Federal Flood Risk Management Standard (FFRMS) Floodplain Determination Job Aid

Version 1.0

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A Product of the Flood Resilience Interagency Working Group

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1. Overview

Executive Order (EO) 13690 on Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input (2015),[1] establishes a Federal Flood Risk Management Standard (FFRMS) so that agencies take actions to enhance the nation's resilience to current and future flooding. EO 13690 and the associated FFRMS amended and built upon EO 11988, Floodplain Management (1977), that requires agencies to take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values of floodplains. EO 13690 was revoked in 2017 but reinstated on May 20, 2021, through EO 14030, Climate-Related Financial Risk, clarifying that the FFRMS and the guidelines for floodplain management under EO 11988 remain in effect. See Appendix A for a listing of the relevant regulations, guidance, and tools.

The FFRMS applies to "federally funded projects" defined as "[a]ctions where Federal funds are used for new construction, substantial improvement, or to address substantial damage to structures and facilities."[2,3] Additionally, individual federal agencies may further define the programs or actions considered to be federally funded projects for applying the FFRMS. Consult agency program documentation with questions about applicability.

Agencies meet EO 11988 requirements by:

- Determining whether a proposed action will occur in a floodplain.
- Considering alternatives to avoid adverse effects and direct or indirect development in floodplains when the agency allows an action to be located in a floodplain.
- Designing or modifying the action to minimize potential harm to or within the floodplain when the agency determines that the only practicable alternative requires siting in a floodplain.
- Preparing and circulating a notice explaining why the action is proposed to be located in the floodplain.

EO 13690 amends EO 11988 by expanding the floodplain to a higher vertical elevation and corresponding horizontal floodplain area (FFRMS floodplain) that addresses current and future flood

[1] EO 14030, Climate-Related Financial Risk (2021), reinstated EO 13690.

[2] See Appendix G of Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, October 8, 2015, at https://www.fema.gov/sites/default/files/documents/fema_implementing-guidelines-EO11988-13690_10082015.pdf.

[3] For actions not subject to the FFRMS, agencies follow the EO 11988 decision-making process using the 1-percent-annual-chance floodplain and the 0.2-percent-annual-chance floodplain for critical actions (sec. 6(c) of EO 11988).

risk due to the effects of climate change and other future changes. EO 13690 also encourages climate-conscious resilient design. Agencies must select from several different approaches to establish the FFRMS floodplain:

1. **Climate-Informed Science Approach (CISA)**[4] – The elevation and flood hazard area (i.e., vertical flood elevation and expanded corresponding horizontal floodplain) that result from using the best available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science. This approach also emphasizes whether the action is a critical action[5] as one of the factors to consider when conducting the analysis.
2. **Freeboard Value Approach (FVA)** – The elevation and flood hazard area that result from adding an additional 2 feet to the Base Flood Elevation (BFE; also known as the 1-percent-annual-chance-flood or 100-year flood) for non-critical actions and by adding an additional 3 feet to the BFE for critical actions.
3. **0.2-Percent-Annual-Chance (500-year) Flood Approach (0.2PFA)** – The area subject to flooding by the 0.2-percent-annual-chance flood.
4. The elevation and flood hazard area that result from using any other method identified in an update to the FFRMS.

1.1. What Is This Document?

This job aid is a resource to help federal agencies and their non-federal partners (including potential federal financial aid recipients) conduct a screening to determine if a proposed federally funded action will be located within an FFRMS floodplain, based on the CISA, FVA, or 0.2PFA, in accordance with Sec. 2(a)(1) of EO 11988. The 2015 Guidelines for Implementing EO 11988, Floodplain Management, and EO 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input (2015 IG) recommend that agencies follow a decision-making process, commonly referred to as the 8-step decision-making process in the 2015 IG, for actions that will take place within or affect the floodplain (Figure 1).

[4] The FFRMS and 2015 Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input identify CISA as the preferred FFRMS approach when climate science and future conditions data are available and actionable. Where data are not available or actionable for CISA, FVA and 0.2PFA are acceptable approaches.

[5] "Critical action" means an action for which even a slight chance of flooding is too great (sec. 6 of EO 11988, as amended by EO 13690). Refer to Section 2.4 of this Job Aid for additional information.

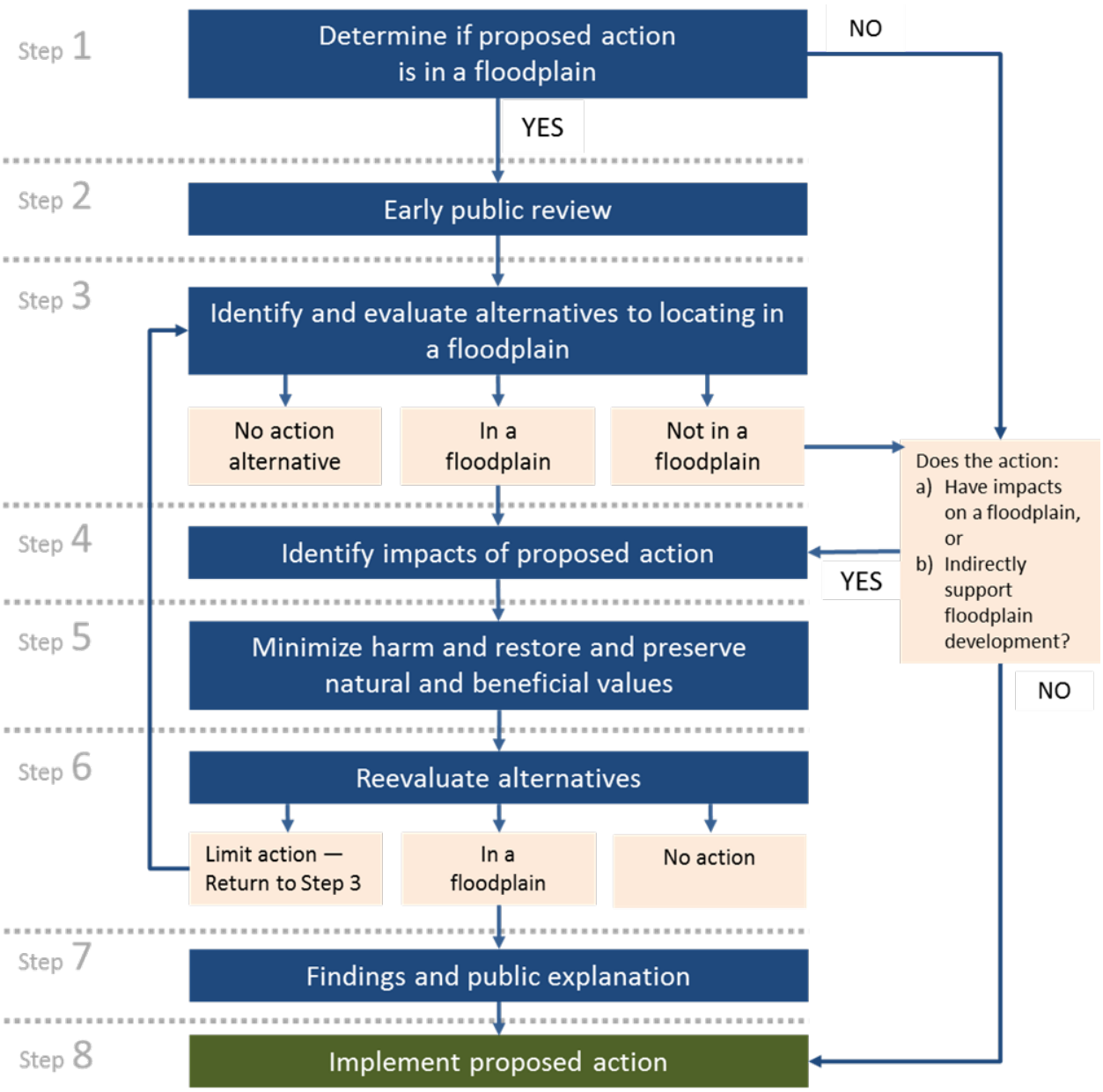

Figure 1: The 8-step decision-making process (Source: 2015 IG, p. 41)

This job aid helps identify the FFRMS floodplain in situations where an agency does not have processes, protocols, procedures, or technical guidance for identifying the floodplain using the approaches identified in the FFRMS. Although this job aid is consistent with the 2015 IG, it does not describe the only methods for identifying the FFRMS floodplain. Agencies may develop other

methods to identify the FFRMS floodplain consistent with the approaches identified in the EOs and the FFRMS.[6]

Use the Decision Support Tool (DST) when it is available.

Note: CEQ, OSTP, NOAA, and FEMA are developing a decision support tool (DST) that leverages information technology and geographic information systems to identify the FFRMS floodplain more easily, particularly where CISA is used. For all approaches, the DST will help determine the appropriate vertical flood elevation and corresponding horizontal FFRMS floodplain.

This job aid helps identify the FFRMS floodplain and will complement the initial versions of the DST.

This job aid and accompanying worksheet (see Appendix B) helps you gather essential information from existing data sources, complete some simple calculations and comparisons, and use the results to assess whether the action is in the FFRMS floodplain under any of the approaches. The job aid contains:

- Instructions to gather key information about the action and complete the identification of the FFRMS floodplain where FEMA flood mapping studies currently exist (Section 2).
- Case studies (i.e., examples for each FFRMS flood determination type) (Sections 3, 4, and 5).
- A worksheet to capture action information and results (Appendix B).

Implement this job aid consistent with applicable laws, regulations, or guidance from the appropriate federal, state, local, or Tribal entity.[7] This job aid is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents or any other persons. Its recommendations may help determine the FFRMS floodplain. The recommendations may not apply to a particular situation based on the individual facts and circumstances and do not describe

[6] Consequently, first consult with the applicable agency to find and follow its method or protocol for identifying the FFRMS floodplain.

[7] Many state and local jurisdictions have adopted model consensus building codes and standards by organizations such as the International Code Council (ICC) or the American Society of Civil Engineers (ASCE). Consensus codes and standards such as ASCE-24 dictate flood load calculations for the building or structure based on defined risk categories. The new consensus standard ASCE 7-22 Supplement 2 (Flood) increases minimum flood design protection for buildings and structures up to the 1,000-Year Mean Recurrence Interval and requires inclusion of the effects of relative sea level change when calculating flood conditions and flood loads for sites whose flooding comes from coastal sources. It is assumed that Industry and design professionals working on the project use proper engineering and design construction standards, so this job aid does not explicitly discuss a methodology for following proper design and construction standards.

all reasonable or available methods for identifying the FFRMS floodplain. Non-mandatory language such as "guidance," "recommend," "may," "should," and "can," describes non-binding recommendations. Mandatory terminology such as "must" and "required" describes controlling requirements under the EO or FFRMS, but this document does not create or affect legally binding requirements.

1.2. Who is the Audience for This Document?

This document is intended for Federal agencies charged with identifying whether a federally funded action will take place in the FFRMS floodplain. This job aid is for agency staff and federal financial assistance applicants or other stakeholders (like consultants) that are undertaking the FFRMS floodplain review.

The job aid assumes 1) a basic to intermediate floodplain management knowledge 2) some familiarity in reading and interpreting FEMA Flood Insurance Rate Maps (FIRMs) and associated online mapping and data, including Flood Insurance Studies (FISs). For more information on FEMA mapping, consult the following resources:

- How to Read a FEMA FIRM Tutorial
- Coastal flood mapping basics (coastal hazards and mapping elements unique to coastal areas).

