

# Climate Resilient Mitigation Activities (CRMA)

## Benefit Cost Analysis Approaches



**FEMA**

The notes contained in the webinar were taken from the webinar's transcript.

## Climate Resilient Mitigation Activities

- In September 2015, FEMA announced the eligibility of three Climate Resilient Mitigation Activities (CRMA) for HMA:
  - Aquifer Storage and Recovery (ASR)
  - Floodwater Diversion, Storage, and Recovery
  - Floodplain and Stream Restoration
- Can be used for all hazards, when applicable. Also provides guidance on drought mitigation actions
- Encourages using green infrastructure or nature-based design to develop and implement mitigation actions and incorporate more nature-based elements that include ecosystem service benefits
- May 2016, released tools and guidance for measuring the cost effectiveness of ecosystem services

In September of 2015 FEMA announced the eligibility of three Climate Resilient Mitigation Activities (CRMA) eligible for mitigation: aquifer storage and recovery; floodwater diversion storage and recovery; and floodplain and stream restoration.

The original impetus for developing the CRMA project types and the accompanying benefit cost analysis (BCA) tools was to find ways to provide technical guidance and targeted actions that could benefit a community suffering from drought. The original purpose of the tool was in response to demand from communities, especially in Western states and Midwest states, and from our executive leaders, including the White House, that wanted to help drought prone communities become more resilient. However, all of the CRMA projects are eligible and available to be used for any hazard that communities may experience, as long as the project demonstrates a positive benefit cost ratio of 1 or more. You could leverage flood reduction benefits for drought mitigation, like with flood diversion or stream restoration, or you may be able to address another hazard to your community like erosion along the stream bank.

What distinguishes CRMA projects from other more traditional mitigation

actions, is the use of nature-based design in the implementation. The purpose utilizing green infrastructure or nature based design is to encourage communities to use more sustainable methods for their resource management and risk reduction, as well as to provide as many additional ecosystem services as allowable.

In the effort to try to make sure there were adequate tools in place for communities to be able to develop and calculate those ecosystem services provided under their projects, FEMA developed specific tools to evaluate the ecosystem services and how they would fit with the rest of the benefit cost analysis toolkit. FEMA encourages communities to look at the connections between the actions and see the systems wide approach, not just isolated problem points.

## Green Infrastructure/Nature-Based Design

- Green infrastructure or nature-based design under HMA
  - Projects that use an integrated, natural systems-based design approach in hazard mitigation actions
  - Restore or replicate a site's natural function
  - Reconnect disrupted natural systems (e.g. reconnect interrupted watersheds or drainage systems)
  - For HMA application
    - Project must demonstrate measurable natural hazard risk reduction
    - Should also provide additional ecosystem services
    - Encourage most sustainable design and method

FEMA encourages communities to try to restore the natural functions of the stream system as much as possible. That could mean restoring banks during flood, stream restoration for flood control so that the natural meander of the stream will control the elements that might diminish the soil erosion, or reconnecting interrupted streams. If the development of a natural watershed or drainage area can restore natural functions, that would be an important part of the mitigation action.

For all HMA actions, all eligible HMA projects must demonstrate there's a risk reduction component to the project. In these cases, at least 75% of the project benefits must come from actual risk reduction to the loss to property or life. For green infrastructure, they should incorporate ecosystem service benefits and be designed in the most sustainable methods possible. In order to carry out this work and figure out how to capture green infrastructure in an HMA application, FEMA developed a calculator for the ecosystem benefits. The calculated ecosystem service benefits will then be included in the benefit cost ratio in the BCA tool.

## Benefit Cost Guidance

- **FEMA distributed guidance for three CRMA project types on May 13<sup>th</sup>. The guidance provides methods to conduct benefit cost analysis for**
  - **Aquifer Storage and Recovery (ASR)**
    - **New Microsoft Excel® based tool**
    - **Detailed guidance for project development and analysis**
  - **Floodwater Diversion and Storage (FDS)**
  - **Floodplain and Stream Restoration (FSR)**
  - **Microsoft Excel® based tool to include ecosystem service benefits for FDS and FSR projects and other mitigation projects in which ecosystem service benefits can be included**
  - **Will be uploaded to FEMA.gov**

FEMA issued guidance for the three Climate Resilient Mitigation Action (CRMA) project types on May 13, 2016. The guidance provides methods to conduct benefit cost analysis for the aquifer storage and recovery (ASR) project type. For ASR, FEMA developed a new Microsoft Excel tool since nothing has ever been done like this before at FEMA. In addition to the tool, FEMA also provided detailed guidance for the project development and analysis.

