

RVAgreen 2050 Buildings & Energy Working Group

1/20/2021

Climate Vulnerability & Risk Assessment



Equitable climate action for a healthy and resilient Richmond

Agenda

- Settling in and ground rules
- How climate change is impacting Richmond
- Climate Vulnerability & Risk Assessment overview
- Activity
- Wrap-up and next steps

Ground Rules / Group Expectations





Your role today

Helping to inform the RVAgreen 2050 Climate Vulnerability and Risk Assessment, a process to identify potential impacts of climate change to Richmond's communities, built assets, and natural resources...

...by participating in a **listening process** we will guide you through,

...with **your knowledge and experience, wherever that comes from!**

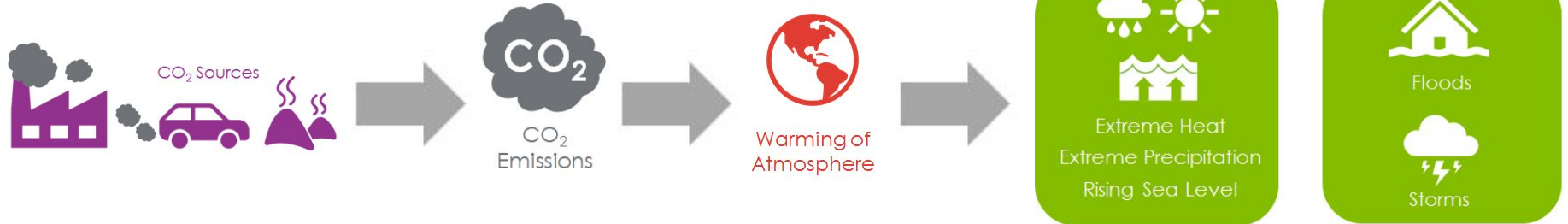
Climate Change



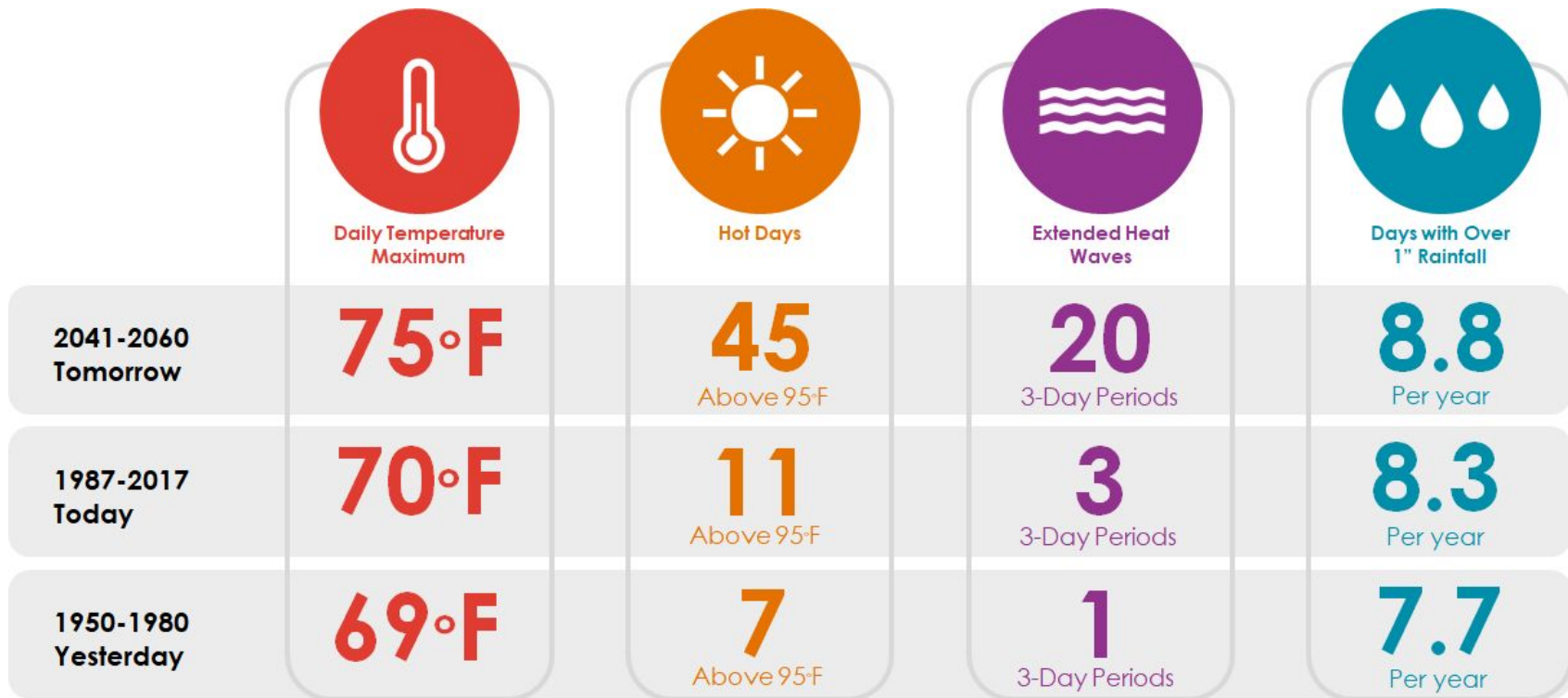
Climate change is
a shift in the
long-term, average
weather pattern