Although intended for federal agency staff, non-federal entities (such as applicants for federal funding and their contractors) may use this job aid as a screening tool to determine if their proposed projects[8] would be within the FFRMS floodplain.

1.3. Basic Concepts Used Throughout This Document

This document refers to the following concepts:

Base flood elevation (BFE) – The computed elevation to which floodwater is anticipated to rise during the base flood (also known as the 1-percent-annual-chance or 100-year flood).

1-percent-annual-chance floodplain – The area subject to flooding by the 1-percent-annual-chance flood (also known as the 100-year floodplain or base floodplain).

Vertical extent – The additional flood height above the BFE.

[8] EO 11988, as amended by EO 13690, applies to federal actions. When considering projects submitted by non-federal applicants, the action that is evaluated is the approval or denial of the project. For this reason, this guidance uses the terms "actions" and "projects" interchangeably.

Horizontal extent – The horizontal land area flooded by the vertical extent (extra flood elevation beyond the BFE).

Non-critical facility – All facilities not deemed critical per EO 13690.

Critical actions – An action for which even a slight chance of flooding is too great. Some key questions to help identify whether the action is a critical action include:

- If flooded, would the proposed action create an added dimension to the disaster?
- If the action involves structures such as hospitals, nursing homes, prisons, and schools, would the occupants of the structure be insufficiently mobile and lack available transport capability to avoid loss of life and injury, given the flood warning lead-time available?
- If the action involves transportation infrastructure, would damage to it significantly or interrupt access to medical, employment, or educational services?
- Would essential or irreplaceable resources, utilities, or other functions be damaged beyond repair, destroyed, or otherwise made unavailable?
- Would damage or disruption due to a local flooding event lead to regional or national catastrophic impacts? Could it have negative effects on the regional, national, or international economy?
- Would the damage or disruption to a given facility or infrastructure component have potential for cascading damage or disruption to other facilities and infrastructure classes?

The 2015 IG provides expanded descriptions of critical actions. If the answers to the above questions are all "No" or "not applicable," the action could be considered non-critical and not subject to the "critical action" flood standard.

Consult with the applicable agency to identify any agency-specific policies, guidance, protocols, or direction on the critical action determination.

CAUTION

The services of a professional engineer, architect, or other licensed design professional are recommended for designing critical actions or assets with long intended service life, and for other situations where risk tolerance is low because of unique characteristics of the action.

1.4. What Is the Relationship Between an Increase in Elevation and the Horizontal Extent of the Floodplain?

The FFRMS recognizes that numerous factors, such as climate change and other future land use changes, may increase the likelihood of future floods exceeding the currently mapped base flood elevation. Changes in flood events may make a wider land area vulnerable to flooding (see Figure 2). For example, in most densely populated areas of the U.S., FEMA identifies and maps the BFE (, also known as the 1-percent-annual-chance flood elevation) and the area of normally dry land that will be inundated when water reaches that flood elevation. Figure 2 displays the BFE as the top of the large dark blue area. The BFE, based on modeling of the current flooding conditions, has been one of the primary standards for minimum protection of structures in the floodplain for many years. The FFRMS flood elevation is higher than the BFE; see "vertical extent" in Figure 2. A higher elevation means that more dry land would be inundated; see "horizontal extent" in Figure 2.

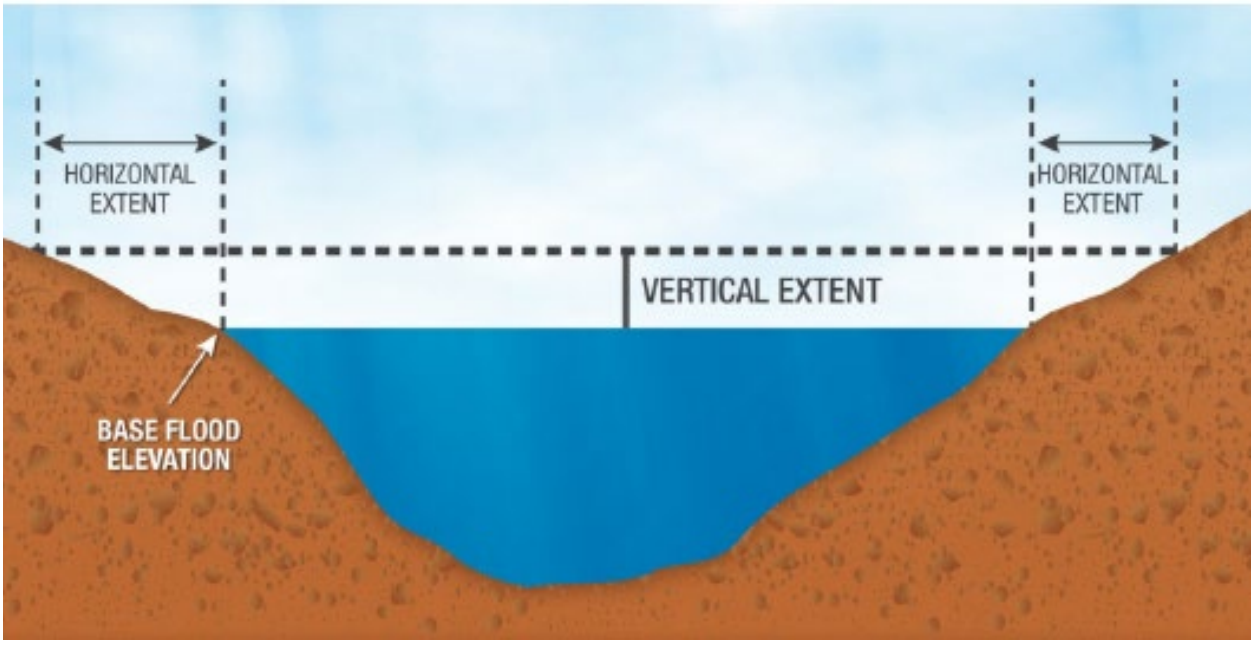

Figure 2: Widening of the floodplain (horizontal extent) due to an increase in the flood elevation above BFE (vertical extent) achieved by applying one of the approaches in EO 13690 to establish the FFRMS flood elevation and corresponding flood hazard area

1.5. The General Methodology To Identify the FFRMS Floodplain Throughout This Job Aid

First, consult applicable agency guidance to determine which FFRMS approach the agency has adopted. For the FFRMS FVA or simplified CISA, compare the ground elevation of the action with the recommended flood elevation to determine if the action will occur in the additional horizonal extent.

In many cases, elevation values are available to the nearest tenth of a foot. If you are unsure of the elevation accuracy (due to the need to interpolate, map age, or otherwise), rely on whole foot values and make conservative elevation estimates.

A "conservative" estimate assumes the broadest floodplain coverage. Therefore, when rounding from the tenth of a foot, round down for all ground elevations and round up for all flood elevations. See the example in section 1.5.1 below. Agency guidance may require a different approach, such as rounding in a more mathematically conventional manner to the nearest whole number. Once you move to the other steps in the decision-making process (for example, during the minimization steps) consider engaging the services of professionals to obtain precise elevation information.

1.5.1. EXAMPLE: FOR THE FFRMS FVA AND SIMPLIFIED CISA

1. Identify and record the action's location (latitude and longitude).
2. Identify and record ground elevations representative of the action's site or adjacent to specific structures, facilities, or infrastructure components. At a minimum, collect ground elevations at the Highest Adjacent Grade (HAG) and Lowest Adjacent Grade (LAG). Round down to the nearest foot.
3. Identify and record other key characteristics of the action and site, including the action's expected service life, whether the action is a critical action, the agency's risk tolerance,[9] and other unique characteristics of the action, site characteristics, or hazard concerns.
4. Identify and record the current FEMA floodplain designation and associated BFE. Round up to the nearest foot.
5. Identify the FFRMS flood elevation as follows, unless applicable agency guidance prescribes an alternate approach:
    a. For actions in **riverine floodplains**, add 2 feet (or 3 feet for critical actions) to the BFE for identifying the FVA.
    b. For actions in **coastal floodplains**, add 2 feet (or 3 feet for critical actions) to the BFE for the FVA or follow the simplified CISA that involves identifying the appropriate localized sea level rise number and add it to the BFE. This simplified CISA method is recommended for actions along low-lying coastal shorelines on the Atlantic and Gulf coasts. For Pacific coasts and other coasts with bluffs, you may need to follow the FVA.
6. For FVA or simplified CISA, compare the ground elevation with the FFRMS flood elevation (as directed by the specific agency), take the key characteristics into account, and determine

[9] The 2015 IG introduced the concept of risk tolerance in the discussion of CISA. The 2015 IG does not define these concepts but recognizes they are considerations that inform an agency's selection of the predictive scenario for CISA.

whether the action is within the FFRMS floodplain. If it is, follow the remaining steps of the floodplain review decision-making process in the 2015 IG.

For the FFRMS 0.2PFA floodplain where the 0.2-percent-annual-chance-flood is mapped, simply compare the location of the site with the extent of the 0.2-percent-annual-chance area. If the location is in the area, follow the remaining steps of the floodplain review decision-making process in the 2015 IG. Do not use the 0.2PFA in coastal floodplains because of technical limitations in 0.2-percent-annual-chance data in coastal areas (for example, no wave action). Agencies can use 0.2PFA data that includes local wave action, when available. CISA remains the preferred approach, because it explicitly considers future sea-level rise[10] at the action site.

To determine which FFRMS approach(es) to apply, rely on federal agency policy, procedures, or guidance. Absent such agency guidance, consult the chart in Figure 3 to select an FFRMS approach.

