RVAgreen 2050 Transportation Working Group
1/21/2021

Climate Vulnerability & Risk Assessment

City of Richmond
RVAgreen 2050

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

1. RESPECT
2. Be present
3. All participate, no one dominates
4. Be additive, not repetitive
5. Aim for consensus ("I can live with that")
6. Be open to new ideas
7. Bring a problem? Bring a solution
8. Separate people from the problem
9. Rule of "thumb"
10. ELMO – Enough, let's move on!
11. Speak from own lived experience ("I" not "we")
12. Language 101: define acronyms and new terms

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
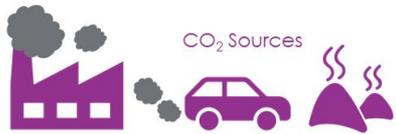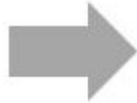
CO₂ Sources → CO₂ Emissions → Warming of Atmosphere → Extreme Heat, Extreme Precipitation, Rising Sea Level → Floods, Storms
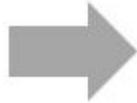
Richmond's Future Weather
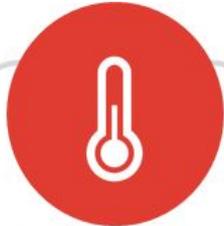
	Daily Temperature Maximum	Hot Days	Extended Heat Waves	Days with Over 1" Rainfall
2041-2060 Tomorrow	**75°F**	**45** Above 95°F	**20** 3-Day Periods	**8.8** Per year
1987-2017 Today	**70°F**	**11** Above 95°F	**3** 3-Day Periods	**8.3** Per year
1950-1980 Yesterday	**69°F**	**7** Above 95°F	**1** 3-Day Periods	**7.7** Per year
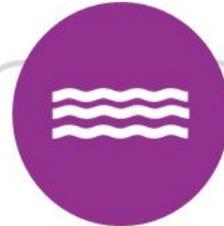
We're Already Seeing Impacts

April 19, 2017

BREAKING
allergy season in Richmond
This year brought Richmon
fourth-highest tree pollen c
in 30 years

By JOHN BOYER-Richmond Times-Dispatch Apr 19, 2017

February 13, 2017

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

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

since 1897

May 10, 2017

Science shows Richmon
season more intense th

POSTED 1:22 PM, MAY 10, 2017, BY TOM PATTON, UPDATED AT 02:11PM, 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.

Experts talk about extreme pollen

May 26, 2017

Two water rescues Fr
James, which is unde
warning much of the

September 17, 201

Remnants of Hurric
gave the Richmond
deadly tornado in 2

By JOHN BOYER Richmond Times-Dispatch Sep 17, 2018

October 19, 2018

Michael, Florence and
deadliest hurricane se

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

Storm clouds-
was ripped op

An enhanced satellite image from NOAA shows Hurricane Florence
THE ASSOCIATED PRESS

February 25, 2019

James River hits highest leve

POSTED 4:06 PM, FEBRUARY 25, 2019, BY WEB STAFF AND BRENDAN KING, UPDATED AT 10:43AM...

FACEBOOK   TWITTER

Parts of city under water
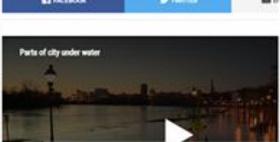
July 20, 2019

Excessive Heat Warning:
in some parts of Central

RICHMOND,

The river lev
time the river

August 5, 2019

'We haven't really seen anything lik
Richmond couple comes across flo
during walk

By: Nick Compliano

Posted: Aug 5, 2019 | 10:22 PM EDT / Updated: Aug 5, 2019 | 11:03 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 Oc
recorded in Richmond — and t
over

From staffreports   Oct 2, 2019

October 10, 2019

Drought expands across Virgin

POSTED 177 PM OCTOBER 10, 2019, BY MIKE STONE, UPDATED AT 2:08PM, OCTOBER 10, 2019

FACEBOOK   TWITTER   EMAIL

COASTAL FLOODING

WATER LEVELS
1 FOOT TO 2.5 FEET
ABOVE NORMAL

abc 8
NEWS

November 12, 2019

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

By JOHN BOYER Richmond Times-Dispatch 10 hrs ago

February 3, 2020

Early spring-like weather c
tracking chance of sprinkle

Rain becomes more likely Wednesday.

Posted: 12:51 PM, Feb-03, 2020   Updated: 9:19 AM, Feb-04, 2020

By: Zach Daniel

February 18, 2020

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

Temperatures this winter have been well above average in Virginia

RICHMOND, Va. -- The latest update from the U.S.
Virginia in a moderate drought. This is an increase

January 2020 was Earth's
January on record

The long-term trend of above-average temperatures

Climate Satellites | climate analyses and statistics

February 1
warmer Ja

Environme

April 30, 2020

After Richmond
months, the Ja
another mino

May 24, 2020

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

John Boyer May 24, 2020 1 2 min to read

July 20, 2020

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

By ELIZABETH BILL Richmond Dispatch Jul 20, 2020 1

July 29, 2020

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

John Boyer Jul 29, 2020 1 2 min to read

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

November 12, 2020

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

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.
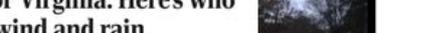
Why does this matter?

