



ALEXRENEW'S APPROACH TO CLIMATE CHANGE

ENVIRONMENTAL POLICY COMMISSION | JUNE 16, 2025

AlexRenew OVERVIEW

Purifies 13 billion gallons of wastewater each year

Serves a population of about 300,000 people in Alexandria and portions of Fairfax County

Established in 1952 as an independent authority

Governed by a 5-member citizen Board



RiverRenew Overview

- Four legacy outfalls dating to the 19th century overflow about **70** times each year, resulting in **140 million gallons** of combined sewage entering our waterways
- **State-mandated** by a law passed by the Virginia General Assembly in April 2017
- **\$615 million** capital investment (2018-2026)
- \$500 million spent to date – 80% complete

Project Benefits

<4

overflow events
each year

120

million gallons
of combined sewage
captured annually



Sets the stage for a fishable, swimmable
future for the Potomac River



Outfall
001



Outfall
003



Outfall
004



Outfall
002

RiverRenew and Climate Change

Is RiverRenew Adaptable and Resilient?

RiverRenew is a major infrastructure project designed to address the discharge of sewage mixed with rainwater to Alexandria, Virginia's waterways. It is being implemented in response to a 2017 Virginia Law that requires completion by July 2026.

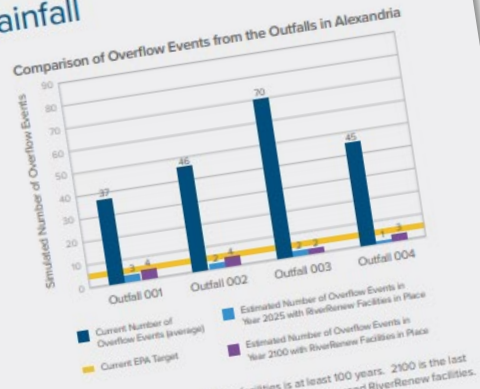
Current climate models show that changing global conditions will trend toward increased rainfall and rising seas in our area. These effects of climate change are being considered as part of the planning process for RiverRenew facilities to ensure the design is adaptable and resilient to future conditions.

Planning for Increased Rainfall

Rising temperatures will intensify Earth's water cycle, resulting in increased frequency and greater intensity of rainfall in our area.

To determine the impacts of increased rainfall due to climate change, RiverRenew:

- Estimated future rainfall in 2100* based on current climate models.
- Simulated RiverRenew facilities under these future rainfall conditions.
- Determined that RiverRenew facilities would meet or exceed the Environmental Protection Agency's (EPA) current targets under future climate conditions.



* Engineers typically plan infrastructure based on its useful life. The useful life of the proposed RiverRenew facilities is at least 100 years. 2100 is the last year for which climate projections are available from international scientific community, and is within the useful life of the proposed RiverRenew facilities.

With RiverRenew facilities in place, it is estimated that the outfalls will discharge less than four times per year in 2100, compared to 70 times per year under current conditions.

RiverRenew facilities will be designed to include:

- Safety factors
- Operational flexibility
- Components to hold back the tide
- Increased capacity at AlexRenew to better handle future additional flows
- Tunnel relief points to protect the existing sewer system



Staying Above Rising Seas

Rising temperatures will melt ice sheets and cause seawater to expand. This will result in sea level rise, especially in coastal areas.

To determine the impacts of sea level rise due to climate change, RiverRenew estimated the future 100-year flood event** in 2100* based on climate models and curves developed by the U.S. Army Corps of Engineers and National Oceanic and Atmospheric Administration.

The map below shows 2019 and future (2100) 100-year flood events. Currently the Potomac River rises to 11 feet above sea level during a 100-year flood event. In 2100, that elevation is anticipated to increase to 14 feet above sea level.

Elevations of the 100-Year Flood Event in the City of Alexandria



Proposed RiverRenew facilities will be built at an elevation higher than the future 100-year flood event.

- 100-Year Flood Elevation (2019)
- 100-Year Flood Elevation (2100)
- Current Shoreline

* Engineers typically plan infrastructure based on its useful life. The useful life of the proposed RiverRenew facilities is at least 100 years. 2100 is the last year for which climate projections are available from international scientific community, and is within the useful life of the proposed RiverRenew facilities. The 100-year flood event has a 1 percent chance of occurring in any given year.

2025

Renew is a program owned and implemented by Alexandria Renew Enterprises in support from the City of Alexandria.
1000 Brick Street, Alexandria, VA 22314 | 703.518.6030 | RiverRenew.com



(2019 Study)

ALEXRENEW CLIMATE STUDY

Our risk-based approach analyzes the impacts of climate change on infrastructure and staff:

- Evaluating how more frequent and intense rainfall will affect our treatment plant and other critical infrastructure
- Understanding the implications of sea level rise at AlexRenew
- Analyzing the effect of temperature changes on staff

Study Outcome:

Establishing guidelines for future capital projects and infrastructure



GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions have been steadily increasing since the 1960s, leading to a warmer atmosphere and climate impacts that include:

Sea Level Rise

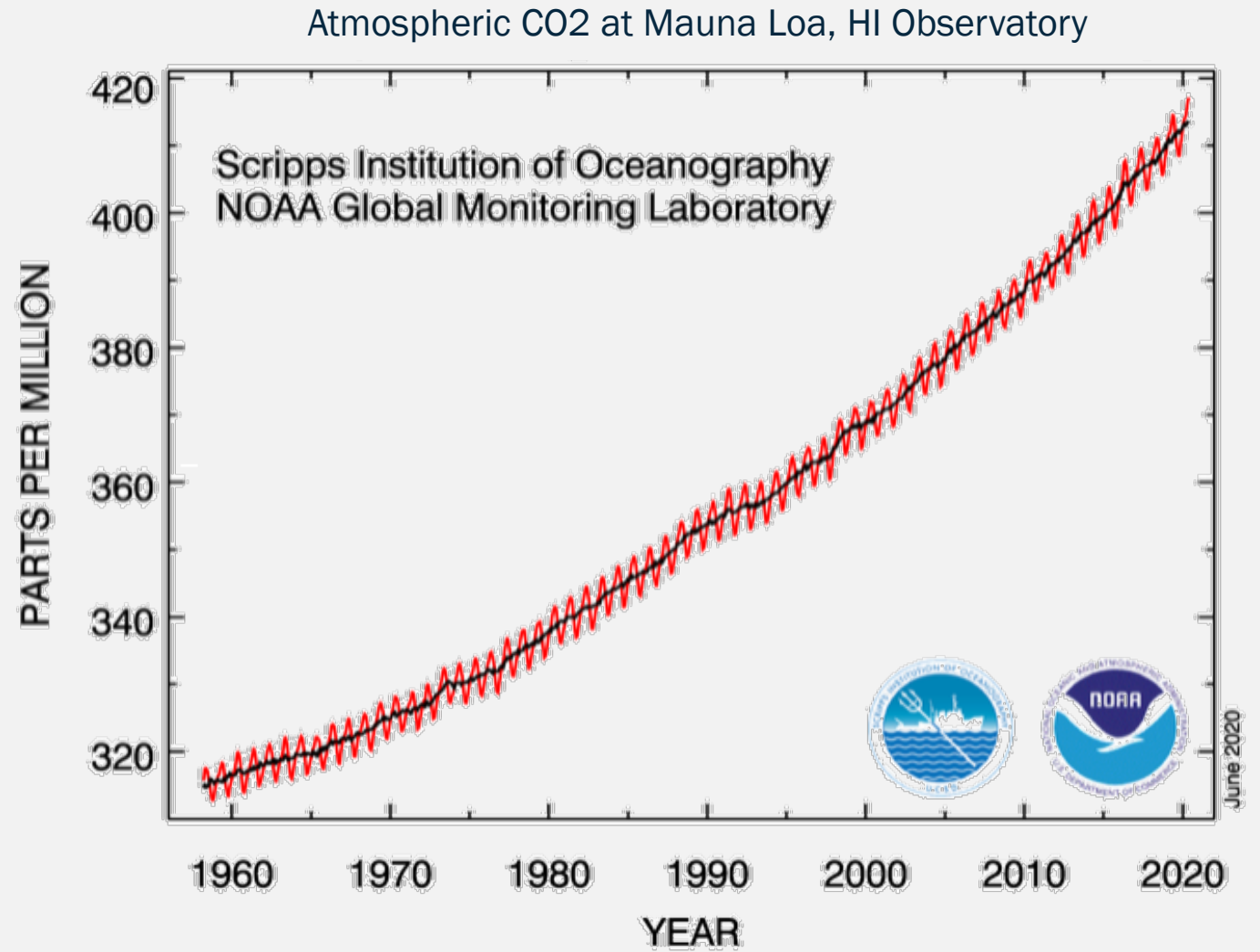
Increase in the level of the world's oceans due to melting polar ice and thermal expansion of water.

