

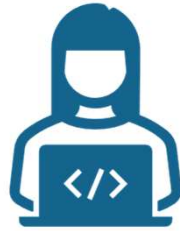
# I-ADAPT: A Tool that Puts Flood Mitigation in the Hands of Delawareans

Presentation By: Jordana Cutajar, Resilience Planner IV  
RASCL Coffee Break 09/19/24



DELAWARE DEPARTMENT OF  
NATURAL RESOURCES AND  
ENVIRONMENTAL CONTROL





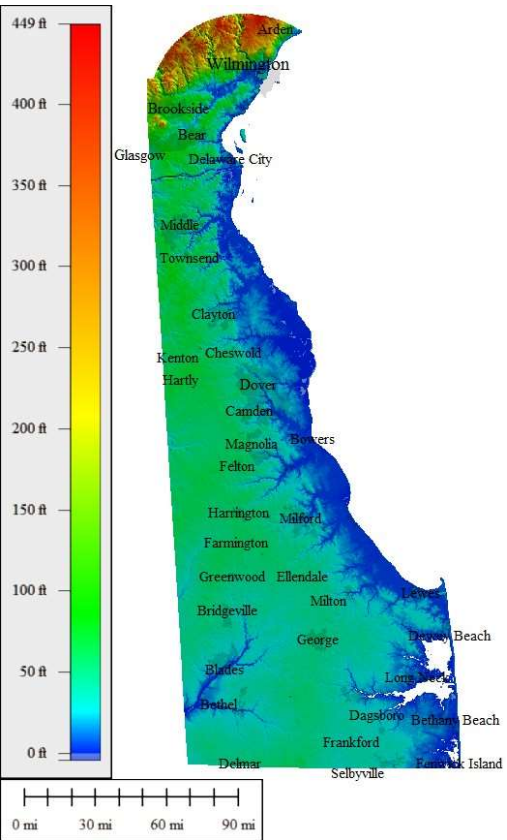
Context:  
Climate  
Change  
in DE

Tool

Adaptation  
Strategy  
Documents

Website

# Climate Change and Flooding in Delaware



Lowest lying state



More frequent and intense storms



Hotspot for sealevel rise

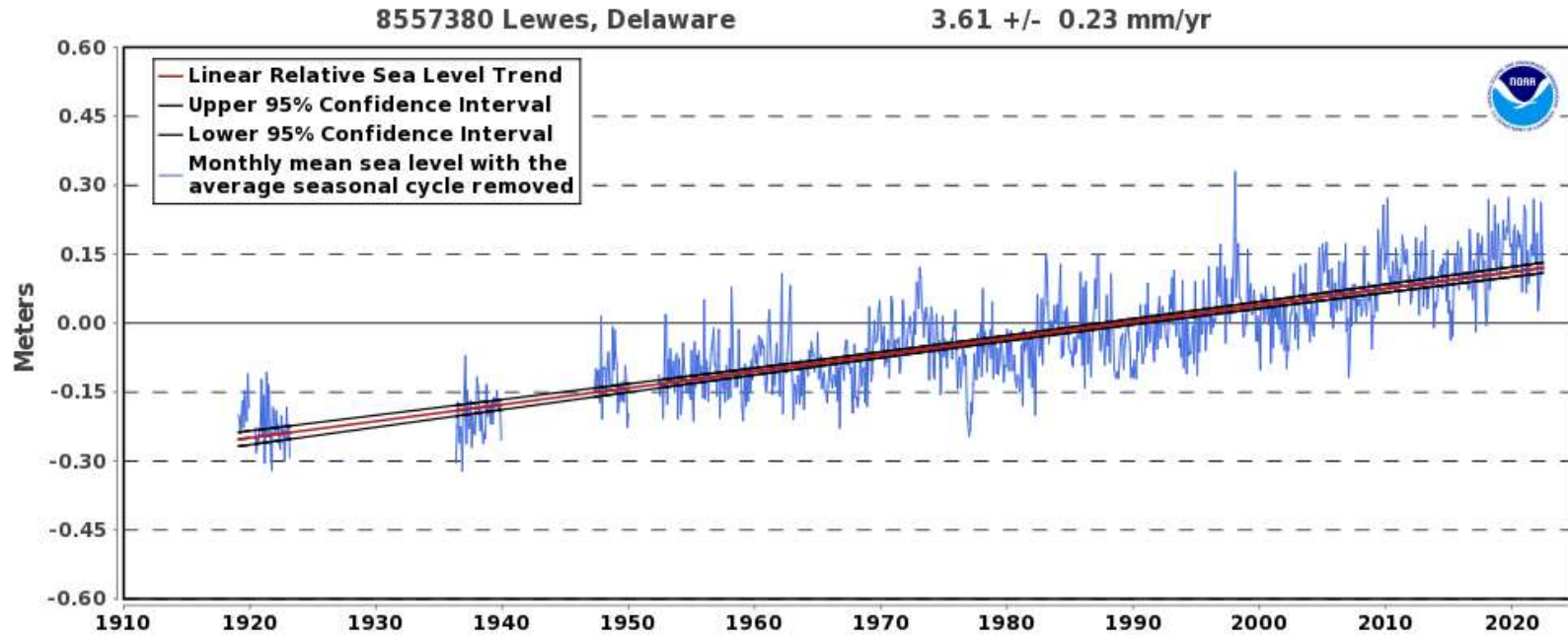


