Extreme Precipitation

Participant Workbook

Name: **Table #:**

Notes

Stakeholders

Gabriel - Soybean Farmer

- Extreme rainfall followed by drought leads to a smaller crop yield
- Rain causes soil erosion and runoff into nearby river
- Concerned about new equipment costs

Ray - Director of Community Health

- Concerned about health problems related to extreme precipitation like bacteria and mold
- Thinks safety should be top concern in the city's resilience plan

Denise - University Professor

- Not an expert on climate science but has been reading about current trends
- Thinks the city should focus on investing in emergency response because of the unpredictability of weather

Stakeholders

Lin - City Planner

- Wants to create safer neighborhoods
- Thinking about what a growing population will mean for the environment
- Worried about getting the public on board with a costly and disruptive sewer system upgrade

Anna - Historian

- Concerned about historic burial mounds located next to the river in the floodplain
- Extreme precipitation could cause the river to flood
- Worried that this historic place will not be considered in the resilience planning process

Maria - Floodplain Resident

- Mother with a young family
- Lives in an affordable neighborhood
- Concerned about flooding on the roads affecting transportation

Resilience

KEEP IT OUT

Keep It Out involves improving water management systems through actions such as separating sewer systems, updating the local wastewater treatment plant, building stormwater basins, and protecting public transit systems.

ECONOMIC ★½

Sewer separation is costly and extremely inconvenient for older cities, likely costing billions of dollars and causing widespread disruption. Replacing aging infrastructure and removing dams is also expensive. Retrofit projects, such as barriers to protect water from entering subway tunnels, are a cost-effective management option but are only a temporary solution.

SOAK IT UP

Soak it up involves creating solutions to increase water drainage by using the earth's natural resilience capabilities. These strategies include vegetative solutions such as green roofs and rain gardens, as well as using porous pavement to allow water to filter into the ground.

ECONOMIC ★★★★

Green infrastructure is cost effective and has the potential to attract residents and businesses to an area due to its aesthetic quality. New building projects such as constructing roads and sidewalks with porous pavement may create jobs.

INFORM THE PUBLIC

Inform the Public involves enhancing public safety, communication, and knowledge about extreme precipitation events. This means keeping the power on so that communities are not isolated, as well as making sure the public is educated about the risks and knows where to go in case of an emergency.

ECONOMIC ★★★

Damage to electricity systems is costly to repair, and burying lines is expensive and makes lines difficult to access if there is a problem. However, there is little to no cost to implement shelter and education programs but a large benefit from preventing loss of life.

Strategies

ENVIRONMENTAL ★★★★

Protecting wastewater treatment plants makes it less likely for plants to flood during storm events, preventing pollution from entering waterways. Stormwater management also helps prevent nutrient pollution, which leads to unwanted consequences such as algal blooms and fish kills.

SOCIAL ★★★★

Even though construction of stormwater management systems is disruptive, separating sewer systems prevents wastewater from entering homes and buildings, protecting residents from pathogens and mold. If built strategically, recreation can be incorporated into stormwater management strategies, like allowing outdoor theaters to collect water during a flood.

ENVIRONMENTAL ★★★★★

Green infrastructure reduces runoff into waterbodies and treats runoff water by filtering pollutants. At the same time, it allows nutrients to be recycled and taken up by plants, leading to increased plant growth. In addition to helping absorb excess water during extreme rainfall events, green infrastructure can help lower carbon emissions, increase oxygen production, and lower urban heat.

SOCIAL ★★★½

Parks, green roofs, and rain gardens create opportunities for recreational space. This strategy also avoids the disruptive construction that comes with installing larger storm pipes. Some of the potential hazards from increased vegetation include infectious pathogens carried via rodents, ticks and mosquitoes, as well as increased pollen allergens.

ENVIRONMENTAL ⊘

Inform the public has little to no measurable environmental impact. A problem may result from managing trees or burying power lines, which could disrupt habitats and cause damage to tree roots.