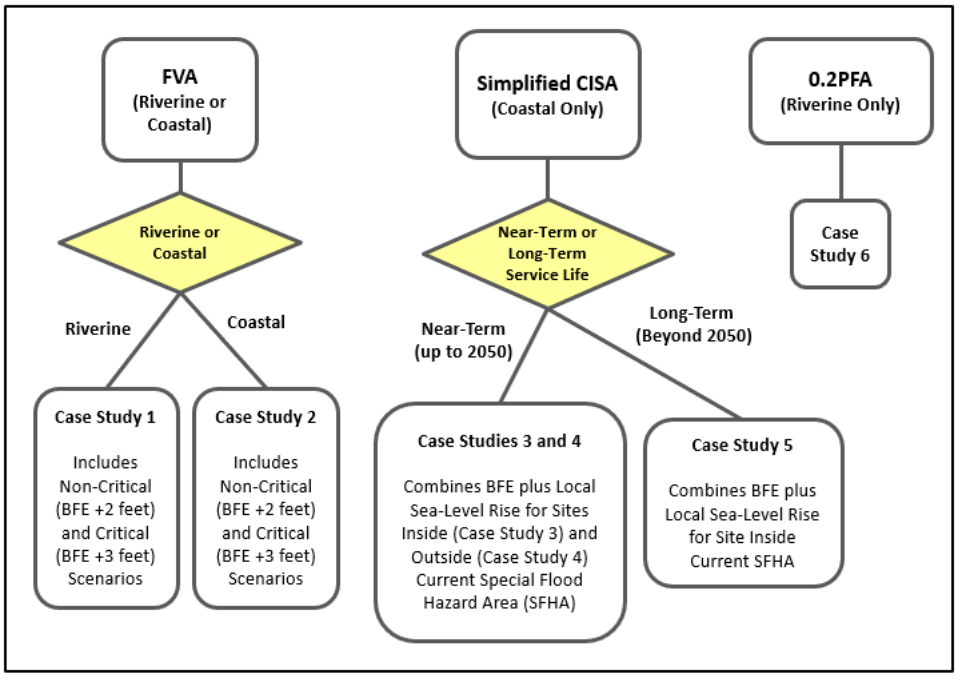

Figure 3: FFRMS flood elevation determination approaches described in this document

1.6. Some Limitations of This Document

This job aid presents a method for identifying the FFRMS floodplain for each of the three approaches that rely on information from available FEMA FIRMs, U.S. Geological Survey (USGS) ground elevations, and NOAA Sea Level Rise estimates. Where no FIRM is available, you may need to rely on

[10] References to sea-level rise within this document denote changes to relative sea level rise (versus absolute sea level change). Relative sea level rise accounts for the rise in absolute mean sea level elevation plus any associated elevation changes in subsidence, sedimentation, and sediment loading at the proposed site of interest.

other resources, including flood hazard data from other federal sources or from state, tribal, territorial, or local government sources to identify the BFE to identify the FFRMS floodplain. Alternatively, you may need to engage in location-specific engineering (e.g., hydrologic and hydraulic) studies.[11]

Some FEMA regulatory flood maps (e.g., effective FIRMs) may not reflect current conditions on the ground (for example, they may be more than 10 years old). The 2015 IG indicates that agencies may consider using information from draft maps or preliminary FIRMs and FISs as best-available information if the information shows that a site previously located outside the floodplain is now in the floodplain or that the existing BFE at the site has increased.[12]

The job aid is conservative. Projects close to the edge of the floodplain are generally found to be in the floodplain using this screening process. More precise analysis done during the 8-step decision-making process may determine that the site is actually outside the FFRMS floodplain.

This job aid presents a simplified method for identifying the CISA FFRMS floodplain in some coastal environments. The science in these areas is sufficiently mature to provide actionable flood risk information. This simplified CISA method suggests adding localized sea-level rise elevation data to the BFE to determine the FFRMS floodplain. For coastal settings, apply the simplified CISA to actions along low-lying coastal shorelines on the Atlantic and Gulf Coasts. Do not use this method for steep bluffs or shorelines armored by large seawalls or similar flood-control structures.

This simplified CISA method is not the only method available to identify the CISA FFRMS floodplain.[13] If you have expertise in incorporating climate considerations into riverine hydrology and hydraulics, or in comparable coastal modeling for steep bluffs and armored shorelines, you can identify the CISA FFRMS floodplain through more comprehensive methods.[14] In addition, this job aid does not

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[11] See 2015 IG, p. 50.

[12] Ibid, p. 52.

[13] See, for example, the Federal Highway Administration Hydraulic Engineering Circular No. 40, 2nd ed., *Highways in the River Environment – Floodplains, Extreme Events, Risk, and Resilience* (June 2016), https://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif16018.pdf; U.S. Army Corps of Engineers Engineer Regulation 1100-2-8162, *Incorporating Sea Level Change in Civil Works Programs*, https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/ER_1100-2-8162.pdf; Engineer Pamphlet 1100-2-1, *Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation*, https://www.publications.usace.army.mil/Portals/76/Users/182/86/2486/EP-1100-2-1.pdf; and Engineering and Construction Bulletin 2018-14, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects*, https://www.wbdg.org/FFC/ARMYCOE/COEECB/ecb_2018_14_rev_2.pdf.

[14] See the information in the 2015 IG's Appendix H, Climate-Informed Science Approach and Resources, https://www.fema.gov/sites/default/files/documents/fema_IGA-appendices-a-h_10082015.pdf.

supplant federal agency-specific policy, procedure, or guidance for identifying the CISA FFRMS floodplain. Some federal agencies may have developed policy and guidance on how to determine the CISA FFRMS floodplain or have technical bulletins and methodologies that are more comprehensive. These methods are valid because they rely on the principles in Appendix H of the 2015 IG and have been tailored to the unique characteristics of the federal agencies' actions. For this reason, check with the respective federal agency to confirm it is applying the applicable and appropriate method for the specific action.

Finally, use this job aid to help with planning and decision-making regarding whether a proposed action is located within the FFRMS floodplain. A licensed design professional should be contacted for the design or engineering of the action. This job aid helps determine whether the action is in the FFRMS floodplain and subject to the requirements of EO 11988 and EO 13690. If an action is in the FFRMS floodplain and its location is the only practicable alternative, then you may need the services of a professional engineer, architect, or other licensed design professional to determine how to minimize the impacts of flood and make the action resilient (e.g., elevation, flood-proofing and/or nature-based solutions), especially when dealing with critical actions.

2. Basic Site and Action Information

2.1. Find the Coordinates of the Site of a Potential Action

One approach for finding the latitude and longitude for the site of the action (address, or specific locations within a parcel) is to use a web-based map application. Here is an example of the process:

1. Open a map application (e.g., National Flood Hazard Layer [NFHL] Viewer, Google maps, Bing Maps, GIS), zoom to the site, and record the latitude and longitude. For example, when using a web mapping service such as Google Maps or Bing Maps, search the location and select the map for details for that site. The pop-up on the bottom of the map provides the address and the latitude and longitude (in decimal degrees) (Figure 4). Record these numbers.

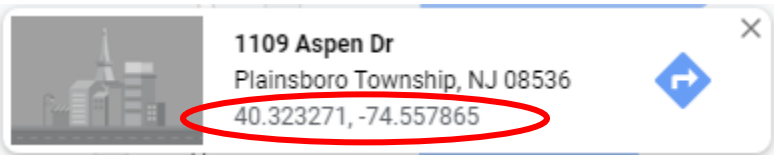


Figure 4: Example Latitude and Longitude Information

A best practice is to capture multiple locations for the action, such as the corners of the property boundary, ground locations just outside the perimeter of a building, and ground locations along or

surrounding an infrastructure component (e.g., pipeline, road, tower) where appropriate. At a minimum, collect ground elevations at the HAG and LAG.[15]

2.2. Find the Elevation of the Site of a Potential Action

One approach to find the elevation of the site of the action is through the USGS National Map.

1. Go to the USGS National Map Elevation Point Query Service at https://apps.nationalmap.gov/epqs/ (Figure 5).

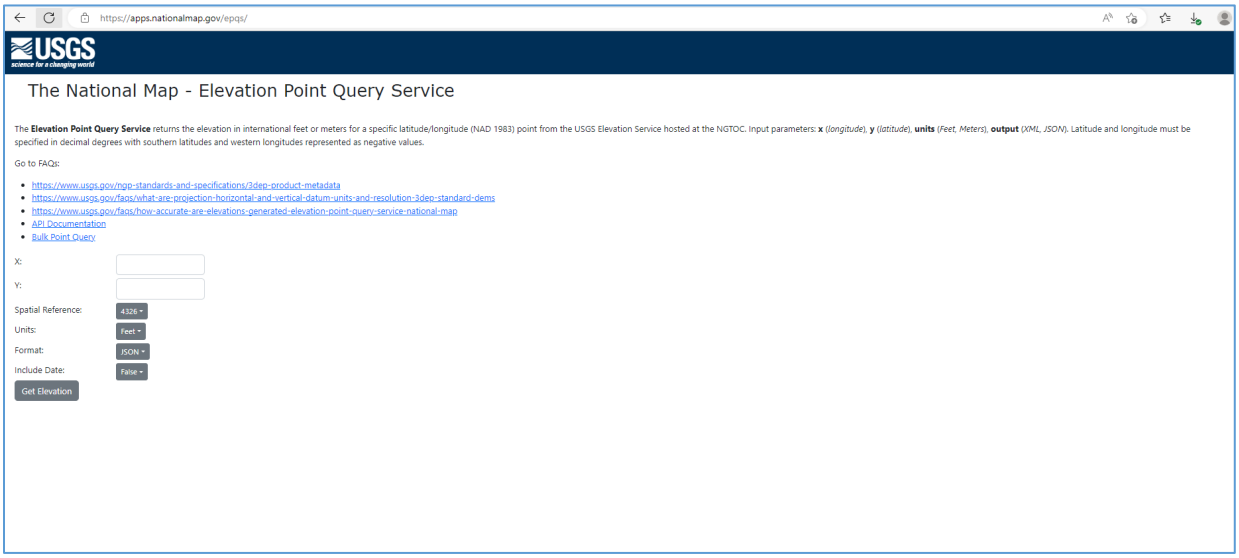


Figure 5: USGS National Map Elevation Point Query Service Screen

CAUTION

Identify/confirm the vertical datum on the FEMA FIRM matches or is converted to the datum used in the USGS mapping tool. Datum conversion tools are at https://vdatum.noaa.gov/.

2. Enter the longitude (Lon) in the X field (for example, -74.557865) and the latitude (Lat) in the Y field (for example, 40.323271).
3. Set the Selection Units as Feet.
4. Leave the output in XML.

[15] Consult with the 2020 FEMA Guidance for Flood Risk Analysis and Mapping (2020 FEMA Guidance) to determine whether hydraulic data for the action area supports the implied accuracy of measuring elevations to a tenth of a foot or if elevations are best expressed as whole-foot rounded values.

5. Select the "Get Elevation" button. The results are a text XML format file (Figure 6) displaying the elevation value (e.g., 75.26 feet).


```
<result>
   <location>
      <x>-74.557865</x>
      <y>40.323271</y>
      <spatialReference>
      <wkid>4326</wkid>
          <latestWkid>4326</latestWkid>
      </spatialReference>
   </location>
   <locationId>0</locationId>
   <value>75.26246509540668</value>
   <rasterId>42092</rasterId>
   <resolution>1</resolution>
</result>
```


Figure 6: Example of XML Results

6. Round down the value to the next whole foot to provide the most caution for this FFRMS floodplain identification step. In this instance, the value is 75 feet. Record this elevation.

2.3. Identify the Flood Elevations Nearest to the Site of a Potential Action

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information in support of the National Flood Insurance Program (NFIP). The MSC website is at https://msc.fema.gov/. The MSC also provides a range of other flood hazard products to help identify the BFE nearest to the site.

- For information on how to use the MSC to access FIRMs and read them, access the FEMA guidance How to Read a Flood Map?
- Most FIRMs are divided into FIRM panels that are large and difficult to print. You can create a FIRMette, a smaller section of the project file. To develop a FIRMette through the MSC, access the FEMA guidance How to Print a FIRMette and Download a FIRM Panel?

In addition, the MSC houses the NFHL. The NFHL is a geospatial database that contains current effective flood hazard data. The NFHL is made from effective flood maps and Letters of Map Change (LOMC) delivered to communities. NFHL digital data covers over 90 percent of the U.S. population. New and revised data is added continuously. In the NFHL Viewer, use the address search or map navigation to locate an area of interest and the NFHL Print Tool to download and print a FIRMette where modernized data exists. Technical GIS users can also leverage a series of dedicated GIS web services to incorporate the NFHL database into websites and GIS applications.

