

RMAT's Climate Resilience Design Standards Tool

Overview
June 2024



ResilientMass
Climate Adaption Clearinghouse
for the Commonwealth



Tool Goals:

- Make preliminary climate resilience analysis **more broadly accessible**
- Inform "**climate smart**" capital planning, project design and procurement
- Provide recommendations based on **consistent use** of state's climate data
- Provide a unified planning and design **support tool** that state agencies can use to administer grant programs
- Provide **consistent information to municipalities** hosted on resilient.mass.gov



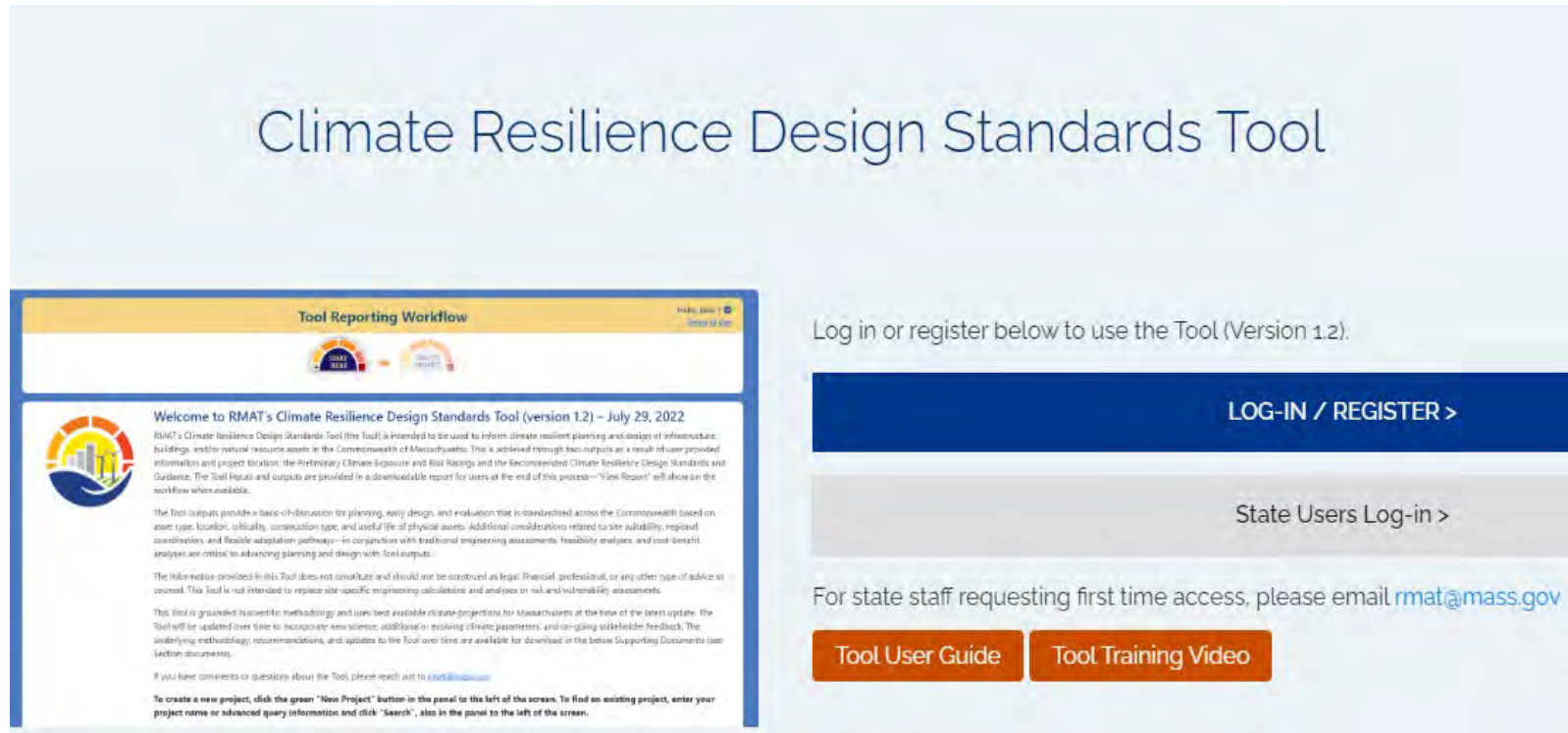
The screenshot shows the ResilientMass website. At the top, there is a navigation bar with "TOOLS & DATA" and "LEARN" menus. The "TOOLS & DATA" menu is open, showing links to "Resource Clearinghouse", "Maps and Data Center", "Climate Resilience Design Standards & Guidance", and "Guides for Equitable & Actionable Resilience (GEAR)". An orange arrow labeled "Link to tool" points to the "Climate Resilience Design Standards & Guidance" link. Below the navigation bar is a large banner image of a tree with red fruit. Underneath the banner, there is a blue section titled "Climate Resilience Design Standards Tool" with the text "Apply statewide data to assess the climate resilience of your project site." and a "LEARN MORE >" link. Another orange arrow labeled "Link to tool" points to this "LEARN MORE >" link. Below the blue section is a white section titled "Climate Resilience Design Standards Tool". It contains a preview of the tool's interface, which includes a "Tool Reporting Workflow" section and a "Log in or register below to use the Tool (Version 1.2)." section. An orange arrow labeled "Log-in/launch tool" points to the "LOG-IN / REGISTER >" button. Below the login button is a "State Users Log-in >" link. At the bottom right, there are two buttons: "Tool User Guide" and "Tool Training Video".

<https://resilient.mass.gov/>

When to use this tool:

The Tool outputs provides a basis-of-discussion for planning, early design, and evaluation that is standardized across the Commonwealth based on asset type, location, criticality, construction type, and useful life of physical assets.

- **Project planning, design and procurement**
- Project siting
- Improving a state grant application



The screenshot displays the homepage of the "Climate Resilience Design Standards Tool". The header features the tool's name in a large, blue font. Below the header, there is a "Tool Reporting Workflow" section with a circular diagram showing the process from "New Project" to "Final Report". The main content area includes a welcome message dated July 29, 2022, and a detailed description of the tool's purpose and usage. On the right side, there is a login/register section with a "LOG-IN / REGISTER >" button and a "State Users Log-in >" link. Below this, there is a note for state staff requesting first-time access, followed by two buttons: "Tool User Guide" and "Tool Training Video".