Human-caused
emissions—especially
from burning fossil
fuels—are driving
climate change



Richmond's Future Weather



We're Already Seeing Impacts

April 19, 2017

This year brought Richmond fourth-highest tree pollen in 30 years

By JOHN BOYER Richmond Times-Dispatch April 19, 2017

February 13, 2017

The warm weather is gone for now, but Sunday left a mark on Richmond's records

By JOHN BOYER Richmond Times-Dispatch Feb. 13, 2017

May 10, 2017

Science shows Richmond season more intense than 1897

POSTED 12:22 PM, MAY 10, 2017 BY TOM RATION, UPDATED AT 12:30 PM, MAY 10, 2017

FACEBOOK TWITTER EMAIL

This is an archived article and the information in the article may be outdated. Please look when it was last updated.

May 26, 2017

Two water rescues for James, which is under warning much of the

By HAJI Richmond Times-Dispatch May 26, 2017

September 17, 2017

Remnants of Hurricane gave the Richmond area deadly tornado in 2

By JOHN BOYER Richmond Times-Dispatch Sep. 17, 2017

October 19, 2018

Michael, Florence and deadliest hurricane since 1897

By JOHN BOYER Richmond Times-Dispatch Oct. 19, 2018



An enhanced satellite image from NOAA shows Hurricane Florence.

February 25, 2019

James River hits highest level

By JOHN BOYER Richmond Times-Dispatch Feb. 25, 2019



July 20, 2019

Excessive Heat Warning in some parts of Central

By JOHN BOYER Richmond Times-Dispatch July 20, 2019



August 5, 2019

'We haven't really seen anything like this'
Richmond couple comes across flood during walk

By JOHN BOYER Richmond Times-Dispatch Aug. 5, 2019



By Rick Campbell
Posted: Aug. 5, 2019, 10:22 PM EDT | Updated: Aug. 5, 2019, 11:09 PM EDT

September 27, 2019

Richmond's September weather is going to rank high for heat and low

By JOHN BOYER Richmond Times-Dispatch Sep. 27, 2019



October 2, 2019

Wednesday was the hottest October recorded in Richmond — and it's over

By JOHN BOYER Richmond Times-Dispatch Oct. 2, 2019



October 10, 2019

Drought expands across Virginia

By JOHN BOYER Richmond Times-Dispatch Oct. 10, 2019



January 2020 was Earth's warmest January on record

The long-term trend of above-average temperatures

Climate Satellites | climate analyses and statistics

January 1 warmer than last year

Environment



January 1 warmer than last year

Environment

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Environment

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Environment

May 24, 2020

Summer weather outlook: extra warmth and rainfall favored across Va.