Using either the MSC or NFHL tools, identify the location and determine whether the action is within the 1-percent-annual-chance floodplain or outside. If the site is within the 1-percent-annual-chance floodplain, simply record the BFE. If the site is outside the 1-percent-annual-chance floodplain, locate the nearest flood zone and estimated BFE from the adjacent 1-percent-annual-chance floodplain (for example, Zone AE, elevation 14 feet).

In some cases, more recent FEMA mapping products may be available for use. FEMA's preliminary flood hazard data provides the public an early look at proposed changes to the community's FIRM. Preliminary data may include proposed revisions to current effective products and include information for areas currently without a FIRM.

Another source of information on areas without a FIRM is FEMA's Flood Hazard and Risk Data Viewer, which provides the most complete set of flood hazard data. This viewer includes data that is not yet at the preliminary stage. Use caution with pre-preliminary data (information still being developed) if effective flood hazard information on a FIRM is available for a location. If unsure, reach out to the FEMA region's Floodplain Management and Insurance Branch to determine if FEMA has helpful information or resources available regarding the FFRMS and best available Information for the subject project area.

2.4. Identify Additional Characteristics of the Action and Site

The identification stage is also an opportunity to capture other characteristics of the action and floodplain that assist the decision-making process. Examples include service life, criticality, area flood characteristics, user and agency risk tolerance, impact to the agency's mission, and costs.

2.4.1. SERVICE LIFE

Identify the service life of the proposed action (for example, how long the structure or facility will remain in place). In determining the service life, factor in structure renovations that extend the service life beyond the original planned date. For example, although a federal action provides a 30-year loan to the structure or facility, the structure or facility may remain in service for much longer (for example, 50 to 100 years), and floodplain hazards may be relevant beyond the years of the federal action. Identify projects that have a service life until 2050 as actions with "near-term" service life, and projects that have a service life beyond 2050 as actions with "long-term" service life.

2.4.2. CRITICAL ACTION

Identify if the proposed action is a critical action, defined in EO 13690 as any activity for which even a slight chance of flooding is too great. For example, siting structures or facilities such as (but not limited to):

- Those which produce or store highly volatile, toxic, radioactive, or water-reactive materials.
- Those with occupants who may have limited mobility (e.g., hospitals, nursing homes, prisons, schools, animal care facilities).

- Research facilities of significant value to research communities.
- Emergency operations centers.
- Data centers that hold physical or electronic records without copies or backup.
- Utilities, critical equipment, system, networks, or functions that are essential or irreplaceable (e.g., water, power, communication, evacuation routes).
- Those that hold items of substantial cultural significance.
- Infrastructure that provides access to critical facilities or services.

CAUTION

The services of a professional engineer, architect, or other licensed design professional are recommended for designing critical actions or assets with long intended service lives, and for other situations where risk tolerance is low because of unique characteristics of the action.

2.4.3. FLOOD CHARACTERISTICS OF THE AREA

Identify unique characteristics of the flood risk and natural features in the area. For example, information on whether the area is susceptible to flash floods or erosion is important supplemental information when identifying the flood hazard, in addition to determining whether the action is within or outside the FFRMS floodplain. Consider the history of river migration and future river migration. Consult with a professional for coastal floodplains with steep bluffs, seawalls, or steep slopes because of the impacts of these on wave action.

3. Freeboard Value Approach (FVA) (Riverine and Coastal)

3.1. Background

Determine the flood elevation for the FFRMS FVA by adding 2 feet (for non-critical actions) or 3 feet (for critical actions) to the BFE for an action site. The corresponding FVA floodplain is the area extending horizontally beyond the 1-percent-annual-chance floodplain that would be covered by the flood with an elevation of BFE +2 feet (for non-critical actions) or BFE +3 feet (for critical actions). The landward extent of the FFRMS FVA floodplain occurs where the FVA flood elevation equals the elevation of the ground. It is presumed that areas with ground elevations exceeding the FVA flood elevation would not be inundated, and thus lie outside of the FFRMS FVA floodplain.

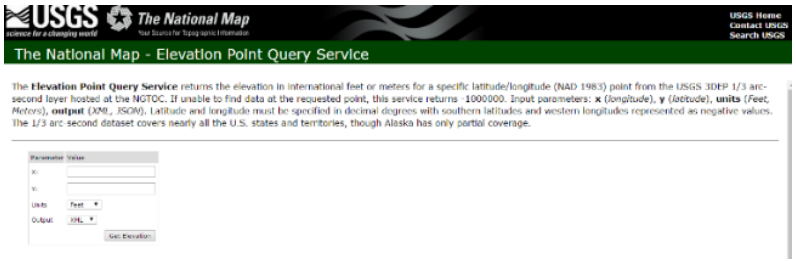
3.2. Instructions (Riverine and Coastal)

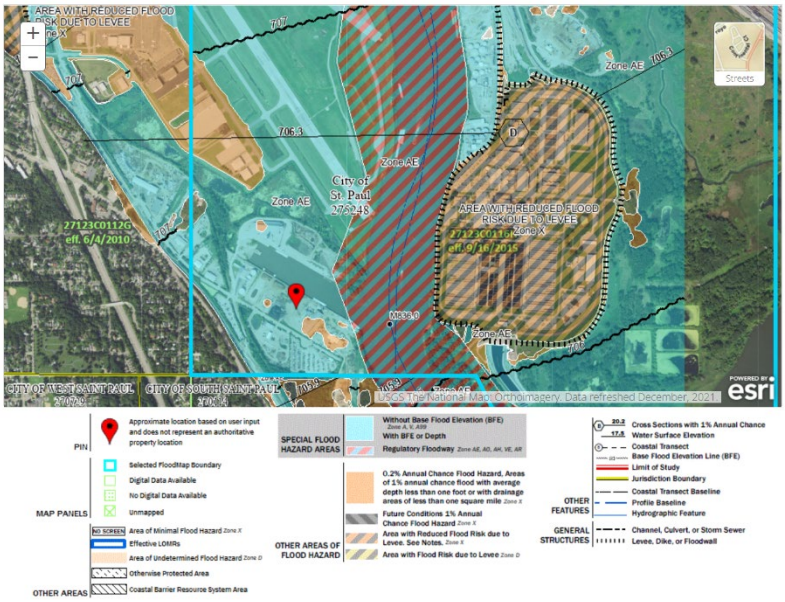
To identify the FFRMS FVA floodplain, add 2 or 3 feet to the BFE, then compare that value to the site elevation (see section 2.2). If the site elevation is less than the BFE+2 feet (for non-critical actions) or BFE+3 feet (for critical actions), then the site is in the FFRMS FVA floodplain.

3.3. Case Studies

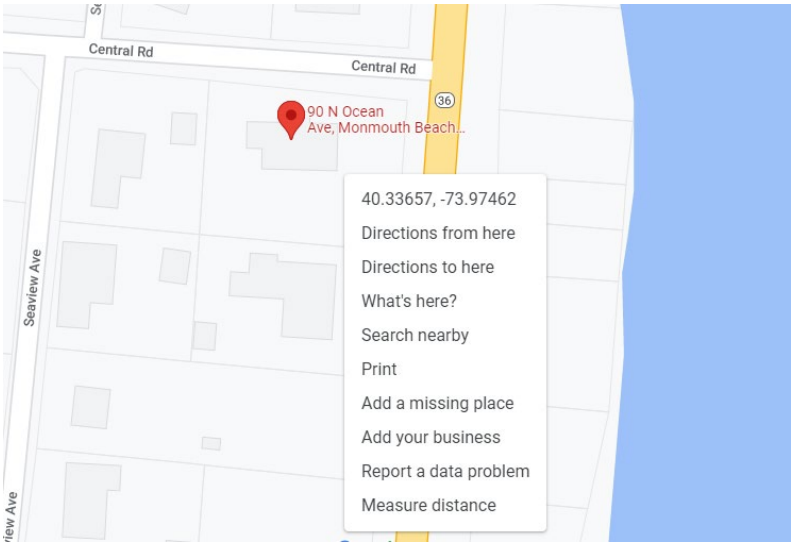
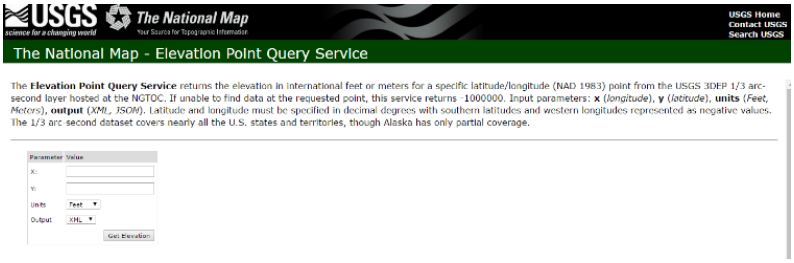
Case studies 1 and 2 apply the FVA to a riverine site (Case Study 1) and a coastal site (Case Study 2), with sample calculations for both non-critical and critical actions (freeboard values of +2 and +3 feet, respectively). For additional guidance, reference FEMA Flood Maps Explained.

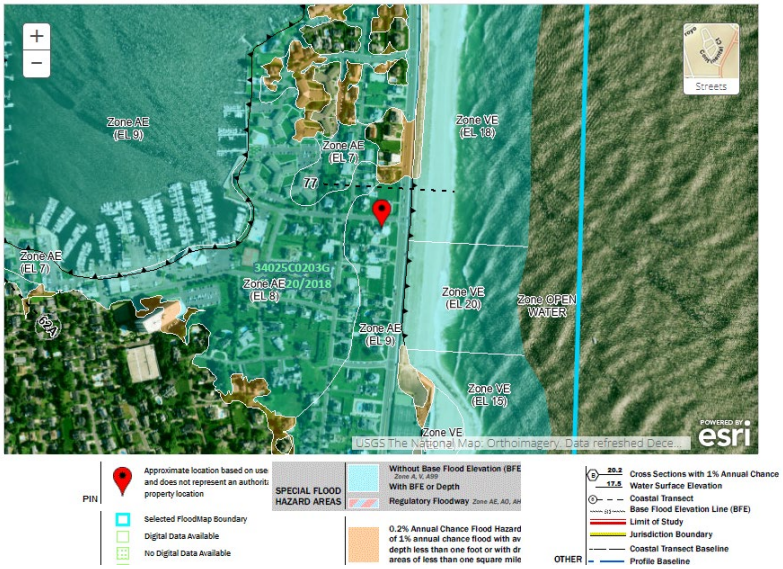
3.3.1. CASE STUDY 1: FVA IN RIVERINE FLOODPLAIN

Steps with Images	Recorded Answers
1. Identify and record the site latitude/longitude 	44.92154260781407, -93.05598200259344
2. Round the site elevation down for the most conservative estimate. 	The website indicates 707.2 feet. Rounding down yields 707 feet.