SOCIAL ★★★★★

Protecting or relocating power and communication lines protects residents by keeping them connected to one another. When combined with education, this improved communication helps to keep people informed about the risks of extreme precipitation so they can remain safe. Additionally, refuge centers provide shelter, safety, and protection for people during storms.

Resilience Plans

KEEP IT OUT

Plan A

- To reduce overflows of untreated wastewater by 95%, the city will replace half of the combined sewer system pipes and update the wastewater treatment plant - investing $5 billion in construction costs over the next 25 years.
- The city will also prepare for future flooding events by installing emergency covers for public transportation station entrances.
- This billion-dollar project will allow for quick and complete coverage of each vulnerable station entrance, allowing the stations to remain dry and functional for use immediately after a storm.

Plan B

- The city cannot currently afford to invest in expensive long term projects.
- The city has invested $4.5 million in building a water plaza for the city. A water plaza can serve as a space to play sports, eat lunch, and relax when it's dry, but will catch stormwater and act as a water basin during an extreme rain event.
- To protect their public transportation tunnels, the city is planning a $30 million project to raise the tunnel vents located in floodplains above ground level to prevent inundation.

Resilience Plans

SOAK IT UP

Plan A

- The city has initiated a $2.5 billion green infrastructure project to prevent sewer overflows and excessive storm water runoff.
- The project will replace unnecessary “grey infrastructure” with new “green” options that slow and filter stormwater.
- Planters will be built around stormwater drains, rain gardens created along buildings, and green roofs installed. The city will also replace asphalt paving with porous pavement.
- Green infrastructure tends to last longer than typical grey infrastructure, can reduce energy costs in the long run, and helps to clean up the river.

Plan B

- The city has initiated a $15 million incentive program that issues grants and tax breaks to private property owners that integrate green infrastructure on their properties.
- Homeowners can apply for grants to design and build rain gardens, purchase rain barrels, and build flow-through planters.
- Businesses can also apply for funding to build green roofs and rain gardens, and purchase cisterns to limit the amount of stormwater runoff from the mostly impervious concrete buildings and surroundings.

Resilience Plans

INFORM THE PUBLIC

Plan A

- To keep the city's power on during unpredictable storms, the city will invest $1 billion to move vulnerable powerlines underground, raise vulnerable switchboards above the floodplain, and improve the system to include more repetition.
- The city will spend an additional $200,000 to update the emergency notification system to reach more people in more languages to make sure people can prepare and head to safety if needed. It will also designate more buildings as storm shelters throughout the city.

Plan B

- To keep costs low, the city has decided to create microgrids for hospitals, homeless shelters, and schools. These microgrids will disconnect from the larger power grid and run on a separate power source during a storm, which allows the buildings to continue running properly if a power outage occurs.
- The city will also set up an emergency alert system that sends alerts in multiple languages to cell phones and start a public safety campaign that explains how to remain safe during extreme precipitation events, including when to evacuate and where to go if an evacuation is needed. All of these updates will cost just over $20 million.

My Resilience Plan 1

KEEP IT OUT	SOAK IT UP	INFORM THE PUBLIC
Plan A	Plan A	Plan A
$ $	$ $	$ $
Plan B	Plan B	Plan B
$	$	$

What resilience plan would you make for Rivertown? Why did you choose this plan?

Mark the empty coin spaces to choose a plan. Remember you only have three coins and can't use all three on one strategy!