Increased precipitation and flooding



# Delaware's Sea Levels are Rising

Relative Sea Level Trend  
8557380 Lewes, Delaware



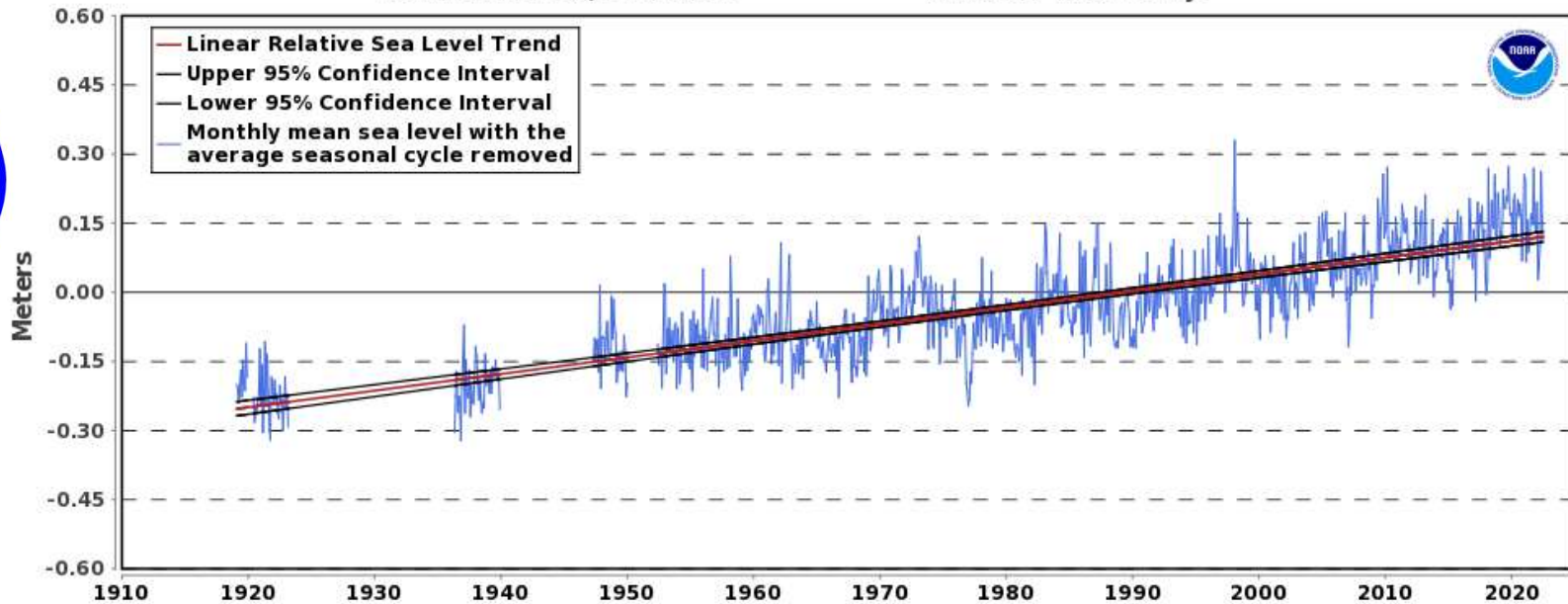


# Delaware's Sea Levels are Rising

Relative Sea Level Trend  
8557380 Lewes, Delaware

8557380 Lewes, Delaware

3.61 +/- 0.23 mm/yr



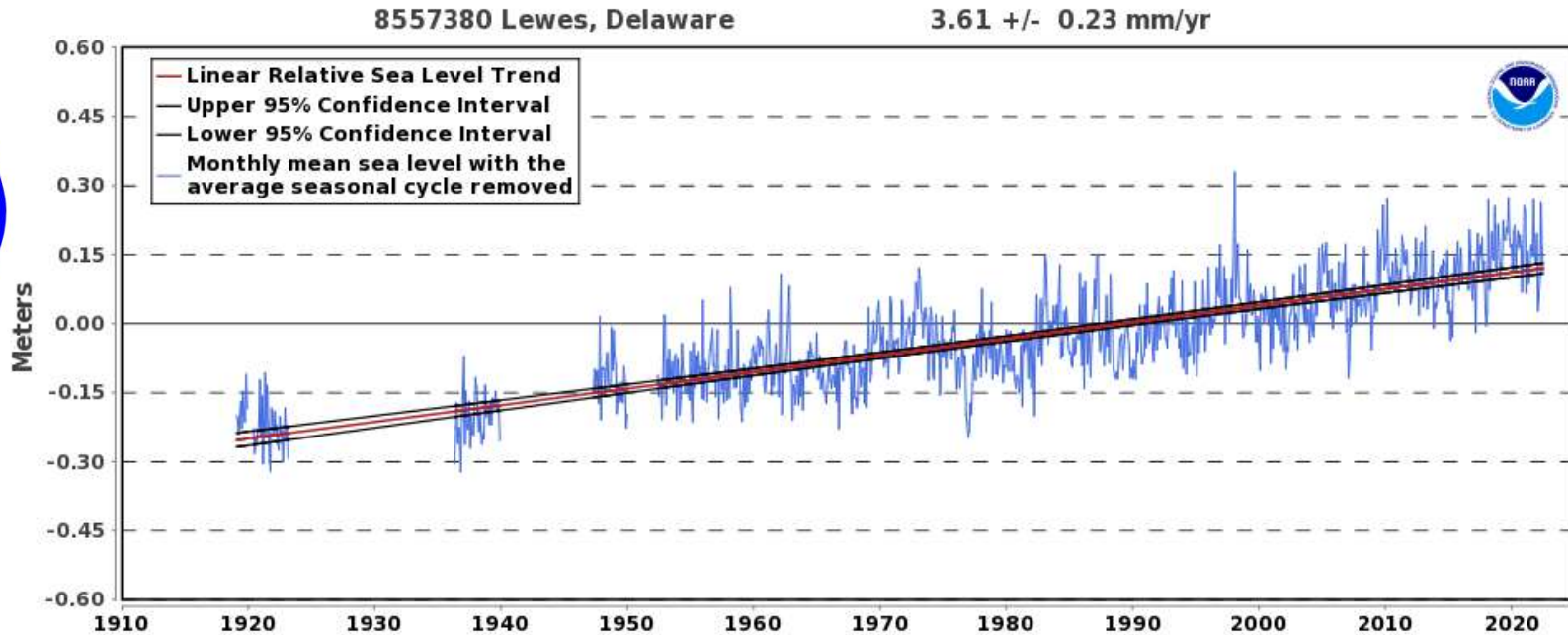
Increased  
14" in last  
100 years





# Delaware's Sea Levels are Rising

Relative Sea Level Trend  
8557380 Lewes, Delaware



Increased  
14" in last  
100 years

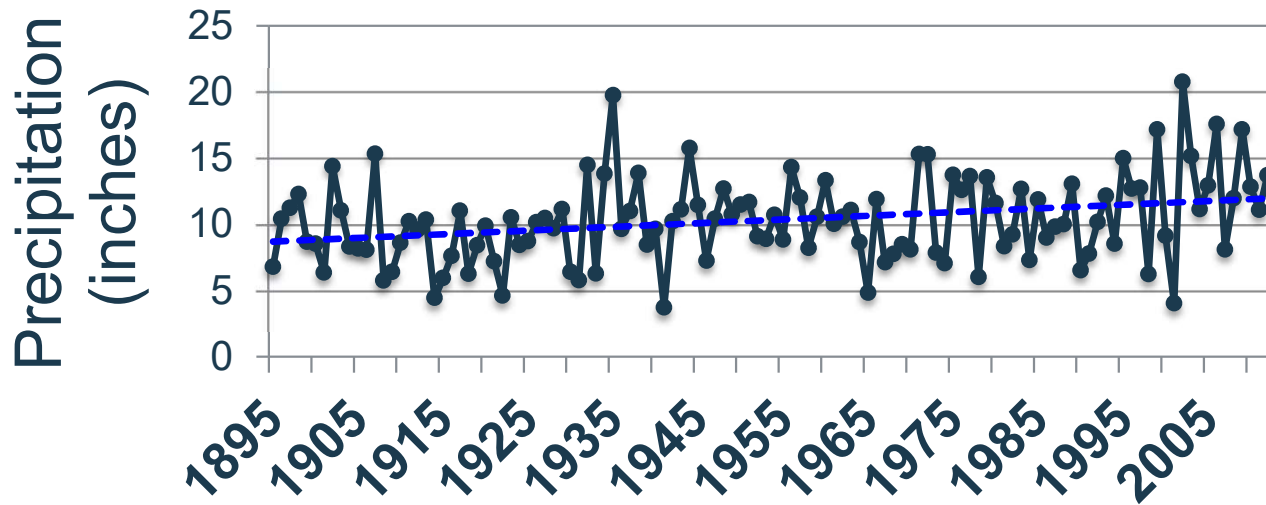
By 2050  
additional  
9-23"