Steps with Images	Recorded Answers
3. Locate the floodplain zone and BFE, rounding to the value that results in the largest potential floodplain. 	**Zone**: Zone AE **BFE**: Between 706 to 707 feet on map. Rounding up yields 707 feet. *In the 1-percent-annual-chance floodplain*
4. Add +2 feet for non-critical action or add +3 feet for critical action.	**Non-Critical**: BFE + 2 = 707 + 2 = 709 feet **Critical**: BFE + 3 = 707 + 3 = 710 feet
5. Compare the site elevation with the applicable FFRMS FVA Floodplain. a. If elevation in step 4 is equal or greater than elevation in step 2, the action is in the FFRMS FVA floodplain. b. If elevation in step 4 is less than elevation in step 2, the action is not in the FFRMS FVA floodplain.	**Non-Critical**: 707 feet < 709 feet *In the FFRMS FVA Floodplain* **Critical**: 707 feet < 710 feet *In the FFRMS FVA Floodplain*
6. Follow the remainder of the 8-step process (2015 IG)	

3.3.2. CASE STUDY 2: FVA IN COASTAL FLOODPLAIN

Steps with Images	Recorded Answers
1. Identify and record the site latitude/longitude 	**Top Left**: 40.33671456740612, -73.9749790195532 **Top Right**: 40.336703001832284, -73.97462245723374 **Bottom Left**: 40.33658734598463, -73.97496763990472 **Bottom Right**: 40.336567106190934, -73.97461866401758
2. Round the site elevation down for the most conservative estimate. 	**Top Left**: 6.76 feet **Top Right**: 7.34 feet **Bottom Left**: 7.17 feet **Bottom Right**: 6.8 feet Rounding down yields: **Top Left**: 6 feet **Top Right**: 7 feet **Bottom Left**: 7 feet **Bottom Right**: 6 feet

Steps with Images	Recorded Answers
3. Locate the floodplain zone and BFE, rounding to the value that results in the largest potential floodplain. 	**Zone**: Zone AE **BFE:** 9 feet
4. Add +2 feet for non-critical or add +3 feet for critical.	**Non-Critical**: BFE + 2 = 9 + 2 = 11 feet **Critical**: BFE + 3 = 9 + 3 = 12 feet
5. Compare site elevation with the applicable FFRMS FVA Floodplain. a. If elevation in step 4 is equal or greater than elevation in step 2, then action is in the FFRMS FVA floodplain. b. If elevation in step 4 is less than elevation in step 2, then the action is not in FFRMS FVA floodplain.	**Non-Critical**: **Top Left**: 6 feet < 11 feet **Top Right**: 7 feet < 11 feet **Bottom Left**: 7 feet < 11 feet **Bottom Right**: 6 feet < 11 feet *In the FFRMS FVA Floodplain* **Critical**: **Top Left**: 6 feet < 12 feet **Top Right**: 7 feet < 12 feet **Bottom Left**: 7 feet < 12 feet **Bottom Right**: 6 feet < 12 feet *In the FFRMS FVA Floodplain*
6. Follow the remainder of the 8-step process (2015 IG)	

4. Simplified CISA (Coastal Only)

4.1. Background

Climate change is affecting coastal flood hazards in multiple ways, from changes in relative/local sea level, to variations in storm intensity, frequency, and geographic distribution (track), to changes in wave parameters. This job aid can help identify and apply a simplified CISA that uses locally relevant, climate-science-based information (relative sea-level rise [SLR] projections).

CAUTION

Do not use the simplified CISA if a coastal site is located along a vertically armored shoreline or has a steep bluff or slope. Current BFE in such physical settings is typically based on wave runup or overtopping hazards, and simply adding a freeboard may misstate the future flood hazard. In these circumstances, consult a professional engineer or other subject-matter expert.

New, authoritative global and regional SLR assessments have been published since the CISA was initially established in 2015 (e.g., Sweet et al., 2017; Sweet et al., 2022). See also Unit III.B. of the Federal Flood Risk Management Standard Climate-Informed Science Approach (CISA) State of the Science Report released by the Flood Resilience Interagency Working Group in March 2023. These data have been integrated into federal SLR viewers available from the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) and are used in the figures, examples, and case studies in this report.

Select the appropriate SLR projection and scenario for the simplified CISA based on the following factors:

- Where (geographically) the action is occurring, as relative SLR projections vary regionally around the U.S. (the NOAA and NASA viewers already account for such variability).
- The criticality of the proposed action (i.e., whether to use more or less conservative SLR scenarios [curves] for low or high-risk tolerance, respectively).
- The action's expected service life, which guides how far into the future to look on a given SLR curve.

As described in Sweet et al. (2022), projections in relative SLR over the next 30 years (through 2050) have greater scientific certainty; beyond this timeframe, uncertainty creates greater variation in the amount of SLR projected across the five scenarios (see Figure 7 as an example on how coastal Texas scenarios range from low, intermediate-low, intermediate, intermediate-high, to high to cover the range of plausible sea level rise by 2150).

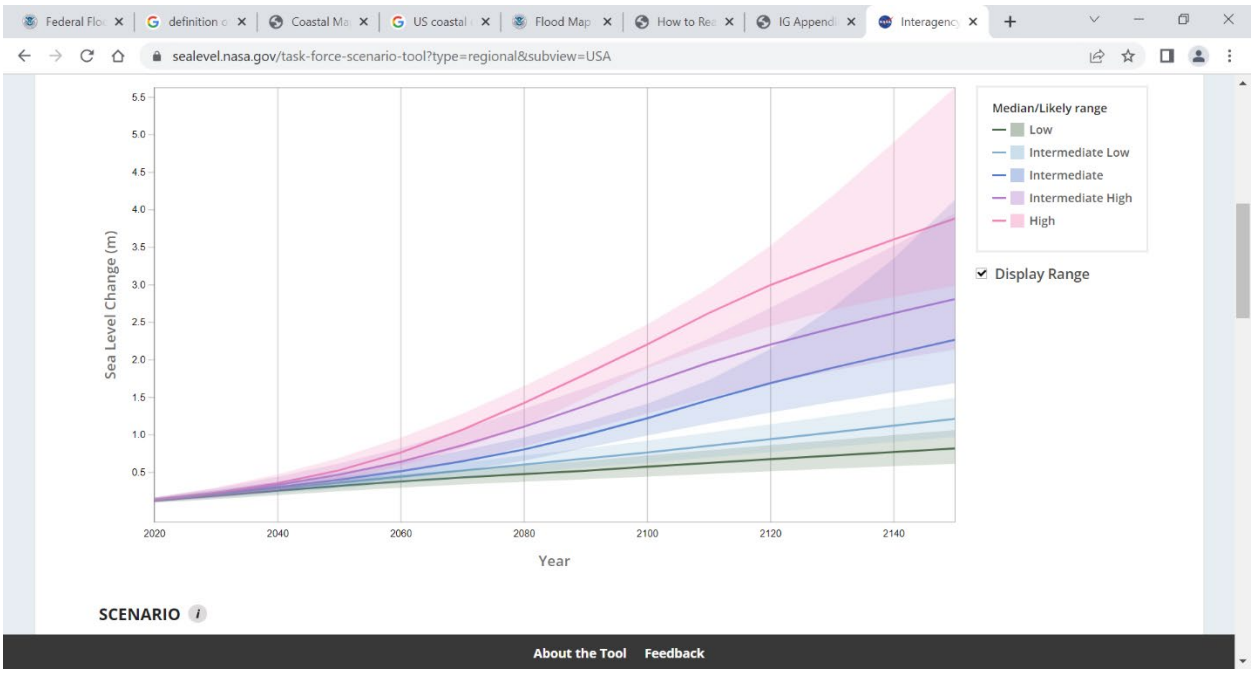


Figure 7: Example of regional SLR projections from the Texas Gulf Coast from 2020 to 2150; the colored lines show the five scenarios (curves) from low to high (see legend at right), with corresponding shaded areas depicting likely ranges for each (17th to 83rd percentile ranges) (Source: NASA)

To determine an SLR value for use in the simplified CISA for the FFRMS, this job aid recommends using the intermediate scenarios for non-critical actions and intermediate-high scenarios for critical actions. However, you can elect other scenarios, accounting for risk tolerance, criticality of the action, and other factors. Document the considerations in selecting other scenarios where appropriate.

As an alternative, you can calculate a range of values using two scenarios for actions with service life to capture the uncertainty in sea level risk projections beyond 2050. For example, use the intermediate-low scenario to calculate the low end of the range and use the intermediate-high scenario to capture the high end. Account for risk tolerance, criticality of the action, and other factors in choosing scenarios for the outer bounds of the range. Document the considerations in selecting other scenarios where appropriate.

4.2. Instructions

To make this determination:

1. Take the representative elevation of the ground at the action site.
2. Locate the nearest BFE to the action site.
3. Open the Sea Level Rise viewer (https://coast.noaa.gov/slr/#/layer/slr). Select the “Local Scenarios” Tab (see Figure 8). Enter the address of the action location in the address bar. This

zooms into the action site. Find and select the closest scenario location (NOAA Tide Gauge) to the action site.

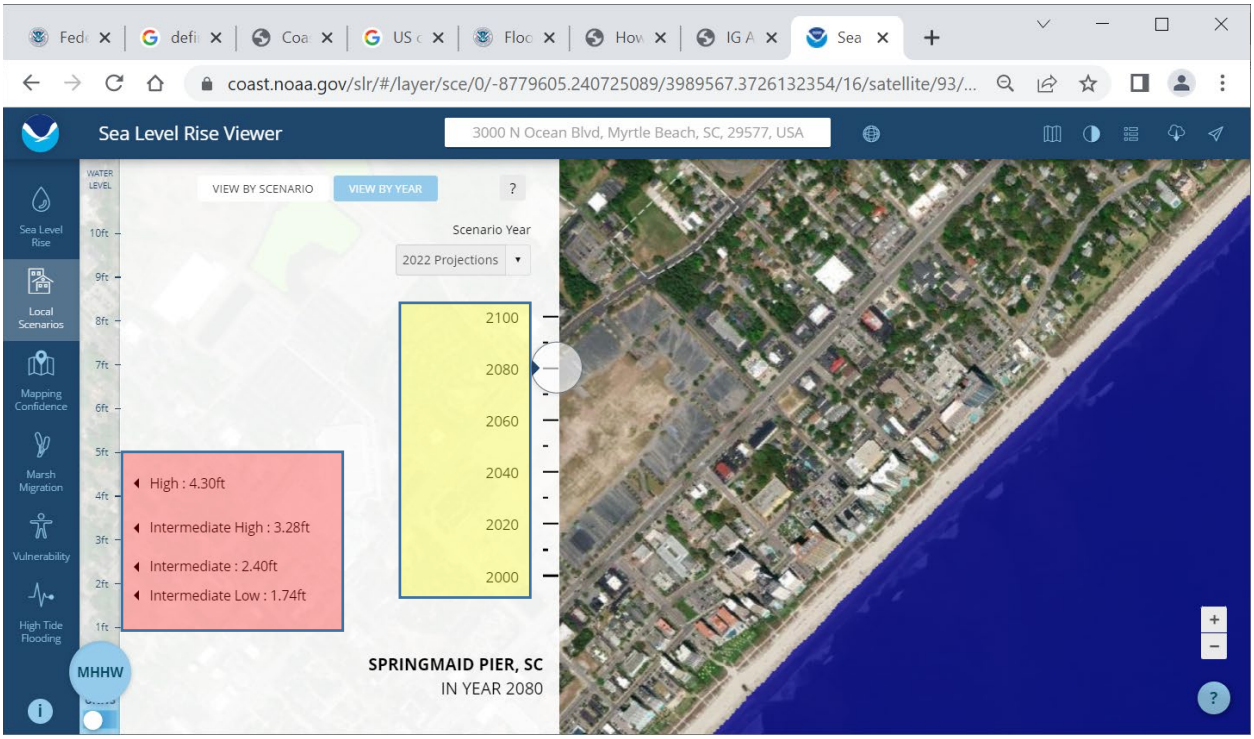


Figure 8: Example of SLR projections for Myrtle Beach, South Carolina (using Springmaid Pier gauge); confirm that "View by Year" is selected at the topic of the left-side panel, and then select Scenario Year (yellow box, here 2080); the application displays the cluster of SLR projections for intermediate-low to high scenarios (red box) (Source: NOAA)

4. Select the "View by Year" Tab. Select the year to get an SLR scenario, depending on the service life of the action for planning purposes. SLR scenarios start in 2000. Year selection is based on 10-year increments, so round to the decade closest to the expected service life.

