

RMAT气候复原力设计标准 工具

概览

2024年6月



ResilientMass
Climate Adaption Clearinghouse
for the Commonwealth



工具目标:

- 使初步的气候复原力分析更广泛地被接受
- 为"气候智能"的资本规划、项目设计和采购提供信息
- 根据对州气候数据的一致使用提供建议
- 提供一个州政府部门可以用来管理补助计划的统一规划和设计支持工具
- 在 resilient.mass.gov 上为市政府提供一致的信息

转到工具的链接

TOOLS & DATA ▾

LEARN ▾

[Resource Clearinghouse](#)

[Maps and Data Center](#)

[Climate Resilience Design Standards & Guidance](#)

[Guides for Equitable & Actionable Resilience \(GEAR\)](#)

转到工具的链接

Climate Resilience Design Standards Tool

Apply statewide data to assess the climate resilience of your project site.

[LEARN MORE >](#)

ResilientMass Maps

Explore the latest state projections.

[LEARN MORE >](#)

Climate Resilience Design Standards Tool

登录/启动工具

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

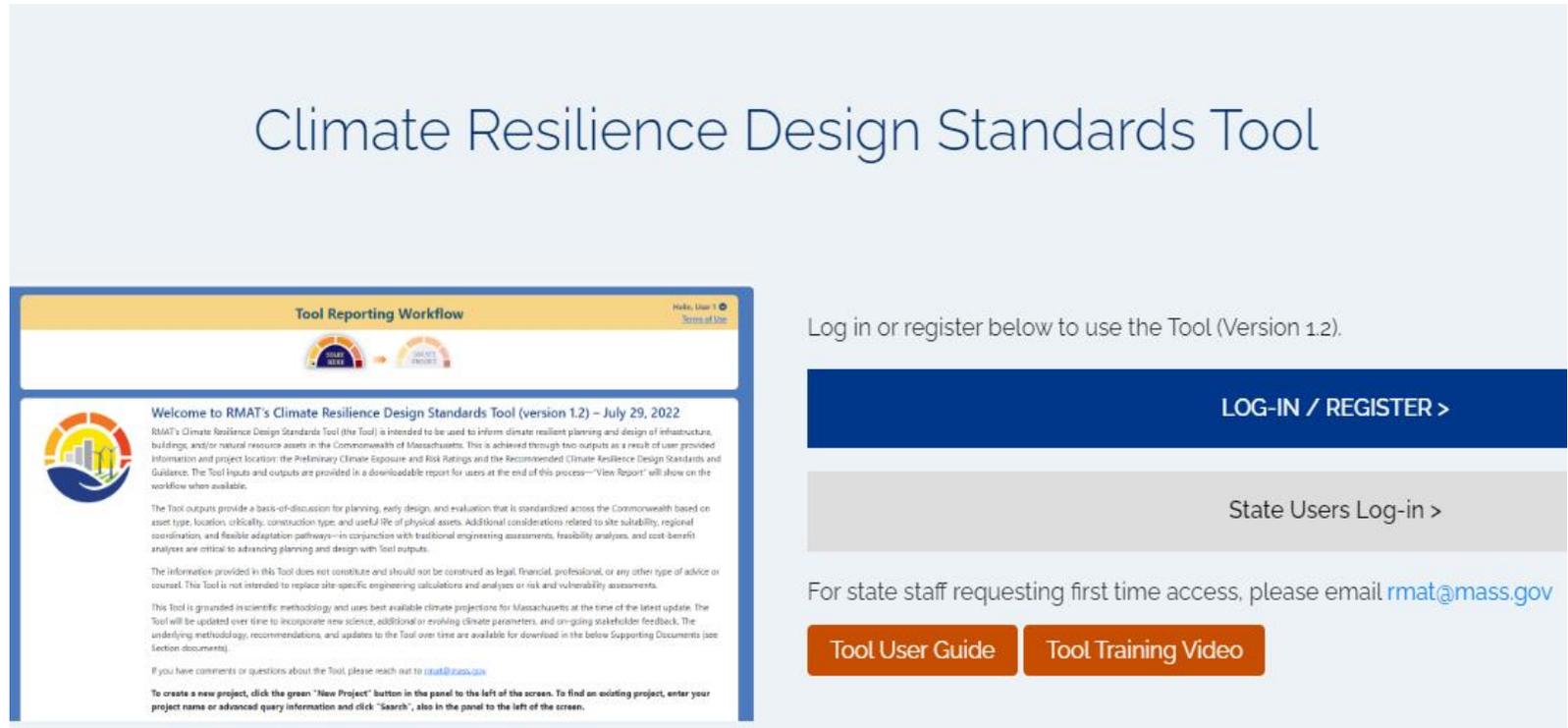
[Tool User Guide](#)