Climate Impacts

Extreme Heat
Extreme Precipitation
Rising Sea Level

Climate Shocks

Floods
Storms

Climate Change Risks

Residents
Safety
Health
Economic Burden
Food Insecurity

Community
Public Safety
Public Health
Physical Damage
Displacement

Government
Core Services
Public Safety
Financial/Credit Risk

Government
Education
Poverty Mitigation

Injury/death
Illness/chronic conditions
Property damage/loss
Displacement
High energy bills
Higher food prices/food unavailable

Loss of life
Critical emergency provisions
jeopardized (medical, water, food,
shelter, etc.)
Population displacement
Population loss

Service delivery delay/disruption
Transportation/infrastructure assets
damaged/destroyed
Communication networks impaired
Strain on financial resources

Schools closed/disrupted
Job disruption/loss
Property damage/loss

Why does this matter?

Impact of Climate Change on Human Health
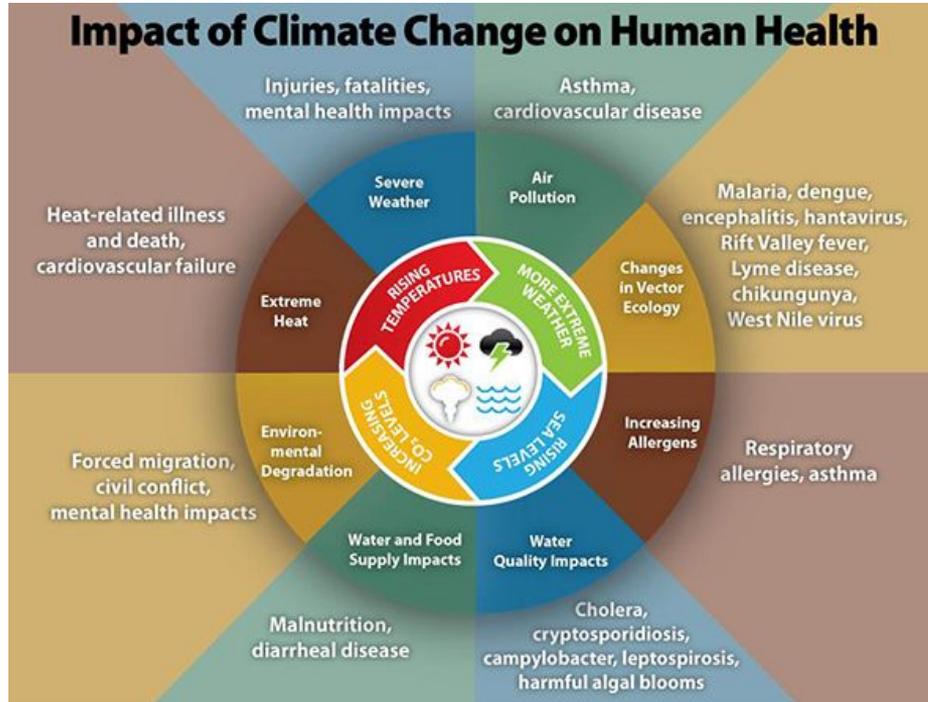
Richmond Times-Dispatch

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?	→	**What is at risk due to these impacts?**	→	**What are the vulnerabilities and risks?** *To answer we need to assess...*

Extreme heat

More frequent, intense, and longer heatwaves

More frequent and intense precipitation events

Localized and river flooding

People

Built assets

Natural resources

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

What are the impacts of climate change?	→	What is at risk due to these impacts?	→	What are the vulnerabilities and risks?