Climate Resilience Design Standards Tool

Tool Reporting Workflow

Welcome to RMAT's Climate Resilience Design Standards Tool (version 1.2) – July 29, 2022

Log in or register below to use the Tool (Version 1.2).

LOG-IN / REGISTER >

State Users Log-in >

For state staff requesting first time access, please email rmat@mass.gov

Tool User Guide Tool Training Video

https://resilient.mass.gov/rmat_home/designstandards/

Key available resources:

Log in or register below to use the Tool (Version 1.2).

[LOG-IN / REGISTER >](#)

[State Users Log-in >](#)



For state staff requesting first time access, please email rmata@mass.gov

[Tool User Guide](#) [Tool Training Video](#)

Climate Resilience Design Standards Tool
Version 1.2, July 2022

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 **Climate Resilience Design Standards Tool**
Resilient MA Action Team 

Project Search

Project Name

Advanced Query

  [Clear Search](#) [Search](#)

[New Project](#)

Tool (V1.2) Training Video - February, 2023

Guidance and Best Practices

The Climate Resilience Design Guidance provides general design guidance to consider while implementing resilience principles that are not specific to project type or climate hazards, and are illustrated through example the Guidance considerations and document decision making throughout the planning process.

[Guidance and Best Practices PDF](#)

Additional forms include:

- [Site Suitability](#)
- [Regional Coordination](#)
- [Flexible Adaptation Pathways](#)

Table 1.1. Climate Resilience Design Guidance Best Practices

Considerations	Best Practice
Site Suitability (SS)	<ol style="list-style-type: none">1. Reduce exposure to climate hazards2. Mitigate adverse climate impacts and provide benefits3. Protect, conserve, and restore critical natural resources on-site and off-site
Regional Coordination (RC)	<ol style="list-style-type: none">1. Assess regional context of vulnerability2. Evaluate impacts beyond site-specific design3. Optimize capital investment opportunities4. Prioritize services and assets that serve vulnerable populations
Flexible Adaptation Pathways (AP)	<ol style="list-style-type: none">1. Embed future capacity and design for uncertainty2. Design for incremental change3. Encourage climate mitigation and other co-benefits4. Prioritize nature-based solutions5. Prepare for current and future operational and maintenance needs

Climate resilience design guidance and best practices

Documentation and training for technical data inputs:

- [Massachusetts Coast Flood Risk Model \(MC-FRM\) FAQ](#) (April 6, 2022)
- [Massachusetts Coast Flood Risk Model \(MC-FRM\) Online Trainings](#) (April-May 2023)
- [EEA's Climate and Hydrologic Risk Project - Weather Generator Technical Document](#) (April, 2022)
- [EEA's Climate and Hydrologic Risk Project - IDF Curves Technical Document](#) (December, 2021)

https://resilient.mass.gov/rmat_home/designstandards/

Getting Started

Log-in at:
https://resilient.mass.gov/rmat_home/designstandards/

External users must follow register wizard for first time access

State users should request first time access at rmat@mass.gov

*Extra lead time needed for new tool accounts with @dot.state.ma.us email addresses

Search for existing projects,

OR

Click on “New Project” to start

Climate Resilience Design Standards Tool

Log in or register below to use the Tool (Version 1.2).

External Log-in

State Log-in

LOG-IN / REGISTER >

State Users Log-in >

For state staff requesting first time access, please email rmat@mass.gov

Tool User Guide Tool Training Video

Climate Resilience Design Standards Tool

Resilient MA Action Team

Project Search

Project Name

Advanced Query

Search

Clear Search

New Project

Search

New

Project Inputs


Tool Reporting Workflow



Draw project footprint

Draw Project Area

You must draw a polygon on the map representing the project area.

1. Find the project location using the map zoom/pan and/or the address search bar in the upper right area of the map.
2. Draw the polygon using the drawing tools under the search bar.
3. Click the  icon when you are satisfied with the polygon.

Find address or place

1

2

3

[Show me how](#)

Map View Additional Documents and Resources

A screenshot of a web application interface. The main area is a map showing a street grid and a body of water. A red polygon is drawn on the map, representing a project footprint. The polygon is located near a green area labeled 'Palmer Cove Park & Playground'. The map includes a search bar in the top right corner with the text 'Find address or place'. Below the search bar, there are several icons: a magnifying glass, a document, a refresh, a share, and a settings gear. A red box highlights these icons. To the right of the map, there is a sidebar with the text '1 Feature' and a trash can icon. At the bottom of the map, there is a legend and a scale bar.

Drawing tools

Project Inputs



Map View **Project Inputs** Project Outputs Additional Documents and Resources

Step 1 Core Project Information *(Click each question to answer and save. All questions in red are required)*

Step 2 **i** Project Ecosystem Services Benefit *(Please identify whether the project provides the following ecosystem services benefits to the project site or surrounding area)*

Step 3 Project Climate Exposure *(Click each question to answer and save. All questions in red are required)*

Step 4 **i** Project Assets

Answer input questions for four steps:

1. Contextual Information
2. Environmental benefits from project
3. History of hazard exposure
4. Asset specific information

Project Inputs

Tool Reporting Workflow



Step 2 Project Ecosystem Services Benefit

STEP 2: Environmental benefits from project

- Provides flood protection through green infrastructure or nature-based solutions No
- Provides storm damage mitigation No
- Provides groundwater recharge No
- Protects public water supply No
 - Filters stormwater No
 - Improves water quality No
- Promotes decarbonization Yes
- Enables carbon sequestration Yes
- Provides oxygen production No
 - Improves air quality No
 - Prevents pollution Yes
- Remediates existing sources of pollution No
- Protects fisheries, wildlife, and plant habitat No
- Protects land containing shellfish No
- Provides pollination No
- Provides recreation No

Guidance (i)

Step 3 Project Climate Exposure

STEP 3: History of hazard exposure

- Does the project site have a history of coastal flooding? Yes
- Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)? No
- Does the project result in a net increase in impervious area of the site? No
- Does the project site have a history of riverine flooding? No
- Are existing trees being removed as part of the proposed project? No

Step 4 Project Assets

STEP 4: Asset specific information

Building/Facility	Add	Selected Asset:	UserGuide Building
UserGuide Building		Asset Type:	Typically Occupied
		Asset Sub-Type:	Residential building - Public Housing
		Construction Type:	Maintenance (critical repair)
		Construction Year:	2025
		Useful Life:	15

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.

Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.

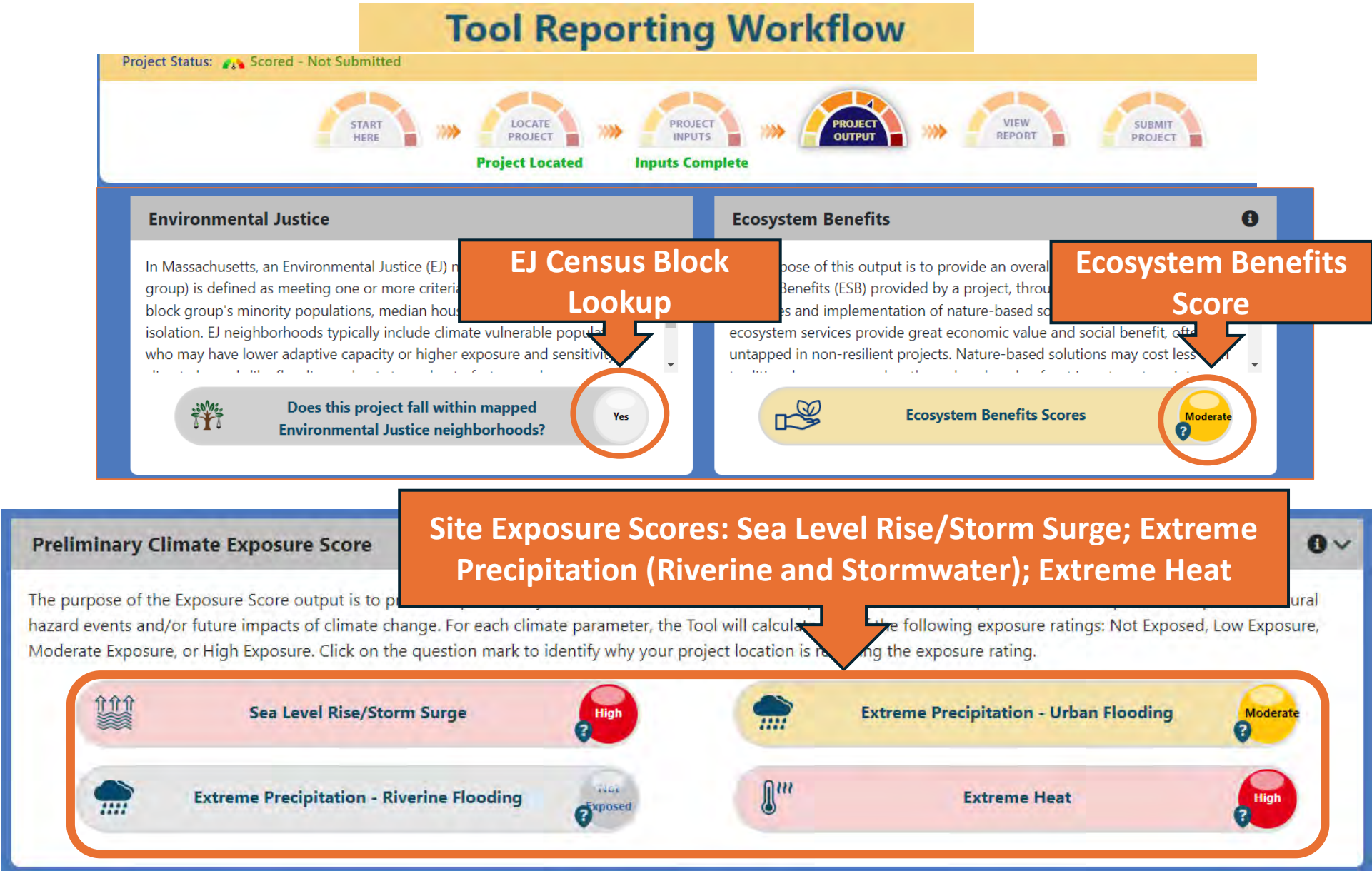
Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.

Building must be accessible/operable at all times, even during natural hazard event