[Tool Training Video](#)

什么时候使用此工具：

该工具的输出为规划、早期设计和评估提供了一个标准化的讨论基础。这个基础在整个联邦州范围内都被标准化，它是以资产类型、位置、重要性、建筑类型和物理资产的使用寿命为基础的。

- 项目规划，设计和采购
- 项目选址
- 改进州级的补助申请



Climate Resilience Design Standards Tool

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[State Users Log-in >](#)

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

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

关键可用的资源：

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

LOG-IN / REGISTER >

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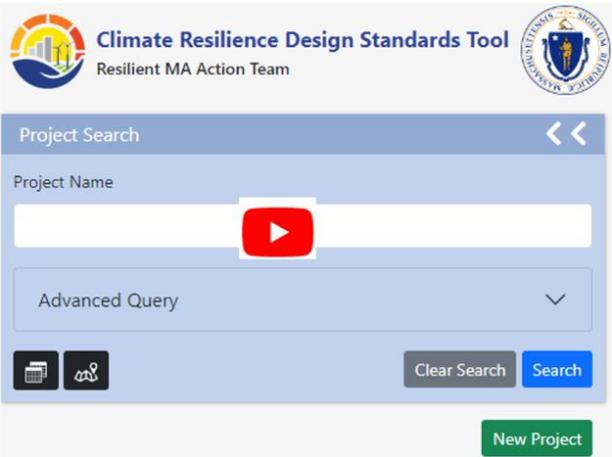
Tool User Guide **Tool Training Video**

用户指南

Climate Resilience Design Standards Tool
Version 1.2, July 2022

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培训视频

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 exam 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](#)

气候复原力设计指南以及最佳做法

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 hazards 2. Mitigate adverse climate impacts and provide benefits 3. 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 vulnerability 2. Evaluate impacts beyond site-specific design 3. Optimize capital investment opportunities 4. 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 uncertainty 2. Design for incremental change 3. Encourage climate mitigation and other co-benefits 4. Prioritize nature-based solutions 5. Prepare for current and future operational and maintenance needs

相关文档以及技术数据相关输入：

- [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/

开始

点击此网址登录:

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

外部用户必须遵循注册向导以获取首次访问权限

州用户应在rmat@mass.gov处请求首次访问权限

*使用**@dot.state.ma.us**电子邮件地址的新工具帐户需要额外的准备时间

搜索已建的项目,

或者

点击“New Project”以开始

Climate Resilience Design Standards Tool



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

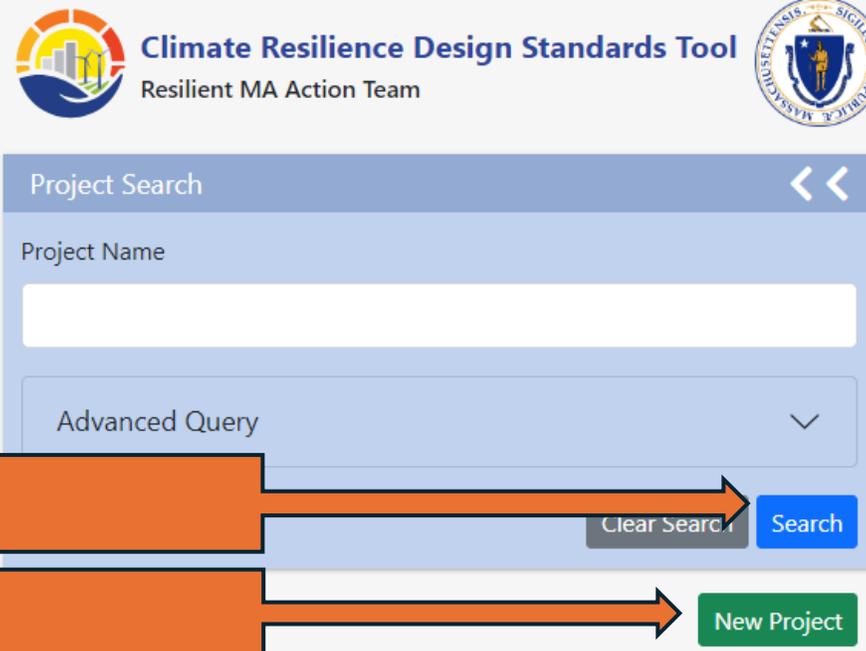
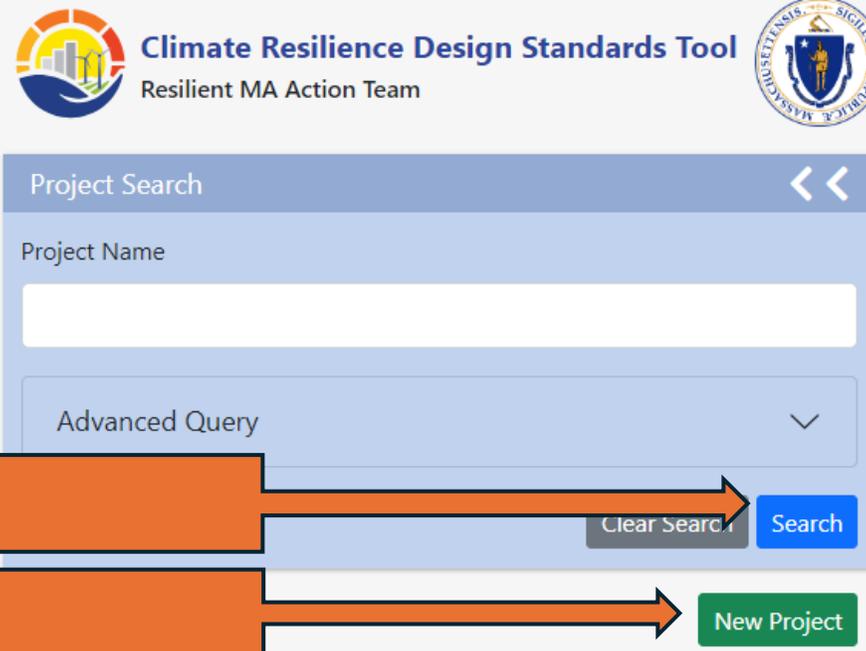
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Tool User Guide

Tool Training Video



项目输入

工具报告相关工作流程



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.

[Show me how](#)

Map View Additional Documents and Resources

Find address or place

1 Feature

Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, MassGIS, BuildingFootprintUSA, Esri Canada, Esri, HERE, Garmin, | Powered by Esri

画下关于项目的
足迹

画画工具

项目输入

工具报告相关工作流程



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 **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 **Project Assets**

请回答四个步骤的输入问题：

1. 背景信息
2. 项目的环境受益
3. 危害暴露历史
4. 资产具体信息

项目输入

工具报告相关工作流程



输入完成后工作流程就会有所扩展

Step 2 **i** Project Ecosystem Services Benefit

第二步：项目的环境受益

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

指南 (i)

Step 3 Project Climate Exposure

第三步：危害暴露历史

- i** Does the project site have a history of coastal flooding? Yes
- i** Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)? No
- i** Does the project result in a net increase in impervious area of the site? No
- i** 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 **i** Project Assets

第四步：资产具体信息

- Building/Facility Add
 - UserGuide Building
- Infrastructure Add
 - N/A
- Natural Resources Add
 - N/A

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

Identify the length of time the asset can be inaccessible/inoperable without significant consequences. Building must be accessible/operable at all times, even during natural hazard event

i Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility. Impacts would be limited to local area and/or municipality

i Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility. Less than 1,000 people

输出：项目级别分数

工具报告相关工作流程



环境正义人口普查
区块查询

生态系统受益得分



场点暴露评分：海平面上升/风暴潮、极端降水（河流和雨水）、极端高温

输出：项目级别分数

工具报告相关工作流程



Preliminary Climate Exposure Score

场点气候威胁暴露评分

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. Click on the question mark to identify why your project location is receiving the exposure rating.