Extreme Precipitation

More intense rain or snowfall over a particular location over a short period of time.

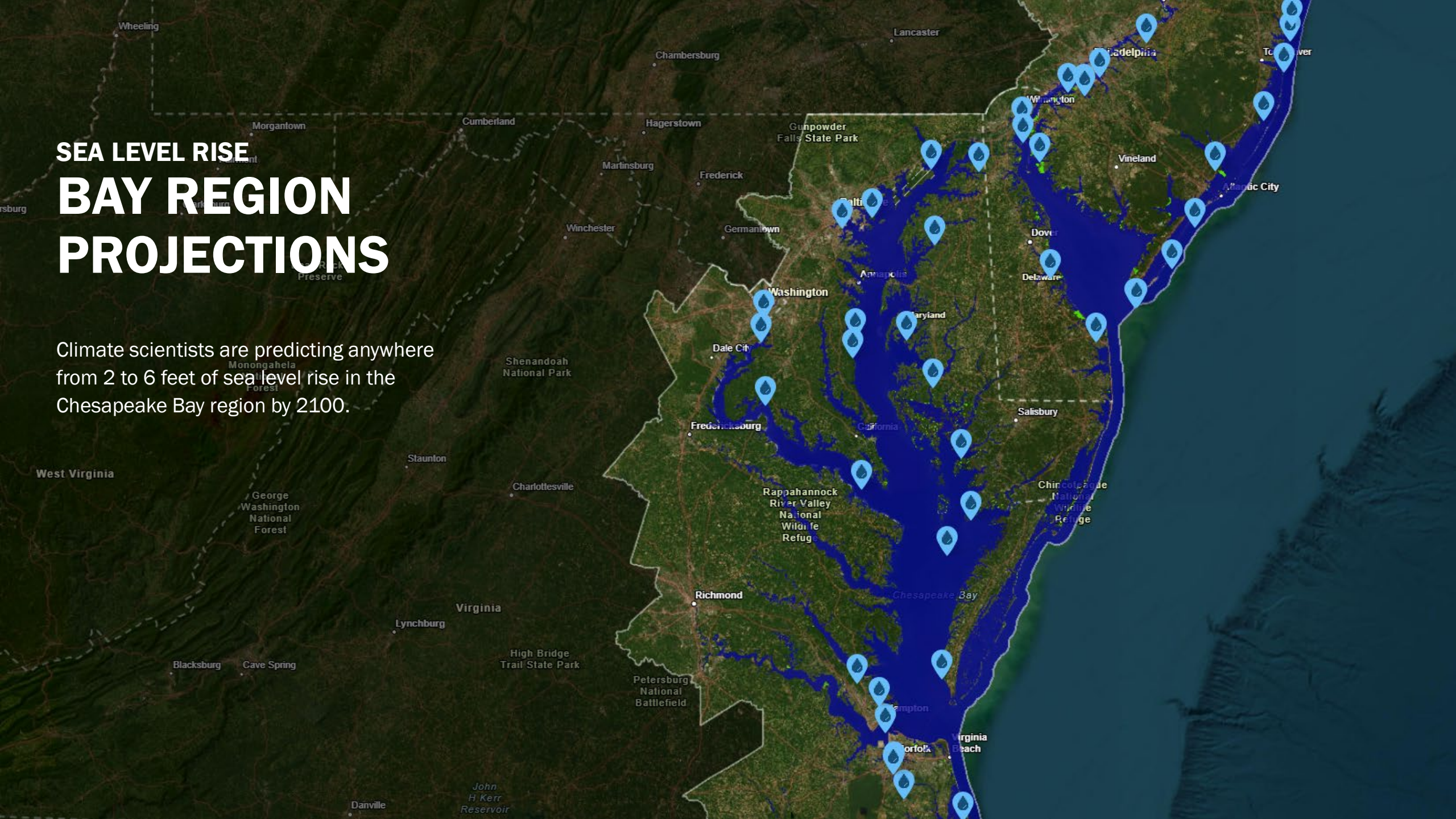
Thermal Stress

Accumulation of local, excess heat over a period of unusually hot days and nights.



SEA LEVEL RISE BAY REGION PROJECTIONS

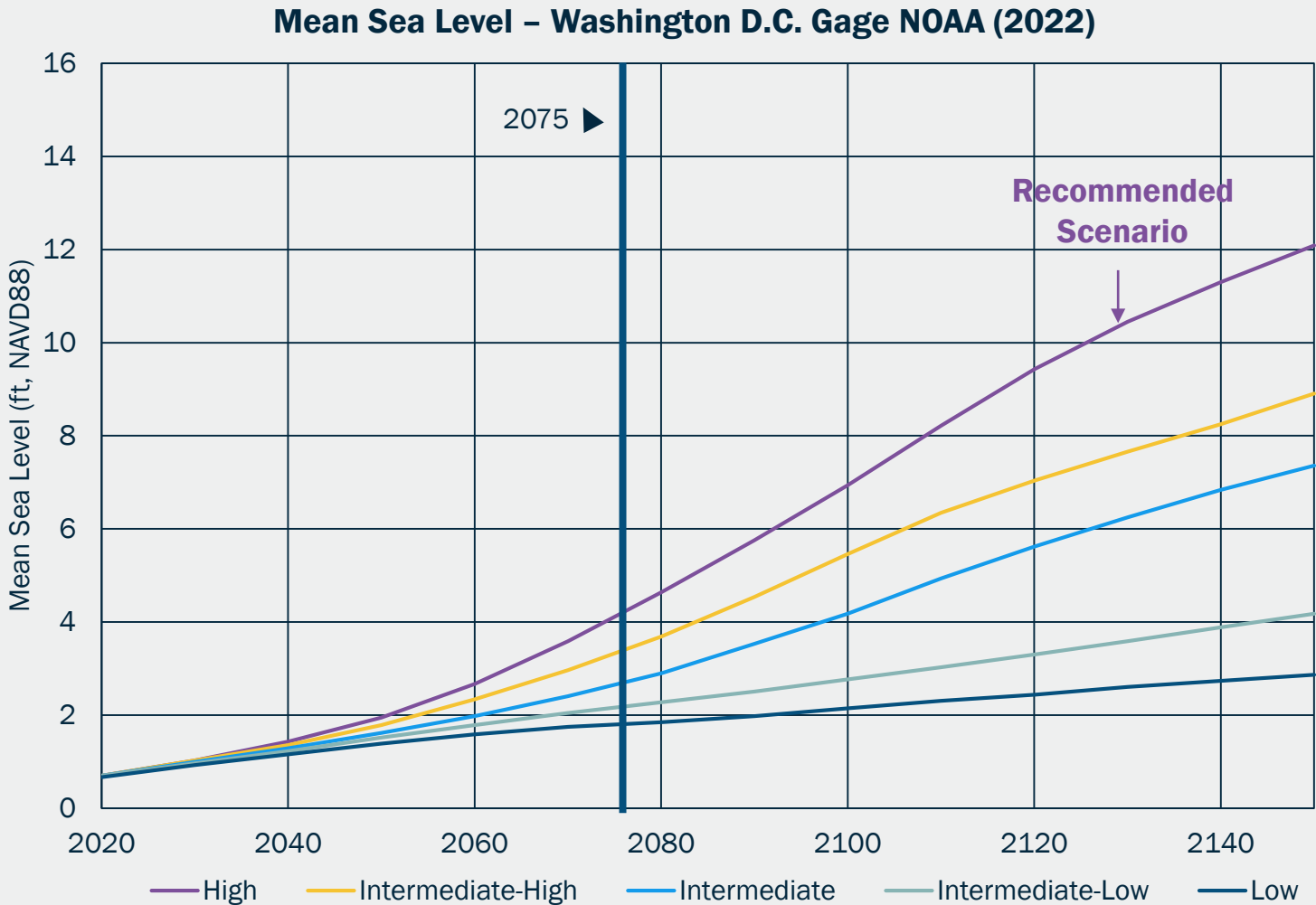
Climate scientists are predicting anywhere from 2 to 6 feet of sea level rise in the Chesapeake Bay region by 2100.