Updated SLR projections  
coming soon!



# Delaware is getting more Rainfall

Delaware Statewide Autumn Precipitation  
1895 - 2012



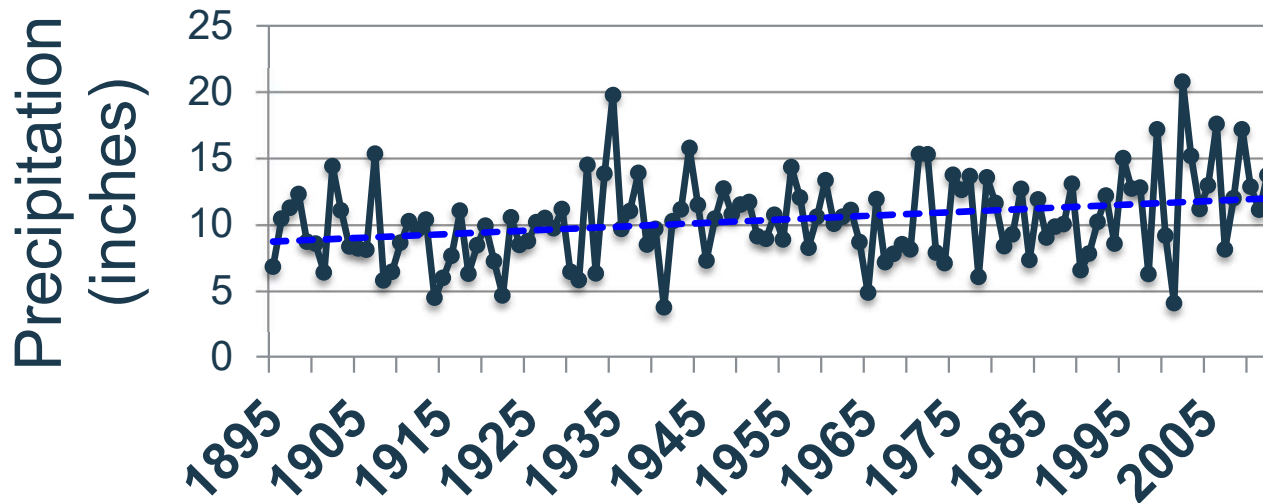
Source: Dr. Daniel J. Leathers, State Climatologist



# Delaware is getting more Rainfall

Increasing  
0.25" per  
decade

Delaware Statewide Autumn Precipitation  
1895 - 2012



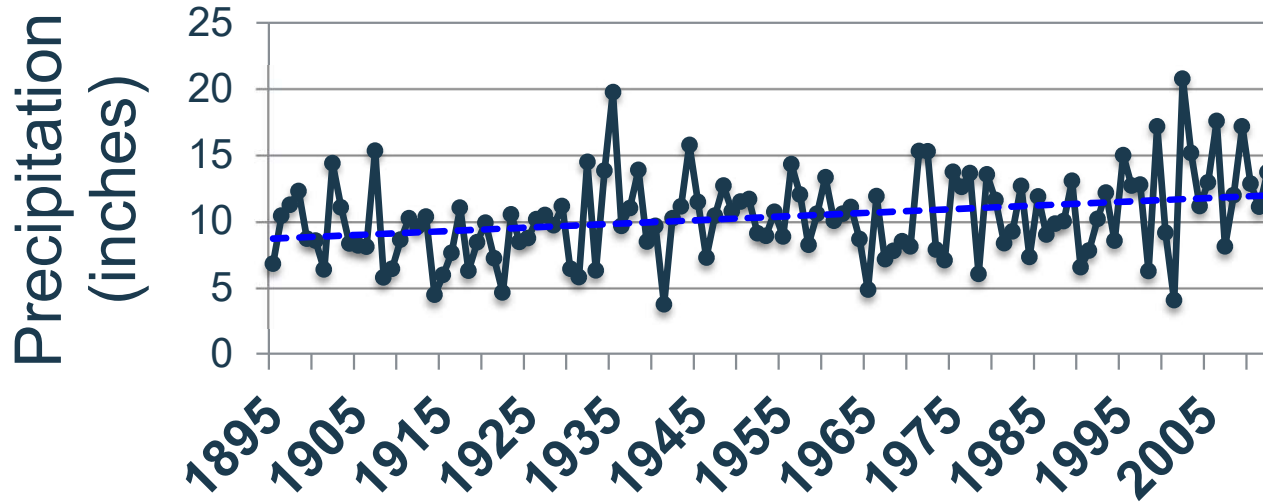
Source: Dr. Daniel J. Leathers, State Climatologist





# Delaware is getting more Rainfall

Delaware Statewide Autumn Precipitation  
1895 - 2012



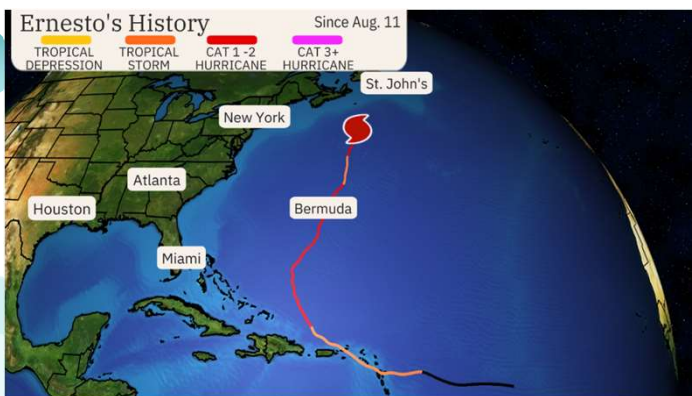
Increasing  
0.25" per  
decade

10%  
increase by  
2100

Source: Dr. Daniel J. Leathers, State Climatologist



# Current Impacts Felt Statewide



## LOCAL

### Tropical Storm Debby's remnants slammed Delaware. Will the weekend offer relief?



**Kelly Powers**

Delaware News Journal

Published 10:37 a.m. ET Aug. 10, 2024 | Updated 10:37 a.m. ET Aug. 10, 2024



# Is my property located in a flood zone?

- Before there was I-ADAPT, there was the Delaware Flood Planning Tool
- <https://floodplanning.dnrec.delaware.gov/>