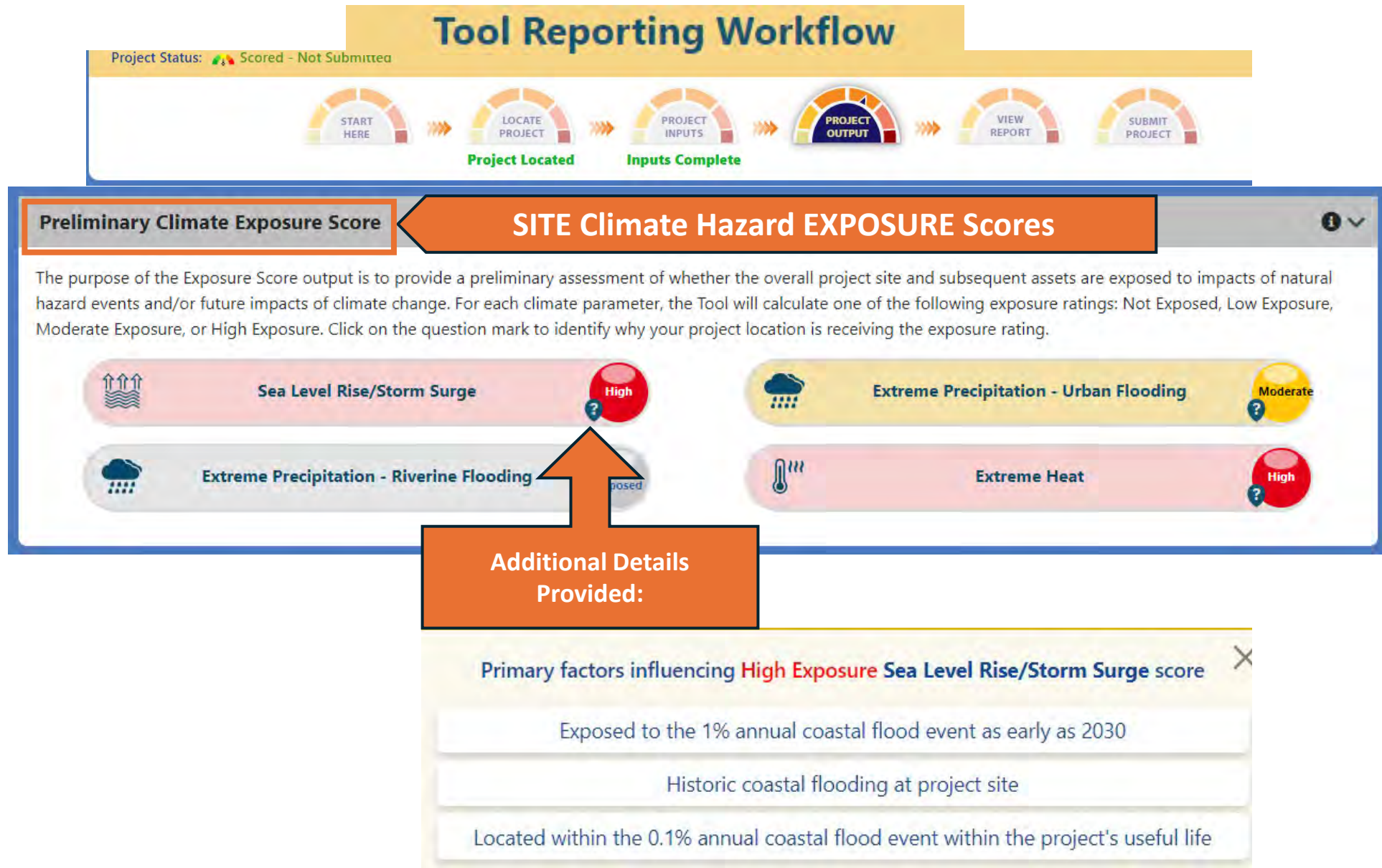
Impacts would be limited to local area and/or municipality