| Localized and river flooding | | Built assets | | **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?*
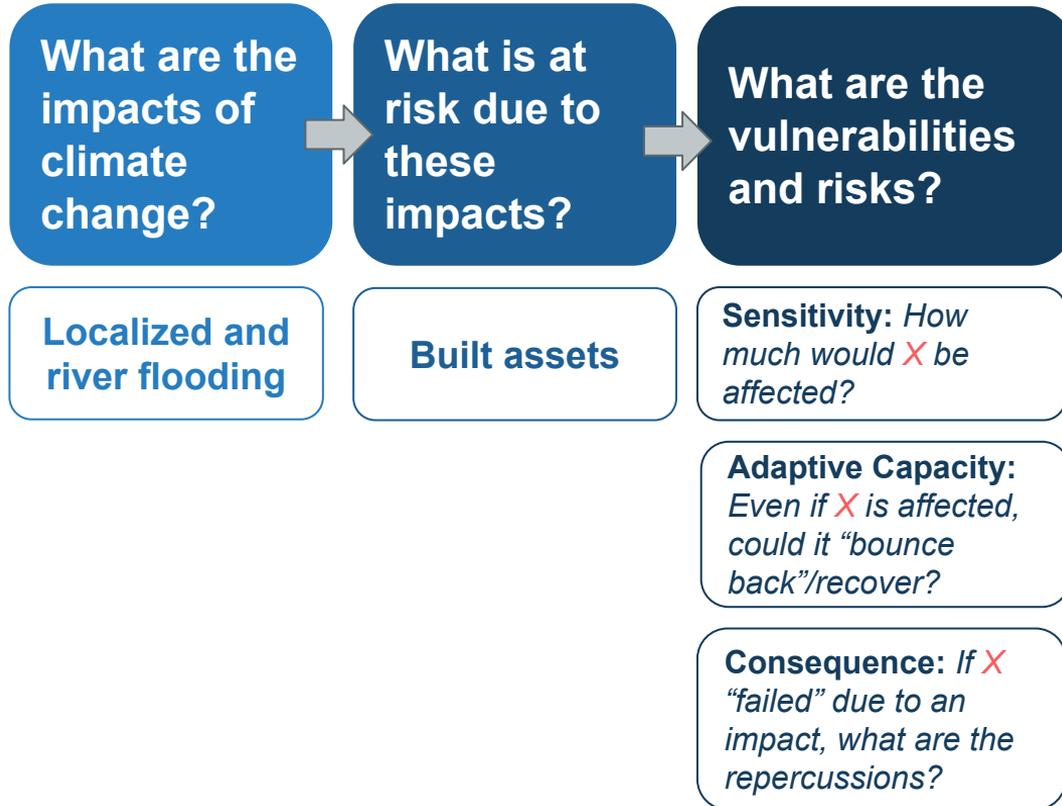
Ex: Amtrak stations

- *Building and facilities could be somewhat impacted depending on depth, intensity of flooding*

- *Probably need some sort of remediation if flooding occurs*

- *Potential moderate impacts to economic activities*
- *Probably lower impacts to public health, natural environment, and 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

Tools we'll use today

Your feedback tool: SurveyMonkey

Additional resources:
- Process and terms overview (sent via email)
- These slides
- Notetaker spreadsheet
- Asset and impacts maps

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

Vulnerability = Sensitivity x Adaptive Capacity
Risk = Probability x Consequence

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

But we need <u>your expertise</u> to assess the other elements of vulnerability...
- **Sensitivity**
- **Adaptive Capacity**
- **Consequence**

Looking at climate impacts over next 50+ years….
- **Heat Threats**
- **Water Threats**

For a series of asset groups: road, transit/rail, bike/pedestrian, and marine/air

Activity Goals

- **Key Goals**: Provide insight on…
  - Sensitivity and adaptive capacity of systems/assets to climate impacts
  - Level of consequence of <u>chronic stress</u> and <u>acute shocks</u>
  - Community <u>Vulnerabilities</u> and <u>Strengths</u>
  - Think about physical assets but also <u>people</u>

- **Additional Outcomes**:
  - Mutual knowledge exchange
  - Prioritize systems/assets to address with adaptation <u>strategies</u>
  - Identify potential <u>co-benefits</u> of adaptation
  - Identify key <u>actors</u> to address the risk
  - Think about how future planning and climate adaptation affects your work and your constituents

BREAK! (5 minutes)

Where we're going next: breakout groups

Breakout Group #1

Introductions

- Name
- Organization

Transportation Asset Types

Type	Description	Discussion (est.)
Road	**Roads:** Roads separated by class, as provided by City of Richmond GIS data **Alleys:** Alleys as provided by City of Richmond GIS data **Bridges:** Public bridges as recorded in the NBI database or 600,000 of the Nation's bridges located on public roads, including Interstate Highways, U.S. highways, State and county roads. **Parking Lots:** Parking lot locations as provided by City of Richmond GIS data	**15 minutes**
Transit/Rail	**Public Transit Stations (GRTC):** Greater Richmond Transit Company (GRTC) stations **Public Transit Routes (GRTC):** GRTC routes **Amtrak Stations:** Updated database of the Federal Railroad Administration's (FRA) Amtrak Station database. **Railroads and Railroad Bridges:** Railroad lines and bridges as provided by the Homeland Infrastructure Foundation-Level Data (HIFLD).	**15 minutes**
Bike & Pedestrian	**Bike Infrastructure:** Bike trails and lanes as provided by City of Richmond GIS data **Bikeshare Stations:** Bikeshare stations operating as of January 2019 **Pedestrian Infrastructure:** Sidewalks, ramps, and other pedestrian infrastructure as provided by City of Richmond GIS **Trails:** Multipurpose, biking, and hiking trails as provided by City of Richmond GIS data	**15 minutes**
Marine	Port of Richmond / Richmond Deepwater Terminal	**10 minutes**
Air	Richmond International Airport, operated by Capital Region Airport Commission (CRAC)	**10 minutes**

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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 treat (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 treat (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
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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?

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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

Breakout Group #2

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PARKING LOT

Leave breakout groups

Reflection
IF TIME ALLOWS

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: Thursday, February 4 @ 1pm
- 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?