Sea Level Rise/Storm Surge High	Extreme Precipitation - Urban Flooding Moderate
Extreme Precipitation - Riverine Flooding Not Exposed	Extreme Heat High

还提供更多的详细信息：

Primary factors influencing **High Exposure** Sea Level Rise/Storm Surge score

- Exposed to the 1% annual coastal flood event as early as 2030
- Historic coastal flooding at project site
- Located within the 0.1% annual coastal flood event within the project's useful life

输出：资产气候风险评级

工具报告相关工作流程



Preliminary Asset Climate Risk Ratings and Recommended Design Standards Output

Select Asset (3 total)

Corridor Revitalization Infrastructure - Transportation Estimated lifespan: 40	Green Infrastructure Improvements Infrastructure - Green Infrastructure Estimated lifespan: 20	Flood Barrier Infrastructure - Dams and Flood Control Structures Estimated lifespan: 50
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选定的资产

工具项目可以适用于多项资产

选定的资产

Preliminary Climate Risk Ratings for Corridor Revitalization

Sea Level Rise/Storm Surge High	Extreme Precipitation - Urban Flooding Moderate
Extreme Precipitation - Riverine Flooding Low	Extreme Heat High

资产风险评级

将获得每项输入资产的气候风险评级

请注意：尽管由于地理位置因素，可能会得到“海平面上升/风暴潮”或“极端降水 - 河流洪水”项目的“无暴露”项目分数，但该工具仍会给出一个资产风险分数（低）。

输出：标准/设计准则（沿海洪水）

项目资产名称 Recommended Climate Resilience Design Standards and Guidance for Pump Station

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (intermediate and/or target), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change.

Each applicable design criteria dropdown has additional design standards and guidance. **Some design criteria dropdowns provide numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.** More information, including design criteria definitions, guidance for planning, early design, and evaluation processes, and limitations is provided in the dropdowns below.

气候威胁

- Sea Level Rise/Storm Surge
- Extreme Precipitation
- Extreme Heat

Design Standards Projected Water Surface Elevation Maps

上下文地图；有更多的MC-FRM地图将于2024年暑期推出！

- Target Planning Horizon: 2070
- Intermediate Planning Horizon: 2050
- Return Period: 50-yr (2%)

标准：
根据项目投入计算/选择价值所用的因素

设计标准和价值
(针对选定资产)

- Design Criteria Applicable for Pump Station
- Projected Tidal Datums
 - Projected Water Surface Elevation
 - Projected Wave Action Water Elevation
 - Projected Wave Heights
 - Projected Duration of Flooding
 - Projected Design Flood Velocity
 - Projected Scour & Erosion

资料源自MC-FRM

大多数沿海设计标准预测值均来自麻萨诸塞州海岸水淹风险模型(MC-FRM)

输出：设计价值指南（沿海水淹）

Design Criteria Applicable for Pump Station

- Projected Tidal Datums
- Projected Water Surface Elevation** ← 设计标准名称/价值

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: ← 价值解释

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.