The screenshot shows the Delaware Flood Planning Tool interface. The top left corner features the Delaware.gov logo and a menu icon. The main title is "FLOOD PLANNING TOOL". Below the title, there is a brief description: "The Delaware Department of Natural Resources and Environmental Control (DNREC) Flood Planning Tool is an interactive web map application designed to aid you in researching your flood risk in the State of Delaware." The interface includes a search bar with the text "Street / Tax Parcel / Watershed" and a search icon. A map of Delaware is displayed with a blue grid overlay. A yellow arrow points to the search bar, and another yellow arrow points to the grid. The text "SEARCH or CLICK" is overlaid on the map. The bottom left corner shows the Delaware Department of Natural Resources and Environmental Control logo and a list of partners: Earthstar Geographics | FEMA | Delaware FirstMap, New Jersey Office of GIS, VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USEWS. The bottom right corner says "Powered by Esri".

The screenshot shows a detailed view of a property within a flood zone. The map displays a blue grid overlay on a satellite image of a residential area. A yellow warning icon is overlaid on the map. The text "Location is **WITHIN** the the FEMA 100-year floodplain in the Effective Map." is displayed. Below the map, there is a table with the following information:

Flood Zone (at Point):	AE
Base Flood Elevation (ft):	9

At the bottom of the interface, there are three buttons: "Summary", "More Details", and "Print".



# So what now?



## Problem

Delaware residents already experiencing increased flooding on their properties and are not sure how to prepare.



## These spots often flood in Delaware. With storm, you may want to avoid them



**Isabel Hughes**  
Delaware News Journal

Published 1:04 p.m. ET Jan. 9, 2024 | Updated 9:43 a.m. ET Jan. 10, 2024







# So what now?



## Problem

Delaware residents already experiencing increased flooding on their properties and are not sure how to prepare.



## Solution

I-ADAPT allows residents to be proactive and get customized adaptation recommendations for their own property without requiring extensive research on the users part.

**These spots often flood in Delaware. With storm, you may want to avoid them**



**Isabel Hughes**  
Delaware News Journal

Published 1:04 p.m. ET Jan. 9, 2024 | Updated 9:43 a.m. ET Jan. 10, 2024



# Creating the Individual Adaptation Decision And Planning Tool (I-ADAPT)



**Nicole Marks**

NOAA Coastal Management  
Fellow 2020-2022

**Goal of the I-ADAPT Products:**  
Help Delawareans become more resilient to climate change by finding **solutions to protect their property** from flooding.



# What is the tool?



## I-ADAPT:

**Individual Adaptation Decision And Planning Tool**  
Uses information provided by the user to generate flooding adaptation strategy recommendations for the user's property.



### I-ADAPT: Individual Adaptation Decision and Planning Tool

#### How to Complete the Tool

**Instructions:** The tool will suggest various flooding adaptation strategies for your property based on your answers to the following questions. In order to receive the most accurate results possible, please fill out the survey questions as accurately as possible. Please answer all questions in the order that they appear. Do not leave any questions blank. If you need to change an answer in the questionnaire, hit the "Back" button at the bottom of the screen. Once you change an answer, different questions may appear. Be sure to go through all questions following the changed answer to make sure you do not miss a new question. The tool will take approximately 15-20 minutes to complete.

**Results:** Your flood adaptation strategy recommendations will be displayed on the last page of the questionnaire. You will also have the option to receive a copy of your recommendations by email.

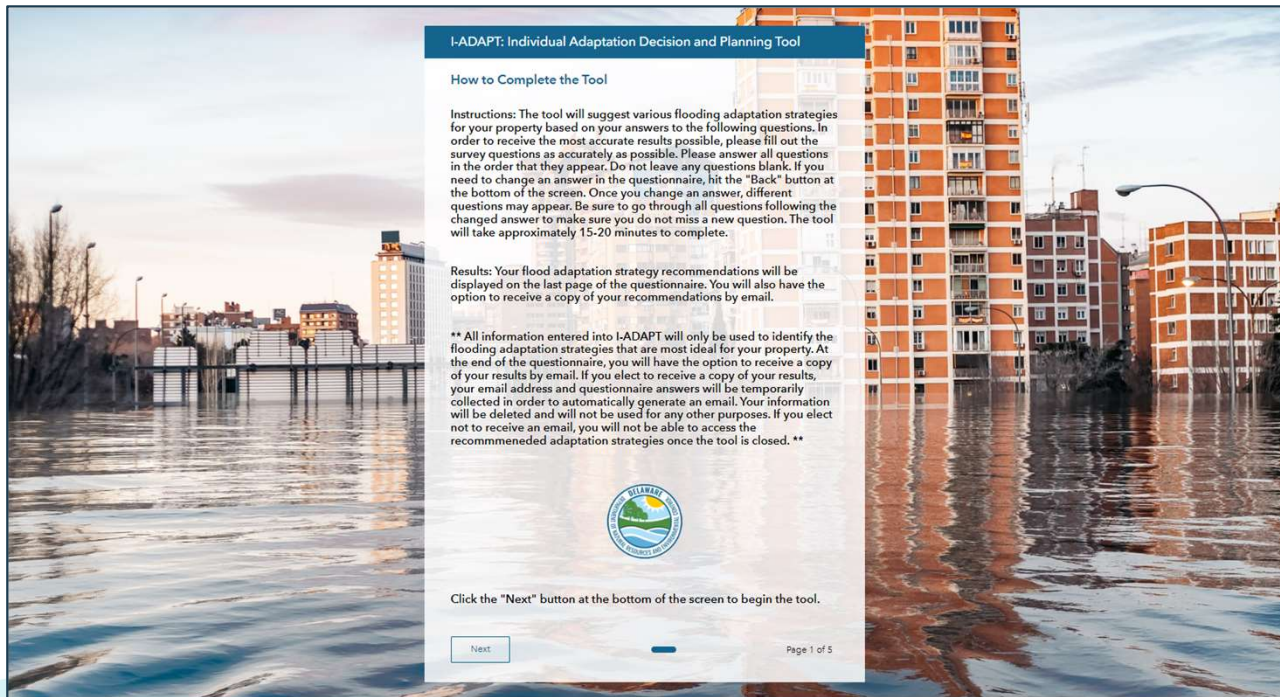
**\*\* All information entered into I-ADAPT will only be used to identify the flooding adaptation strategies that are most ideal for your property. At the end of the questionnaire, you will have the option to receive a copy of your results by email. If you elect to receive a copy of your results, your email address and questionnaire answers will be temporarily collected in order to automatically generate an email. Your information will be deleted and will not be used for any other purposes. If you elect not to receive an email, you will not be able to access the recommended adaptation strategies once the tool is closed. \*\***



Click the "Next" button at the bottom of the screen to begin the tool.