5. The scenarios with SLR amounts appear on the vertical scale (see Figure 8).

   a. For non-critical actions, identify the intermediate scenario number and round up to the next whole foot (for example, if you select 2080, value is 2.40 feet; rounding up to the next whole foot is 3 feet).

   b. For critical actions, identify the intermediate-high scenario number (for example, if you select 2080, value is 3.28 feet; rounding up to the next whole foot is 4 feet).

   Record this number. Note: For more a conservative planning scenario for critical actions, you could use the high scenario, which adds more freeboard. Examples do not show this.

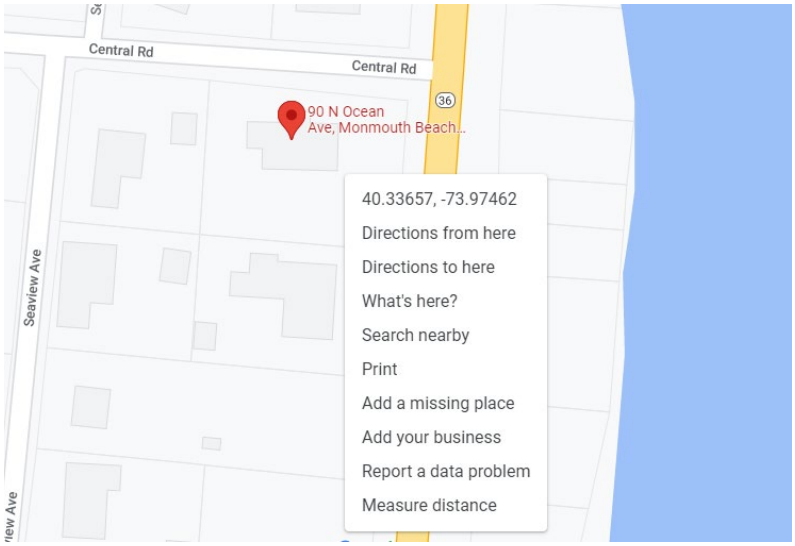
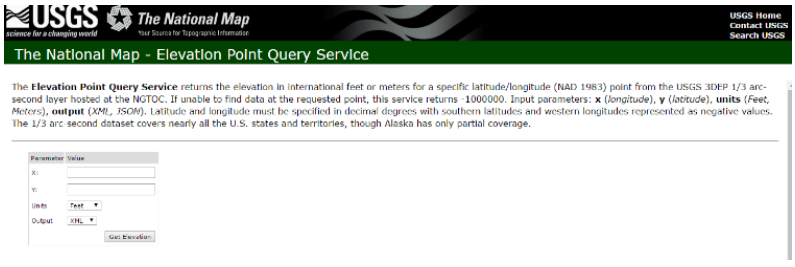
   As an alternative, establish a range, since this action has a long-term service life (i.e., 2080). The range for the SLR using intermediate-low and intermediate-high would be 2 to 3 feet.

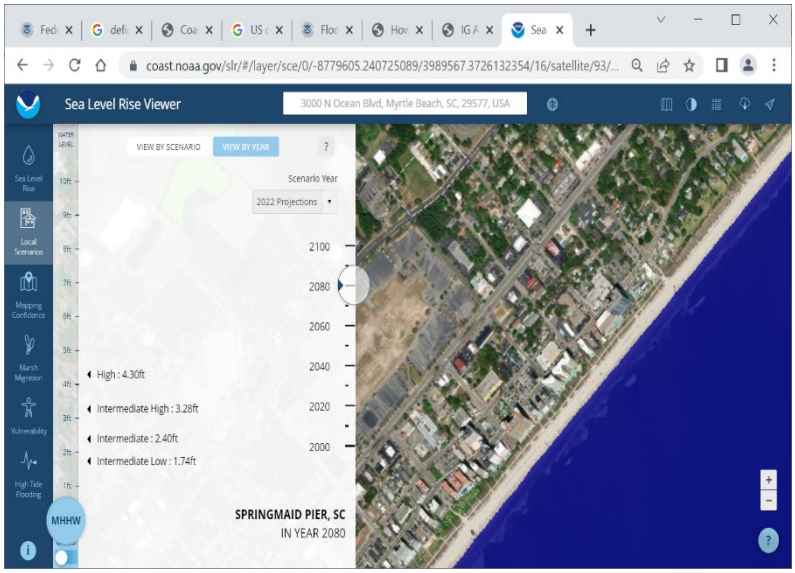
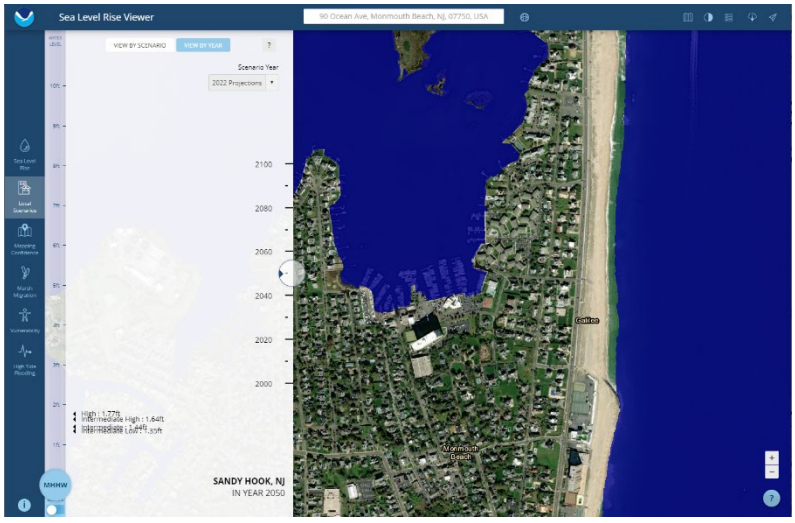
6. Add the amount to the previously identified BFE value. The result is the total for the simplified FFRMS CISA floodplain.
7. Determine if the calculated flood elevation for the FFRMS CISA floodplain is greater than or less than the ground elevation. If equal or greater, then the action is in the FFRMS CISA floodplain. If less, then the action is not within the FFRMS CISA floodplain.

4.3. Case Studies

Case studies 3 and 4 apply the simplified CISA for near-term service life actions, one with the action site located in the current 1-percent-annual-chance floodplain (Case Study 3) and the other with a site outside but adjacent to the 1-percent-annual-chance floodplain (Case Study 4). Case Study 5 describes a long-term service life example within the current 1-percent-annual-chance floodplain.

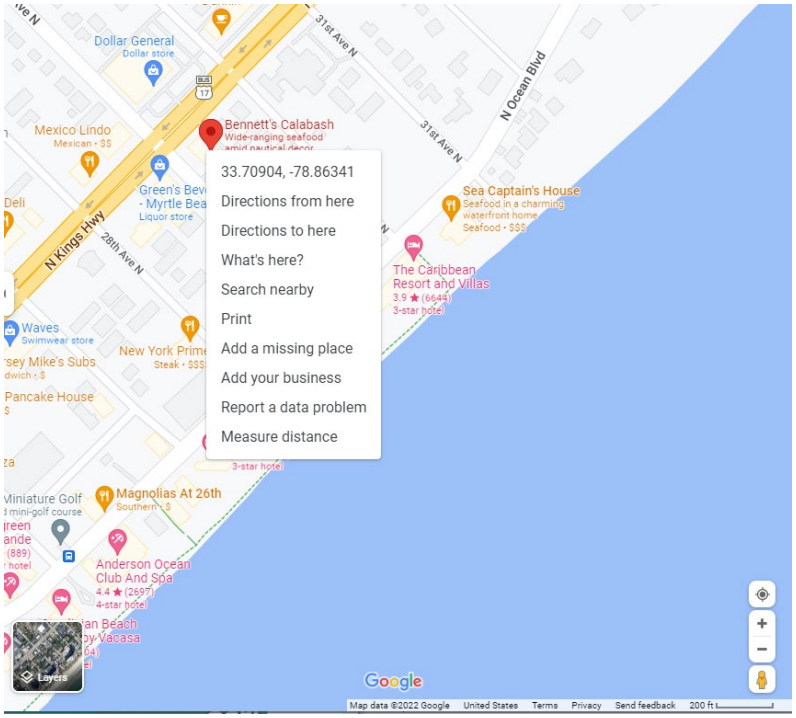
4.3.1. CASE STUDY 3: SIMPLIFIED CISA, NEAR-TERM SERVICE LIFE FOR SITE WITHIN CURRENT 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN

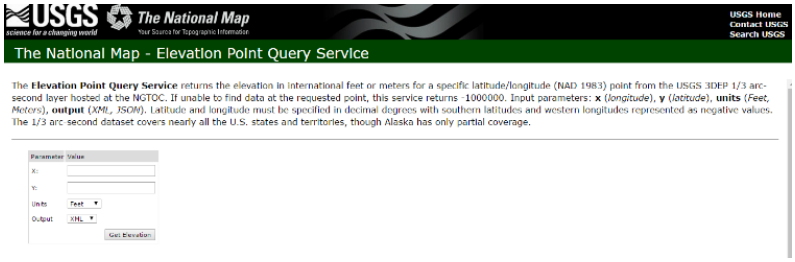
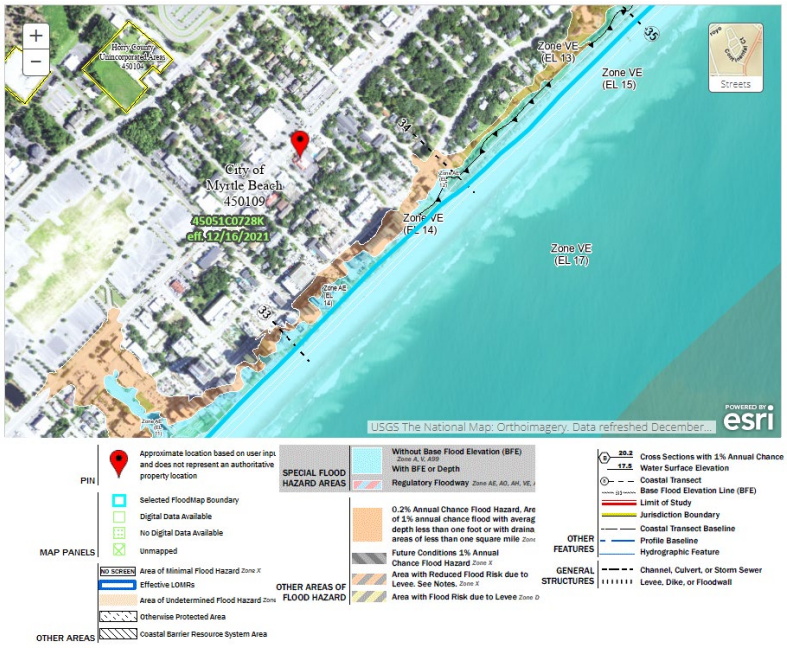
Steps with Images	Recorded Answers
1. Identify and record the site latitude/longitude 	**Top Left**: 40.33671456740612, -73.9749790195532 **Top Right**: 40.336703001832284, -73.97462245723374 **Bottom Left**: 40.33658734598463, -73.97496763990472 **Bottom Right**: 40.336567106190934, -73.97461866401758
2. Round the site elevation down for the most conservative estimate. 	**Top Left**: 6.76 feet **Top Right**: 7.34 feet **Bottom Left**: 7.17 feet **Bottom Right**: 6.8 feet Rounding down yields: **Top Left**: 6 feet **Top Right**: 7 feet **Bottom Left**: 7 feet **Bottom Right**: 6 feet