SEA LEVEL RISE
**PROJECTIONS IN
ALEXANDRIA**

The U.S. Army Corps of Engineers developed a tool based on a variety of climate models to project sea level rise associated with greenhouse gas emissions scenarios.

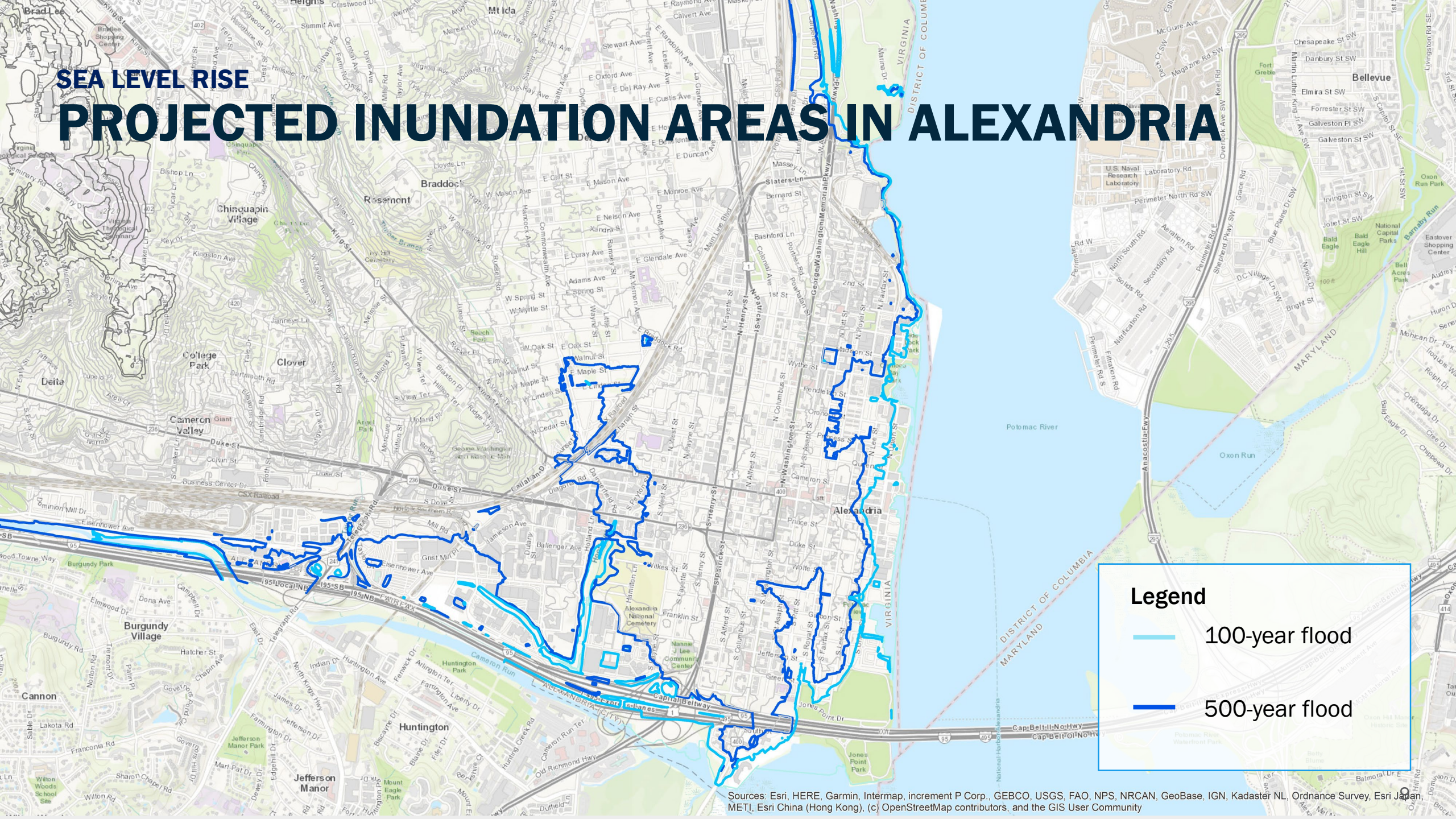
AlexRenew selected the high value for use in the coastal flood modeling because it is conservative and similar to what was selected for planning the RiverRenew facilities.



Source: National Oceanic and Atmospheric Administration (NOAA). 2022. Global and Regional Sea Level Rise Scenarios for the United States.