Next

# How was the tool created?



## Background information

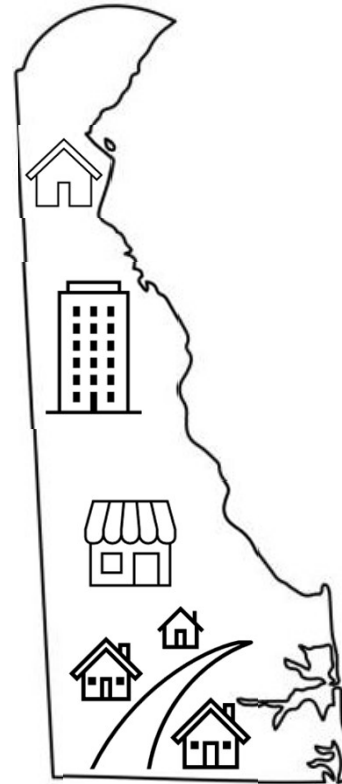
- Extensive literature review
- Technical expert input
- Contractor interviews
- Public Focus Groups
- Technical Focus Group

# Who should use I-ADAPT?



## Residential

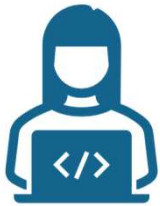
- Residential property **owners** (homeowners)
- Residential property **renters**



## Business

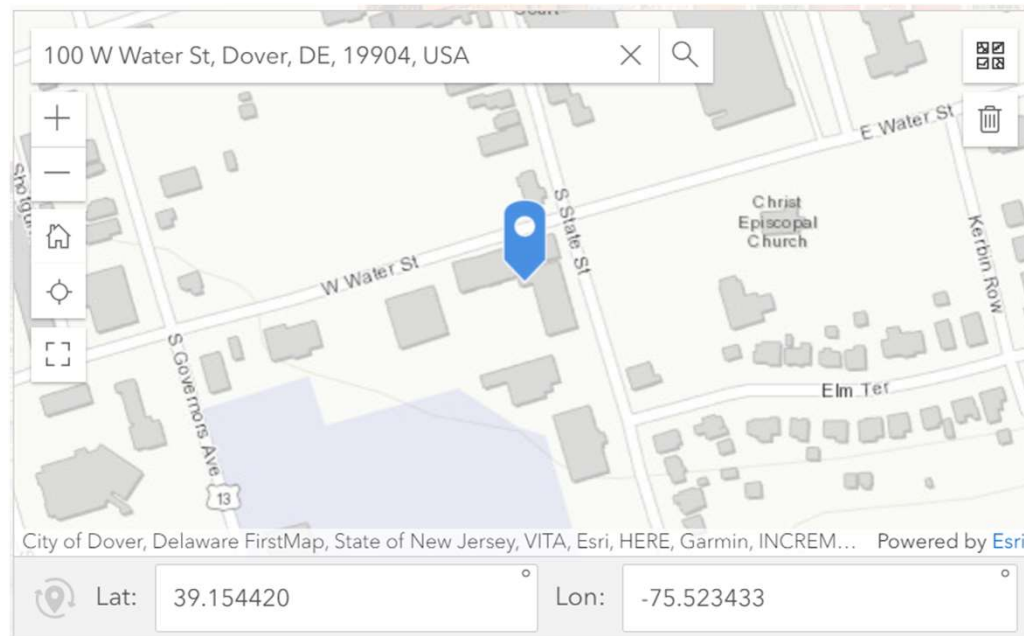
- Business property **owners**
- Business property **renters**

# How does the tool work?

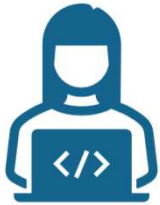


## Property Location

User inputs exact location of the primary structure on their property.