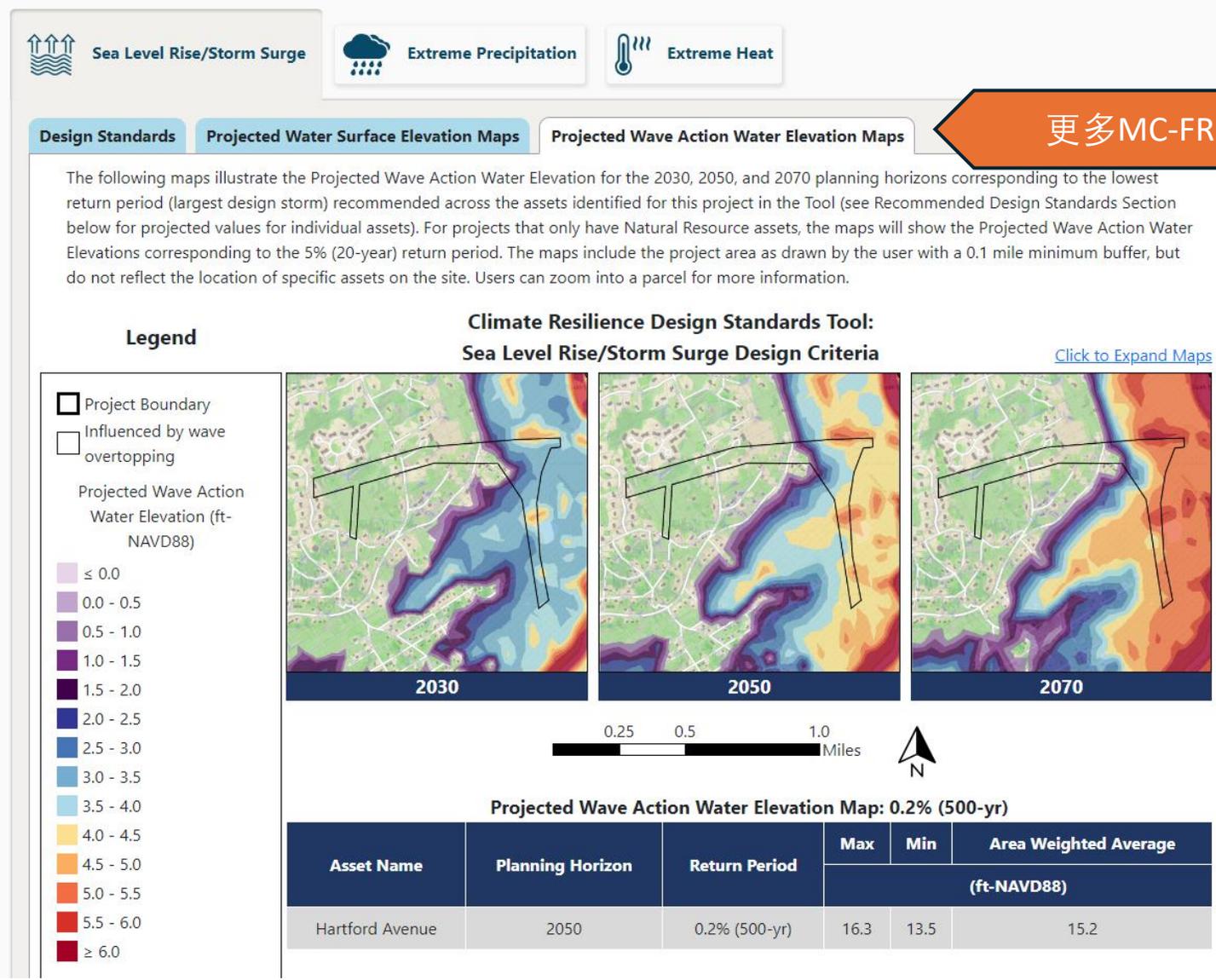
Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average ⓘ
			(ft - NAVD88)		
Pump Station	2050	2% (50-Year)	12.1	12.0	12.0
	2070		13.9	13.8	13.8

↑ 选定资产的价值

- 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

← 关于如何在规划、早期设计和项目评估（例如MEPA）期间使用价值指南

输出：沿海水淹地图



更多MC-FRM地图将于2024年暑期推出!

项目场点视野有限，无法预见沿海水淹情况

大多数沿海设计标准预测值均来自麻萨诸塞州海岸水淹风险模型 (MC-FRM)

输出：标准/设计准则（降水量）

Sea Level Rise/Storm Surge Extreme Precipation 气候威胁

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 U... receive a projected value for the 24-hour Total Precipitation Depth associated with a recommended return... (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

设计标准和价值
(针对选定资产)

标准：
根据项目输入计算/选择价值所用的因素

选定资产的价值

将收到针对每项资产的推荐标准和设计准则

在外部控制页面上查找其他设计风暴降水值：

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

输出：标准/设计准则（温度）

The screenshot displays a web-based interface for climate risk assessment. At the top, there are three tabs: 'Sea Level Rise/Storm Surge', 'Extreme Precipitation', and 'Extreme Heat'. The 'Extreme Heat' tab is selected and highlighted with an orange arrow labeled '气候威胁'. Below the tabs, there are two input fields: 'Target Planning Horizon: 2050' and 'Percentile: 50th Percentile', both with question mark icons. An orange arrow points to these fields with the text '标准：根据项目输入计算/选择价值所用的因素'. The main content area is titled 'Design Criteria Applicable for Hartford Avenue'. It features a section for 'Projected Annual/Summer/Winter Average Temperatures' with a green checkmark icon. Below this is a 'Definition' section explaining that average temperatures represent daily averages over time. Another section, 'Projected Annual/Summer/Winter Average Temperature Value', explains that the tool uses climate projections from Cornell University. An orange arrow points to this section with the text '选定资产的价值'. At the bottom, there is a table with columns for Asset Name, Recommended Planning Horizon, Recommended Percentile, Projected Annual Average Temperature [°F], Projected Summer Average Temperature [°F], and Projected Winter Average Temperature [°F]. The table shows data for Hartford Avenue with a 2050 horizon and 50th percentile, resulting in projected temperatures of 56.15, 73.97, and 38.21 respectively. Below the table are four expandable sections: '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', and 'Limitations for Average Annual/Summer/Winter Temperature Standards and Guidance'. An orange arrow points to the table with the text '2024年暑期即将推出新外观/功能!'.

