Land Use and Infrastructure Planning in a Changing Climate: Integrating Regional Climate Information with Local Policies

The Climate IMPACTs Decision Support Tool

CIMPACT-DST™

Spencer Reeder – Cascadia Consulting Group

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SE Florida Regional Compact
Climate Leadership Summit
December 2012

Hoboken

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that is not en

predicated on the past.

Rockaways_Sandy_Disaster_MDPNY_33

Hurricane Sandy Destruction, Photographed November 3, 2012, Rockaways, NYC.

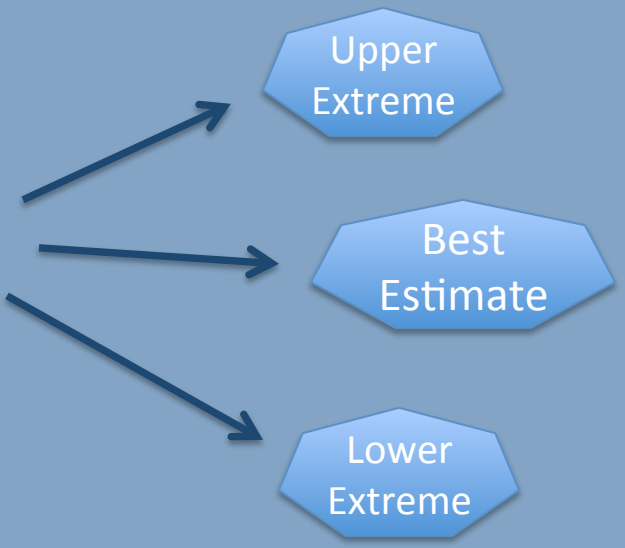
"We're seeing a one-hundred year storm every two years."

-NY Governor Mario Cuomo

Key Challenge

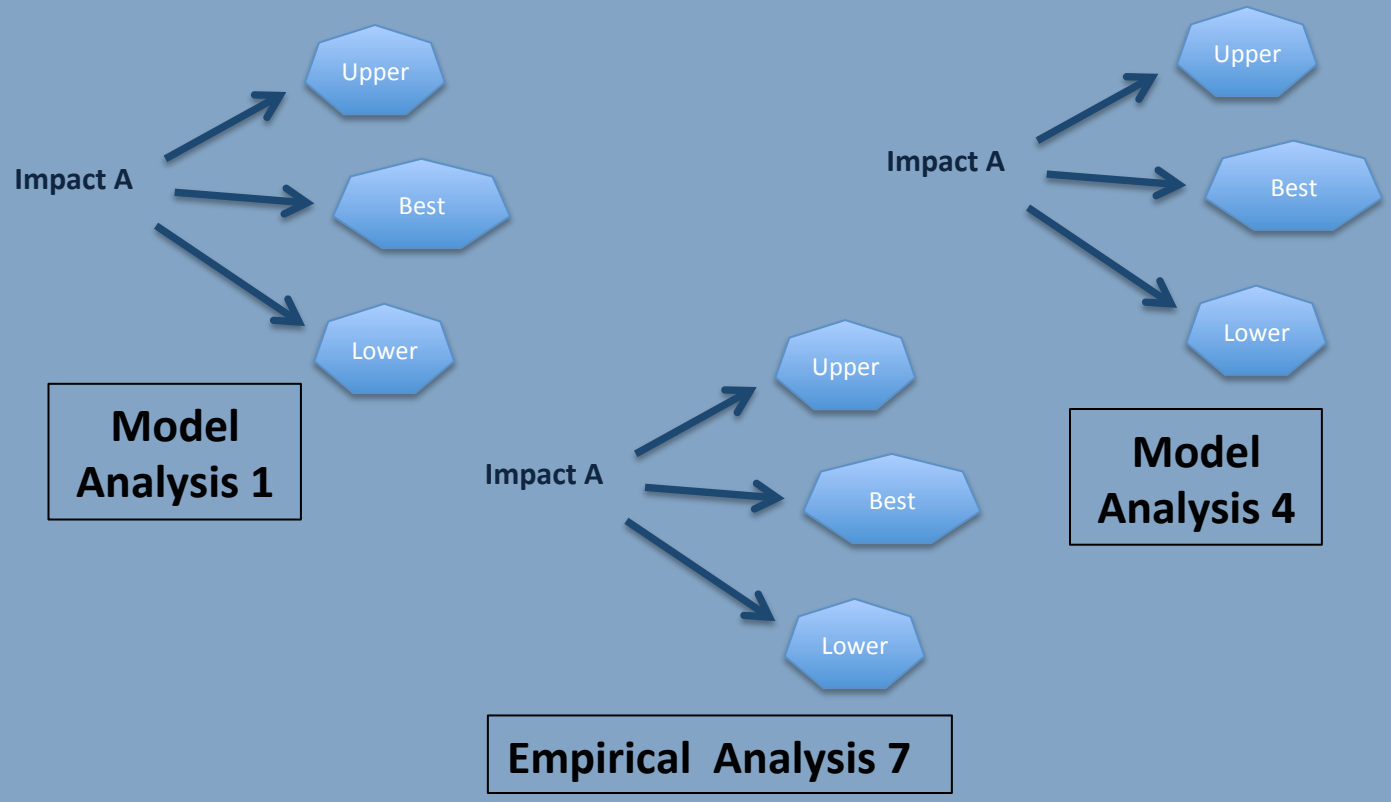
What Most Decision Makers Want:

Impact A



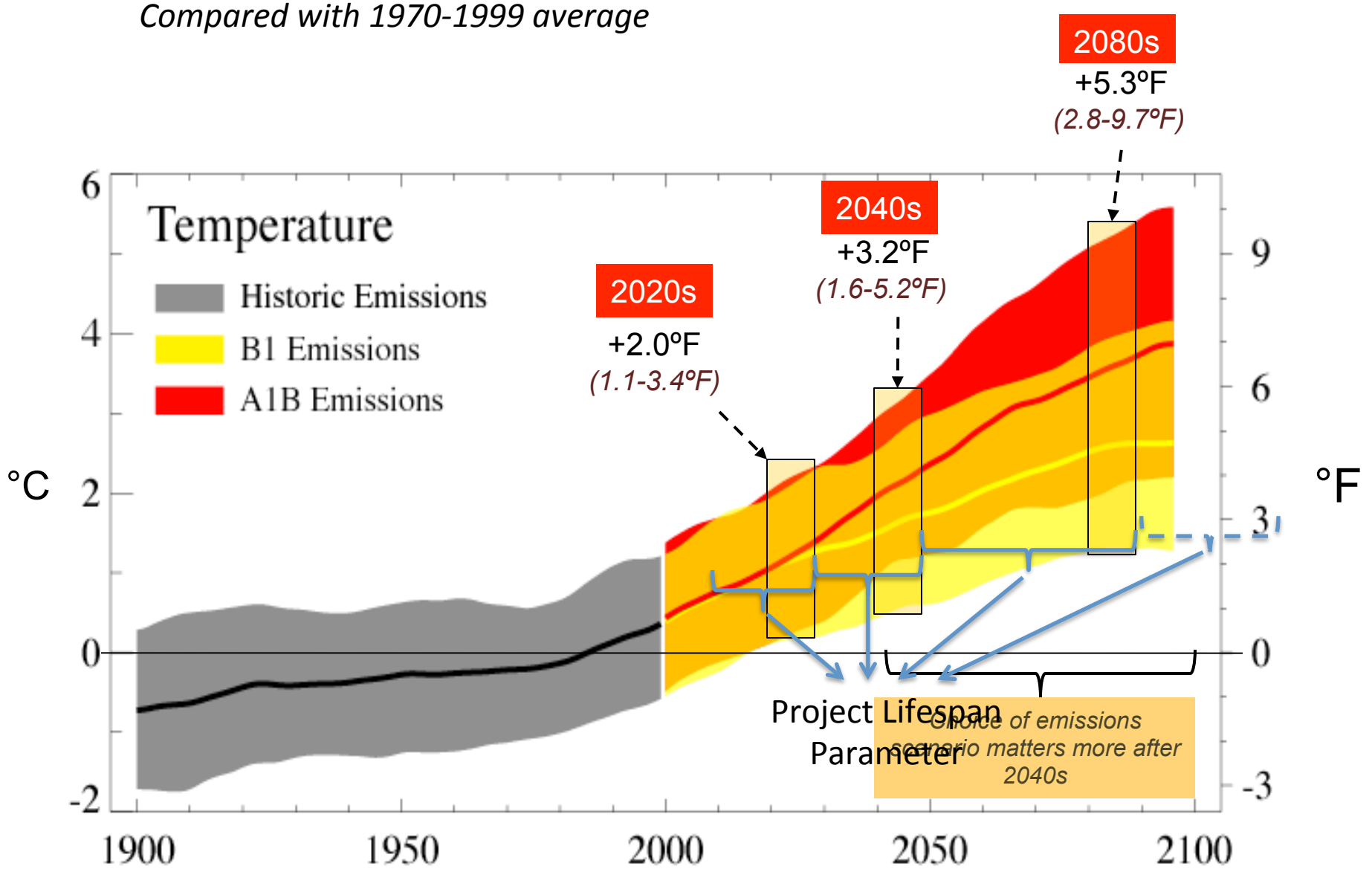
Year X, Y, Z

What Science Often Produces:



Projected Increases in Annual Temperature

Compared with 1970-1999 average

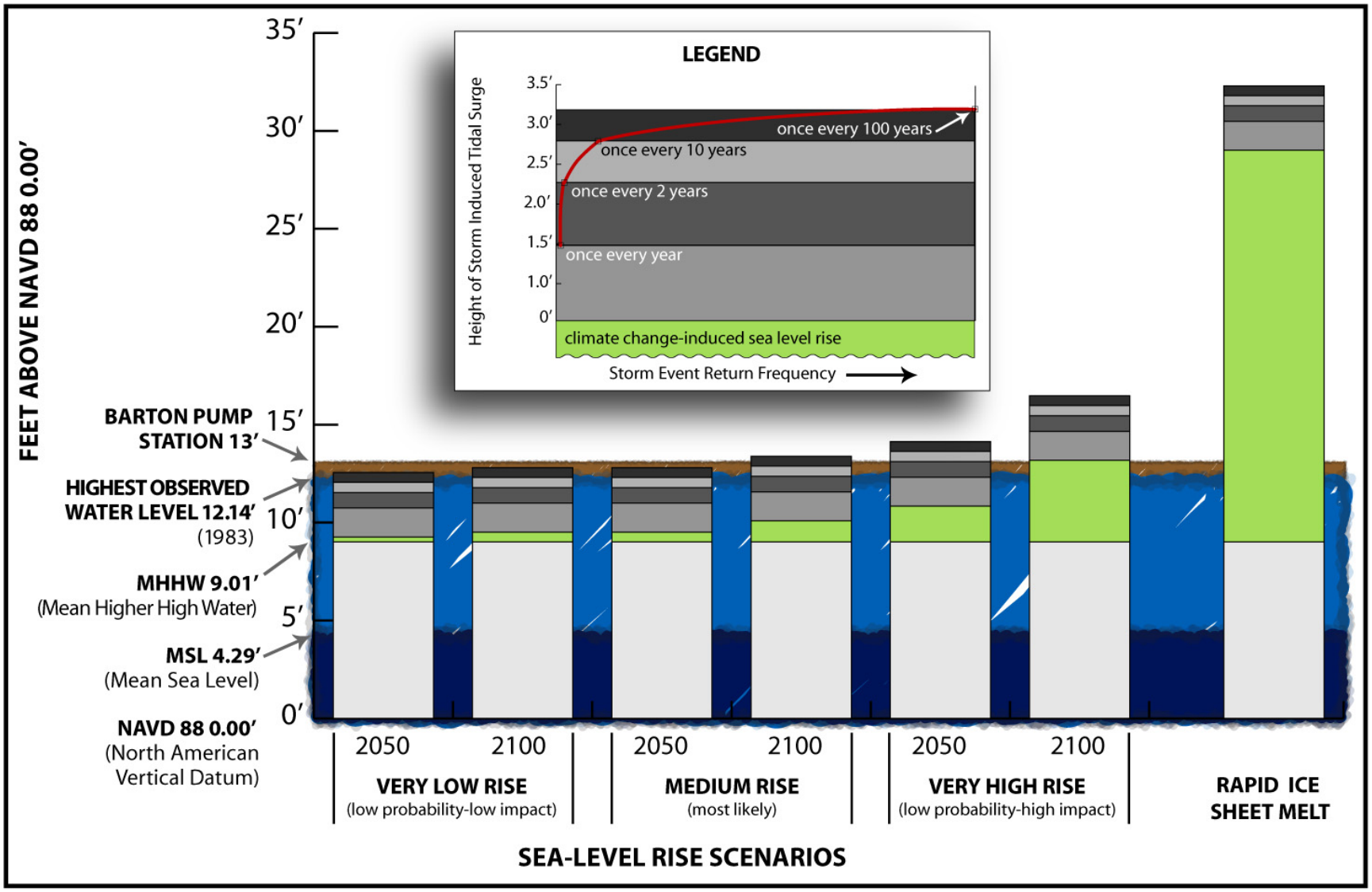


Climate Impacts Group 2009, Ch. 1

Cities can be HOT

NASA infrared Sacramento (1998)

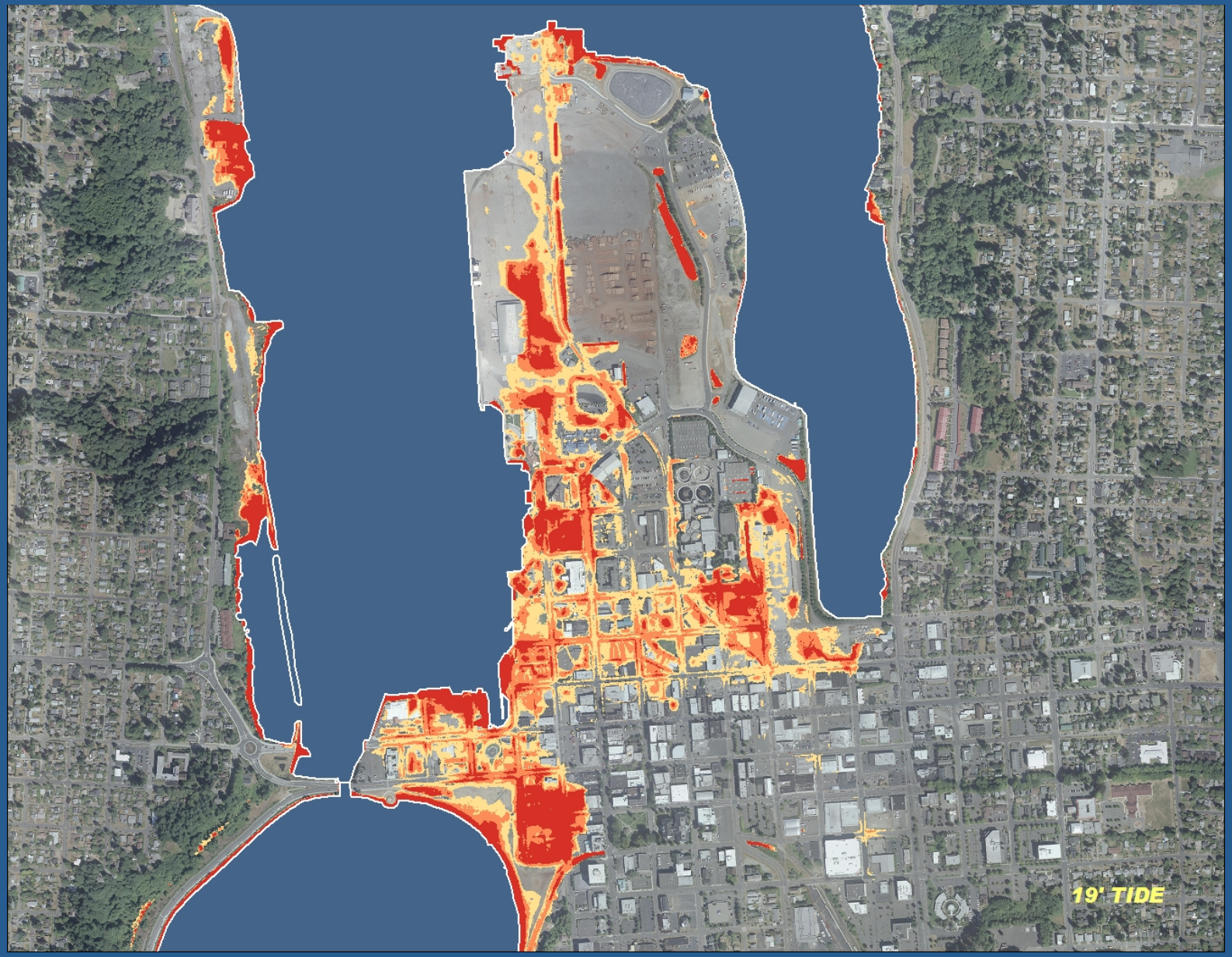
Image: NASA/Marshall Space Flight Center