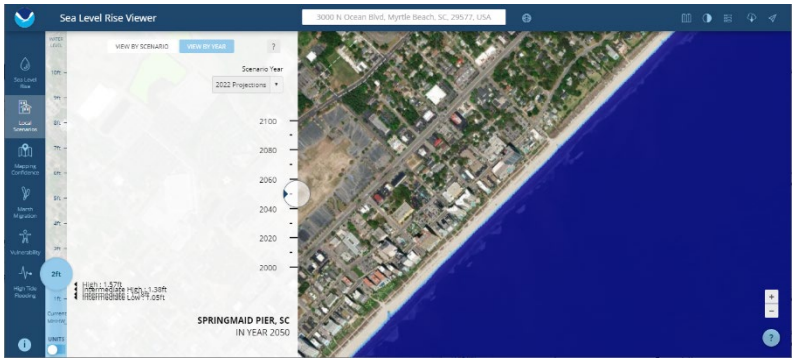
Steps with Images	Recorded Answers
3. Locate the floodplain zone and BFE, rounding to the value that results in the largest potential floodplain. 	**Zone**: Zone AE **BFE**: 9 feet *Site is in the 1-percent-annual-chance floodplain*
4. Enter the action site address, then select the closest scenario location (NOAA tide gauge) – Sandy Hook, NJ. a. For a non-critical facility, record the intermediate scenario number and round to the next whole foot. b. For a critical facility, record the intermediate-high scenario number and round to the next whole foot. 	**Non-Critical**: Coastal SLR (2050, intermediate scenario): 1.44 feet. Rounding up to the next whole foot = 2 feet. BFE + 2 = 9 + 2 = 11 feet **Critical**: Coastal SLR (2050, intermediate-high scenario): 1.6 feet. Rounding up to the next whole foot = 2 feet. BFE + 2 = 9 + 2 = 11 feet

Steps with Images	Recorded Answers
5. Compare the site elevation with the applicable FFRMS CISA floodplain. a. If elevation in step 4 is equal or greater than elevation in step 2, the action is in the FFRMS CISA floodplain. b. If elevation in step 4 is less than elevation in step 2, the action is not in the FFRMS CISA floodplain.	**Non-Critical**: **Top Left**: 6 feet < 11 feet **Top Right**: 7 feet < 11 feet **Bottom Left**: 7 feet < 11 feet **Bottom Right**: 6 feet < 11 feet *In the FFRMS CISA floodplain* **Critical**: **Top Left**: 6 feet < 11 feet **Top Right**: 7 feet < 11 feet **Bottom Left**: 7 feet < 11 feet **Bottom Right**: 6 feet < 11 feet *In the FFRMS CISA floodplain*
6. Follow the remainder of the 8-step process (2015 IG)	

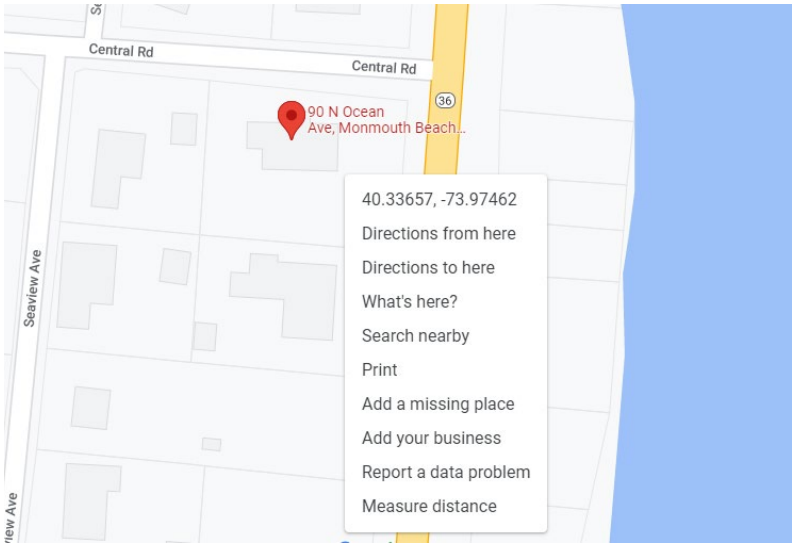
4.3.2. CASE STUDY 4: SIMPLIFIED CISA, NEAR-TERM SERVICE LIFE FOR SITE OUTSIDE OF CURRENT 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN

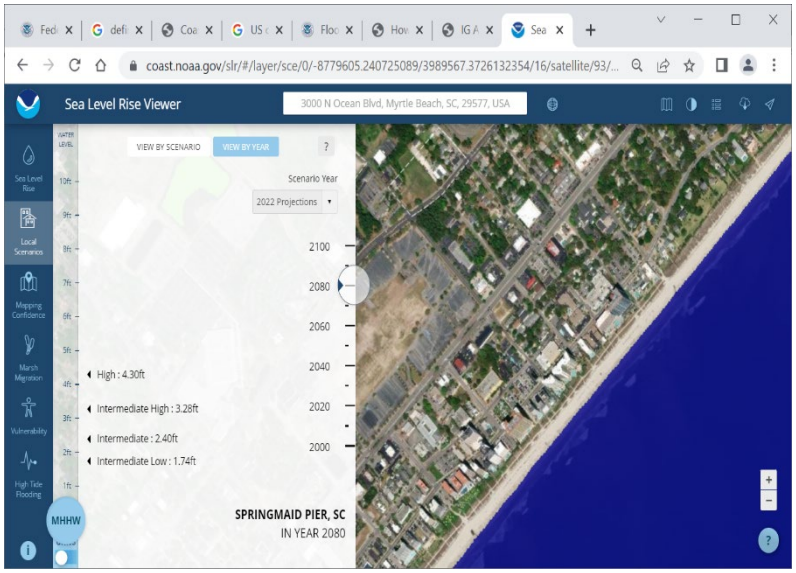
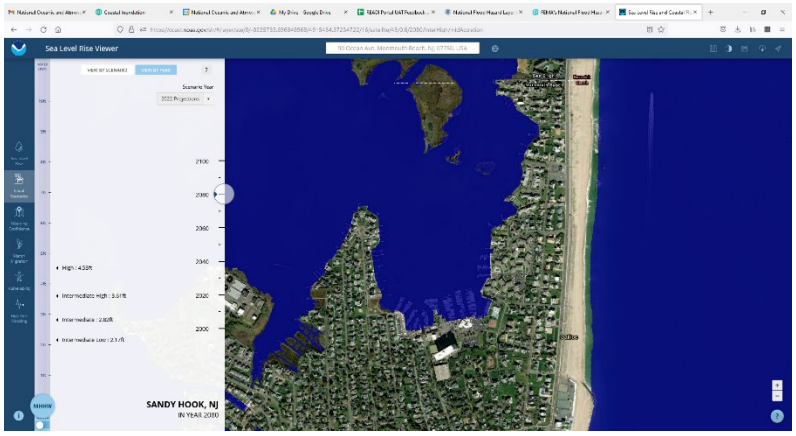
Steps with Images	Recorded Answers
1. Identify and record the site latitude/longitude 	33.709044285567195, -78.86341048455891

Steps with Images	Recorded Answers
2. Round the site elevation down for the most conservative estimate. 	30.58 feet. Round down to 30 feet for a more conservative number.
3. Locate the floodplain zone and BFE, rounding to the value that results in the largest potential floodplain. 	**Zone**: Zone AE **BFE**: 14 feet

Steps with Images	Recorded Answers
4. Enter the action site address, then select the closest scenario location (NOAA tide gauge) – Springmaid Pier, SC. a. For a non-critical facility, record the intermediate scenario number. b. For a critical facility, record the intermediate-high scenario number. 	**Non-Critical**: Coastal SLR (2050, intermediate scenario): 1.18 feet. Rounding up to the next whole foot = 2 feet. BFE + 2 = 14 + 2 = 16 feet **Critical**: Coastal SLR (2050, intermediate-high scenario): 1.38 feet. Rounding up to next whole foot = 2 feet. BFE + 2 = 14 + 2 = 16 feet
5. Compare the site elevation with the applicable FFRMS CISA floodplain. a. If elevation in step 4 is equal or greater than elevation in step 2, the action is in the FFRMS CISA floodplain. b. If elevation in step 4 is less than elevation in step 2, the action is not in the FFRMS CISA floodplain.	**Non-Critical**: 30 feet > 16 feet *Not in the FFRMS CISA floodplain* **Critical**: 30 feet > 16 feet *Not in the FFRMS CISA floodplain*
6. No need to finish the 8-step process (2015 IG) unless the action is outside of and affects the floodplain.	

4.3.3. CASE STUDY 5: SIMPLIFIED CISA, LONG-TERM SERVICE LIFE FOR SITE WITHIN CURRENT 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN

Steps with Images	Recorded Answers
1. Identify and record the site latitude/longitude 	**Top Left**: 40.33671456740612, -73.9749790195532 **Top Right**: 40.336703001832284, -73.97462245723374 **Bottom Left**: 40.33658734598463, -73.97496763990472 **Bottom Right**: 40.336567106190934, -73.97461866401758
2. Round the site elevation down for the most conservative estimate. 	**Top Left**: 6 feet **Top Right**: 7 feet **Bottom Left**: 7 feet **Bottom Right**: 6 feet

Steps with Images	Recorded Answers
3. Locate the floodplain zone and BFE, rounding to the value that results in the largest potential floodplain. 	**Zone**: Zone AE **BFE:** 9 feet *Site is in the 1-percent-annual-chance floodplain*
4. a. Enter in action site address, then select the closest scenario location (NOAA tide gauge) – Sandy Hook, NJ. 1) For a non-critical facility, record the intermediate scenario number. 2) For a critical facility, record the intermediate-high scenario number. 	**Non-Critical**: Coastal SLR (2100, intermediate scenario): 2.82 feet. Rounding up to next whole foot = 3 feet. BFE + 3 = 9 + 3 = 12 feet **Critical**: Coastal SLR (2100, intermediate-high scenario): 3.61 feet. Rounding up to the next whole foot = 4 feet. BFE + 4 = 9 + 4 = 13 feet

Steps with Images	Recorded Answers
b. Since it is a long-term service life, an alternative is to use a range. For this, use intermediate-low and intermediate-high scenarios.	**Low end of range**: Coastal SLR (2100, intermediate-high scenario): 2.17 feet. Rounding up to the next whole foot = 3 feet. BFE + 3 = 9 + 3 = 12 feet **High end of range**: Coastal SLR (2050, intermediate-high scenario): 3.61 feet. Rounding up to the next whole foot = 4 feet. BFE + 4 = 9 + 4 = 13 feet
5. Compare the site elevation with the applicable FFRMS CISA floodplain. a. If elevation in step 4 is equal or greater than elevation in step 2, the action is in the FFRMS CISA floodplain. b. If elevation in step 4 is less than elevation in step 2, the action is not in the FFRMS CISA floodplain.	**Non-Critical**: **Top Left**: 6 feet < 12 feet **Top Right**: 7 feet < 12 feet **Bottom Left**: 7 feet < 12 feet **Bottom Right**: 6 feet < 12 feet *In the FFRMS CISA floodplain* **Critical**: **Top Left**: 6 feet < 13 feet **Top Right**: 7 feet < 13 feet **Bottom Left**: 7 feet < 13 feet **Bottom Right**: 6 feet < 13 feet *In the FFRMS CISA floodplain* In this case the action is also in the FFRMS CISA floodplain using the range approach.
6. Follow the remainder of the 8-step process (2015 IG)	

5. 0.2-Percent-Flood Approach (0.2PFA) (Riverine only)

5.1. Background

In some locations, FEMA maps the 0.2-percent-chance (500-year) floodplain. For these mappings, you can plot the approximate location of the action site and determine whether it lies within the current 0.2-percent-annual-chance floodplain.