FEMA released guidance and methodologies for the floodwater diversion and storage (FDS) and the floodplain and stream restoration (FSR) project types. This webinar will not go into detail on the FDS and FSR guidance documents, as they provide a comprehensive methodology.

FEMA also released a Microsoft Excel based tool to include the ecosystem service benefits for the FDS and FSR project, and other mitigation projects in which ecosystem services can be included.

All of these guidance documents and tools can be located at:  
<http://www.fema.gov/climate-resilient-mitigation-activities-hazard-mitigation->

assistance

## Aquifer Storage and Recovery

- **Primary goal of the project is to capture water when abundant during rainy seasons or snow melts and store the water in subsurface aquifer for later use**
  - **New benefit cost methodology developed to capture the value of water benefits**
  - **Ecosystem service benefits will generally not be included with this project type**
- **Will require extensive consultation for EHP concerns and time for permitting by the EPA**

This type of project captures water when it's abundant, such as during rainy season or snow melts, and stores the water in subsurface aquifers for later use. The new benefit-cost methodology we developed to capture the value of the projects is based on the value of water. For years, FEMA has used the economic value of water to do projects mitigating potable water treatment facilities. We wanted to make the process to do the benefit-cost analysis easy for this new project type so we are sticking with the federal methodology of using \$103 per day per person.

The ecosystem service benefits will generally not be included in this project type. Aquifer storage and recovery takes water and stores it in the aquifers for future use. In most cases, land that is not being protected is allowed to revert to its natural and beneficial function. Generally we are not going to see aquifer storage and recovery including ecosystem service benefits as a component of that. Just one note, if your community is looking at these projects, they will require extensive consultation with the Environmental and Historic Preservation (EHP) concerns and there's a lot of permitting requirements for the EPA the Environmental Protection Agency. If you are considering a project, even though we're talking about benefit cost analysis, you also need to consider the time involved with the permitting and planning

out the project long-term.

## Aquifer Storage and Recovery (continued, 2 of 4)

- **Key inputs required for conducting the analysis**
  - **Population** – Those impacted by the drought and would benefit from the project
  - **Average Water Use Rate** – total annual production in gallons divided by population divided by 365 days for normal, non drought conditions
  - **Maximum Volumetric Pumping Rate** – production pumping rate to deliver stored water for drought mitigating purposes
  - **Average Depth to Recoverable Water** – Depth of stored water used for production
  - **Estimated Cost** – The total, one time cost to install ASR system

When we talk about the aquifer storage and recovery projects, there are inputs required when you conduct the analysis.

Number one is the population that will benefit from the project. As we mentioned, those populations are the ones impacted by the drought and would benefit from the project. If you are looking at putting an ASR project in the community, you want to count the community drawn from the water supply that will get the benefits for it. You don't want to count the entire population of a county if they are on a different water system. I only mention this because I've seen this done incorrectly. Make sure you only include those that will benefit from the aquifer storage and recovery project.

The average water use rate is also an input required by the tool. It's a pretty simple math equation so you don't have to freak out about math this afternoon. We're looking at the total annual production in gallons of the aquifer divided by the population that is benefiting from an aquifer. What you're trying to get is the average use per individual in terms of amount of water being used.

The next key in point is the maximum volumetric pumping rate. This is the pumping rate to deliver the stored water for drought mitigating purposes. We also need to know what the average depth of recoverable water is. In some cases it can be shallow aquifers and some deeper but that needs to be provided in the tool as well.

The estimated cost is the total one-time cost to install the ASR system. I recommend you look at HMA guidance for details and what project costs are but we're looking at the total cost to put the project in place.