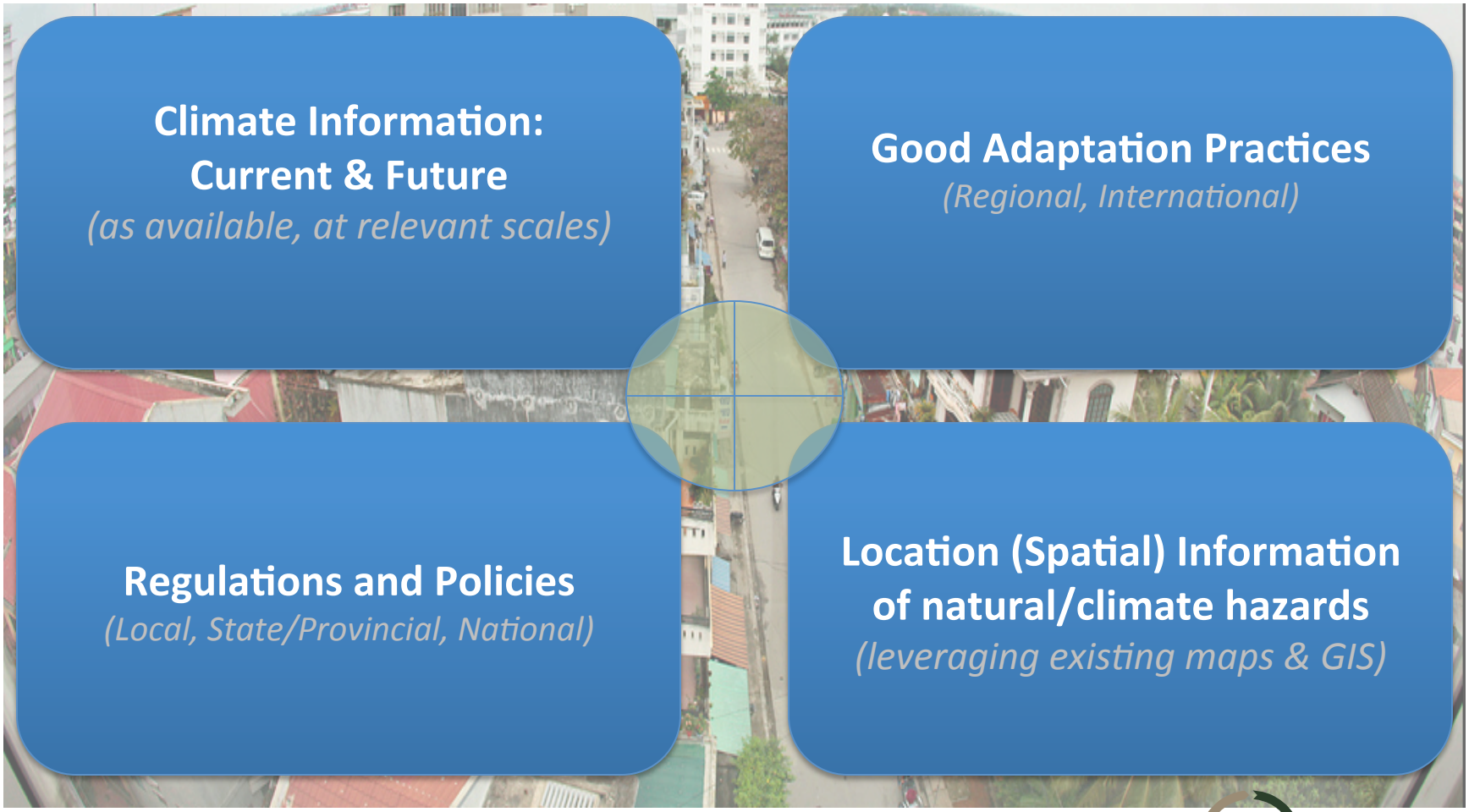
King County

Produced by King County DNRP, WLRD, GIS Visual Comm & Web Unit File name 0802_SLR_VF_TM_RGB bh