SEA LEVEL RISE

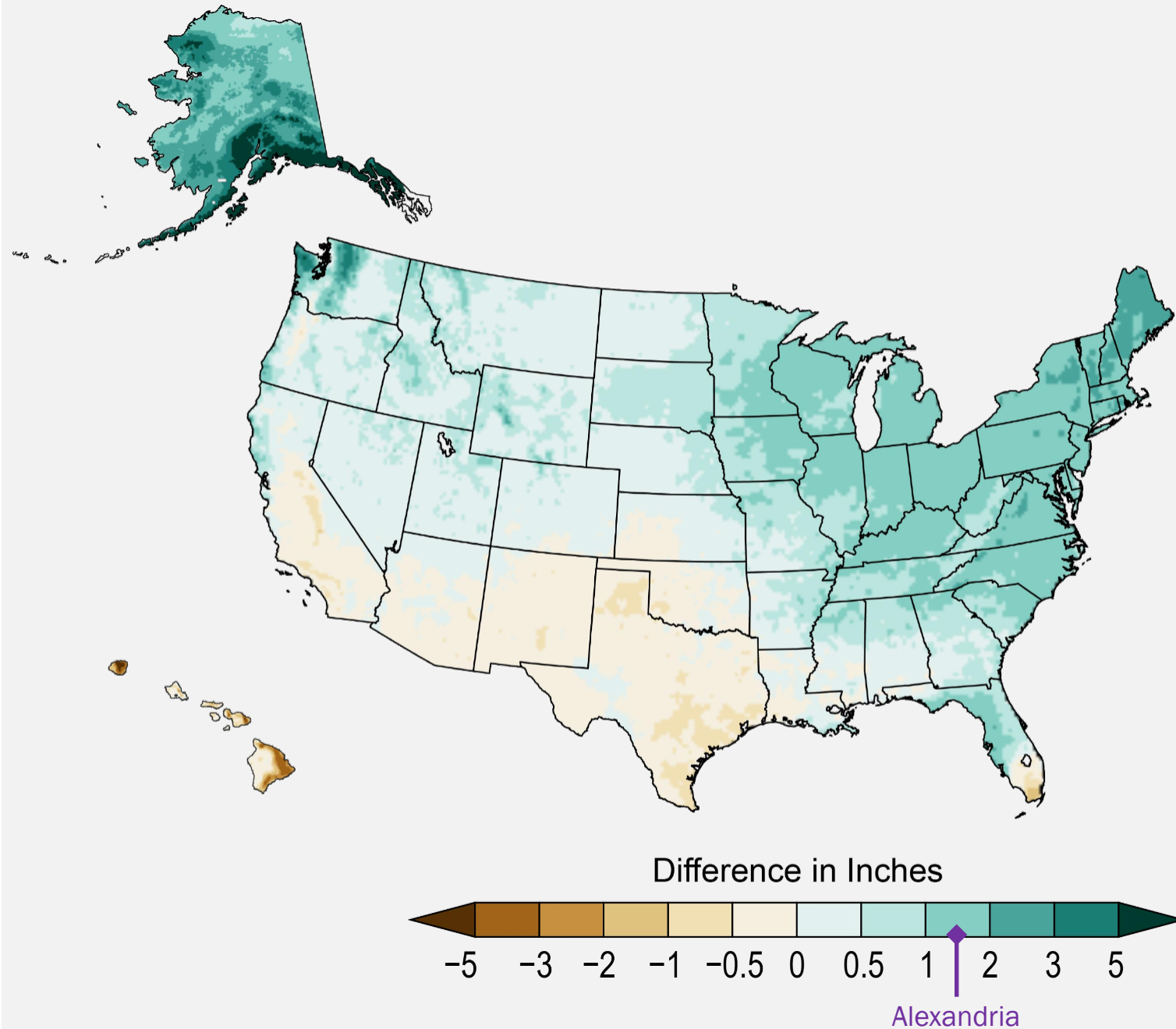
PROJECTED INUNDATION AREAS IN ALEXANDRIA



EXTREME PRECIPITATION PROJECTED ANNUAL CHANGE BY 2050

Annual **precipitation projections** are projected to increase for much of the U.S. Differences in annual precipitation are projected to 2036-2065 and compared to 1991-2020. Future rainfall amounts represent an average of all available climate model projections.

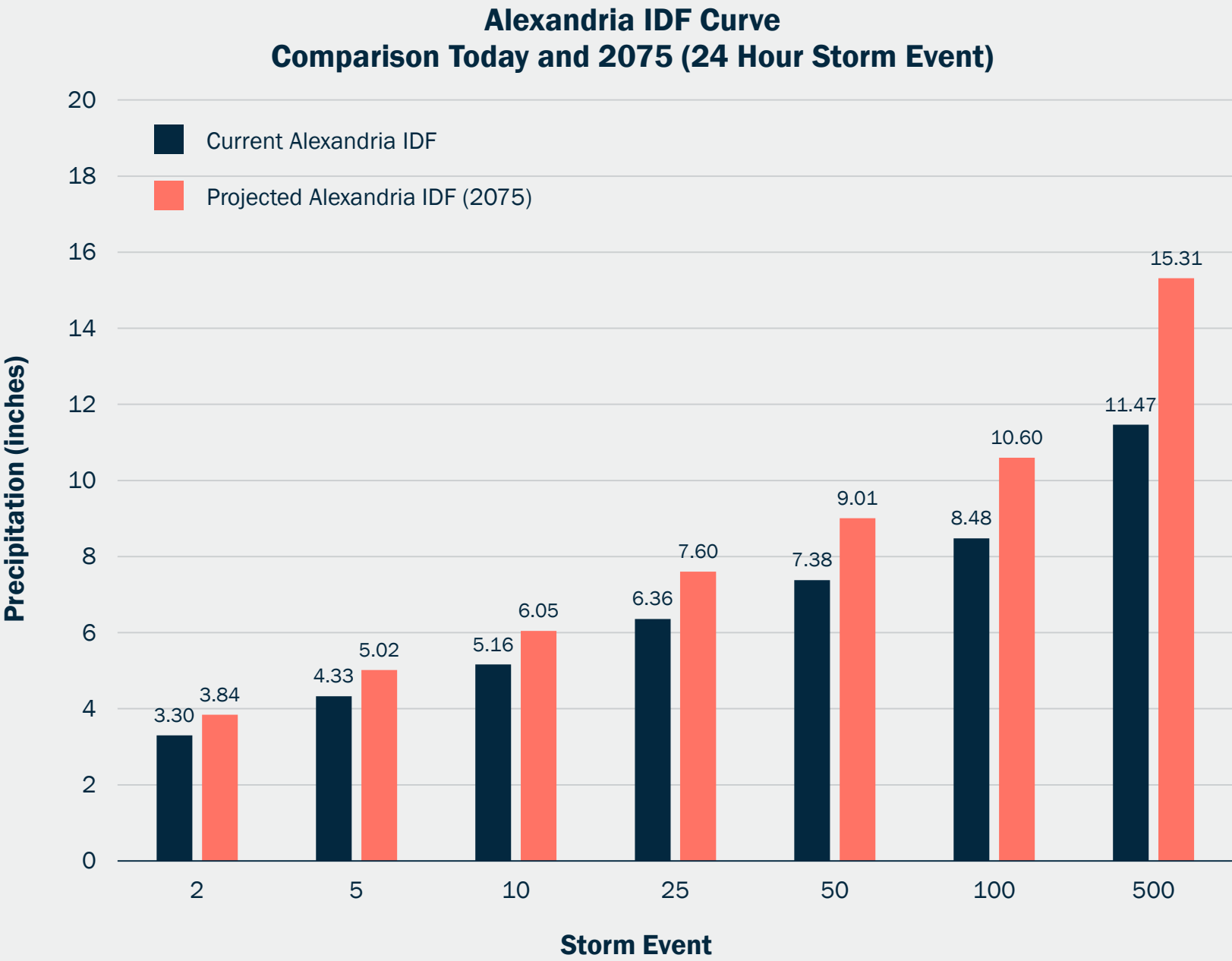
Source: U.S. Global Change Research Program, 2023: Fifth National Climate Assessment



EXTREME PRECIPITATION PROJECTIONS IN ALEXANDRIA

Intensity-duration-frequency curves (IDF curves) are graphical representations that illustrate the relationship between the intensity of precipitation, its duration, and frequency of occurrence over a specific time period.

Precipitation was projected to 2075. The future projected storm intensity, duration, and frequency increases were applied to the current rainfall baseline to predict new rainfall amounts for 10, 25, 50, 100, and 500-year rainfall events.



RIVERINE FLOODING

Riverine flooding occurs when a river overflows its banks and water flows into nearby areas.