Less than 1,000 people

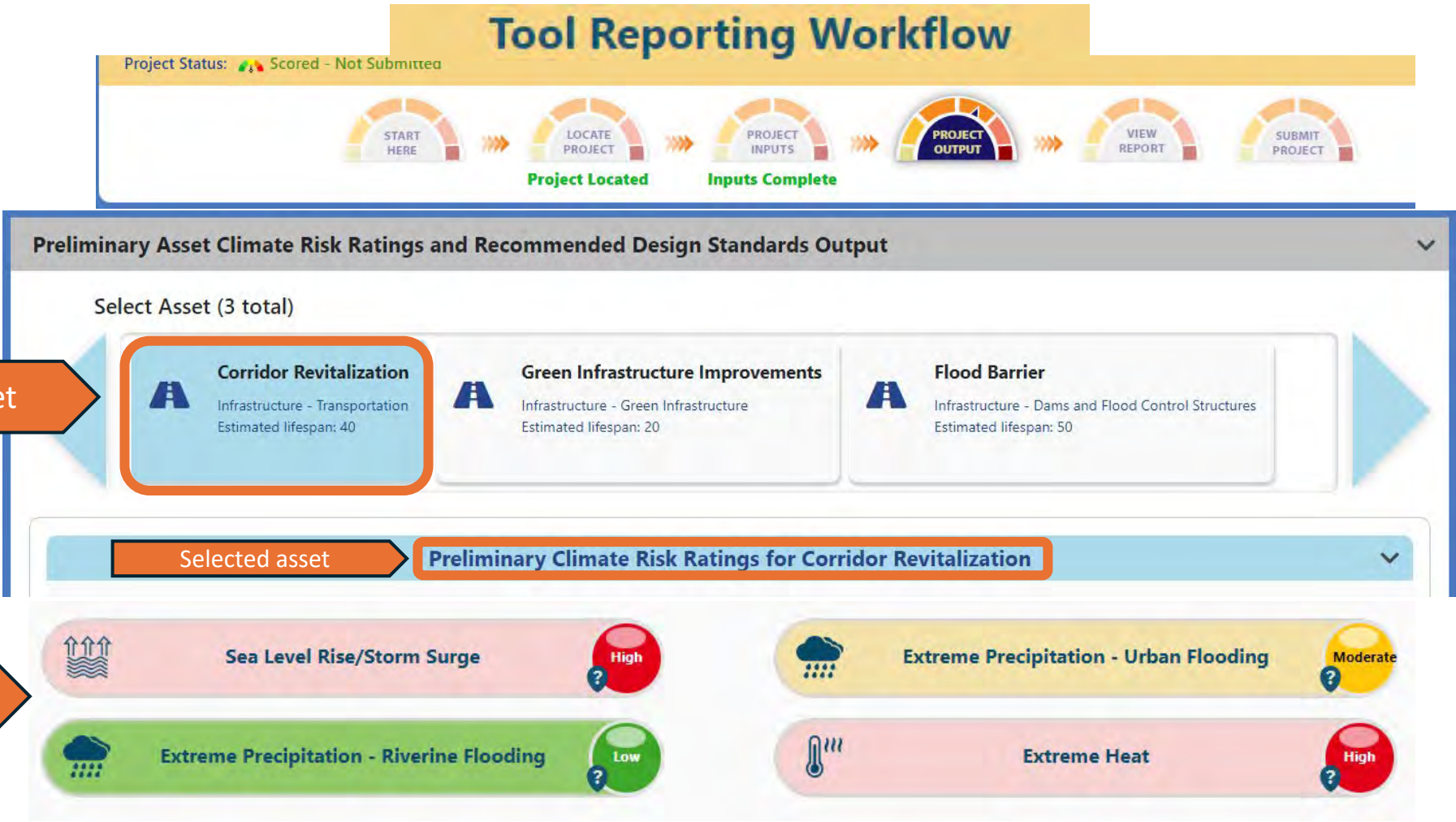
Outputs: Project Level Scores



Outputs: Project Level Scores



Outputs: Asset Climate Risk Rating

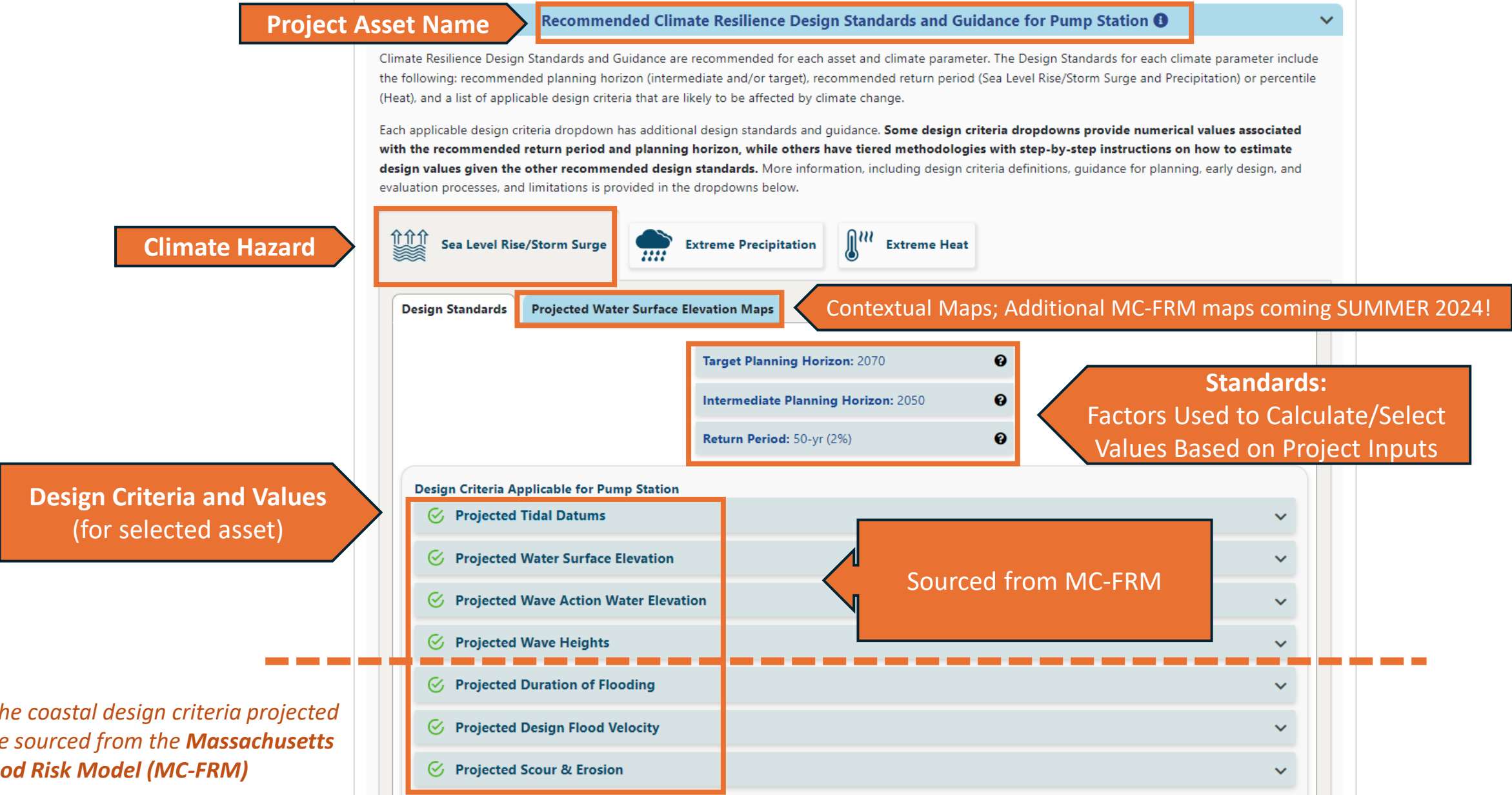


Tool projects can accommodate multiple assets

*Will receive **climate risk** rating for **each asset** entered*

NOTE: While it is possible to get a “no exposure” **project** score for “Sea Level Rise/Storm Surge” or “Extreme Precipitation – Riverine Flooding” because geographically dependent, the tool will still give an **asset risk score** (low).

Outputs: Standards/Design Criteria (Coastal Flooding)



Outputs: Design Value Guidance (Coastal Flooding)

Design Criteria Applicable for Pump Station

✓ Projected Tidal Datums

✓ Projected Water Surface Elevation

Name of Design Standard/Value

Definition

Projected Water Surface Elevation is the projected elevation for a specific future flood event, considering storm surge, tides, and wave setup. Wave setup, as included in water surface elevation, is defined by FEMA as “an increase in the total stillwater elevation against a barrier (dunes, bluffs, or structures) caused by breaking waves.” (https://www.fema.gov/sites/default/files/2020-02/Coastal_Wave_Setup_Guidance_Nov_2015.pdf).

Projected Water Surface Elevation Values:

Explanation of value

Value(s) for selected asset

The projected modeled elevations may vary across large sites due to variations in the site’s physical characteristics. The values are presented as a maximum, minimum, and area weighted average values in the table below. The area weighted average value corresponds to the projected Water Surface Elevation of the project site.

