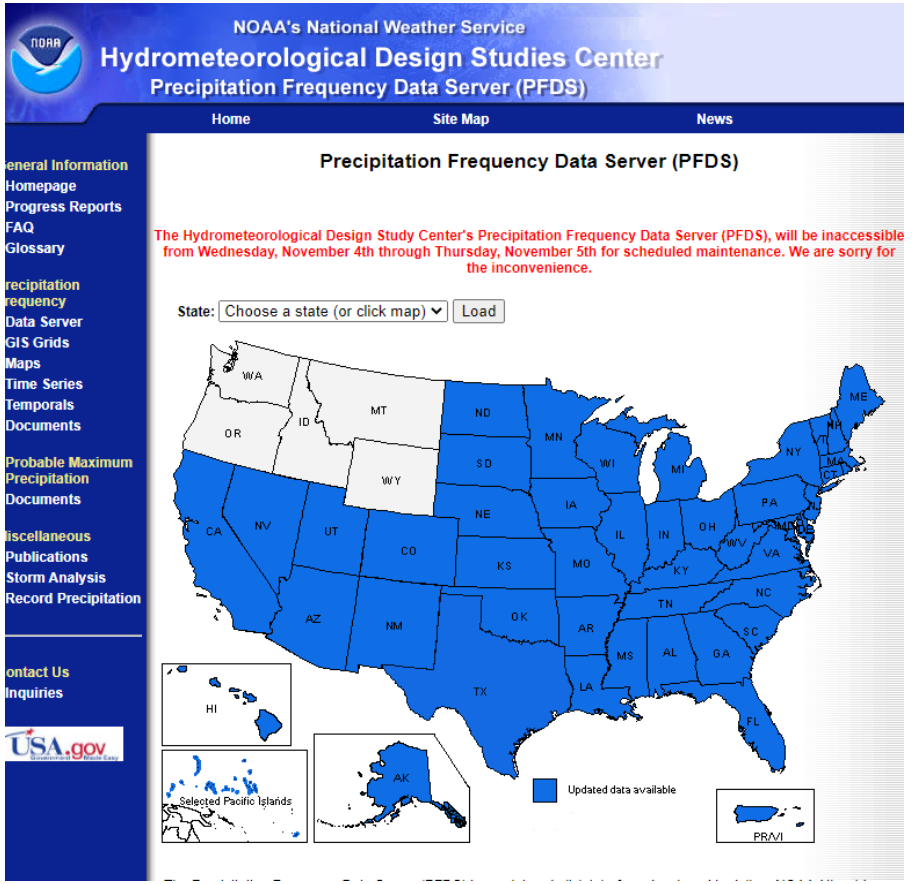
# Recurrence interval (RI): resource

## Precipitation Frequency Data

The NOAA's National Water Center has released updated precipitation frequency estimates for Massachusetts. These estimates (published in Atlas 14, Volume 10) are used in many infrastructure design and planning activities, and are available for download through the Precipitation Frequency Data Server (PFDS).

The Northeast Regional Climate Center (NRCC) and the Natural Resources Conservation Service (NRCS), through a joint collaboration, have developed a web-based platform that allows users access to updated extreme rainfall analyses for New York and New England. The website provides a subset of users access to extreme rainfall statistics through the most recent year (i.e., there will be an automatic update of the rainfall statistics on an annual basis). In future years, these updates will provide the necessary information for considering subsequent updates and provide a readily available source of updated statistics. The website can be found at: http://precip.eas.cornell.edu/ .

For help with FEMA's benefit-cost analysis, call the BCA Helpline at 1-855-540-6744 or email bchelpline@fema.dhs.gov.



# Project effectiveness

***Benefits = Costs Before Mitigation – Costs After Mitigation***

**Project effectiveness** measures how well the project will reduce future damages

- Only structure acquisition/demolition projects are 100% effective – i.e., they have $0 costs after mitigation
- ALL other project types assume some (but reduced) hazard risk upon project completion—this is called **residual risk**
  - *Example, if a floodwall protects up to the 0.2% annual chance (500-year) flood, then it will no longer be effective in events exceeding the 500-year*

# What is a Damage?

- An application must contain actual or projected damage history
  - *Clearly explain the purpose and need for the project*
- Damage history should include:
  - *Damage figures and dates*
  - *Details about the storm event*

# How to Document Damages?

Sources of information for damage include:

- Insurance claims/records
- FEMA mapping data
  - Frequencies or Reoccurrence Intervals (RIs) linked to documented Flood Insurance Study (FIS) data
  - State NFIP representatives: repetitive loss, documented damages
- U.S. Army Corps of Engineers (USACE)
- U.S. Geological Survey stream gauge data or National Oceanic and Atmospheric Administration (NOAA) tide gauge data
- Water management agencies
- Newspaper accounts citing credible sources, such as a public agency
- Copies of engineering/technical expert reports
- StreamStats (USGS)

# What documentation is needed/preferred?

Historical occurrences can be documented by:

- Letter from a local official with identified damage and/or damage assessment methodology
- Newspaper account
- Technical study
- National Weather Service
- USGS
- NOAA
- National Climactic Data Center
- FEMA Project Worksheets/Damage Survey Reports
- Insurance claims, BureauNet/Simple and Quick Assessment (SQA) Net information
- Damage repair records, or data from the State/local agency, local government

Understanding the FEMA Benefit Cost Process

# What to do with expected damages

If historical damage are unknown or undocumented, use Expected Damages

- Professional Expected Damages:
  - Based on damage estimates from a licensed and qualified professional with known recurrence intervals (RI)
  - Identified RI(s) and estimated damages for each event.
  - Must identify and document data

- Examples:
  - *Hydrology and hydraulics (H&H) studies that indicate expected flood damages*
  - *Technical studies containing project area*
  - *Qualified engineer report and/or analysis*
  - *Hazus with project specific depth grids*

# Documentation best practices

**DOCUMENT ALL DATA, NUMBERS, INFORMATION, ANYTHING SUBMITTED IN AND WITH THE BCA**

**ORGANIZE LIKE TELLING A STORY OF THE DAMAGE: WHAT, WHERE, WHY, HOW**

**PICTURES! PICTURES OF DAMAGE AND/OR DAMAGE EVENT DOCUMENTS OCCURRENCE AND SEVERITY (IN SOME CASES)**

# Documentation References

**APPENDIX A**
**Data Documentation Templates**

## Benefit-Cost Analysis (BCA) Data Documentation Template – Damage-Frequency Assessment

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

1. Credible and well-documented
2. Prepared in accordance with accepted FEMA BCA practices
3. Able to demonstrate that the project is cost-effective

The Damage Frequency Assessment can be used for any hazard to which frequency-damage relationships can be established from historical damage data and/or engineering judgment. The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA Standard Value (Default).

| Obtained | Input | Documentation Summary | Potential Sources | Software Input/ Justification |
|---|---|---|---|---|
| ☐ | Name, address, county, and latitude/longitude for each project structure | Include contact information and whether building is historic. | Documents available from homeowner, local building inspector, local tax assessor's office, or title documents. | |
| ☐ | Project Information | Project Information includes:<br>• Project Number<br>• Analyst Name and Contact Information<br>• Grant Program<br>• Project Point of Contact (POC) | Information available from the project manager or POC. | |

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# References

## Helpful Online References:

- FEMA Benefit Cost Analysis Toolkit
- Understanding the FEMA Benefit-Cost Analysis Process
- FEMA BCA Reference Guide
- FEMA Supplement to the Benefit-Cost Analysis Reference Guide
- BCA Software Guidance
- Mass Gov MEMA BCA Page