1 Rain falls in upstream portion of watershed



3 Delayed floods downstream in Alexandria

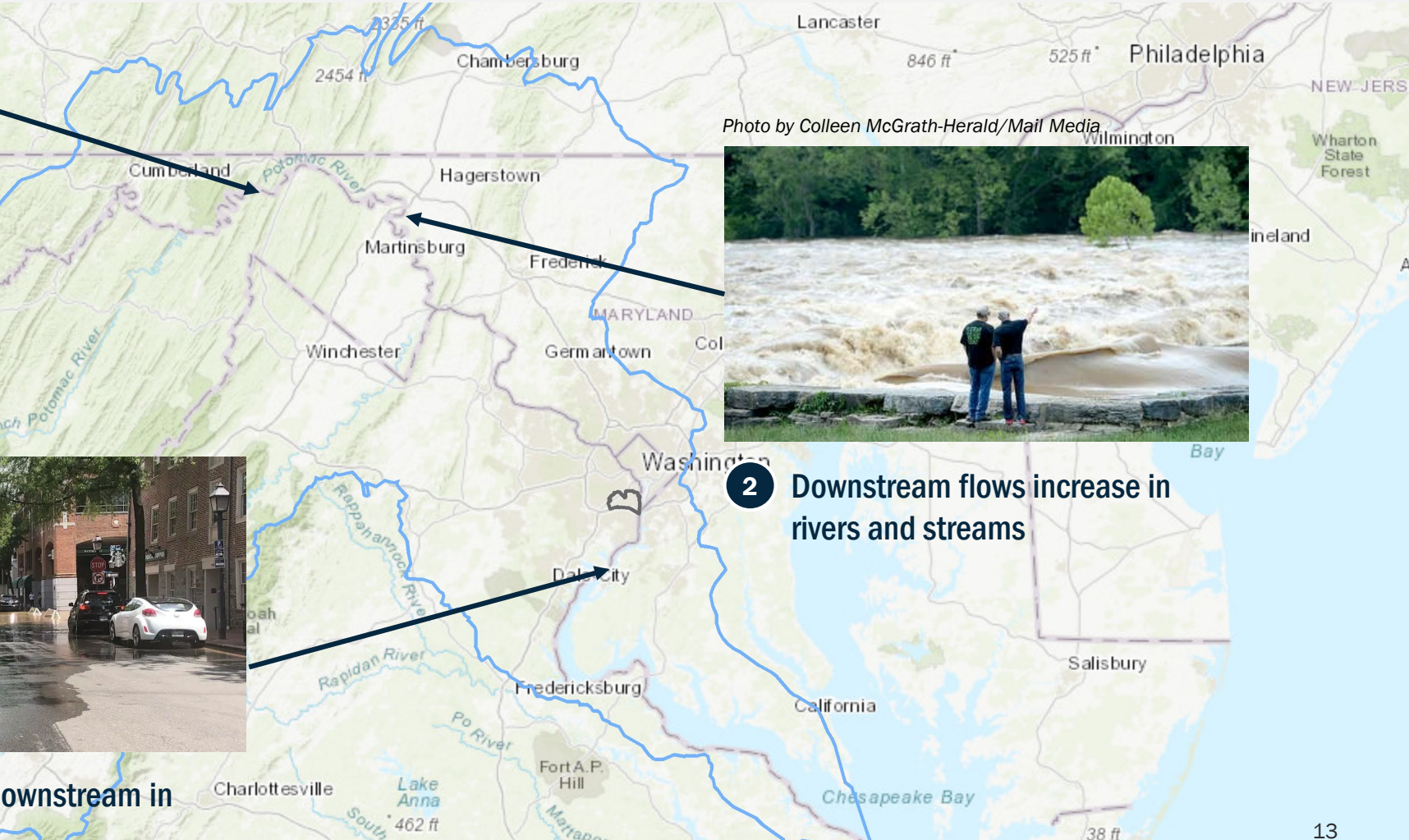
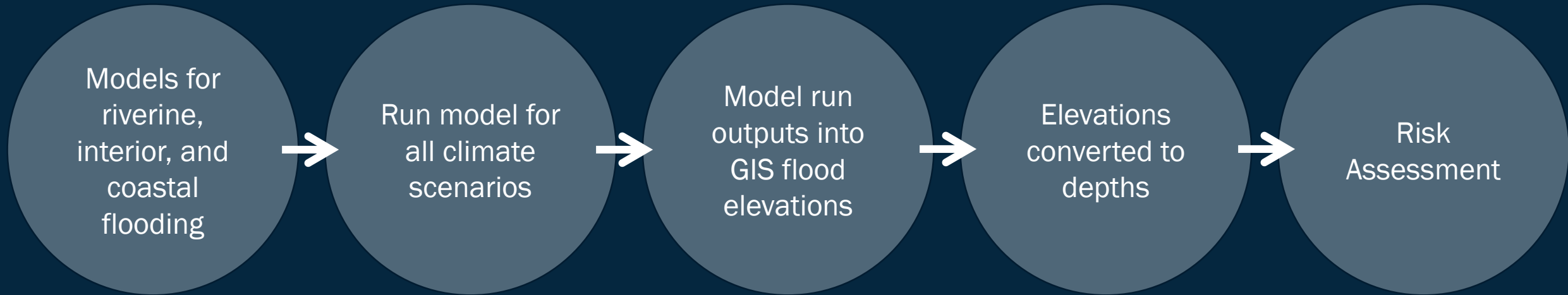


Photo by Colleen McGrath-Herald/Mail Media



2 Downstream flows increase in rivers and streams

ALEXRENEW FLOOD MODELING APPROACH



Climate scenarios:

Riverine and Inland Flooding

15 climate scenarios

- Updated precipitation statistics
- Baseline, 2045, 2075
- 10, 25, 50, 100, 500-year storms

Coastal **Sunny Day**

6 climate scenarios

- High sea level rise curve
- Baseline, 2045, 2075
- Mean higher high water, king tide