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average ⓘ
			(ft - NAVD88)		
Pump Station	2050	2% (50-Year)	12.1	12.0	12.0
	2070		13.9	13.8	13.8

How Water Surface Elevation may inform Planning

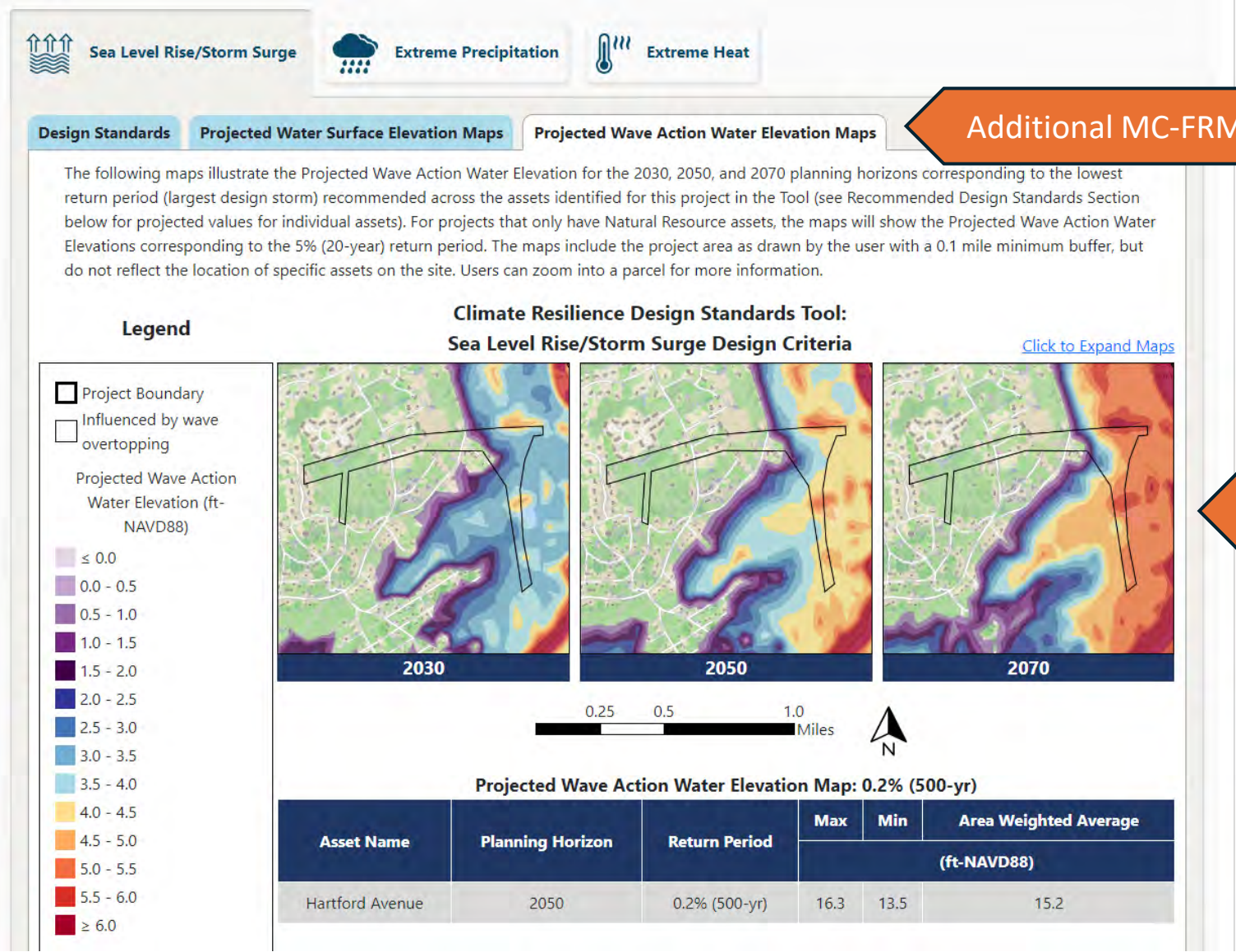
How Water Surface Elevation may inform Early Design

How Water Surface Elevation may inform Project Evaluation

Limitations for Projected Water Surface Elevation Values, Standards, and Guidance

Guidance on how to use values during Planning, Early Design, and Project Evaluation (e.g., MEPA)

Outputs: Coastal Flooding Maps



Outputs: Standards/Design Criteria (Precipitation)

Sea Level Rise/Storm Surge

Extreme Precipitation

Climate Hazard

Target Planning Horizon: 2050

Return Period: 100-yr (1%)

Design Criteria Applicable for Test2050

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms

Definition

Total Precipitation Depth for 24-hour Design Storms is the total amount of rain in inches that falls over a period of 24-hours. It can be any 24-hour period, not just a traditional calendar day. This is given for a specific design storm (return period) such as the 100-year or 10-year storm (1% or 10%). Peak Intensity is the maximum rate of rainfall in inches per hour of a 24-hour design storm*.

Projected Total Precipitation Depth and Peak Intensity values can be used to assess potential flooding impacts and inform design of green and grey infrastructure solutions to mitigate flooding and manage stormwater.

Projected Total Precipitation Depth Values and Peak Intensity

The Tool uses climate projections developed by Cornell University for the 2050 planning horizon. Assets receive a projected value for the 24-hour Total Precipitation Depth associated with a recommended return period (design storm) and planning horizon.

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Test2050	2050	100-Year (1%)	9.9	Downloadable Methodology PDF

ATTENTION: This is a Tier 3, Dams & Flood Control Structures project. Due to the criticality and useful life of this project, it is recommended that NCHRP15-61 methodology be used to calculate total precipitation depth for 24-hour design storms, and those results be compared to the provided total storm depth output: [Tier 3 methodology PDF](#).

How Total Precipitation Depth may inform Planning

How Total Precipitation Depth may inform Early Design

How Total Precipitation Depth may inform Project Evaluation

Limitations for Projected Total Precipitation Depth & Peak Intensity, Standards, and Guidance

Design Criteria and Values
(for selected asset)

Standards:
Factors Used to Calculate/Select
Values Based on Project Inputs

Value for selected asset

Will receive recommended standards and design criteria for **each asset entered**

Explore **additional design storm precipitation values** on external dashboard:

<https://mass-eoea.maps.arcgis.com/apps/dashboards/2e8534bc2a7849b0aa6f64d0f79a8937>

Outputs: Standards/Design Criteria (Temperature)

Design Criteria and Values
(for selected asset)

Sea Level Rise/Storm Surge

Extreme Precipitation

Extreme Heat

Climate Hazard

Target Planning Horizon: 2050

Percentile: 50th Percentile

Standards:
Factors Used to Calculate/Select
Values Based on Project Inputs

Value(s) for selected asset

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Hartford Avenue	2050	50th	56.15	73.97	38.21

NEW LOOK/FUNCTIONALITY
COMING SUMMER 2024!