## Aquifer Storage and Recovery (continued, 3 of 4)

- **Key inputs required for conducting the analysis**
  - **Operation and Maintenance Costs** – Total yearly costs to operate facility, required in the benefit cost analysis but is not reimbursable by the FEMA HMA grant
  - **Project Useful Life** – Default of 30 years, can be overridden but requires sufficient documentation and sound reasoning from expert
  - **Annualized Costs** – Calculated by tool

Another input required when you are doing the benefit cost analysis is the operation and maintenance costs. These are the total yearly costs to operate the facility. This might be your staff time, personnel, maintenance, and any costs to operate the facility on a yearly basis. This is required in the benefit cost analysis. This is not a reimbursable cost of the grant. We have to include the operation and maintenance costs of the project because when we look at the OMB Circular A-94, which are the benefit cost analysis statues, anytime we are funding a project we have to include all future costs so even though FEMA does not reimburse or pay for the maintenance of the facilities after the initial grant. Those costs have to be used when performing the benefit cost analysis.

The project useful life is also required as a tool and by default, from talking to the experts that helped us develop this project type, 30 years is a reasonable project useful life for this type of facility. When the facility is installed and maintained appropriately, it would be expected the facility can provide dependable service for 30 years. This value can be overridden however. We recommend that you use the default value of 30 years. If you're looking at trying to use a higher value, you're going to have to provide a lot of documentation and sound reasoning from an expert or an engineer on why

you're using a project useful life greater than the default value.

Annualized cost is calculated by the tool.

## Aquifer Storage and Recovery (continued, 4 of 4)

- **Inputting Drought Information**
  - **Drought Recurrence Information (RI)** – Available from literature or other agencies, 1 RI can be used, maximum of 3
  - **Unconstrained Potable Water Demand** – Average potable water demand considering the specific RI and Duration of Impact (DOI)
  - **Pre-mitigation System Supply Yield** – Supply available during drought conditions
  - **Pre-mitigation Duration of Impact** – Duration of drought impact on municipality's water supply. Different than duration of drought as the impact of a drought may not affect the supply of a municipal system immediately
  - **Post-mitigation System Supply Yield** – Supply available after mitigation
  - **Post-mitigation Duration of Impact**

Those are some of the other key inputs that are required based on your hazard information. These are usually some of the higher-order and harder types of information.

The first key input is drought recurrence information, known as RI for some of you that worked on benefit costs. This kind of information is available from literature from other government agencies. This could be a study in your area or state that has identified the drought recurrence intervals in your area. The tool will require a minimum of one recurrence interval for performing the benefit cost analysis, and a maximum of three. You may have had different drought recurrence intervals in different severities. The tool will allow the minimum of one. Similar to the damage frequency assessment module now where we allow one reoccurrence. This tool allows one use as well.

The next key input is the unconstrained water demand. It sounds complicated but this is basically the average potable water demand considering the specific recurrence interval and duration of an impact. If I am in a drought situation, my water supply is going to be impacted. It is how your water changed due to this drought.

Pre-mitigation system supply yield is the system available during drought conditions. When you start in a drought condition, your amount of available supply changes because you don't have much available in the aquifer it's not being recharged like it should.

The next key input is the pre-mitigation duration of the impact. Basically this is asking how long is this drought impacting the municipal water supply. One important note is that this is a different than the duration of drought. As the impact of the drought may not affect the water supply immediately, it might be lagging behind in some time. There is a little bit of difference there.

Post mitigation system is asking if we do install an aquifer restoring system, what is the supply after you do the mitigation?

Then the post mitigation duration of impact. Hardly any project is ever 100% effective. Even with aquifer storage and recovery systems, when you are under a drought condition the aquifer will still be impacted by the drought especially if it's a long duration over a couple of years. In the total you'll have to put in an estimate of what the duration of impact will be posed. Before the project you may say we have been effective for 365 days. And we come in and put in an aquifer storage and recovery and you can say the drought is still impacted if but the duration is shorter because we been able to build up that water supply and been able to help augment that with the system in place.

## Aquifer Storage and Recovery (continued)

- **Benefits are calculated based on increased water supply by installation of ASR project**
  - Benefits are discounted at the OMB required 7% discount rate
  - Benefits are based on the economic value loss of water service, currently \$103 per person per day
    - FEMA default value
    - Can be overridden but must include extraordinary documentation from an expert
  - Strongly recommend communities interested in ASR projects consult with experts and review the detailed guidance.
  - Ecosystem service benefits will generally not be included or allowed as primary purpose is water production and no land is being preserved

With all of that information, the benefits are calculated on the increased water supply by the installation of that project.