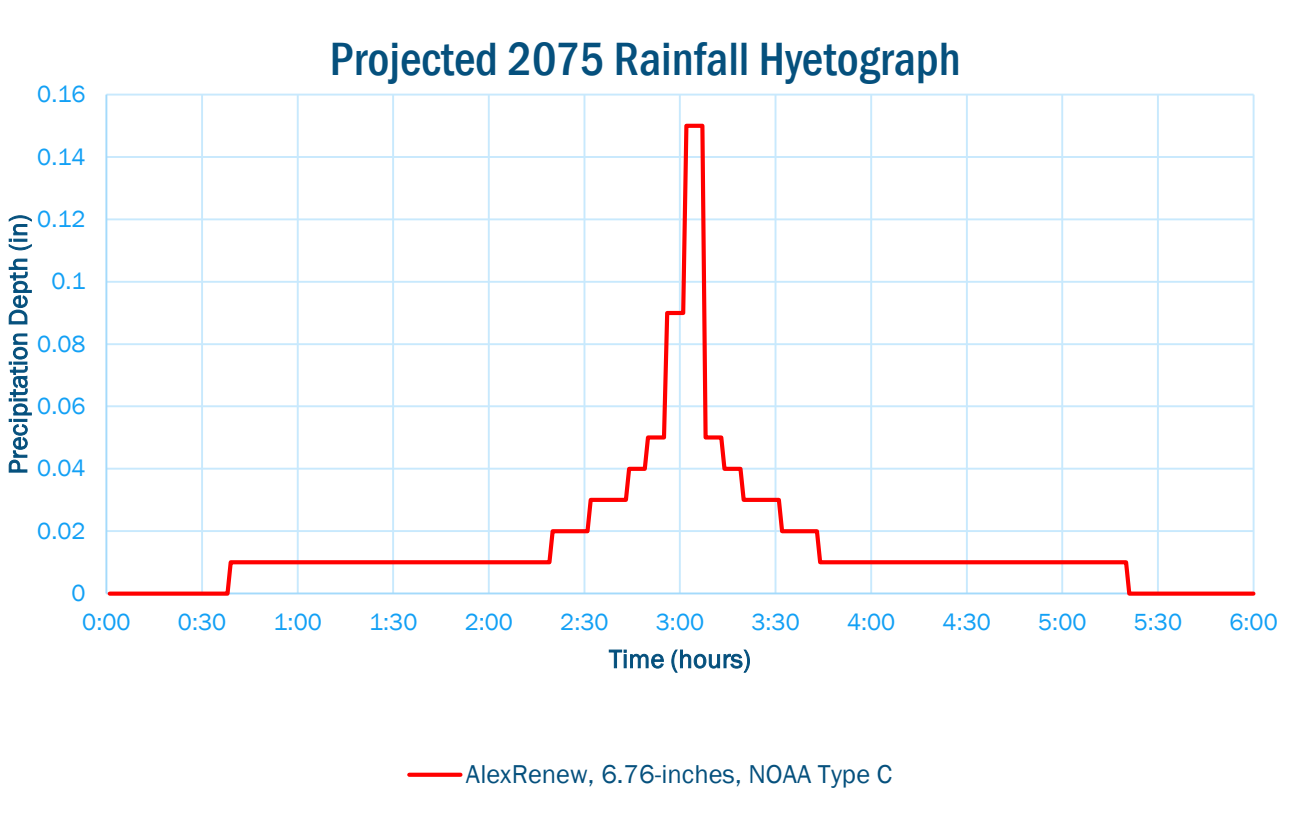
Coastal **Storm Surge**

9 climate scenarios

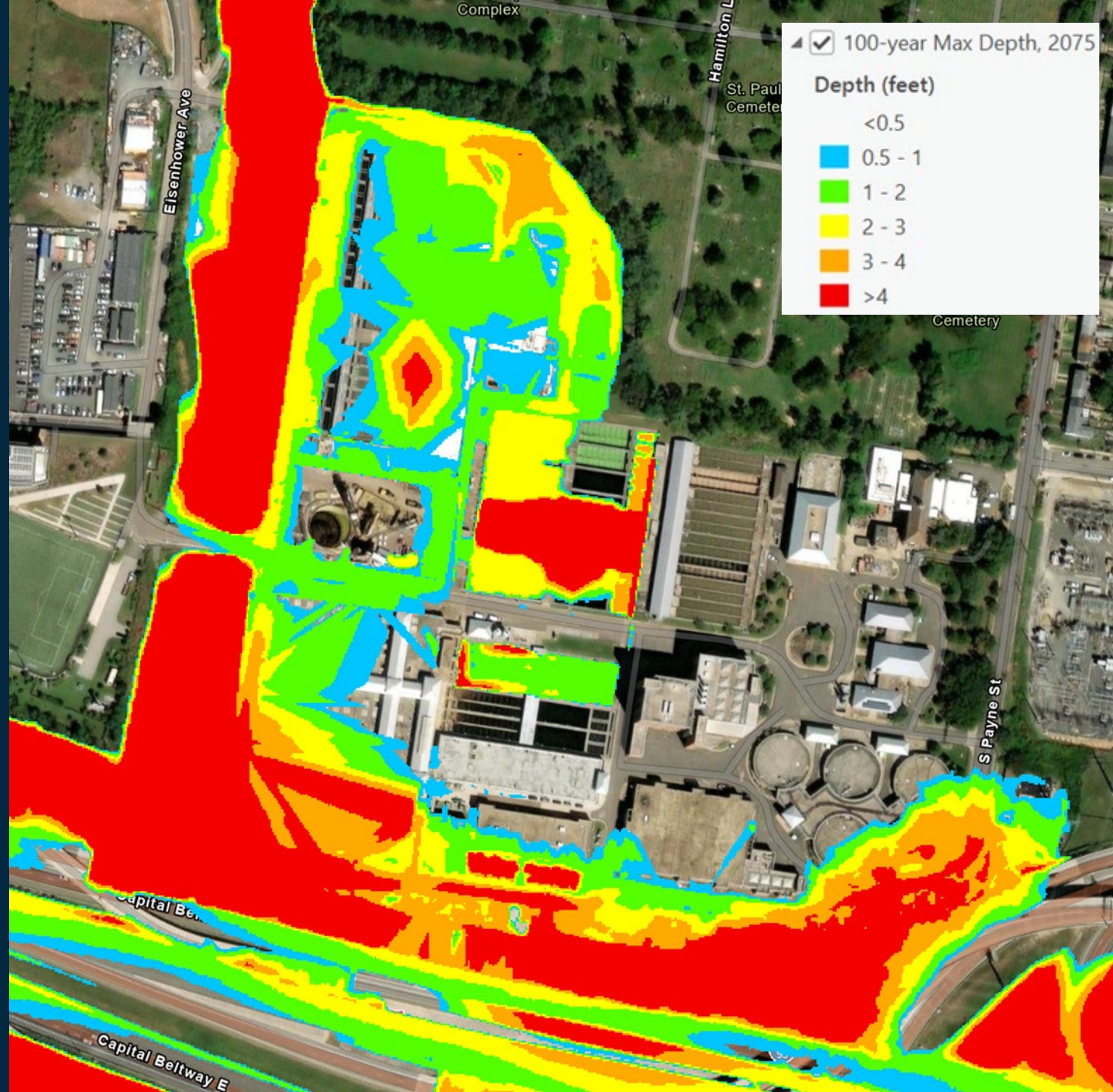
- High sea level rise curve
- Baseline, 2045, 2075
- 10, 100, 500-year storms

RIVERINE FLOOD MODELING

Parameter	AlexRenew Projected 2075
Hydrology Model	HEC-HMS 4.12 (2023)
Hydraulic Model	HEC-RAS 2D: one integrated model for Cameron Run and Hooffs Run
100-year Storm Precipitation	6.76-inches
Flow in Cameron Run	37,576 cfs
Flood Elevation at Building P	17.1-feet