My Resilience Plan 2

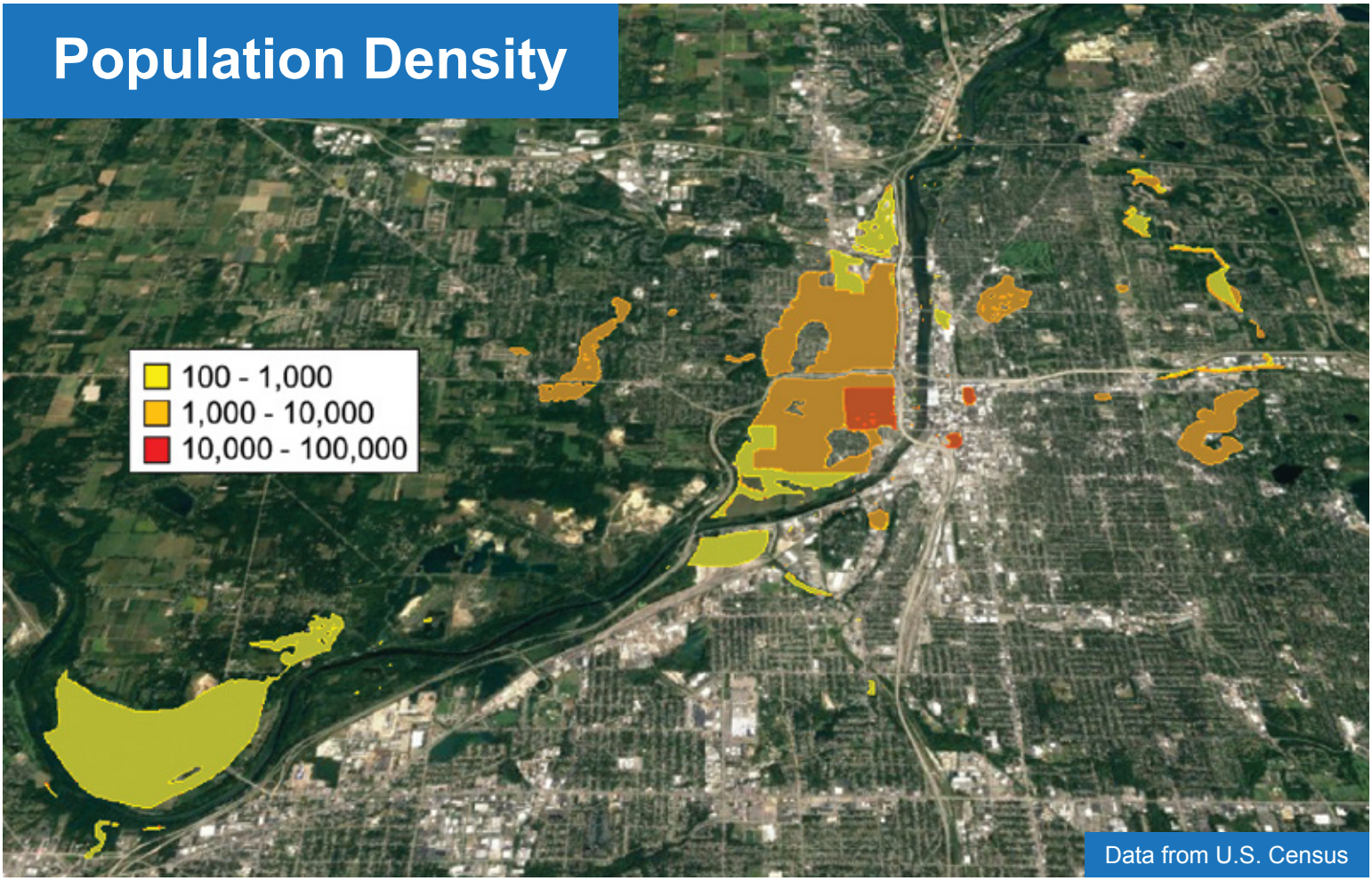
KEEP IT OUT	SOAK IT UP	INFORM THE PUBLIC
Plan A	Plan A	Plan A
$ $	$ $	$ $
Plan B	Plan B	Plan B
$	$	$

What resilience plan would you make for Rivertown? Why did you choose this plan?

Mark the empty coin spaces to choose a plan. Remember you only have three coins and can't use all three on one strategy!