Sea Level Rise/Storm Surge Extreme Precipitation Extreme Heat 气候威胁

Target Planning Horizon: 2050 ?

Percentile: 50th Percentile ?

标准：根据项目输入计算/选择价值所用的因素

设计标准和价值 (针对选定资产)

Design Criteria Applicable for Hartford Avenue

✓ Projected Annual/Summer/Winter Average Temperatures

Definition

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.

Projected Annual/Summer/Winter Average Temperature Value

The Tool uses climate projections developed by Cornell University as part of the EEA's Massachusetts Climate and Hydrologic Risk Project. Assets receive a projected value for Annual/Summer/Winter Average Temperature associated with a recommended percentile and planning horizon.

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

选定资产的价值

2024年暑期即将推出新外观/功能!

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

下载项目报告

在查看报告的工作流页面上预览报告摘要。

下载项目报告的PDF。点击“Submit”以提交报告。

将PDF上传/附加(Upload/attach)到相应的授权门户/MEPA文件。

浏览报告页面



RMAT Climate Resilience Design Standards Tool Project Report

EJD Test
Date Created Example Project Created By: RMATReport

下载  **Download**

完整的项目场点暴露评分

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



资产风险评级 (针对每项资产)

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

提交项目报告



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.

点击“Submit”提交
报告

提交

Submit Project

工具版本相关历史

Beta工具（2021年4月）

- MVP 和 Massworks 要求在资助申请中提供工具报告

版本1.0（2022年2月）

- 气候暴露相关最新消息
- 生态系统服务利益相关最新消息
- 增加工具内引导

版本1.1（2022年4月）

- **MC-FRM 二级输出**（适用于沿海设计标准的动态表格）
- 麻州气候水文风险项目输出（适用于极端降水设计标准的动态表格）

版本1.2（2022年7月）

- **MC-FRM预计水面高度地图**（工具内接口交互以及项目报告中的打印版地图）

版本1.3（2024年）- 进行中

- 更新温度设计标准（将预计值添加到工具接口中）
- 增加MC-FRM地图（预计波动水位高度）
- 错误修复

相关资源:

气候获悉降水值 (强度-持续时间-频率)

Climate Change Projections Dashboard

HOW TO USE THIS DASHBOARD

Use the **filter data** options below to view **projections of climate metrics** for specified areas of interest under a future warming scenario. Select either a **Watershed** or **Town**. Next, select the **Target decade** and **Season**. Toggle between tabs to view climate metrics at the bottom of the dashboard.

Use the locator map to view **projections of extreme precipitation frequency estimates** across Massachusetts. Click on the layer icon (stacked squares) in the top right corner and click on **"IDF Sites"**. Zoom with mouse to desired area or use search icon to zoom and click on blue box and then click **"Select"** in the pop-up box (box with plus sign). Click on the **"Precipitation Frequency Table"** tab at the bottom of the dashboard to view precipitation depth values (inches) for various future design storms.

FILTER DATA

Climate Projections by Watershed:
Blackstone

Climate Projections by Town:
None

Target Decade:
2070

Season:
Annual

选定场点

HOW TO USE THIS DASHBOARD

Stochastic Weather Generator outputs:

To view **temperature and precipitation projections**, use the **filter data** options in the left panel for specified areas of interest under a future warming scenario (**Representative Concentration Pathway [RCP] 8.5, a comparatively high greenhouse gas emissions scenario**). Temperature and precipitation projections for Massachusetts are provided at the watershed scale (averaged across **HUC 8** watershed boundaries) and were developed with downscaled Global Climate Models and a **Stochastic Weather Generator** (see the **Background** to learn more).