By JOHN BOYER Richmond Times-Dispatch May 24, 2020



July 20, 2020

Richmond's heat wave continues after hottest day of the summer on Sunday

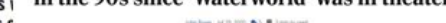
By JOHN BOYER Richmond Times-Dispatch July 20, 2020



July 29, 2020

Richmond hasn't seen 20 straight days of highs in the 90s since 'Waterworld' was in theaters

By JOHN BOYER Richmond Times-Dispatch July 29, 2020



October 15, 2020

U.S. Winter Outlook: Cooler North, warmer South with ongoing La Nina

Persistent drought dominates the Western landscape

Weather | Climate | climate outlooks | winter

Weather | Climate | climate outlooks | winter

Weather | Climate | climate outlooks | winter

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Weather | Climate | climate outlooks | winter

November 12, 2019

4 PM UPDATE: Dry and frosty after Richmond's snowies 30 years

By JOHN BOYER Richmond Times-Dispatch Nov. 12, 2019



February 3, 2020

Early spring-like weather cuts tracking chance of sprinkle

Rain becomes more likely Wednesday.

By JOHN BOYER Richmond Times-Dispatch Feb. 3, 2020

February 18, 2020

Henrico storm spotter compares 1 to prior years - the difference is

temperatures this winter have been well above average in Virginia

By JOHN BOYER Richmond Times-Dispatch Feb. 18, 2020

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By JOHN BOYER Richmond Times-Dispatch Feb. 18, 2020

February 18, 2020

Henrico storm spotter compares 1 to prior years - the difference is

November 12, 2020

UPDATE: James River in Richmond could rise to its highest levels since 1996 following

By JOHN BOYER Richmond Times-Dispatch Nov. 12, 2020



November 30, 2020

The 2020 hurricane season was extremely busy for the Atlantic, and for Virginia. Here's who

saw the most wind and rain.

By JOHN BOYER Richmond Times-Dispatch Nov. 30, 2020

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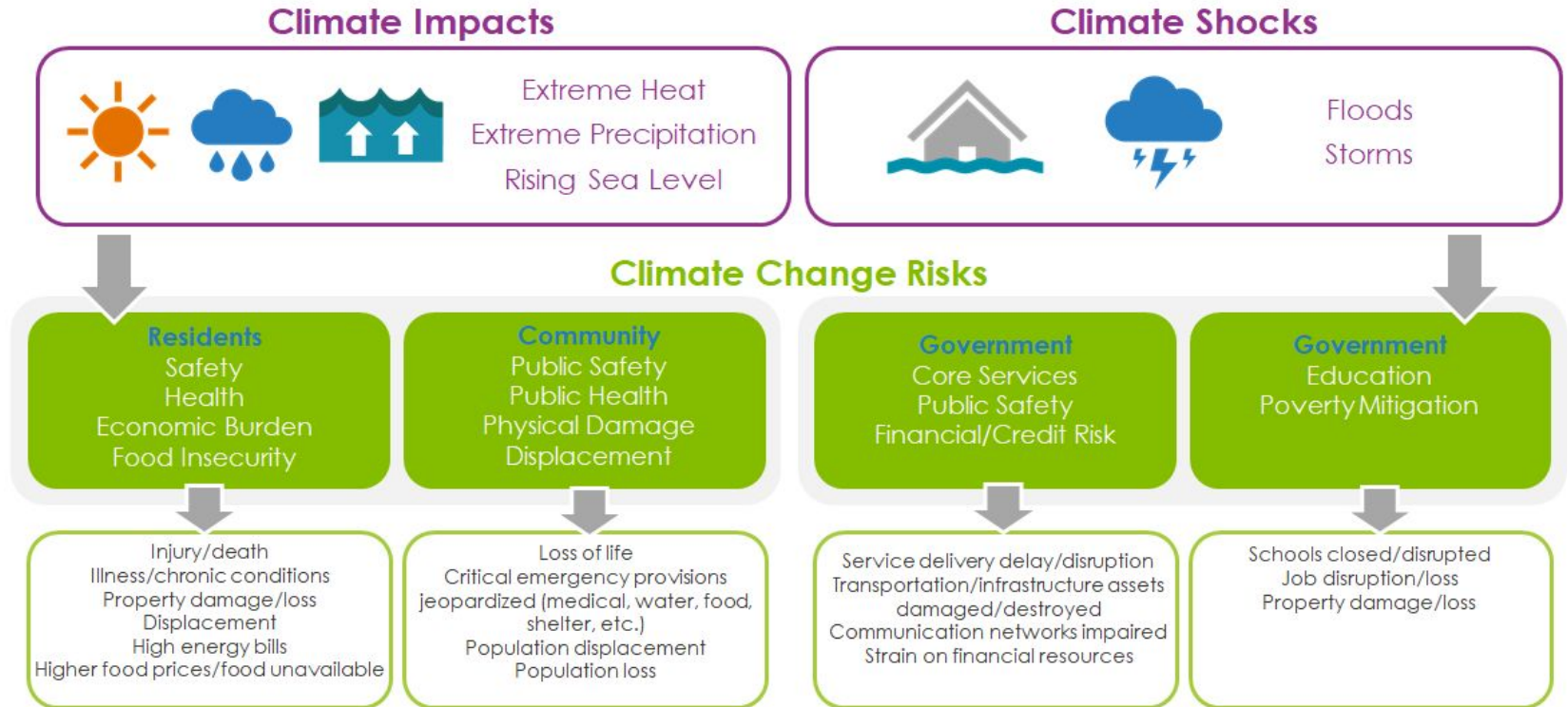
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By JOHN BOYER Richmond Times-Dispatch Nov. 30, 2020