Projection: 13” Increase in Sea Level



Integrating Key Factors in the CIMPACT-DST



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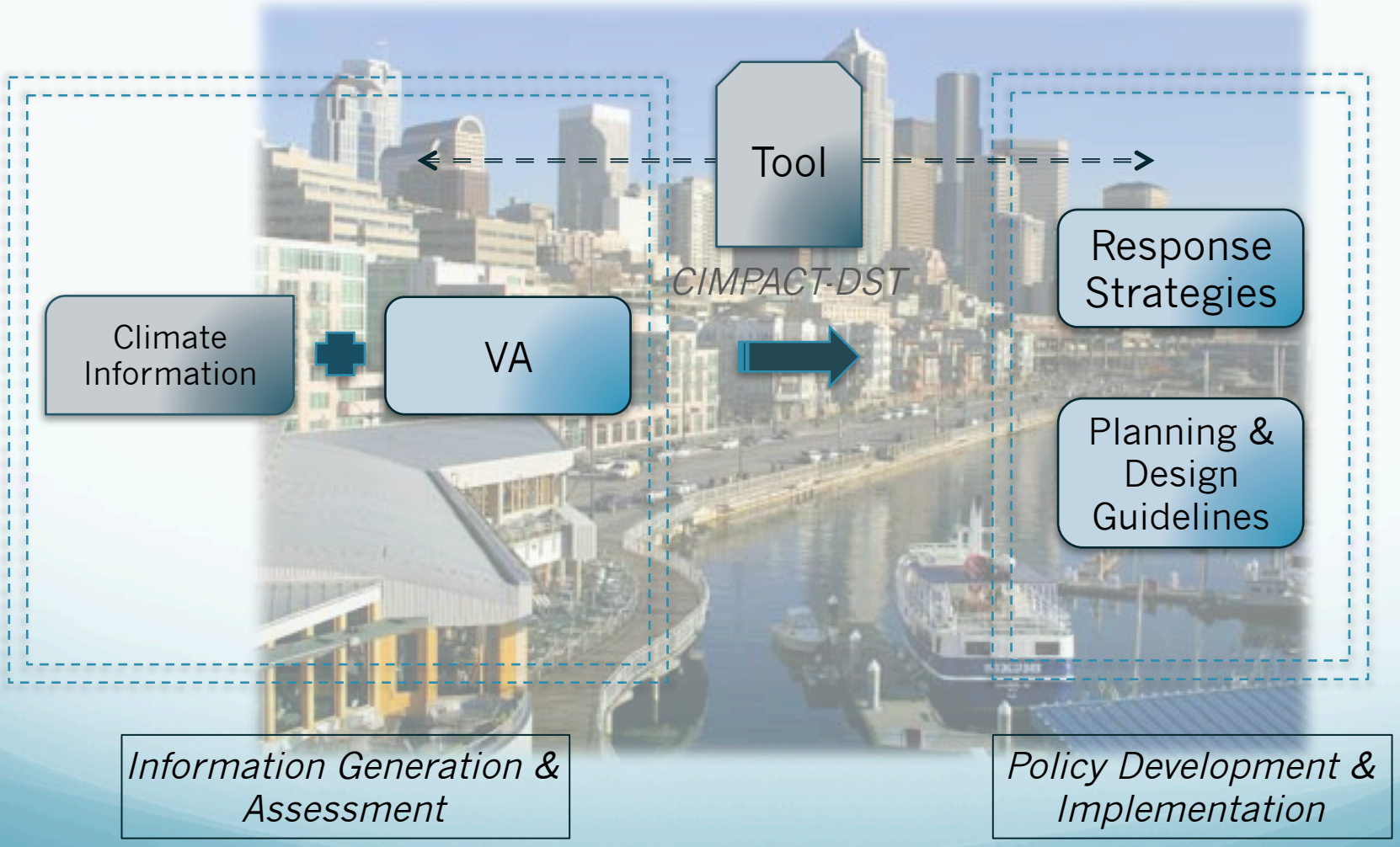
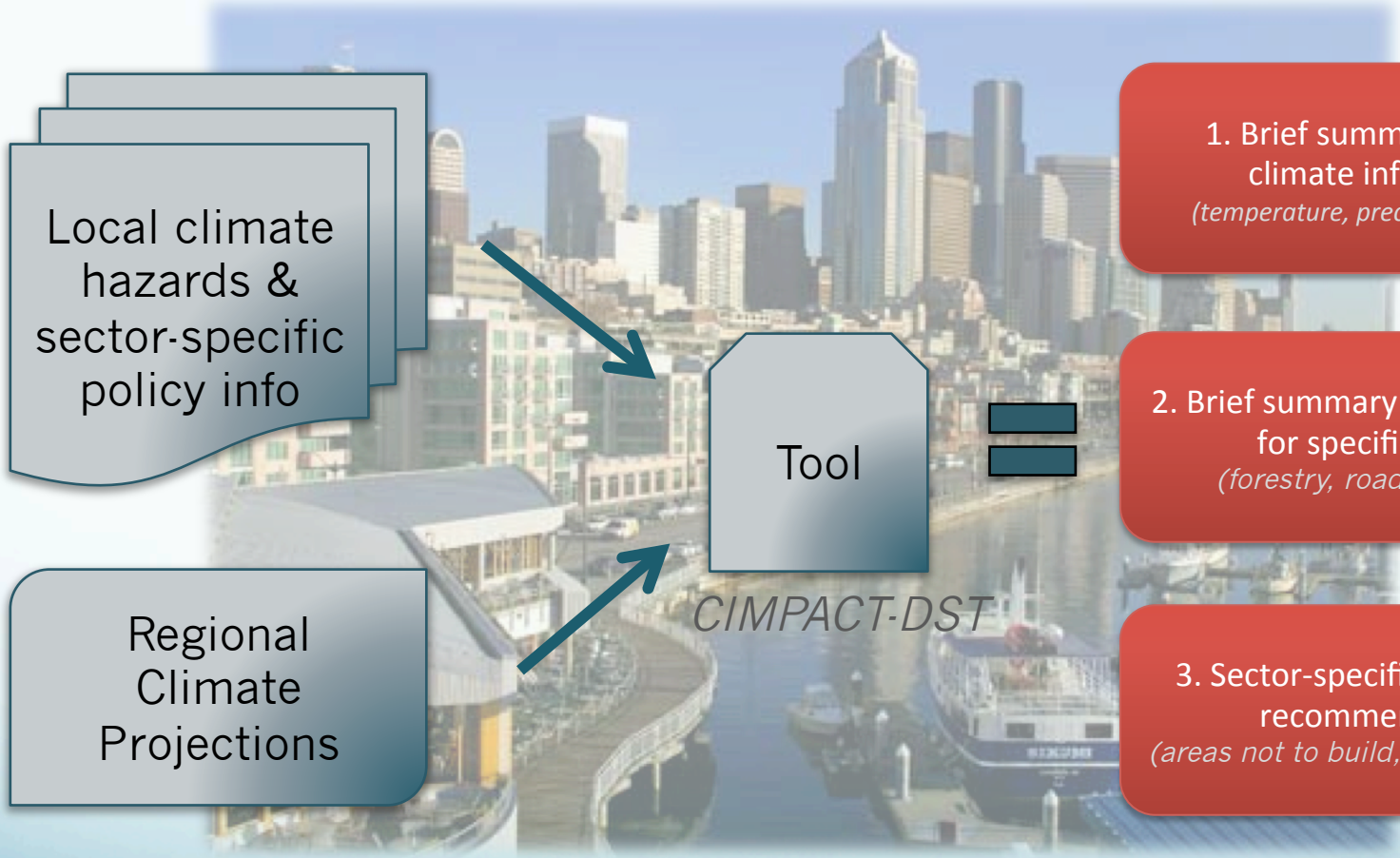
How the Tool fits in the overall process



