FEMA'S BENEFIT COST-ANALYSIS TOOL FOR AQUIFER STORAGE AND RECOVERY (ASR) PROJECTS

General Guidance

The purpose of this document is to provide potential subapplicants with general guidance on FEMA's Hazard Mitigation Assistance (HMA) benefit-cost analysis (BCA) tool. This guidance is not intended to provide complete information, but rather to outline some basic requirements and considerations as subapplicants begin the analysis process. OES is available to answer technical questions about BCAs and can be contacted by emailing HMA@caloes.ca.gov.

Benefit-Cost Analysis for ASR Mitigation Projects

Drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. Drought mitigation projects are defined as actions taken to reduce the potential depletion of water sources in a community and/or improve recharge of those water sources. For the purpose of FEMA HMA projects, such actions fall into two general categories: supply increase and demand reduction.

BCA Software and Methodology

FEMA requires the use of its BCA software (version 6 for all BCAs). Subapplicants can get the software by visiting FEMA's Benefit-Cost Analysis Guidance and Tools website: https://www.fema.gov/media-library/assets/documents/179903. BCAs for drought projects follow the specific paths in the software, which are selected via the drop list for *hazard type* and *mitigation action type*. FEMA offers guidance on one as guidance on one aspect of such BCAs – for aquifer storage

and recovery (see footnote)[1]. This guidance does not address BCAs for all potential projects.

Data used in the Analysis

This subsection is intended as a general summary of data requirements for the two types of BCAs, not a comprehensive explanation of how to complete an analysis.

The Aquifer Storage and Recovery (ASR) projects are based on the assumption that drought affects the population by reducing available water for consumption for a prolonged period of time. In that particular aspect, the BCA methodology for ASR projects is different than a standard damage-frequency assessment (DFA) approach. The DFA methodology assumes the binary (on or off) availability of potable water, where users are either completely deprived of water-supply services or have them available in full capacity.

Consequently, the ASR data input requirements are different than in the DFA approach as seen below.

1. Project title and property address and/or latitude and longitude of the proposed project site per standard DFA approach.
2. The project useful life is 30 years.
3. The property structure type is "Utilities".
4. The hazard type is "Drought".
5. The mitigation action type is "Aquifer Storage and Recovery".
6. The data is based on "Modelled Damages".
7. The recurrence interval (in years) is a cyclical time interval in which the affected area is declared under drought. This data can be obtained from various official sources, such as local water boards, climatological, and academic sources. If the data is available, the table of drought

[1] *https://www.fema.gov/media-library-data/1464288989120-5439c85896bf950c82009b95dbe2c16b/15_J_0051_ASR_BCA_Methodology_508.pdf*

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induced losses can have multiple lines corresponding to the different recurrence intervals.

8. A typical water demand (in MGD) by the effected population under non-drought conditions can be obtained from the local water utility agency or department.
9. Pre-Mitigation System Supply Yield (in MGD) is the amount of available water yield (the reduced water supply), resulting from the corresponding drought. This information can be obtained from the local water utility agency or department.
10. Pre-Mitigation Duration of Impact (in days) is the duration of the reduced water supply. This data point reflects the effect of the drought, which may span beyond the drought itself, such as the time allowed for underground resources to be replenished. It is important to note that this duration is in days; the duration of impact should not be longer than the recurrence interval of the drought in question (i.e., the 3-year drought should not have a duration of impact of 5 years).
11. Post-Mitigation System Supply Yield (in MGD) is the amount of available water yield, following the proposed ASR project. Depending on the project, this number should aim to be close to the non-drought water yield.
12. Post-Mitigation Duration of Impact (in days) is the duration of drought impact after the ASR project is implemented. This input is in days and should be relatively low for higher-frequency drought events.
13. Population served is the population that is both impacted by the drought and benefited from the proposed ASR project.

Benefits

The principal benefits of ASR drought mitigation are the avoided (or reduced) partial losses of potable water to the community. Additional benefits may include avoided agricultural damages, avoided reductions in fire flows, and others, but only as ancillary benefits.

Project Useful Life and Project Effectiveness

Project useful life is simply the period over which a project is effective. FEMA's 2009 BCA guidance (Appendix D) provides specific values for useful life, and can be found by visiting FEMA's Benefit-Cost Analysis Guidance and Tools website:

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https://www.fema.gov/media-library/assets/documents/179903. Project effectiveness is the extent to which a mitigation activity reduces future damages. In the full flood methodology, the software requires the analyst to enter information to calculate this value.

Documentation

OES and FEMA require subapplicants to provide documentation for all data that is used in a BCA. This must be included with the materials that are submitted as part of the application package.

Best Practices

OES strongly recommends that each subapplicant BCA be supplemented by a brief technical report that summarizes the approach to the analysis, the data that was used, the sources of the data, and the results of the analysis.

Subapplicants should provide electronic copies of any data sources that are used in a BCA. Ideally, every data point entered into the software will be explained in a technical report and backed up with written documentation.