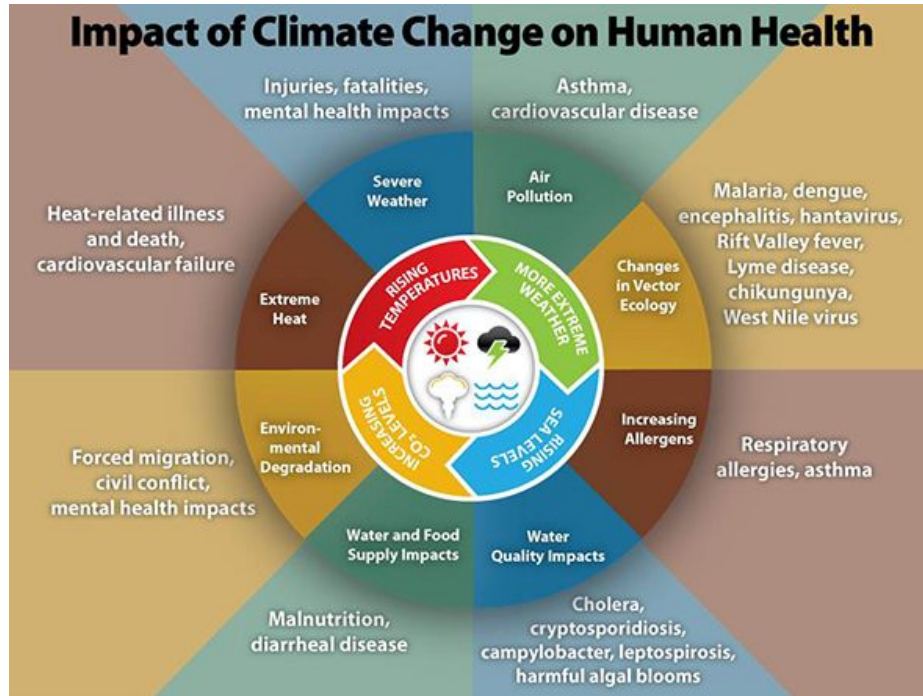
November 30, 2020

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Why does this matter?



Why does this matter?



<https://www.cdc.gov/climateandhealth/effects/default.htm>

Richmond Times-Dispatch

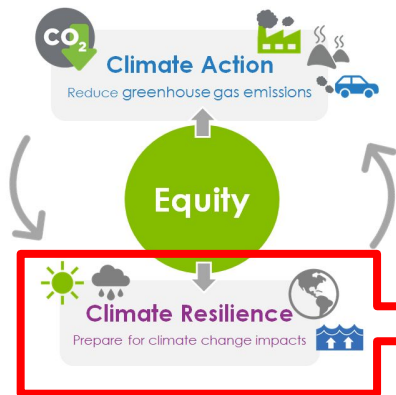
In July, more than 1,000 in Virginia have sought emergency care for heat-related illness

By BRIDGET BALCH Richmond Times-Dispatch Jul 22, 2019 0

Michael, Florence and Alberto made this Virginia's deadliest hurricane season in 15 years

John Boyer Oct 19, 2018 0

What do we do about it?



Understand climate impacts

What will Richmond's weather look like in the future?

Assess potential vulnerabilities and risks

What could happen to Richmond's people, built assets, and natural resources?

Today!