The benefits are calculated and being discounted at a 7% discount rate as mandated from OMB. There's no way around the 7% discount rate. That is built into the tool.

The benefits are based on the economic value of loss of water service which is currently \$103 per day per person. This is the FEMA default value, and as with any default value the value can be overridden, but must include extraordinary documentation on why you are changing the value of \$103 per day per person. It's strongly recommended that communities interested in these projects consult with experts in review the detailed guidance.

When we released the tools, the benefit cost methodology, it also included a lengthy document on how to do the benefit cost analysis for the systems, and how to go about getting them in place. Make sure you read these documents very carefully. Also as a hint, don't think you will be able to pull this project together in one or two weeks before the PDM application closes. These

projects have a lot of moving wheels to them. They do require someone with expertise about the aquifer system, the amount of water available in it, how deep the water is, how effective a project will be. These are things that take some time to gather the information. These are things that shouldn't be left until last minute to do.

The last point, ecosystem service benefits, will generally not be included. Since the primary purpose is water production, no land is being preserved. Generally it is not a default we will allow unless the applicant can demonstrate how land is being preserved and how we can count it. We did want to harden that because you don't know what may develop in the future.

## FDS and FSR

- **The new project types have very similar approaches to conducting a benefit cost analysis**
  - **Primary benefits of the project must come from avoided damages to structures, infrastructure, utilities, roads/bridges or “traditional benefits”**
  - **Ecosystem service benefits can not be included with the project until a 0.75 is demonstrated by the benefit cost analysis**
  - **Analysis for FDS and FSR can be conducted using existing benefit cost analysis tools (BC Toolkit v.5.2.1)**
    - **Use Microsoft Excel® tool to add ecosystem service benefits once a 0.75 is demonstrated**

Generally, these project types have a very similar approach to conducting a benefit cost analysis. These are not too different than projects we've been doing for several years. I know some people have done flood detention and retention basins in the past. These are very similar when we were able to count additional benefits to the projects and look at the ecosystem services these projects provide.

The primary benefit of the projects must come from avoided damages to structures, infrastructures, utility, roads, bridges, or what we generally call our traditional benefits. This is the way we've been doing a lot of detention, retention basins in the past. These structures may be residences, businesses may be factors in electrical or utility type projects. We have to still ensure that when we are funding these projects and performing the benefit cost analysis, the primary purpose is hazard mitigation. Statutory and regulatory requirements require that we fund projects to save lives, avoid damages to structure, avoid damages to infrastructure, and protect all of these built infrastructures.

Ecosystem service benefits cannot be included with the project until 0.75 is demonstrated by the benefit cost analysis. Essentially what this means is

when we have done these projects, you have to have enough benefits to cover 0.75 of the project cost.

The analysis for the FDS and FSR project can be conducted using the existing benefit cost analysis toolkit, which is version 5.2.1. If you are using 5.3, that is a beta version that got leaked to a few people so do not try to use 5.3. 5.2.1 is the acceptable version to do these projects currently. Version 5.3 was not officially released by FEMA. We are working on Version 5.4 which will incorporate all of these new environmental benefits and these new project types in new methodologies. But we wanted to be able to go ahead and allow people to put these projects together instead of waiting for the software to be done. If you've never developed software, it is not something that is very easy to do. It's a very long process and there are security processes that we have to send the software through. These calculators provide an option for the communities and states to do these projects without waiting for the tool release. While 5.2.1 only includes ecosystem service benefits for acquisition projects, if you are interested in one of these projects you can use the Excel tool to add system benefits for these FDS and FSR projects once you have a 0.75.

## FDS and FSR (continued 2 of 4)

- **Benefits calculations**
  - The Full Data Flood module can be utilized if detailed H&H analysis for the project is available
  - Benefits derived from change in H&H conditions pre- and post-mitigation project
    - Most useful for when flooding to structures (residential and non-residential) can be demonstrated and will be reduced by the project
    - Benefits calculated by the BC Toolkit for avoided damage to structure, contents and displacement which result from decreased flooding

The easiest way that requires expense up front and time to develop is use of the full data flood module in the current tool and if you have a detailed Hydrology and Hydraulics (H&H) analysis for the project area.