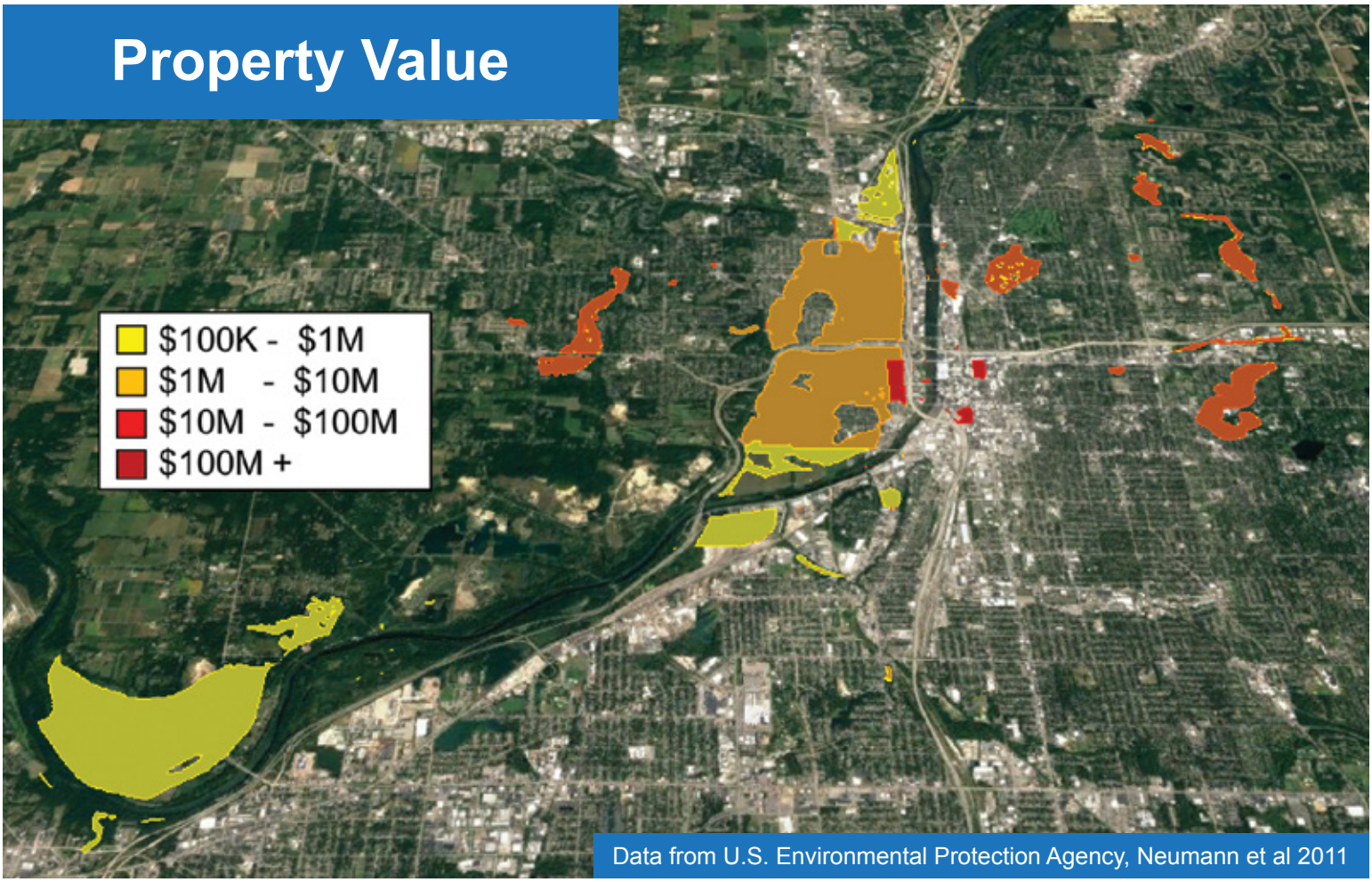
What would you change about this plan? Are there specific resilience actions you would like to add or remove?

Population Density



Data from U.S. Census

Property Value



Data from U.S. Environmental Protection Agency, Neumann et al 2011

Rivertown

Museum of Science

NOAA

ASU
Arizona State University

Northeastern University