Develop strategies to enhance resilience to climate impacts

Feb-March

How do we do it?

What are the impacts of climate change?

Extreme heat

More frequent, intense, and longer heatwaves

More frequent and intense precipitation events

Localized and river flooding

What is at risk due to these impacts?

People

Built assets

Natural resources

What are the vulnerabilities and risks? *To answer we need to assess...*

Sensitivity: *How much would X be affected?*

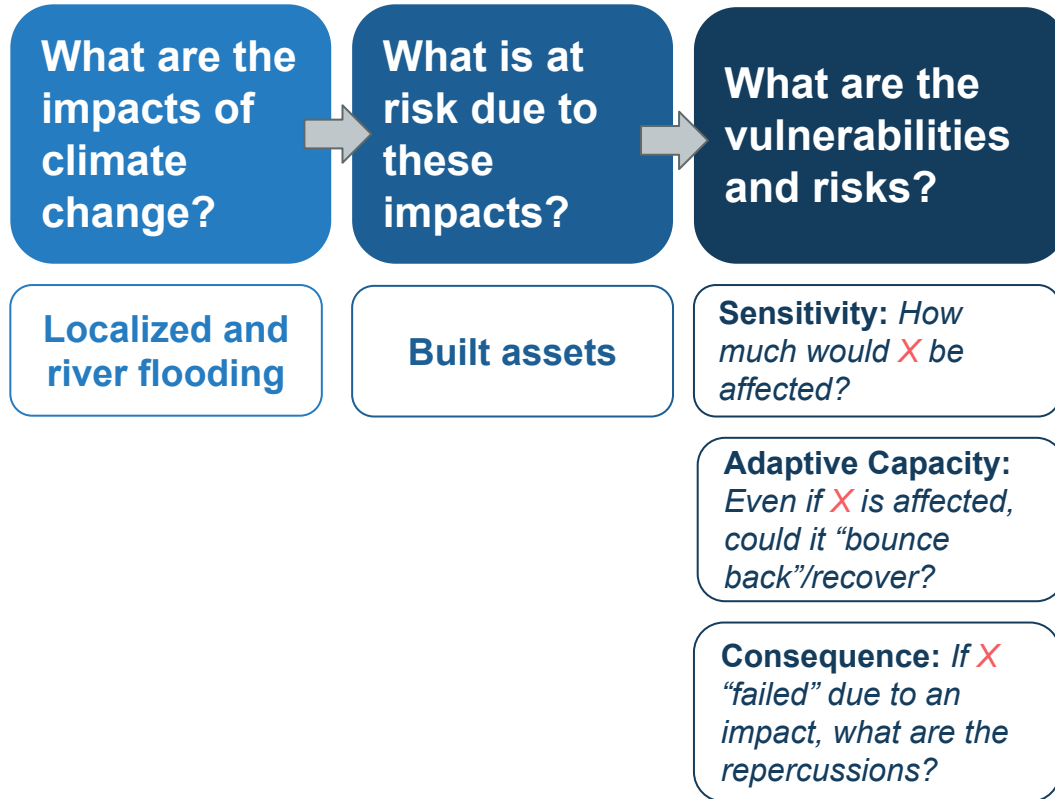
Adaptive Capacity: *Even if X is affected, could it “bounce back”/recover?*

Consequence: *If X “failed” due to an impact, what are the repercussions for...*

- People, especially those most vulnerable
- Literal costs
- Public safety services
- Economic activities
- Public health
- Natural environment

Probability: *Is X actually in harm's way?*

Example



Ex: Hospitals

- Building and facilities could be somewhat impacted depending on depth, intensity of flooding
- Depends on the particular building, but probably need some sort of remediation if flooding occurs
- Potentially high impacts to public health and vulnerable populations
- Relatively low impacts to natural environment, economic activities, public safety

Keep in mind...

This is not going to be scientific/perfect

This is a discussion and listening exercise for us!

We want your judgments based on your knowledge and lived experience

We don't have time to get in the weeds with any one area/asset - we can meet 1-1 later to get your valuable input

Don't get bogged down by what WILL happen - this is a partially hypothetical exercise

How does this fit into the process?

RVAgreen 2050... is at the nexus of... with inputs/tools for each element... in addition to...