The benefit derived from the change in H&H convention pre-and post-mitigation project is the basis on calculating benefits. You enter in the current H&H information, your 10, 50, 500 year flood recurrence information, the depth of that, the flow rate, and then you enter in the predicted H&H analysis post project completion. When you look at retention detention basin and floodplain retention you are changing the H&H profile of a stream. Hopefully you are lowering your 10 year flood elevation. If you were doing a detention basin this is done by capturing the water and releasing it at a slower rate than what it would be if the retention basin is not in place. When you put in or doing a Floodplain and Stream Restoration process you are looking at increasing the size of a floodplain which increases storage capacity. Both these projects should be reducing flooding downstream from where these projects are installed and implemented.

What this is doing is reducing damages on structures and this may prevent bridge washout downstream. One project that I had the luck to participate in,

we did a retention basin and this reduced the flooding to a manufacturing facility downstream. Luckily, we had the H&H analysis but again H&H analysis can take some time and be expensive up front.

## FDS and FSR (continued 3 of 4)

- **Benefits calculations**

- The damage frequency assessment (DFA) module can be used if damages are based on past damages and damage amount is known OR if damages are going to be estimated based on detailed analysis by experts. Will also need to know the project effectiveness and how much future damages will be reduced by the project.
- DFA module provides the most flexibility but requires the most assumptions. Key inputs must be documented and methodologies for inputs demonstrated. Requires the most extensive engineering judgment.
- Can include many categories of damages such as loss of bridges, roads, crop damages, loss of business income, value of water for aquifer recharge.

If you do not have an H&H analysis but you do have some data available for flooding that has occurred, you can use the damage frequency assessment module which is also known as the DFA module. You have to know what your damages are, what the damage amounts are, and what the recurrence intervals of those damages is. You will also need to know how effective the project will be in eliminating those future damages. So you need to know recurrence intervals, you need to know estimated dollars of damages from past events , and for post-mitigation effectiveness you will need to have a reasonable estimate of how those damages will be reduced but probably not completely eliminated in the future.

The DFA module provides the most flexibility but requires the most assumptions. Key inputs must be documented and methodologies for inputs demonstrated. This requires the most extensive engineering judgment when you put together one of the projects.

The DFA module can include many categories of damages such as loss of bridges, loss of roads which we have FEMA's standard values for, and we can allow the inclusion of crop damages, loss of business income, value of water for aquifer recharge. When we install retention basins and do

floodplain restoration, we are allowing the water to be absorbed at a slower rate and being able to recharge the aquifer naturally. The detailed guidance that we have developed does provide a lot more detailed information on all of these benefits and how to include them in your analysis, especially the calculation for water be charged to the aquifer. There was a specific set of calculations on how to include that benefit. Go to that guidance and follow what we provided in the guidance to include that in your analysis.

## FDS and FSR (continued 4 of 4)

- **Including ecosystem service benefits**
  - FDR and FSR projects can create buffer zones for flooding while mitigating risks. Land that is part of the project area can provide benefits to the environment including habitat, recreational opportunities, water absorption and nutrient cycling, among other things
  - Current benefit cost toolkit does not include these benefits for the new project types
    - FEMA created a spreadsheet tool to include the benefits once analyzed in the current tool
    - Ecosystem service benefits can be included once a 0.75 BCR is reached by calculating “traditional” benefits, such as damage to structure, infrastructure and property.

Including ecosystem service benefits is some of the most exciting work that policy and data analysis has done over the past years.

The FDR and FSR projects create buffer zones for flooding while mitigating risks. Land is part of the project area and can provide benefits to the environment which include habitat, recreational opportunities, absorption of water, a buffer zone for reducing risks, nutrient cycling, and also provide information on the value of pollinators. Everyone wants to save the bees and we need to know the economic value. All these things are ecosystem service benefits that we round up by benefit use time.

The current benefit cost toolkit does not include benefits for the new project. It includes benefits for acquisition only. We're looking at expanding the use of ecosystem service benefits across more projects. We created a spreadsheet tool to include these benefits and the next slide includes the actual dollar values for the benefits. Ecosystem service benefits can be included once a project reaches a 0.75 from traditional benefits. You can only include these benefits at a 0.75. I say this is once or twice a week, we're having people come to the helpline trying to include ecosystem service benefits when a project is a 0.1 from traditional benefits. We have to keep reminding folks that

the primary mission of FEMA's is to reduce damages to structures , owned infrastructure, utilities, so on and so forth. If we were the EPA or other nature-based agencies we can allow benefits more widespread, however due to statutory and regulatory requirements we have to ensure most benefits come from avoided future damages. 0.75 is the number.