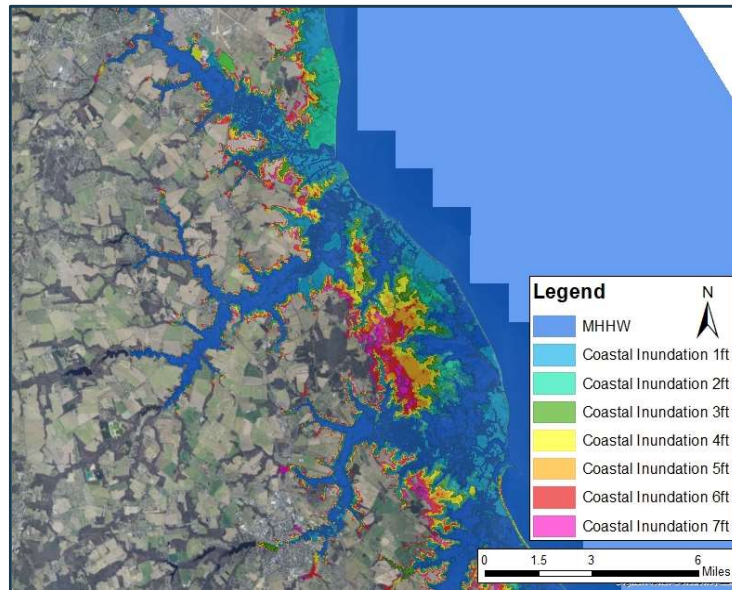


# How does the tool work?

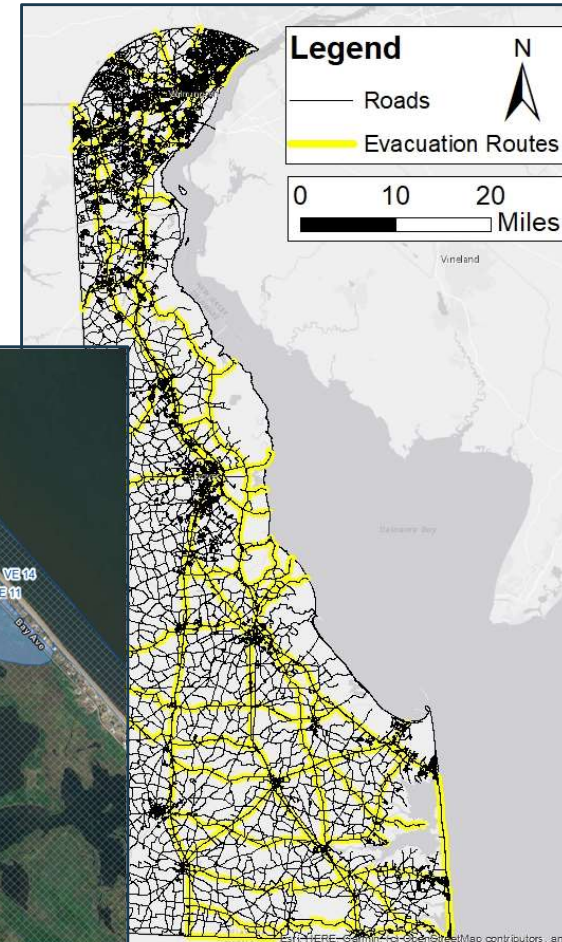
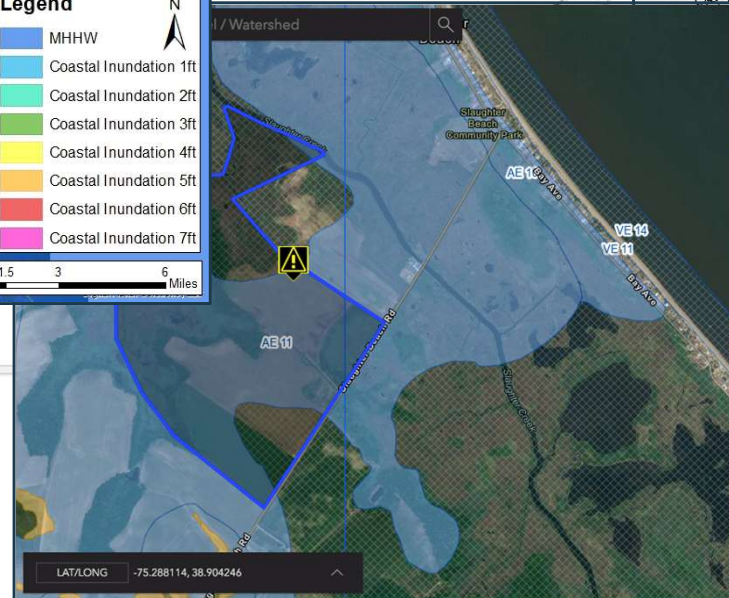


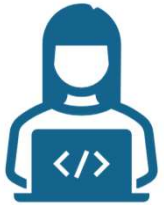
## Property Location

User inputs exact location of the primary structure on their property.



Lat: 39.154420





# How does the tool work?



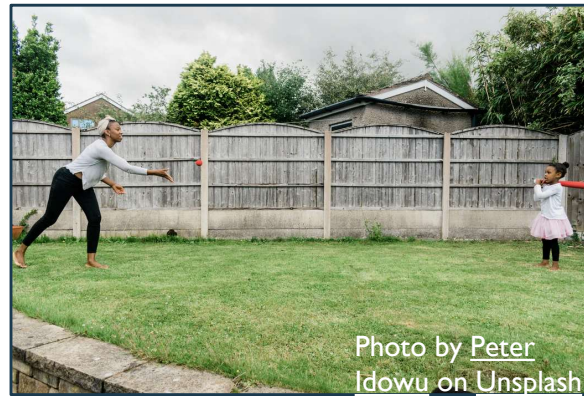
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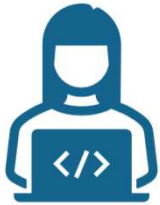


## Physical Factors

Ex: Do you have a yard?







# How does the tool work?



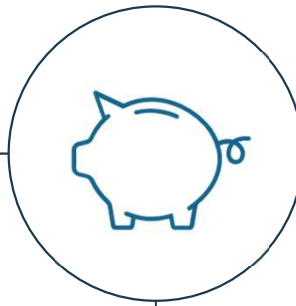
## Property Location

User inputs exact location of the primary structure on their property.



## Physical Factors

Ex: Do you have a yard?



## Personal Preferences

Ex: How long do you want to live at the property?



# How does the tool work?



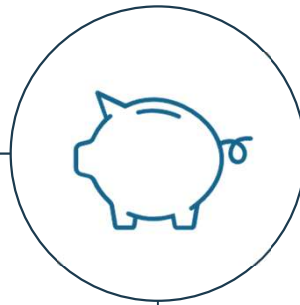
## Property Location

User inputs exact location of the primary structure on their property.



## Physical Factors

Ex: Do you have a yard?



## Personal Preferences

Ex: How long do you want to live at the property?



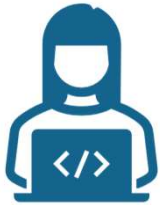
## Personalized Results

Results include recommended strategies for now and for later.

**Right Now:**  
Strategies you can implement **right now** to reduce your property's flood risk.

**Future:**  
Strategies that you will **likely need to implement** to reduce your property's flood risk through **2050**.

# How does the tool work?



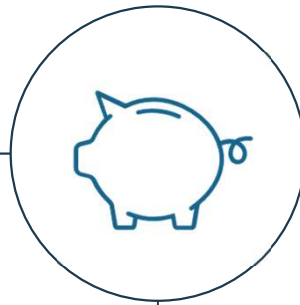
## Property Location

User inputs exact location of the primary structure on their property.



## Physical Factors

Ex: Do you have a yard?



## Personal Preferences

Ex: How long do you want to live at the property?



## Personalized Results

Results include recommended strategies for now and for later.



## Adaptation Strategies

Describe each of the recommended adaptation strategies.

# Example Adaptation Strategy



## FLOODING ADAPTATION STRATEGY RECOMMENDATIONS

Strategies that you could implement right now to reduce your property's flood risk:

[Caulk Around Windows and Doors](#)

[Delaware Emergency Notification System \(DENS\)](#)

[Landscape with Native Plants](#)

[Learn About Your Community's Emergency Plan](#)

Strategies that you will likely need to implement to reduce your property's flood risk from sea level rise through 2050:

Your primary building is in Flood Zone X.

Flood Zone X: An area which falls outside of the Special Flood Hazard Area. Some Zone X areas represent the 0.2-percent-annual chance (500-year floodplain).

Please enter your email address if you would like to receive your results in email form. (This is not required.) Your email address will not be distributed or used for any other purpose.\*

When you close this page, your recommendations will not be recoverable. If you would like to save your results, please enter your email address and click the "Click here to receive an email containing your results" button below.