Equity

- Climate Equity Index
- Training and capacity building
- Community priorities
- **Equity Screening Tool**

Climate Action

- Greenhouse gas inventories
- Richmond 300 actions
- Best practices and examples
- Greenlink GHG emissions modeling

Climate Resilience

- Climate change impacts data
- Richmond 300 actions
- Best practices and examples
- **Climate Vulnerability & Risk Assessment**

Today!

**Your knowledge
and lived
experience**



Community input



**RVAgreen 2050
Plan!**

Questions?

Activity Overview

$$\text{Vulnerability} = \text{Sensitivity} \times \text{Adaptive Capacity}$$
$$\text{Risk} = \text{Probability} \times \text{Consequence}$$

City staff are conducting a detailed evaluation of the Probability of climate change impacts to hundreds of systems/assets.

But we need **your expertise** to assess the other elements of vulnerability:

- **Sensitivity**
- **Adaptive Capacity**
- **Consequence**

For each of these three elements, we will go through the same groups of assets, looking at:

- **Heat Threats**
- **Water Threats**

Activity Goals

1. Provide insight on sensitivity and adaptive capacity of systems/assets
2. Provide insight on level of consequence
3. Prioritize systems/assets to address with adaptation strategies
4. Identify potential co-benefits of adaptation
5. Identify key actors to address the risk
6. Why all of this matters

Resilience

“The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience.”

~100 Resilient Cities

Resilience

“The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience.”

~100 Resilient Cities

- Who are your constituents? Who do you serve through your work?
- How will climate impact them?

Resilience

“The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience.”

~100 Resilient Cities

- Chronic stress limits the ability of a community or systems to adapt
- Acute Emergencies over the next 50+ years

Resilience

“The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience.”

~100 Resilient Cities

- Where are we going?
- How do we not just survive, but thrive?

Tools we'll use today

Your feedback tool: SurveyMonkey

Additional resources:

- Process and terms overview (sent via email)
- These slides

Facilitator tools:

- Notetaker spreadsheet
- Asset and impacts maps

All of these are available to you!

Sensitivity to HEAT THREATS (extreme temperatures, extended heat waves, etc.)

	1: Low (minimally affected/slightly to somewhat susceptible)	2: Moderate (somewhat affected/moderately susceptible)	3: High (largely affected/very to extremely susceptible)	Not sure
Biodiesel Plants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electric Power Transmission Lines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electrical Substation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Natural Gas Liquid Pipelines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non Gasoline Alternative Fueling Stations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Petroleum Ports & Terminals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Potential Renewable Energy Sites	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comments:

0 of 22 answered

BREAK! (5 minutes)

Where we're going next:

Breakout Groups:

- Energy Assets
- Building & Infrastructure Assets

Energy Breakout Group

Introductions

- Name
- Pronouns
- Organization
- Neighborhood (if in Richmond)

Energy Asset Types

Type	Description
Electric Power Transmission Lines	Lines are operated at relatively high voltages varying from 69 kV up to 765 kV; underground transmission lines are included only when data was available.
Electrical Substation	Bellemeade Power Station
Natural Gas Pipelines	Natural gas interstate and intrastate pipelines
Petroleum Ports & Terminals	Ports handle 200 or more short tons per year in total volume of petroleum products. Terminals are used to provide storage of crude oil & refined petroleum products.
Biodiesel Plants	Plants which manufacture diesel fuel from vegetable oils, animal fats, or greases.
Non-Gasoline Alternative Fueling Stations	Public and private fueling stations for biodiesel, compressed natural gas, ethanol, electric, hydrogen, and propane.
Potential Renewable Energy Sites	Potential sites for biomass, geothermal, solar, and wind energy production as provided by the U.S. Environmental Protection Agency
Communications Infrastructure	AM and FM transmission tower locations, Cellular tower, and Land Mobile Broadcast Tower locations, per Federal Communications Commission records.

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We want your judgments based on your knowledge and lived experience

We don't have time to get in the weeds with any one area/asset - we can meet 1-1 later to get your valuable input

Don't get bogged down by what WILL happen - this is a partially hypothetical exercise

Part I: Sensitivity

Sensitivity is the degree to which the functionality of a system/asset is affected by a specific climate impact. Sensitivity of a particular asset will be different depending on the threat (we will consider heat vs. water threats).