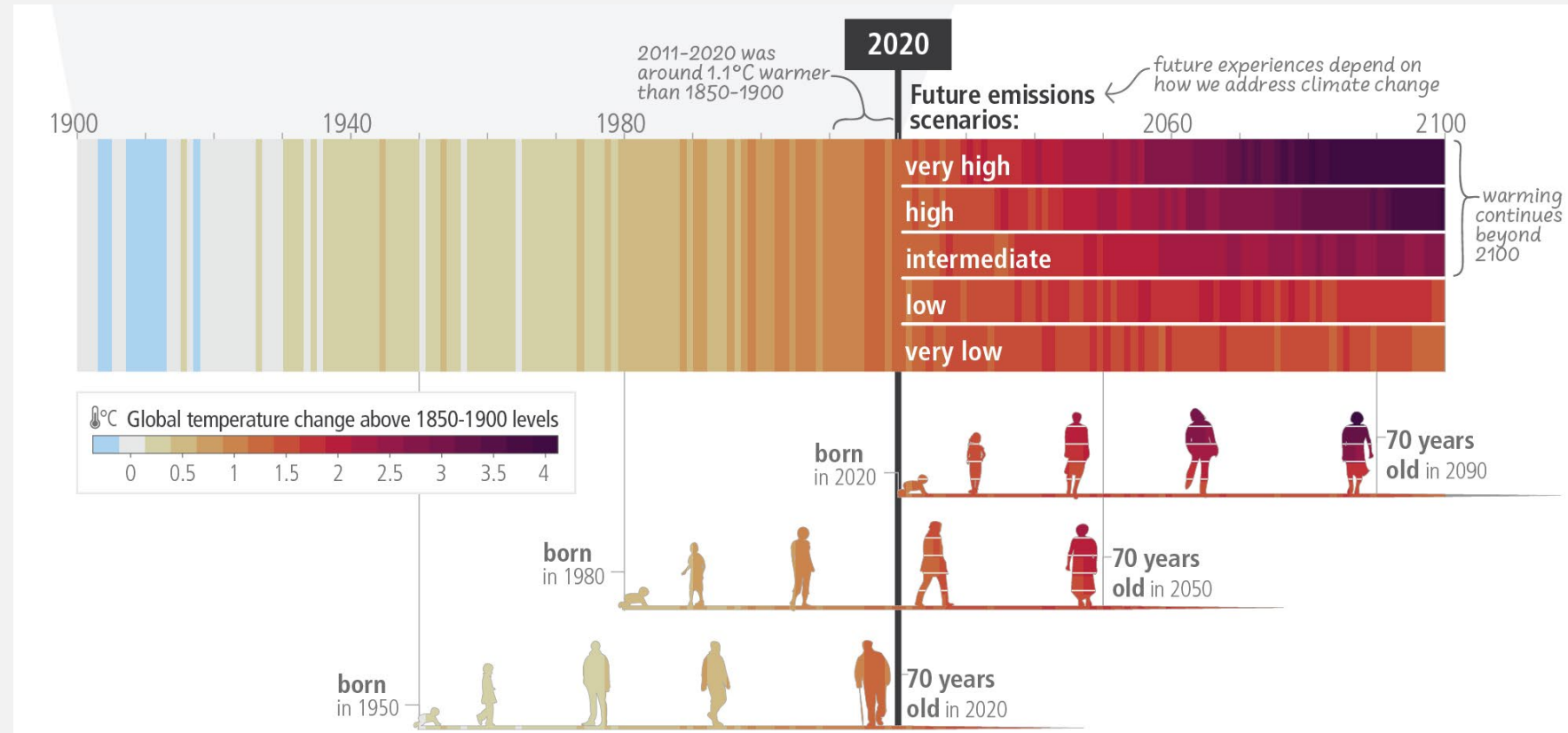
PROJECTED FLOOD MAP AT ALEXRENEW (2075)



THERMAL STRESS

GLOBAL TEMPERATURE CHANGE

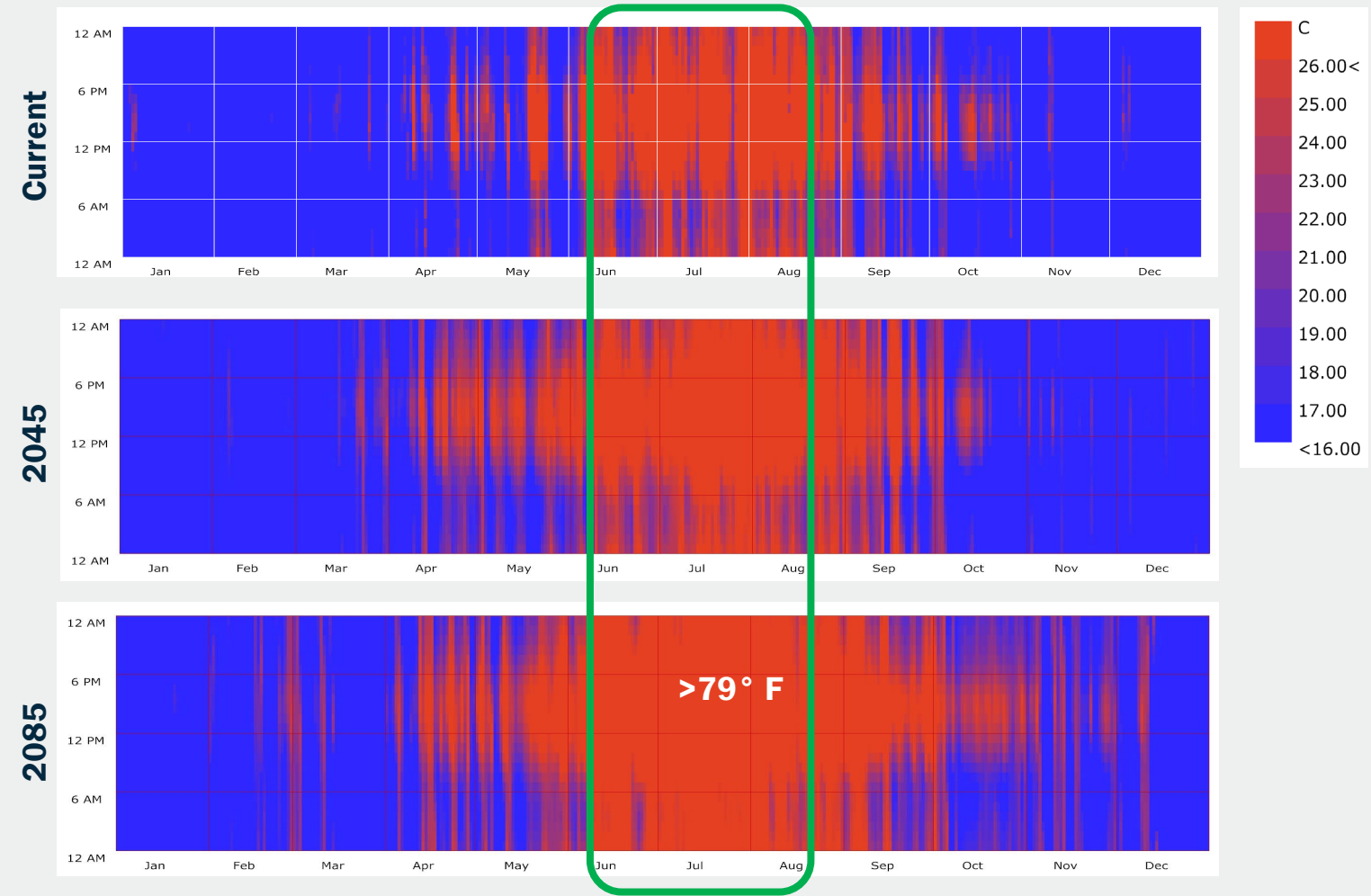
This graphic shows how observed (1900–2020) and projected (2021–2100) changes in global surface temperature will impact representative generations. Future projections (2021–2100) of changes in global surface temperature are shown for very low, low, intermediate, high, and very high greenhouse gas emissions scenarios.



Source: Intergovernmental Panel on Climate Change (IPCC), 2023: AR6 Assessment Report: Climate Change 2023

THERMAL STRESS

HIGH TEMPERATURE OCCURRENCES



Projections for 2045 and 2085 show an increase in both frequency and duration of high temperatures compared to current conditions. Future scenarios also show fewer nighttime cooling periods, highlighting increased thermal stress.

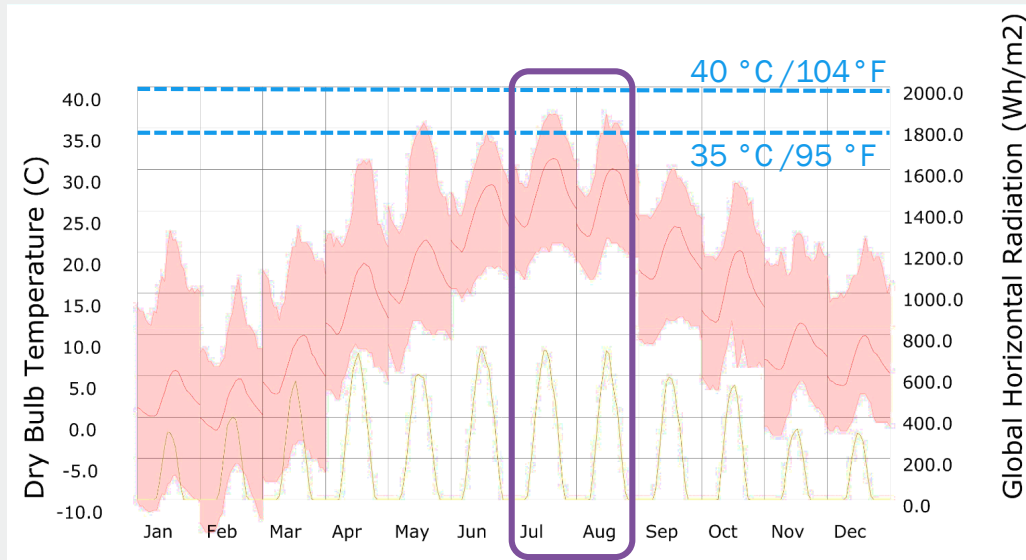
Red areas indicate hours in July and August when dry bulb temperatures exceed 79° F.