## Ecosystem Service Benefits Calculator

- **Provides ecosystem service benefits for post mitigation land use types**
  - Forest - \$554 /Acre/Year
  - Green Open Space - \$8,208 /A/Y
  - Marine and Estuary - \$1,799 /A/Y
  - Riparian - \$39,535 /A/Y
  - Wetland - \$6,010 /A/Y
- **Applicable for the new FDS and FSR restoration projects and any other project in which land and ecosystem services are provided**
  - Wildfire mitigation projects
  - Drainage projects that incorporate natural systems

The new tool we have released in the spreadsheet format includes land-use types for five areas. The values are based in acres per year. When we use the benefits, because OMB requires a 7% discount rate, the benefits have to be reduced every year until the project useful life is completed. In this case we have forest at \$554 per acre per year. We have green open-space a little bit over \$8,000 per acre per year is the value. Marine and estuary areas are valued at a little bit more than \$1,700 per acre per year. Riparian areas have the highest value at almost \$40,000 per acre per year in benefits. And then we have wetlands at \$6,000 per acre per year. All of the dollars per acre are based on the services that these land types provide, and we have all that detailed and research provided in another report that we hope to be posting to FEMA.gov in the near future as well. If you are using the benefits to do the calculation by hand, you have to remember to reduce the benefits by a 7% discount rate. This is why we released a tool. The tool does it for you. I strongly encourage you to use the tool we provided.

These ecosystem service benefits are applicable to our acquisition projects. It is also applicable for new project types, for flood retention and storage, the flood stream restoration, and any project in which land and ecosystem services are provided. What this means is FEMA's allowing the ecosystem

service across any project when it can be demonstrated that the project provides habitats and preserves land.

A good example of this may be a wildfire mitigation project we have been funding the past 20 or 30 years. We have done vegetation management projects for wildfire where we reduce the fuel loads. Now we will allow the inclusion of the forest benefit per acre per year when you are doing these projects. If you have a vegetation management project and you are doing 100 acres, you can count that 100 acres at \$554 per acre over the life of the project. You can use the Excel-based tool to do that. If I were interested in doing a wildfire project now, I would go into the traditional benefit cost tool version 5.2.1, perform benefit cost analysis, and if I reach a 0.75 or greater, I can take the information from my analysis out of the tool and plug it values into the Excel-based tool that we released, the tool will add the ecosystem service benefits and you will have a revised benefit cost analysis. That would be what you submit.

Another project type might be a drainage system that includes natural features. We've seen a few projects go this way where they are were moving streams from culverts and putting them back out in the open. They are creating habitats and nice water features and recreational opportunity. You may very well have a drainage project that is not using gray but green infrastructure and you can include ecosystem service benefits.

## Ecosystem Service Benefits Calculator (continued)

- **The tool allows for one predominant ecosystem service type**
  - While something can be green open space AND riparian, select only one type, otherwise the benefits could be double counted
  - Enter in the number of acres of the project, Project Useful Life (PUL), the benefits calculated by the BC Toolkit and the total project costs from the BC Toolkit
- **The tool will add the appropriate dollar amount of ecosystem service benefits, discounted at the OMB required 7% discount rate and combine the value with the benefits entered from the BC Toolkit, providing a “Total Project Benefits with Ecosystem Service Benefits”**

Currently, the Excel tool allows for one predominate ecosystem service type. We went this way for this version of the tool for a couple of reasons. Mostly it was to prevent folks from accidentally over counting benefits. One may argue that I could have a riparian area and it's also open green space at the same time. You can only count the benefit once. If I have a 10 acre project I can only count that 10 acres for the predominant land type use in the project area.

When you use the tool, you enter the number of acres of the project, the project useful life , and in these cases they are pretty much all 30 years, the benefits calculated by the benefit cost toolkits and the total project cost that you used in the BC Toolkit. Those values will be located on the last screen when you conduct your benefit cost analysis. Run your analysis and then go to the last screen and plug the information into the Excel tool. It will give you your revised benefit cost analysis that includes ecosystem service benefits.