Consider:

- How are the climate impacts currently stressing the asset?
 - Example: Currently impacted by intense rainstorms.
- How might climate impacts stress the component in the future?
 - Example: Flooding might occur more frequently due to increased rain intensity.
- Assuming **NO ACTION**, how might climate impacts further stress this asset?
 - Example: It might result in more localized flooding because stormwater will be unable to enter an already flooded drainage system.

Scoring:

- **3: High** - System/asset will be largely affected by climate-related impacts; is very to extremely susceptible by 2050
- **2: Moderate** - System/asset will be somewhat affected by climate-related impacts; is moderately susceptible by 2050
- **1: Low** - System/asset will be minimally affected by climate-related impacts; is slightly to somewhat susceptible by 2050

Part II: Adaptive Capacity

Adaptive capacity is the ability of a system/asset to respond and recover effectively in the face of climate change impacts. Adaptive capacity of a particular asset will be different depending on the threat (we will consider heat vs. water threats).

Consider: **If this asset were to be impacted by extreme heat or flooding, can the infrastructure adjust to the climate threat with no modification or cost or would it require substantial modification or cost?**

Scoring:

- **3: High** - Mostly or entirely able to accommodate or adjust to projected changes in climate; can adjust to threat with no to slight modification and minimal cost
- **2: Moderate** - Somewhat able to accommodate or adjust to projected changes in climate; can adjust to threat with some modification and cost
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Part III: Consequence

Consequence is the magnitude of the repercussions associated with **system/asset failure** in the event of a climate impact.

Area of service loss: What geographic area will be impacted? How large is the area?

Duration of service loss: How long will it take to bring the asset back “online?”

Cost of damage: What is the literal cost of the damage to the asset?

Public safety: What are the impacts to the well-being of residents, workforce, and visitors with regard to safety from physical threats such as storms or flooding?

Economic activities: What are the impacts to government infrastructure or public services, including damage to city-owned assets or financial burdens associated with asset repair or increased maintenance? This takes into account city-wide economic consequences to local business and tourism, as relates to loss of public services.

Public health: What are the impacts to the well-being of residents, workforce, and visitors with regard to health impacts from threats such as heat stress, discomfort (energy demand), water quality, air quality, and disease?

Vulnerable populations: What are the impacts to historically disenfranchised communities that are *already* disproportionately affected by inequities, including Black and African American, Hispanic, Latino, lower-income, and others?

Natural environment: What are the impacts to natural resources including water, land, tree canopy and vegetation, and animal habitat?

Part III: Consequence

Consequence is the magnitude of the repercussions associated with **system/asset failure** in the event of a climate impact.

Consequence Score	Area of service loss	Duration of service loss	Cost of damage	Impacts to public safety services	Impacts to economic activities	Impacts to public health	Impacts to vulnerable populations	Impacts to natural environment
3 - High	2 or more council districts	> 7 days	\$\$\$ > \$1M	High	High	High	High	High
2 - Moderate	1 council district	1 - 7 days	\$\$ \$100k-\$1M	Moderate	Moderate	Moderate	Moderate	Moderate
1 - Low	Neighborhood (not an entire district)	< 1 day	\$ <\$100k	Low	Low	Low	Low	Low

PARKING LOT

Buildings & Infrastructure Breakout Group

Introductions

- Name
- Pronouns
- Organization
- Neighborhood (if in Richmond)

Buildings & Infrastructure Asset Types (1/2)

Type	Description
Affordable Housing (HUD/RRHA)	<p>HUD: HUD's Multifamily Housing property portfolio consist primarily of rental housing properties with five or more dwelling units such as apartments or townhouses, but can also include nursing homes, hospitals, elderly housing, mobile home parks, retirement service centers, and occasionally vacant land. HUD provides subsidies and grants to property owners and developers in an effort to promote the development and preservation of affordable rental units. The three largest programs are Section 8 (Low-Income housing), Section 202 (Elderly), and Section 811 (Persons with Disabilities).</p> <p>RRHA: Richmond Redevelopment and Housing Authority public housing facilities</p>
Sewer Treatment Plant	Sewer treatment plants as provided by City of Richmond GIS data
Public Safety Buildings	<p>Police: Police Stations as provided by City of Richmond GIS data</p> <p>Fire: Fire Stations where firefighters are stationed or based out of, or where equipment is stored for ready use.</p> <p>Correctional: The prison boundary feature class/shapefile contains secure detention facilities.</p> <p>Sheriff: Sheriff Facilities as provided by City of Richmond GIS data</p> <p>Courts: City, state, and federal courthouses and judicial facilities</p>
Emergency Operations	<p>Operations Centers: The physical location at which the coordination of information and resources to support domestic incident management activities normally takes place. An Emergency Operations Center may be a temporary facility or may be located in a more central or permanently established facility. Emergency Operations Centers may be organized by major functional disciplines (e.g., fire, law enforcement, and medical services), by jurisdiction (e.g., Federal, State, regional, county, city, tribal), or some combination thereof.</p> <p>National Shelter System: Facilities that can house individuals in the event of an issued evacuation for the facilities area.</p>