Click here to receive an email containing your results

## I-ADAPT Other Adaptation Learn About Your Community's Emergency Plan

### Overview

- Contact your local community leaders to learn about your community's emergency plan and evacuation plan in order to better prepare for emergency situations including flooding.
- A community emergency plan will help the residents save time and money and will increase resiliency to flooding events.
- If your community does not have an emergency plan and/or evacuation plan, encourage your community leaders to develop these plans.
- The community emergency plan should contain information relevant to all potential emergency situations (e.g. coastal flooding, hurricanes, wind, riverine flooding, public health crises, etc.).
- Encourage your community leaders to practice implementing the emergency plan at least once per year.
- Although this method will not extend the life of property, it can give coastal residents more time to evacuate as well as move any valuables/furniture and implement any temporary flooding strategies.
- Additionally, sign up for the Delaware Emergency Notification System (DENS) to receive notifications regarding emergency situations.



### Key Takeaways

During flood events or other natural disasters, the health, safety, and welfare of Delawareans may be at risk.

When residents receive warning of emergency conditions, it is important that they are ready to respond quickly to better ensure their comfort, cost savings, and even survival.

In order to better prepare for emergency conditions such as flooding, learn about your community's emergency plan.



### Estimated Costs/Benefits

\*U.S. dollars (2021); estimates are subject to change

Potential Costs		Potential Benefits	
Item	Estimate	Health	Estimate
Learn about your community's emergency plan	\$0	Help avoid delays and obstacles when trying to evacuate	Incalculable
<b>ESTIMATED TOTAL COST</b>	<b>\$0</b>	<b>ESTIMATED TOTAL SAVINGS</b>	<b>Incalculable</b>

### Expected Maintenance

- Update any changing information on the emergency contact list.
- Help community leaders update the emergency plan as needed.

### Additional Resources

- [Delaware Emergency Management Agency \(DEMA\)](#)
- [Delaware Emergency Notification System \(DENS\)](#)
- [Delaware Homeowner Handbook to Prepare for Natural Hazards](#)
- [Ready.gov](#)

Resources can also be found at <https://de.gov/iadapt>

Technical definitions and more information are located on the I-ADAPT website: <https://de.gov/iadapt>

This information is intended to be used for planning purposes. It is not intended to substitute or take precedence over the guidance of design engineers, contractors, utility companies or regulatory agencies.

For more information, contact DNREC's Division of Climate, Coastal and Energy at [DNREC-IADAPT@Delaware.gov](mailto:DNREC-IADAPT@Delaware.gov)





# What are adaptation strategy documents?

Each **adaptation strategy document** provides information on one flooding adaptation strategy.

Flooding adaptation strategies include everything from elevating a home to installing a rain garden to moving valuables out of the basement.

Strategies grouped by the following **categories**:

**Interior** adaptations

**Exterior** adaptations

**Shoreline** adaptations

**Yard** adaptations

**Other** adaptations



Photo credit: DNREC



Photo credit: FEMA

# What information is in the documents?



- Key takeaways
- Overview
- Estimated costs/benefits
- Potential funding sources
- Expected maintenance
- Permitting agencies
- Additional Costs
- Who to contact
- Additional Resources

I-ADAPT Other Adaptation

## Commercial NFIP Flood Insurance

### Rain Garden

**Overview**

- Building a well-designed rain garden can reduce potential flood damage costs.
- Rain garden installation projects can vary in complexity and cost:
  - Simple "Dig it yourself" projects
  - Complex projects involving downspouts, pipes, or French drains
- For the average single-family home, a rain garden should be about 20% of the impervious surface (roof, patio, driveway) draining into the garden.
- Residential gardens are typically 10-15 feet in diameter.
- Excavation of soil is often necessary.

**Potential Benefits:**

- On-site stormwater management
- Reduces local mosquito populations
- Recharges the water table
- Visually appealing
- Improves mental health
- Provides wildlife habitat

### Re-vegetate Sand Dunes

**Overview**

- Vegetated dunes provide flooding protection from sea level rise and storm surge.
- When dunes are vegetated, air-borne sand piles up around the plants, new root systems develop on the buried root systems, and a dense vegetative mat provides dune stabilization during flooding and wind events.
- The leaves of the plants will also reduce everyday wind erosion by catching airborne sand.
- Vegetated dunes provide habitat for native Delawarean coastal species.
- Vegetated dunes are aesthetically pleasing.

**Design Recommendations:**

- November to April is the best planting time.
- Three zones of dune vegetation:
  - Frontal dune zone – closest to the water, grasses and herbaceous plants (beach grass)
  - Back dune zone – behind the frontal zone, trees, shrubs, vines, grasses, and herbaceous plants (beach grass, beach heather, seaside goldenrod, and prickly pear cactus)
  - Maritime forest zone – furthest from the ocean, pines and hardwoods (bayberry and beach plum)
- Most projects use predominantly "Cape" American beach grass (*Ammophila* *Intelligens*) to re-vegetate the frontal and back dune zones.
- \*\* ALWAYS plant native plant species \*\*
- \*\* ALWAYS check to see if the dune is in a rare, threatened or endangered shortland habitat region before planting, you may be limited in what/how much you can plant \*\*

**Key Takeaways**

- During flood events, flood water made the building can damage indoor appliances.
- Buoyancy forces may also cause the appliances to float and become projectiles, which can cause further damage inside the structure.
- To avoid replacement or repair costs associated with flood-related damage or destruction of indoor appliances, the equipment can be elevated to a floor above the Base Flood Elevation level.

### Secure Fuel Tanks Above Ground

**Design Recommendations**

**Mounting to a concrete slab or counterweights:**

- Mount or strap fuel tank to a concrete slab OR strap fuel tank to concrete counterweights on both sides of the tank.

- OR -

**Strapping a tank to earth augers:**

- Straps attached to earth auger anchors.
- Generally, increasing the number and/or the size of the augers increases total holding strength.

**Tip:**

- Expected buoyancy forces must be calculated to ensure that the slab/counterweights or the augers are strong enough to withstand all flooding forces.
- Straps must be made of non-corrosive material, especially in coastal areas.
- If possible, fill tank completely before flood event as it is less likely to float.
- \*This measure should not be used if tanks experience velocity flooding.\*

**Costs/Benefits of Securing Tanks**

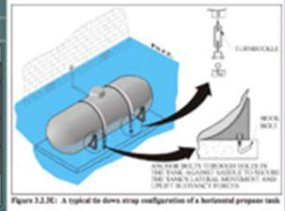
Potential Costs		Potential Benefits	
Item	Cost	Item	Benefit
\$20 (2)	Two-foot straps	\$200-3,000	Prevention of a new fuel tank
\$20 (1)	One-foot straps	\$60-80	Prevention of new fuel tank
\$1 (1)	Formaldehyde	\$170-760	Prevention of new fuel tank
\$1 (1)	Reinforcing concrete	\$1,500-4,000	Prevention of new fuel tank
<b>\$26</b>	<b>ESTIMATED TOTAL COST</b>	<b>\$1,500-4,000</b>	<b>ESTIMATED TOTAL SAVINGS</b>

**Key Takeaways**

During flood events, buoyancy forces can dislodge ground level fuel tanks. Unsecured tanks could explode or leaking fuel could cause a fire.