Select either a **Watershed** or **Town** from the filter menus on the left panel. For towns that span more than one watershed, users will see those watersheds listed in the drop-down menu after a town is selected, but users must

DETAILED INSTRUCTIONS

Site	Year	Duration	RI_1yr_50th	RI_2yr_50th	RI_5yr_50th	RI_10yr_50th	RI_25yr_50th	RI_50yr_50th	RI_100yr_50th	RI_200yr_50th	RI_500yr_50th	RI_1000yr_50th
Site 5503		05m	0.4 (0.4 - 0.4)	0.5 (0.4 - 0.5)	0.6 (0.5 - 0.6)	0.7 (0.6 - 0.7)	0.8 (0.8 - 0.9)	0.9 (0.9 - 1)	1.1 (1 - 1.1)	1.2 (1.1 - 1.2)	1.3 (1.2 - 1.4)	1.5 (1.4 - 1.6)
Site 5503	2030	10m	<div style="border: 1px dashed purple; padding: 5px; display: inline-block;"> 2030年暴风雨持续时间为1小时/60分钟、年发生概率为1%（100年暴风雨史）的示例值（英寸） </div>									
Site 5503	2030	15m										
Site 5503	2030	60m										
Site 5503	2030	02h										
Site 5503	2030	03h										

选定场点

风暴延续时长

预计时间范围

重现期/频率

降水频率表

AVERAGE AND COLD DAYS
HOT DAYS
PRECIPITATION
STOCHASTIC WEATHER GENERATOR TABLE
PRECIPITATION FREQUENCY TABLE

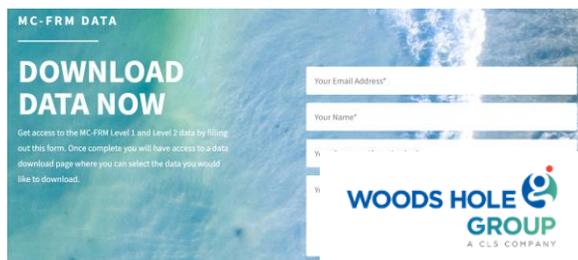
相关资源:

麻萨诸萨州海岸水淹警示模式(MC-FRM)

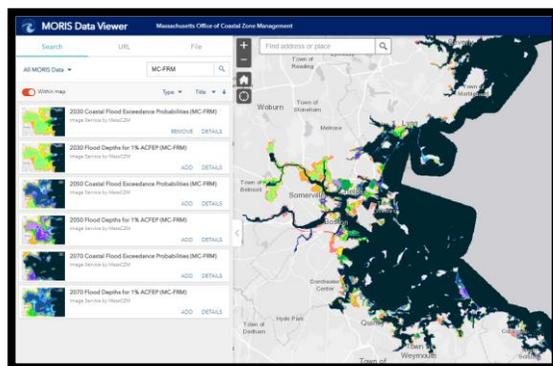
培训视频



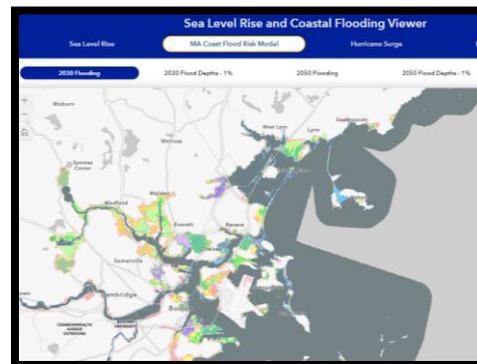
数据下载页



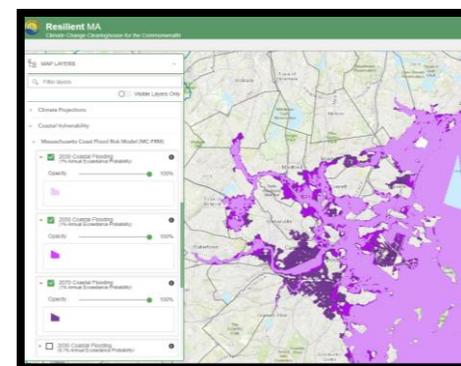
州相关数据浏览



CZM's MORIS 数据浏览



CZM海平面上升以及海岸水淹浏览



ResilientMass 气候以及危险浏览



ResilientMass

Climate Adaption Clearinghouse
for the Commonwealth

如有任何问题请发邮件给 rmat@mass.gov 以联系!

* 请注意：没有全职专门的人员来为与该工具相关的技术问题提供相关的支持，因此请至少留出三到五个工作日来解决这个问题。