Buildings & Infrastructure Asset Types (2/2)

Type	Description
Hospitals	Major hospital facilities based on data acquired from various state or federal sources; does not include nursing homes or health centers.
Colleges & Universities	The Colleges and Universities feature class/shapefile is composed of all Post Secondary Education facilities as defined by the Integrated Postsecondary Education System (IPEDS), U.S. Department of Education
Public Schools	This Public Schools feature dataset is composed of all Public elementary and secondary education facilities (Kindergarten - 12th grade) as defined by the Common Core of Data, US Department of Education.
Community Centers & Libraries	Community centers: as provided by City of Richmond GIS data Public libraries: as provided by City of Richmond GIS data
City Buildings	Other Property owned by the City of Richmond according to City Assessor records
Convention Center & Museums	Convention Center: Greater Richmond Convention Center Museums: Museums, including the Virginia Museum of History & Culture and Science Museum of Virginia
State/Federal Buildings	Buildings or properties that are owned or leased by state level governments—including buildings occupied by the headquarters of state government executive departments, legislative office buildings, and state office buildings.
Historic Resources	National Register: a federal designation and carries no restrictions. City Old and Historic Districts are local designations and carry restrictions on exterior alterations and construction.
Businesses	Fortune 500 Company Headquarters: This database is composed of "an annual list of the 500 largest industrial corporations in the U.S., published by Fortune magazine.

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PARKING LOT

*Leave breakout
groups*

Reflection

What is the greatest vulnerability or risk you see related to your work / what is your top priority concern?



Wrap-up and next steps

- Homework
 - Send us any additional thoughts or questions via email
- Next meeting: Wednesday, February 3rd at 11am
- NOW: Hit “done” on SurveyMonkey
- NOW: Fill out feedback survey
- NOW: Share updates, upcoming events, and resources in the chat

Reference Slides

Guiding Questions - Your Perspective

1. What changes to Richmond's climate have you noticed?
2. Who are your constituents? Who do you serve through your work?
3. How does your work help create a stronger or healthier community?
4. How might climate change impact your constituents and/or your ability to serve them?
5. What is the greatest vulnerability or risk you see related to your work?
6. What is your top priority concern?

Guiding Questions - Infrastructure

1. What are the strengths of an asset, system, or community in facing climate impacts?
(e.g. past investment, current plans, location)
2. What makes a particular asset, system, or community particularly vulnerable?
(e.g. location, age, codes and regulation, deferred maintenance)
3. Where has investment been ongoing? Where has maintenance/investment been deferred?
4. Which assets will be even more important (or less important) in a low-carbon future?
5. What other systems rely on an asset and could also fail if the asset is negatively impacted?

Guiding Questions - Social / Equity

1. How do chronic stresses degrade the ability of communities and networks to adapt?
2. What are the population characteristics of the people living in high-risk areas?
3. What are the strengths and vulnerabilities of people in your community?
4. How can hazards intensify these characteristics?
5. Where are areas for improvement in the community in adapting to climate change?
6. Which populations are most negatively impacted by a vulnerability or a potential failure?

Guiding Questions - Natural Resources

1. Which natural resources are most important to your constituents?
2. What benefits do these natural resources provide?
3. How can natural resources and help buffer or limit Richmond's vulnerabilities? (e.g. storm buffering, fire breaks, erosion control, water quality, slope stabilization, recreation)
4. What have been the effects of these hazards on these natural resources in the past?
5. Which natural resources are most exposed to current and future hazards?