The tool will add the appropriate dollar amount, discount it, add the 7% discount rate. We always have to discount it per OMB requirements.

## Pre-calculated Benefits for Post-wildfire Mitigation Measures

- **Pre-calculated benefits based on ecosystem services and flood risk reduction**
  - Allows for \$5,250 per acre for mitigation projects that reduce risks associated with post wildfire burned areas
    - Ground cover
    - Soil stabilization
    - Replanting
    - Flood mitigation measures
  - Example: 1,000 acres of burned area x \$5,250 = \$5,250,000 in project benefits to implement post wildfire mitigation measure
  - If benefits are not enough, traditional benefit cost analysis may be performed utilizing the benefit cost analysis toolkit

Something else done recently is the pre-calculated benefits based on ecosystem service benefits and flood reduction specifically for post-wildfire areas when we do mitigation projects.

Based on the ecosystem service benefits, we were able to arrive at \$5,250 per acre for mitigation projects that reduce risks associated with post-wildfire burned areas. If you live in one of these areas, you always have difficulty with soil stabilization, with flooding, and these pre-calculated benefits can be used to provide groundcover, temporary or permanent, such as putting down mulch covering to avoid soil loss and plant saplings, or you could do hydroseeding in the area. You could also do emergency flood mitigation measures which could be outside culverts to protect infrastructure or installation of temporary flood diversion.

An example how you would use this is if you have 1,000 acres of burned area, you multiply that 1,000 acres by \$5,250 and that gives you \$5.2 million in benefits to do mitigation projects. In a post-wildfire area, and it's for post-wildfire mitigation areas only, you cannot use this value for vegetation management. We are working on other values that pre-calculated benefits for wildfire but this is a post-wildfire benefit only.

If the benefits are not enough to do the project you want, you can always revert back to the traditional benefit cost methodology and use the toolkit. This is an efficiency we want to get out to help communities recover very quickly after wildfires have happened.

## Submitting BCAs

- **When submitting applications, provide the following for the benefit cost analysis**
  - Complete scope of work
  - Complete cost estimate
  - Values used in analysis must be documented and documentation submitted with application for review and acceptance
  - Details of project design and demonstration of risk being mitigated
    - Remember, projects funded by FEMA HMA must demonstrate risk mitigation for structures, property, infrastructure, avoidance of loss of life, etc.
  - Exported BC analysis from toolkit, PDF of BC analysis, and completed Ecosystem Service Benefits spreadsheet.

As a reminder, when submitting applications, provide the following for the benefit cost analysis.

- The complete scope of work of the project.
- The complete cost estimate, preferably not lump sum as lump sums are not allowed as part of the application.

Values used in the analysis must be documented and submitted with the application for review and acceptance by the reviewer, typically the FEMA region.

Details of the project design and demonstration of the risk of being mitigated. Oftentimes I have seen projects that were submitted that the reviewer had a very difficult time identifying what the hazard or risk was being mitigated. For FEMA's mitigation programs, as a reminder, you need to tie it back to avoiding damages to structure, content of structures, infrastructure, saving lives, etc.

Also when you submit your benefit cost analysis, please export the benefit cost analysis from the toolkit and create the analyses from the toolkit and submit those with the ecosystem service benefits if you have included those. When we review these projects, we would like to see is the exported benefit cost analysis, the PDF report of the benefit cost analysis, and if you are using the ecosystem service benefits, please make sure you include the filled out ecosystem service benefits spreadsheet.

## Benefit Cost Assistance

- If local community, check with your State Hazard Mitigation Officer for project eligibility.
- The benefit cost helpline can provide answers to specific questions when performing analysis. The helpline will not review completed analysis or teach users how to perform an analysis.
  - E-mail – [bchelp@fema.dhs.gov](mailto:bchelp@fema.dhs.gov)
  - Toll-free number - 1-855-540-6744
- Software and materials at <https://www.fema.gov/benefit-cost-analysis>
- FEMA Independent study courses for Benefit Cost Analysis, concepts and tool usage
  - IS-276 - <https://www.training.fema.gov/is/courseoverview.aspx?code=is-276>
  - IS-277 - <https://www.training.fema.gov/is/courseoverview.aspx?code=is-277>

Questions?



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