Tool Overview



INPUTS

OUTPUTS

The State of Washington, USA

Impacts on Washington's natural and human environments

Primary Impacts translating to Downstream Impacts

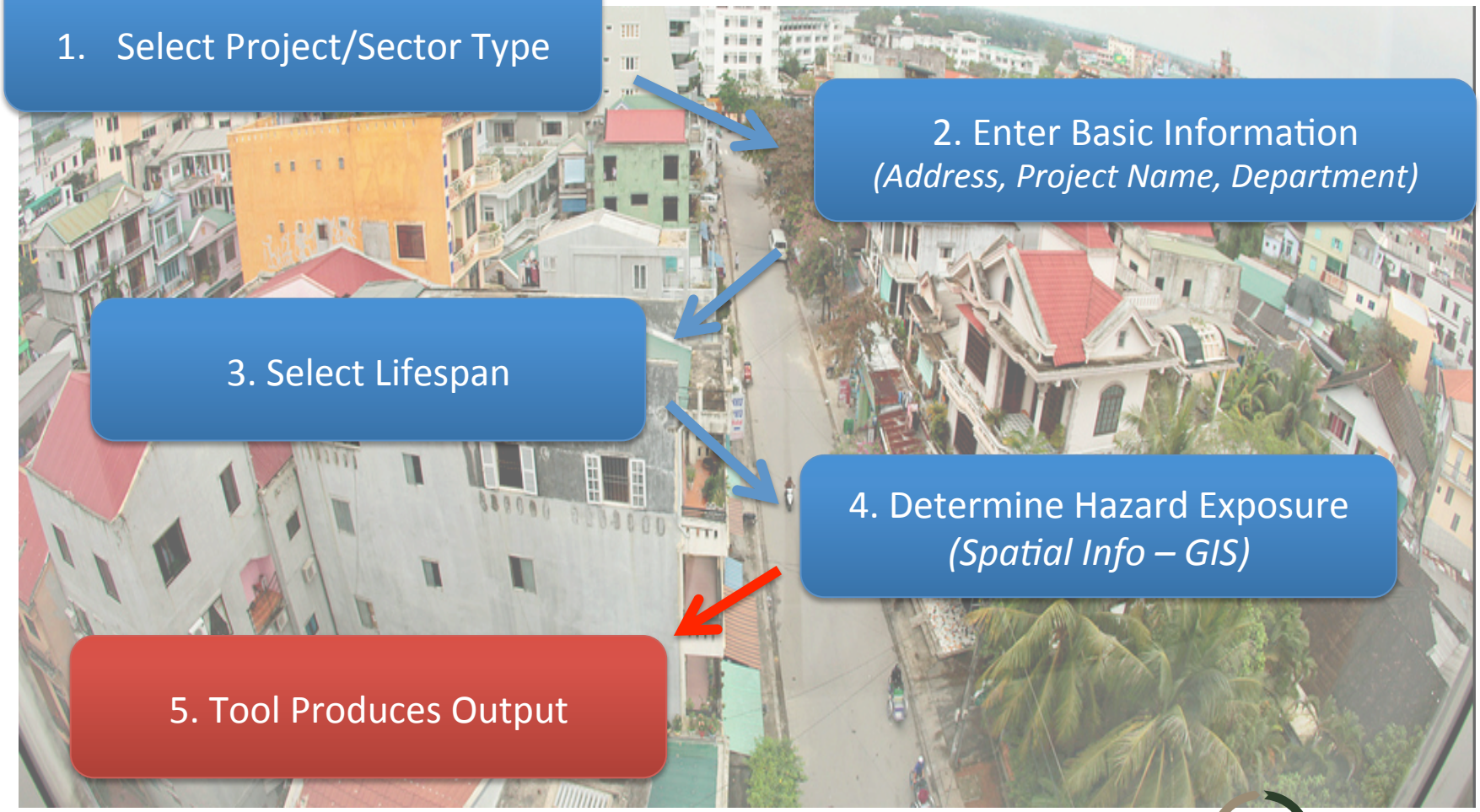
Sea Level Rise

Ecosystems & Species
- Marine & coastal ecosystems
- Salmon and other species
- Aquaculture

Human Health
- Injury/safety
- Coastal drinking water supply

Communities
- Transportation infrastructure
- Coastal infrastructure (e.g., bulkheads)
- Recreation & tourism
- Ports, harbors & shipping
- Homes & building
- Communications infrastructure
- Urban flooding/ stormwater

Using the Tool: Overview



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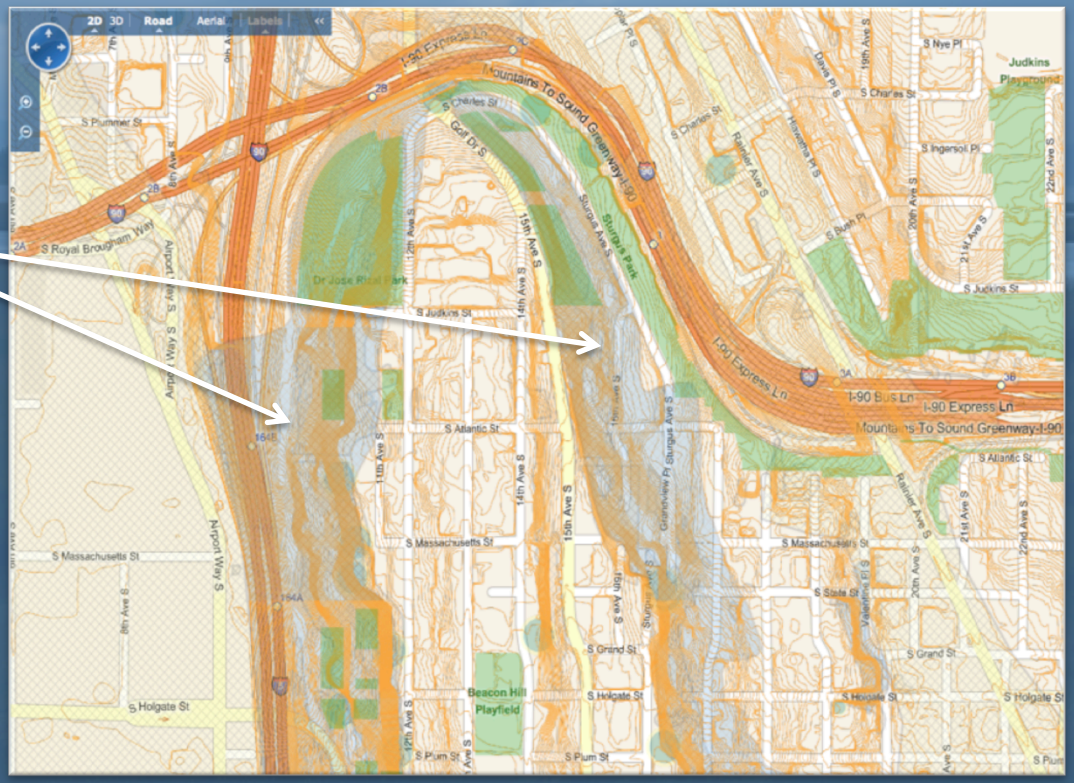
Hazard Locations identified with City's mapping resources (e.g., GIS)

Flood prone areas



Climate impacts table (Seattle, USA)

Projected Range of Climate Impacts (Full range representing B1 & A1B emissions scenarios)			
Project Lifespan	**Temperature Increase**	**Sea Level Rise**	**Changes in Precipitation & Streamflow**
up to 2030	+1.1°F to +3.3°F annual average temperature increase during the 2020s.	+2 to +13 inches by 2030. Extreme tides and storm events can add an additional 1 to 3+ feet to marine water levels.	-9% to +12% change in annual precipitation during the 2020s.
up to 2050	+1.5°F to +5.2°F annual average temperature increase during the 2040s.	+3 to +22 inches by 2050. Extreme tides and storm events can add an additional 1 to 3+ feet to marine water levels.	-11% to +12% change in annual precipitation during the 2040s.
up to 2090	+2.8°F to +9.7°F annual average temperature increase during the 2080s.	+6 to +46 inches by 2090. Extreme tides and storm events can add an additional 1 to 3+ feet to marine water levels.	-10% to +20% change in annual precipitation during the 2080s.