Additionally, the tank could become a floating projectile and cause extensive damage to property.

To avoid additional replacement/repair costs, the fuel tank should be secured to the ground using tie-downs or anchors.



Water entering the property. According to FEMA, flood water can cause damage to a structure. Flood insurance typically does not cover the actual cost of repair costs related to damaged property, business interruption, flood insurance, and flood insurance program.





# Where can I find the tool?



Website:

[de.gov/iadapt](https://de.gov/iadapt)



Or scan this QR code to visit the website!

The screenshot shows the Delaware.gov website page for "I-ADAPT: A Flood Planning and Adaptation Tool". The page features a navigation menu on the left with links to Home, Contact Us, Delaware Coastal Management Program, National Estuarine Research Reserve, Stewardship, Coastal Science, Planning & Training, I-ADAPT: Flood Planning and Adaptation, Outreach, and Division of Climate, Coastal and Energy. The main content area includes an introduction to the tool, a section titled "A Tool to Help Delawereans Prepare for Flooding" with a list of community workshops, and a "Privacy Information and Disclaimer" section at the bottom. A small image of a flooded area with a "HIGH WATER" sign is also visible.

# What information is on the website?




- Link to the Tool
- Tool overview
- How to use the tool
- Tool definitions
- Additional resources
- Comprehensive list of flood adaptation strategies

The screenshot displays the Delaware.gov website page for the I-ADAPT tool. The page title is "I-ADAPT: A Flood Planning and Adaptation Tool". The navigation bar includes "Delaware.gov", "Agencies", "News", "Topics", and "Contact". The main content area features a sidebar for "Delaware Coastal Programs" with links to Home, Contact Us, Delaware Coastal Management Program, National Estuarine Research Reserve, Stewardship, Coastal Science, Planning & Training, and Outreach. The main text describes the tool's purpose: "The Individual Adaptation Decision and Planning Tool, I-ADAPT, is designed to help Delaware residents adapt to increased flooding." It includes a "Go to the I-ADAPT Tool" button and a "How to Use I-ADAPT" section. A section titled "A Tool to Help Delawareans Prepare for Flooding" features an image of a flooded street with a "HIGH WATER" sign. The page also includes a "Privacy Information and Disclaimer" section and a footer with "Related Topics" such as adaptation, applications, climate coastal energy, climate plan, coastal programs, flooding, resources, strategies, and tool.

# Help Spread the Word!!


**I-ADAPT**  
Individual Adaptation Decision And Planning Tool

**Learn How I-ADAPT Can Help You Prepare Your Property For Potential Flooding**



**3 Easy Steps**


1. Scan the QR Code to visit the I-ADAPT website
2. Answer questions about your property and preferences
3. I-ADAPT generates personalized recommendations, complete with estimated budgets and additional resources



**Learn More About I-ADAPT**  
Tuesday, May 21, from 6 p.m. to 7:30 p.m. Dover Public Library, 35 Loockerman Plaza, Dover

Featuring:  
 \*Information on I-ADAPT\* \*Demonstrations\* \*Assistance From Trained DNREC Staff\*

DelawareLibraries.org



-Tabling/flying at community events:  
 Visit us at Coast Day, Sunday October 6<sup>th</sup>

-Trainings for interested communities and organizations



Delaware Partners **Better Together** Workshop Series | Disaster Readiness Tools & Tips

**RESOURCE FAIR**

**Tuesday, May 7, 2024**  
4:00pm - 6:00pm

**I-ADAPT Workshop 6:00pm - 8:00pm**  
Route 9 Library


**FREE** Demonstrations & Assistance on how to use I-Adapt by DNREC Staff!

**I-ADAPT**  
Individual Adaptation Decision & Planning Tool  
Presented by DNREC 6:00pm - 8:00 pm

**Learn How I-ADAPT Can Help You Prepare Your Property For Potential Flooding**

- Scan the QR Code to visit the I-ADAPT website & learn more
- Answer questions about your property and preferences
- I-ADAPT generates personalized recommendations, complete with estimated budgets and additional resources


Scan Me!



dnrec.delaware.gov/coastal-programs/i-adapt

**Join us!**  
Rt. 9 Library will host more Delaware Libraries Partners onsite. All welcome to stay through I-ADAPT Workshop! This event is free & open to the public!

**LIBRARY & innovation center**  
3022 New Castle Ave, New Castle, DE  
DelawareLibraries.org



# The Future of I-ADAPT

- Updating pricing
- Translating I-ADAPT into Spanish and Haitian Creole
- What would you like to see in future iterations of I-ADAPT?

## Estimated Costs/Benefits

\*U.S. dollars (2022), estimates are subject to change

Potential Costs		Potential Benefits		
<i>Backflow Valve Types (not all valves are necessary for all structures)</i>	<i>Estimate per Valve</i>	<i>Post-Flooding Recovery Action</i>	<i>Estimate</i>	
Sewer line backflow valve including installation	\$200-\$300	Flood damage recovery (professional clean-up, mold removal, replacement/repair of flood damaged items)	1 inch water	\$10,800-\$53,500+
Basement floor drain backflow valve including installation	\$150-\$1,000		↓	↓
Sprinkler system backflow valve including installation	\$100-\$400		3 feet water	\$39,800-\$185,700+
<b>ESTIMATED TOTAL COST</b>	<b>\$100-\$1,700</b>	<b>ESTIMATED TOTAL SAVINGS</b>		<b>\$10,800-\$185,700+</b>

Help evaluate I-ADAPT!







# Thanks!

Jordana Cutajar (she/her)  
Resilience Planner IV  
DNREC Coastal Programs  
[Jordana.Cutajar@delaware.gov](mailto:Jordana.Cutajar@delaware.gov)

**Acknowledgements:** Nicole Marks, Mike Townsend, Sashidhar Sivalingala, Christy Shaffer, Jim Lee, Mike Mahaffie, Kym Kelly  
Focus Group attendees and the Coastal Programs team!

**Slide credits:** Slidesgo



DELAWARE DEPARTMENT OF  
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