Design Criteria Applicable for Hartford Avenue

Projected Annual/Summer/Winter Average Temperatures

Definition

Projected Annual/Summer/Winter Average Temperature V

Average Temperatures represent the daily average temperature over a period of time: Annual represents January through December, Summer represents June through August, and Winter represents December through February. Annual Temperatures are anticipated to increase with climate change, but the rate of change varies depending upon the season.

The Tool uses climate projections developed by Cornell University... receive a projected value for Annual/Summer/Winter Average Temperature associated with a recommended percentile and planning horizon.

How Annual/Summer/Winter Average Temperatures may inform Planning

How Annual/Summer/Winter Average Temperatures may inform Early Design

How Annual/Summer/Winter Average Temperatures may inform Project Evaluation

Limitations for Average Annual/Summer/Winter Temperature Standards and Guidance

Download Project Report

Preview report summary on **View Report** workflow page


Download PDF of project report
Click **“Submit”** report

Upload/attach PDF to respective grant portal/MEPA filing

View Report page

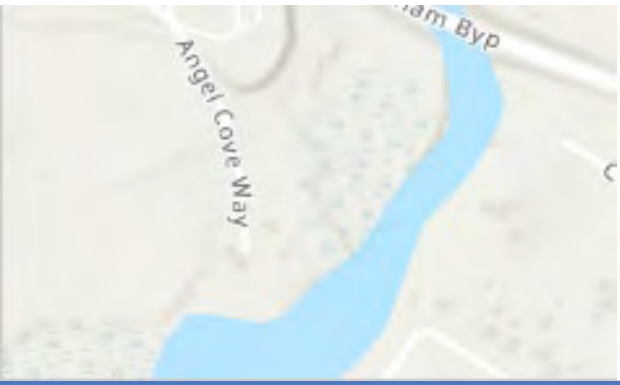
RMAT Climate Resilience Design Standards Tool Project Report

EJD Test
Date Created Example Project Created By: RMAReport

Download  **Download**

Full project site exposure scores

Ecosystem Service	Scores
Benefits	
Project Score	Moderate
Exposure	
Sea Level Rise/Storm Surge	High Exposure
Extreme Precipitation - Urban Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Not Exposed
Extreme Heat	High Exposure



Asset Risk Ratings
(for each asset)

Asset Preliminary Climate Risk Rating Summary					Number of Assets: 3
Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Urban Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat	
Asset A	High Risk	High Risk	Low Risk	High Risk	
Asset B	High Risk	High Risk	Low Risk	High Risk	
Asset C	High Risk	High Risk	Low Risk	High Risk	
Cranberry					
Agawam River					

— Natural Resource project assets do not receive a preliminary climate risk rating. —

Submit Project Report



SUBMIT PROJECT

This project has not been submitted

Once you have answered all Project Input questions and reviewed your Project Outputs and Report, you are ready to submit your project. Until submitted, you may continue to edit the project inputs.

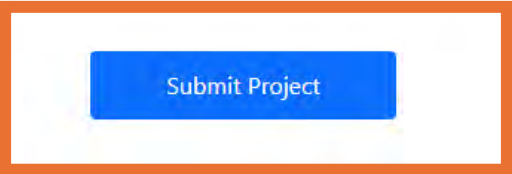
Submission is not required to view Project Outputs or download a Report (available on "View Report" tab), but may be requested in accordance with guidelines from grant programs, or state planning or review processes.

Only submitted projects are searchable and accessible to Commonwealth administrators.

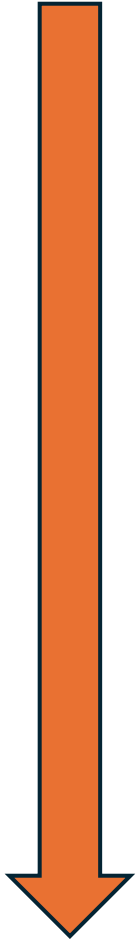
Once you click "Submit Project", project information will be saved, and the "Download Report" icon will appear to download the latest report version. You are not able to edit your project information once you click Submit.

Click "Submit" report

Submit



Tool Version history



Beta Tool (April 2021)

- MVP and Massworks requested Tool reports in grant applications

Version 1.0 (February 2022)

- Climate exposure updates
- Ecosystem service benefits updates
- Additional in-tool guidance

Version 1.1 (April 2022)

- **MC-FRM Level 2 outputs** (dynamic tables for applicable coastal design criteria)
- MA Climate Hydrologic Risk Project outputs (dynamic tables for applicable extreme precipitation design criteria)

Version 1.2 (July 2022)