Functional Overview

Project Factors

Type
- Bridge
- Building (new/remodel)
- Drainage System
- Electricity Distribution
- Park/Open Space
- Right-of-Way

Lifespan
- Up to 2030
- Up to 2050
- Up to 2090
- Beyond 2090

Hazard Zone
- Flood Zone
- Landslide
- Sea Level Rise

Climate Factors

Primary Impacts
- Temperature
- Sea Level Rise
- Precipitation

Secondary Impacts
- Thermal Loads/Stress
- Erosion/Landslides
- Flooding
- Etc. ….

Outputs
Overview
Impact Range
Guidance

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Huế Climate Impacts Planning Tool

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Impacts to the city's physical environment resulting from a changing climate will pose challenges for capital projects. The **Climate Impacts Planning Tool** will assist you in identifying key factors to be considered in the design and implementation of a project. It will also provide information and guidance on assessing risk and possible adaptation strategies.

System Requirements: Windows Excel 2007/2010, macro-enabled.

Note: For projects whose overall budget exceeds $5 million, a more detailed business case analysis should be used.

Enter information about your project and select from the drop-down menus. The climate impact buttons and map below show where in the city significant impacts are expected. Please allow 10-20 minutes to complete the Climate Impacts Planning Tool. Click the ? icons for help.

Project name:
(enter project name)

Site street address: ?
(enter site address, if known)

City department:
(select City department)

Project type: ?
(select project type)

Continue

Zoom to Fit Page
Zoom In
Clear All Project Inputs
Clear Selections on This Page

Climate Impacts

Higher Temperatures
Sea Level Rise
Precipitation & Streamflow

Climate Impact Overview:

For an overview of each of the three climate impact categories (Temperature, Sea Level Rise, or Precipitation & Streamflow), click on the corresponding button above.

ProjectType | ProjectInfo | Temperature | SeaLevelRise | Precip&Stream - Flooding | Precip&Stream - Landslide | Summary | Tables | Lists

AdaptationTool_BETA_v3b1 - Microsoft Excel

Temperature Impacts

New City Hall Building, 123 Main Street

Project Type • Building - new

Projected Impacts & Exposure

Projected Range of Impact

+1.1°F to +3.3°F annual average temperature increase during the 2020s.

Summer temperatures during the 2020s are expected to increase an average of +3.1°F (+1.1°F to +4.2°F).

Winter temperatures during the 2020s are expected to increase an average of +2.2°F (+0.8°F to +3.1°F).

Potential Exposure - Temperature

LOW potential exposure to increased thermal stress for this project. However, an increase in the number of isolated heat waves is expected.

Sensitivity

Project Sensitivity

(select sensitivity)

Other factors to consider in determining sensitivity:

When determining the sensitivity of your project to each climate impact, it is also worth considering the related financial, environmental, and social consequences. The example questions listed below can assist as you determine how sensitive your project might be to higher temperatures, sea level rise, and changes in precipitation and seasonal streamflow.

Financial:

- What is the cost tradeoff of a design improvement or modification now versus a retrofit later?
- Is a retrofit possible, or will complete re-design or replacement be required?

Environmental:

- How might the project's design, subjected to future climate conditions, affect nearby ecosystems?

Human Health and Social Justice:

- If the project does not adequately accomodate future climate conditions, how might this affect under-served communities or at-risk segments of the population, like the very young or elderly?

Impact Overview

- Minor changes in performance and lifespan of surface materials.
- Undersized HVAC systems likely to have increasing difficulty cooling buildings in summer.
- Increased heat stress on surrounding vegetation likely in summer.

Guidance Information

- Review materials selection criteria to ensure they are appropriate for the projected future temperature range. Careful attention to the surface properties of materials (e.g., roofing material, windows, pavements), landscape design, and placement of vegetation can have a profound effect on building thermal performance and a significant impact on the surrounding urban heat island intensity.
- Ensure that electrical system components, especially those related to the HVAC system, are rated for projected future temperature range.

This information generated collaboratively with local partners

< BACK | CONTINUE > | GO TO OVERALL SUMMARY

Primary Objective -> User-friendly, rapid assessment; provide information & guidance

Phases of Seattle Project:

1. Departmental
2. Synthesize loc
3. Vulnerability a
4. Craft candidat
5. Evaluation of a
6. Integrate abov
7. Internal outre

Departmental Interviews

- City Light (Electricity Provider)
- Dept. of Planning & Development
- Dept. of Transportation
- Fleets & Facilities Dept.
- Parks & Recreation
- Seattle Center (Public Events Assets)
- Seattle Public Utilities

- Solicited representative project types
- Gathered climate impact concerns
- Captured existing planning processes & tools