The dry bulb temperature refers to the air temperature as measured by a thermometer that is freely exposed to the air but shielded from radiation and moisture.

THERMAL STRESS

DIURNAL TEMPERATURE CHANGES

Current
1991-2003



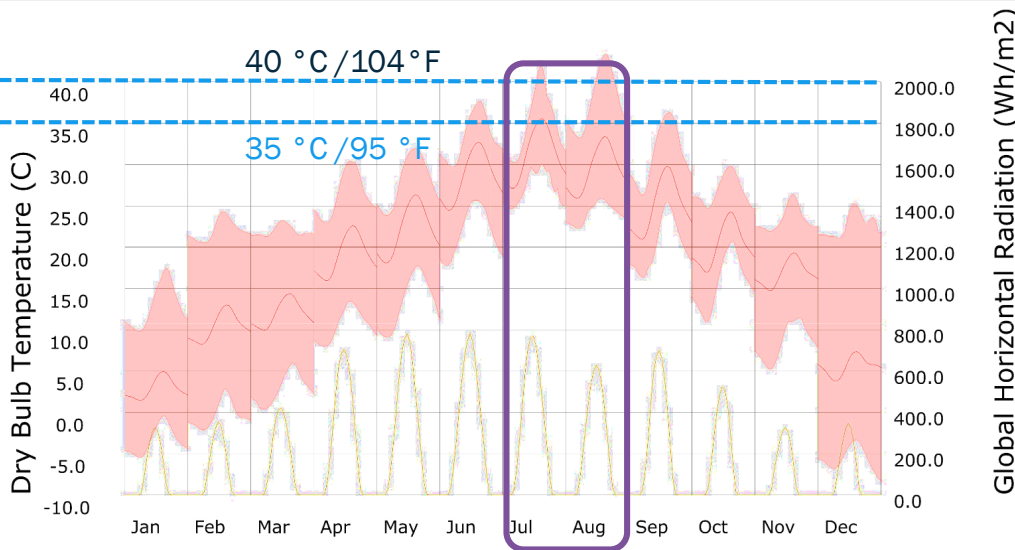
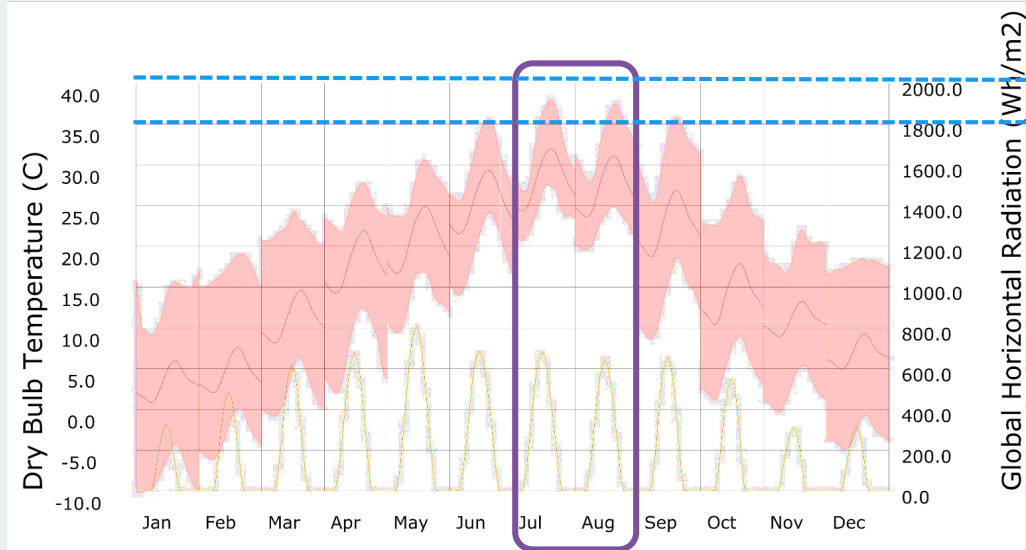
These curves illustrate that by 2085, maximum daily temperatures are projected to exceed 104 °F in July and August, with consistently higher temperatures across all hours of the day compared to baseline and 2045 scenarios.

Diurnal temperature refers to the difference between the minimum at night (low) and the maximum during the day (high).

LEGEND:

- Dry Bulb Temperature (Hourly Avg)
- Dry Bulb Temperature (Hourly Max and Min)

2045



2085

ALEXRENEW THERMAL MODELING APPROACH

Thermal
modeling for
hottest times of
the year



Model run
outputs into 3D
site model



Thermal impacts
simulated for
personnel and
equipment
indoors and
outdoors



Risk
Assessment

Climate scenarios:

Indoor Thermal Hazards

6 climate scenarios

- Model cooling energy demand intensity
- Baseline, 2045, 2085
- July and August

Outdoor Thermal Hazards

9 climate scenarios

- Universal Thermal Climate Index (UTCI) for personnel
- Dry bulb temperature for equipment
- Baseline, 2045, 2085
- July and August

CLIMATE RISK ASSESSMENT

IMPACT RATING

Public Health and Safety

Results in threat
to public health
and safety

Regulatory Compliance

Results in a
permit violation,
regulatory action,
or loss of
regulator trust

Financial Impacts

Results in a
financial impact

Production Impacts

Results in loss of
processing
capacity, product
quality

Environmental Impact

Results in release of
pollution that
negative impacts
land, air, or water

Public Perception

Results in a loss
of public and
stakeholder trust

1 Minor Impacts

2 Moderate
Impacts and likely
can be mitigated

3 Significant
Impacts can
occur quickly or
accumulate,
mitigation is
possible


4 Major Impacts
are immediate,
mitigation is
limited


5 Impacts are
severe,
immediate, and
cannot be
mitigated


The impact of climate events was evaluated using AlexRenew’s asset management impact methodology. Ratings were imported from AlexRenew’s asset management system for each asset and were reviewed to assess whether climate events would increase or decrease the impact to each factor.













CLIMATE CHANGE IMPACTS TO ALEXRENEW ASSETS

Legend

 High Impact

 Moderate Impact

 Low Impact

SCENARIOS	WRRF	INTERCEPTORS	PUMPING STATIONS	TUNNEL SYSTEM
Sea Level Rise (2075)				
Extreme Precipitation (2075)				
Thermal Stress (2085)				

SUMMARY OF CLIMATE CHANGE IMPACTS

Condition	Expected Change by 2075
Average High Temperature (1)	>114.8° F
Sea Level Rise (2)	1–6 feet
Annual Total Precipitation (2)	2–3 inches
100-Year Storm Intensity (1)	2.12 inches

(1) AlexRenew Thermal and Flood Climate Assessment

(2) NOAA. Mid-Atlantic Regional Integrated Sciences and Assessment for Alexandria, VA ([Alexandria VA.pdf](#))