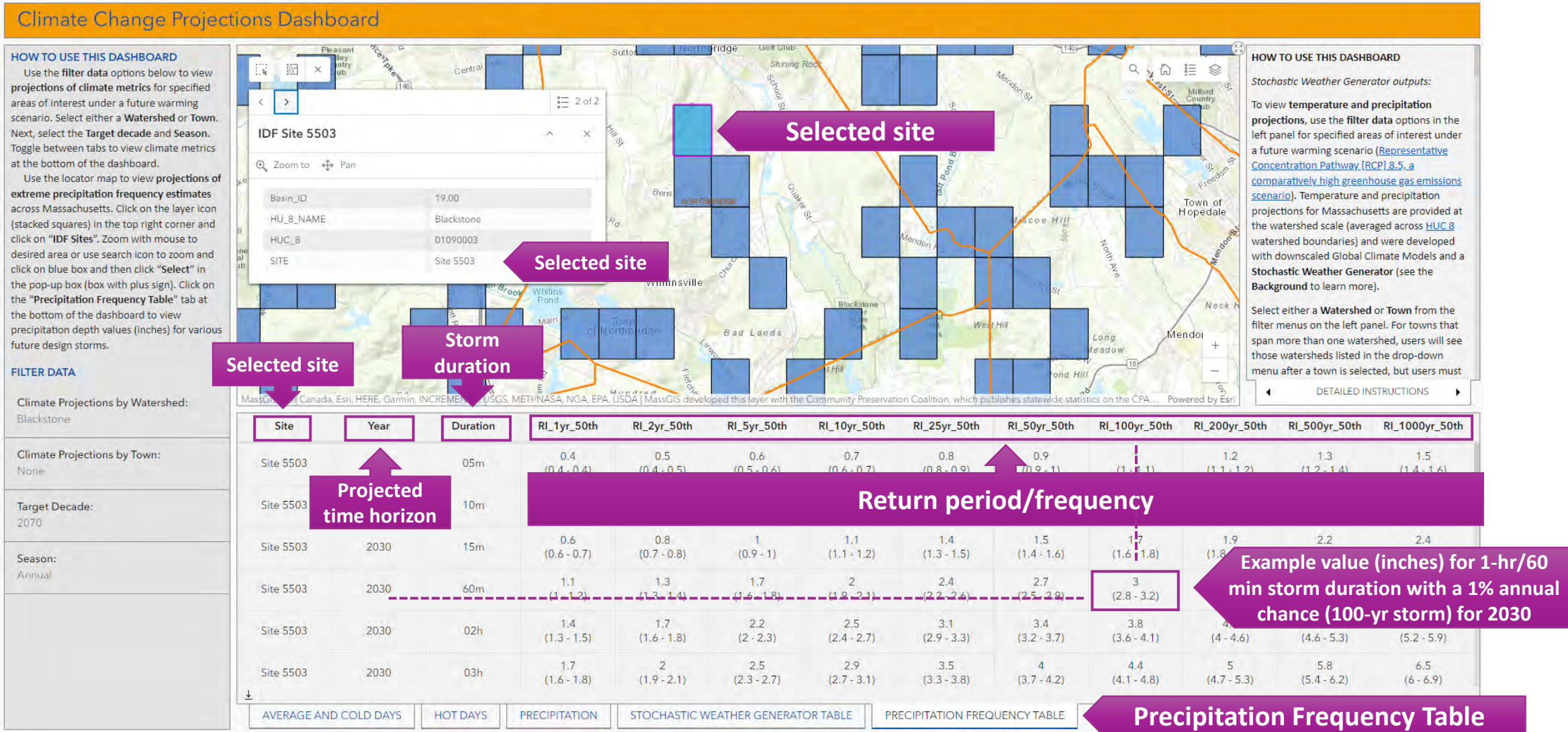
- **MC-FRM Projected Water Surface Elevation Maps** (interactive in-tool interface and printed maps in project report)

Version 1.3 (2024) – In progress

- Updates to temperature design standards (**adding** projected values into tool interface)
- Additional MC-FRM maps (**Projected Wave Action Water Elevation**)
- Bug fixes

Related resources:

Climate informed precipitation values (Intensity-Duration-Frequency)

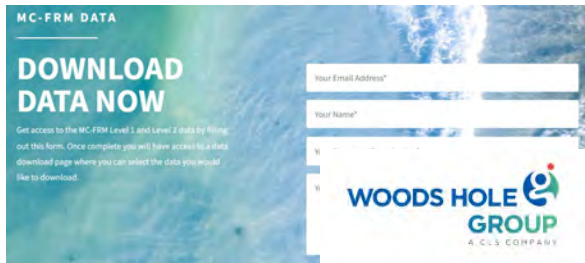


Related resources: Massachusetts Coast Flood Risk Model (MC-FRM)

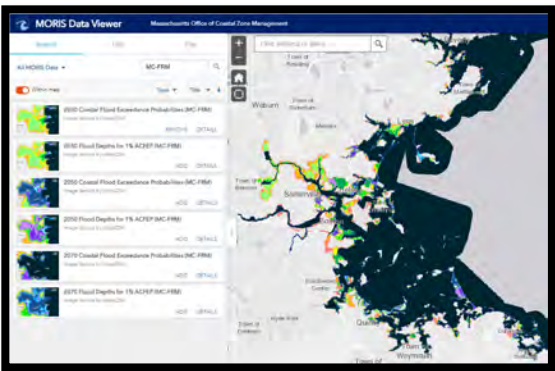
Training Videos



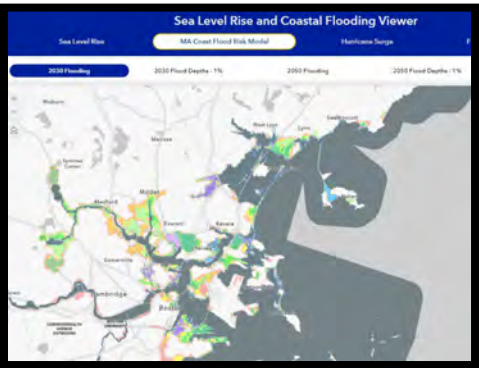
Data Download Page



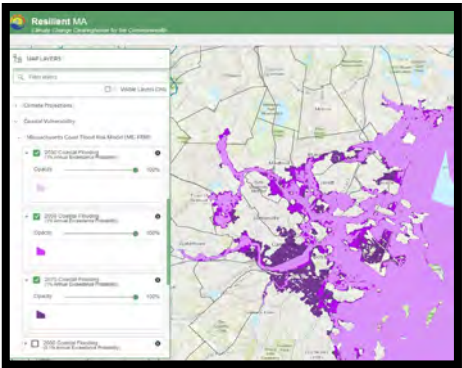
State Data Viewers



CZM's MORIS Data Viewer



CZM's Sea Level Rise and Coastal Flooding Viewer



ResilientMass Climate & Hazards Viewer



ResilientMass

Climate Adaption Clearinghouse
for the Commonwealth

Reach out to
rmat@mass.gov
with any questions!

*NOTE: There is no full-time dedicated staff to support technical issues pertaining to the tool, so please allow at least three to five business days to resolve issues.