CAUTION

The absence of a mapped 0.2-percent-annual-chance floodplain in an area does not indicate that a location is not in the 0.2-percent-annual-chance floodplain. For action sites where the 0.2-percent-annual-chance floodplain is not on the FIRM or where flood elevations are not available in an FIS or through other federal, state, or local agencies, use another FFRMS approach.

CAUTION

Do not use the 0.2PFA for coastal floodplains. The NFHL may contain 0.2-percent-annual-chance flood hazard areas, which are typically mapped as shaded X zones. However, this mapping in most cases is based on the stillwater component of coastal flooding and does not include the components due to wave action.

5.2. Instructions

To use the 0.2PFA in riverine floodplains, go to the MSC or NFHL tools, identify the location of the action, and determine whether it is within or outside the 0.2-percent-annual-chance floodplain depicted in the map.

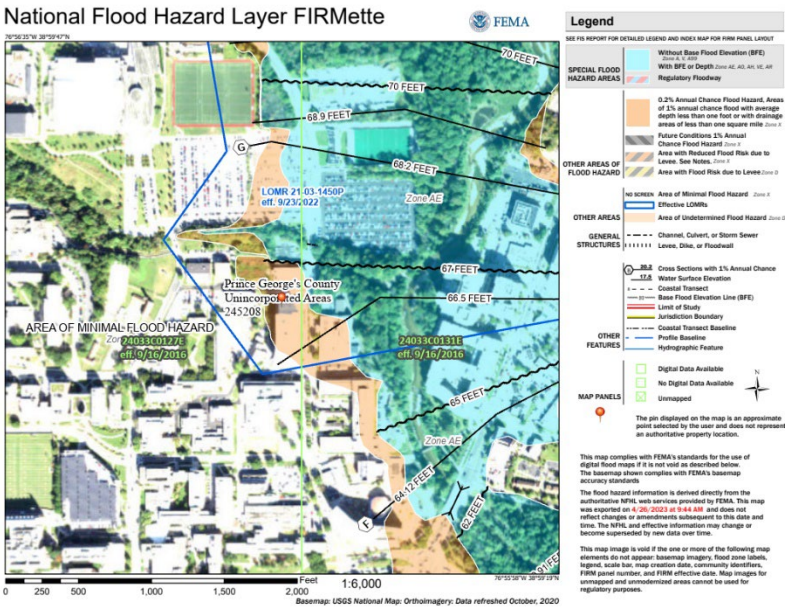
5.3. Case Study

Case Study 6 applies the 0.2PFA in a riverine floodplain.

5.3.1. CASE STUDY 6: 0.2PFA FOR SITE IN RIVERINE FLOODPLAIN

The 0.2PFA is suggested for locations for which 0.2-percent-annual-chance floodplain is mapped.

Steps with Images	Recorded Answers
1. Identify and record the site latitude/longitude.	**Top Left:** 38.992315, -76.939103 **Top Right:** 38.992326, -76.938521 **Bottom Left:** 38.991405, -76.939102 **Bottom Right:** 38.991477, -76.938624

Steps with Images	Recorded Answers
2. Navigate to a floodplain mapping tool and locate the floodplain zone. 	The pin is in tan shaded area, which is the 0.2% annual-chance-flood hazard area. *Site is in the FFRMS 0.2PFA floodplain*
3. Follow the remainder of the 8-step process (2015 IG)	

Optional: If you want to learn more:

FEMA offers Independent Study (IS) Courses for specific assistance in developing a corresponding elevation for the 0.2%PFA.

- Independent Study (IS) Course IS-274 (How to Use a Flood Insurance Study) https://emilms.fema.gov/is_0274/curriculum/1.html
    - Lesson #6 of IS-274 goes into detail the information contained in the Flood Profiles in a Flood Insurance Study (FIS)
- IS-273 (How to Read a Flood Insurance Rate Map) https://emilms.fema.gov/is_0273/curriculum/1.html

Appendix A: References

Regulations

- Executive Order (EO) 11988, Floodplain Management, 42 Fed. Reg. 26951 (May 24, 1977). https://www.archives.gov/federal-register/codification/executive-order/11988.html.

- EO 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 80 Fed. Reg. 6425 (Jan. 30, 2015). https://www.federalregister.gov/documents/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and.

- EO 14030, Climate-Related Financial Risk, 86 Fed. Reg. 27967 (May 25, 2021). https://www.federalregister.gov/documents/2021/05/25/2021-11168/climate-related-financial-risk.

Publications

- Federal Emergency Management Agency (FEMA). Building Community Resilience with Nature-Based Solutions: Strategies for Success. March 2023. https://www.fema.gov/sites/default/files/documents/fema_nature-based-solutions-guide-2-strategies-success_2023.pdf

- FEMA. Federal Interagency Floodplain Management Task Force. A Unified National Program for Floodplain Management. 1994.

- FEMA. Further Advice on EO 11988 Floodplain Management. 1983.

- FEMA. Guidance for Flood Risk Analysis and Mapping: Mapping Base Flood Elevations on Flood Insurance Rate Maps. December 2020. https://www.fema.gov/sites/default/files/documents/fema_bfe-mapping-guidance.pdf

- FEMA. Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, (including appendices A-H). October 8, 2015. https://www.fema.gov/sites/default/files/documents/fema_implementing-guidelines-EO11988-13690_10082015.pdf

- FEMA. Managing Floodplain Development in Approximate Zone A Areas: A Guide for Obtaining and Developing Base (100-Year) Flood Elevations (FEMA 265). April 1995. https://www.fema.gov/sites/default/files/documents/fema_approx-zone-a-guide.pdf

- Federal Flood Risk Management Standard (FFRMS) Science Subgroup, Flood Resilience Interagency Working Group, National Climate Task Force. Federal Flood Risk Management Standard Climate-Informed Science Approach (CISA) State of the Science Report. March 2023.

(https://www.whitehouse.gov/wp-content/uploads/2023/03/Federal-Flood-Risk-Management-Standard-Climate-Informed-Science-Approach-CISA-State-of-the-Science-Report.pdf)

- Federal Highway Administration (FHWA). Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide (FHWA-HEP-19-042). 2019. https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/green_infrastructure/implementation_guide/

- White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Office of Domestic Climate Policy. Nature-Based Solutions Resource Guide. 2022. https://www.whitehouse.gov/wp-content/uploads/2022/11/Nature-Based-Solutions-Resource-Guide-2022.pdf

Websites and Online Tools

- FEMA. FEMA Flood Map Service Center. (https://msc.fema.gov/portal/home)

- FEMA. National Flood Hazard Layer (basic information about it and some tutorials) (https://www.fema.gov/flood-maps/national-flood-hazard-layer)

- FEMA. National Flood Insurance Program. (https://www.floodsmart.gov/)

- NOAA. Online Vertical Datum Transformation. (https://vdatum.noaa.gov/vdatumweb/)

- USGS. The National Map – Data Delivery: Elevation Tools. (https://www.usgs.gov/the-national-map-data-delivery/elevation-tools)

Appendix B: FFRMS Floodplain Determination: Worksheet

This is a worksheet to assist in the FFRMS floodplain determination process. The spaces below follow the steps identified in this job aid. The case studies provide examples of how to use the table.

Basic Project Information	
Name and Organization of Person Completing the Form:	
Federal Agency (if different from above):	
Project Name:	
Project Type:	
Critical or Non-Critical Action:	
Coastal or Riverine:	
Select FFRMS Flood Determination Approach (CISA, FVA, 0.2PFA):	

Steps with Images	Recorded Answers
1. Identify and record the site latitude/longitude. [Paste relevant image snapshot]	

Steps with Images	Recorded Answers
Skip to step 7 if using 0.2PFA 2. Round the elevation(s) down for the most conservative estimate (for FVA or CISA) [Paste relevant image snapshot]	
3. Locate the floodplain zone and BFE if within the Special Flood Hazard Area, or nearest floodplain zone and BFE if action is outside, and round to the value that results in the largest potential floodplain. [Paste relevant image snapshot]	

Steps with Images	Recorded Answers
4. Note action characteristics such as service life, criticality, risk tolerance (low, medium, high), and any other hazards of concern (flash floods, erosion).	
5. a. Determine the FFRMS flood elevation based on FVA (if applicable).	
b. Determine the FFRMS flood elevation based on simplified CISA (if applicable).	
6. Compare the answer in step 2 to step 5 and determine if the site is in the FFRMS floodplain.	
7. **For 0.2PFA only**, locate the site in the flood map and determine if it is in 0.2 percent-annual-chance hazard area (if applicable).	

Appendix C: Acronym List

BFE	Base Flood Elevation
CEQ	Council on Environmental Quality
CISA	Climate-Informed Science Approach
DHS	Department of Homeland Security
DOC	Department of Commerce
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOJ	Department of Justice
DOL	Department of Labor
DOT	Department of Transportation
DST	Decision Support Tool
EO	Executive Order
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFRMS	Federal Flood Risk Management Standard
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FVA	Freeboard Value Approach
GIS	Geographic Information System
GSA	General Services Administration

HAG	Highest Adjacent Grade
HHS	Health and Human Services
HUD	Housing and Urban Development
IWG	Interagency Working Group
LAG	Lowest Adjacent Grade
LOMC	Letters of Map Change
MSC	Map Service Center
NASA	National Aeronautics And Space Administration
NCPC	National Capital Planning Commission
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
NOAA	National Oceanic And Atmospheric Administration
NSF	National Science Foundation
OMB	Office of Management and Budget
OPM	Office of Personnel Management
OSTP	Office of Science and Technology Policy
SBA	Small Business Administration
SLR	Sea-Level Rise
SSA	Social Security Administration
TVA	Tennessee Valley Authority
U.S.	United States
USDA	United States Department of Agriculture
USGS	United States Geological Survey