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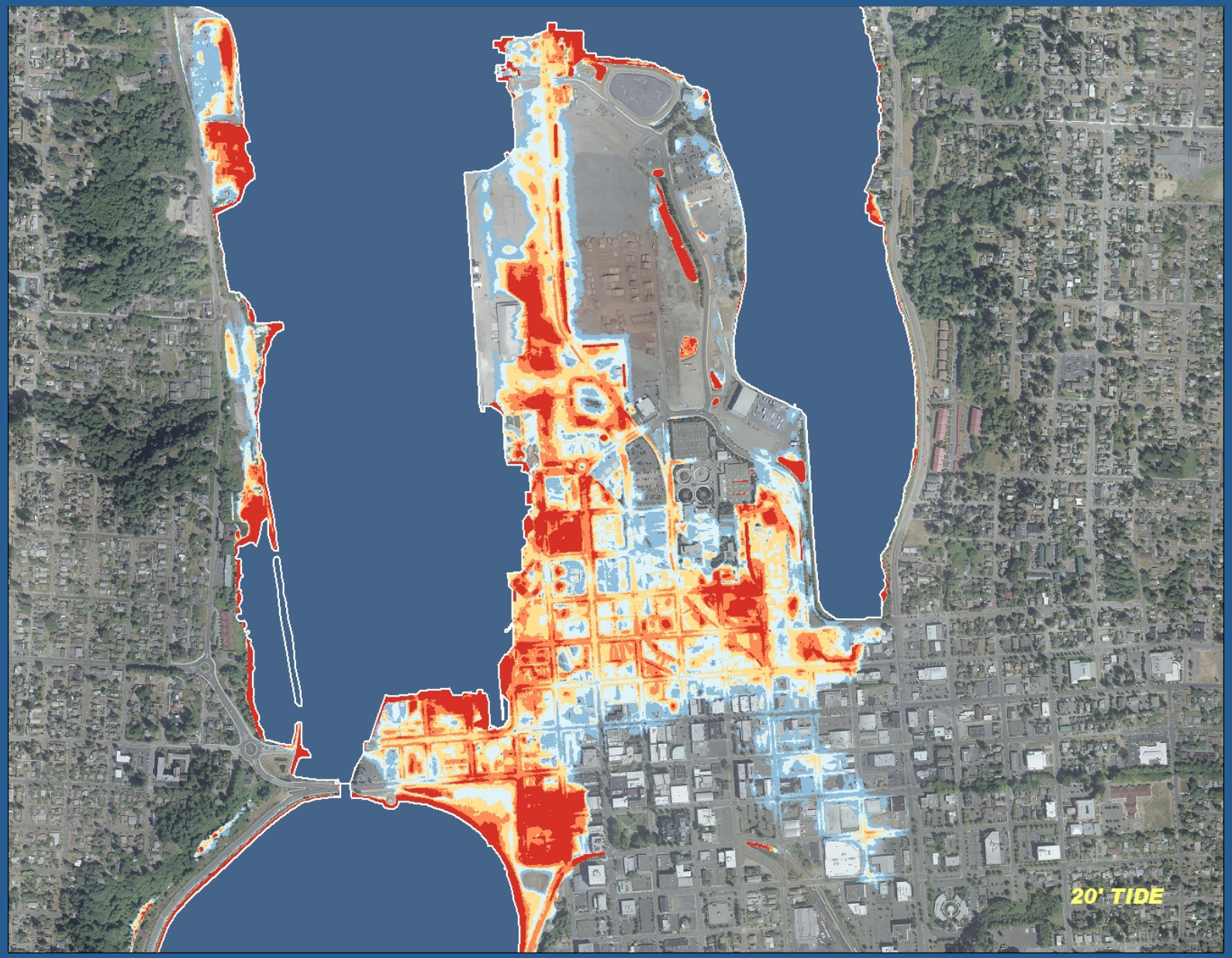
Seattle Project Status

- Deploying the tool as part of an effort to integrate climate change adaptation into city planning & project design
- Influenced bridge design on drawbridge project

- <u>Achievements:</u>
  - Building internal **awareness** with City staff
  - **Increasing the resilience** of a variety of projects (e.g., bridge design, City facility site selection)
  - Integrating tool into current City project design processes

City of Olympia – Extreme High Tide + 22” Increase



City of Olympia: Near-Term Responses

- Raise floor elevations of new buildings
- Consolidate stormwater outfalls; reduce avenues for marine water to flow into downtown
- Prepare for tidal gate and pump installations
- Heighten shorelines
- Monitor hot spots and tides

Project Type: Electricity distribution/transmission

New Power Lines, Vo Thi Sau

Enter information about your project. Use the map link below on the right to obtain the necessary location information about the project's proximity to climate impact hazard zones. This information is needed for three of the dropdown menus on the left side of the page.

Expected lifespan of project:

(select lifespan)

- (select lifespan)
- up to 2030
- up to 2050
- up to 2090
- beyond 2090

Drainage Zone

(select zone)

Vulnerable Population Zone:

(select zone)

Back

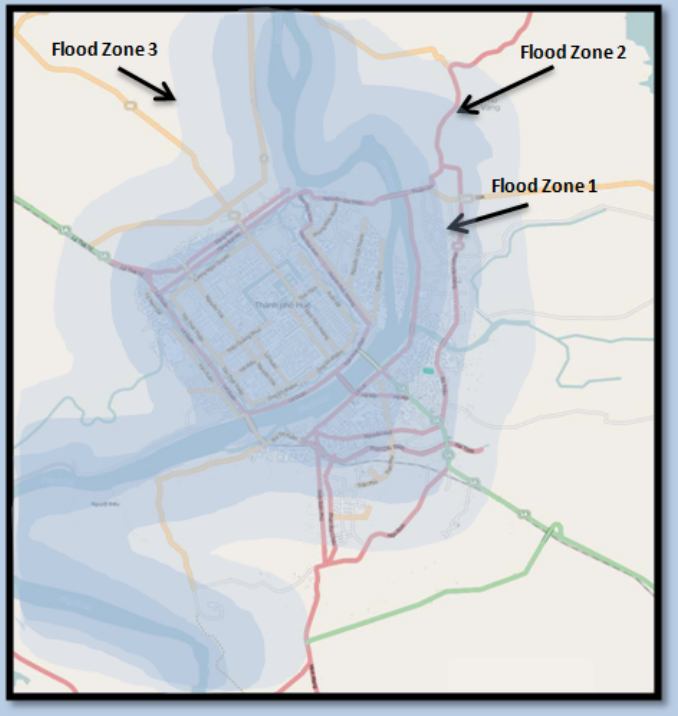
Continue

Zoom to Fit Page

Zoom In

Clear All Project Inputs

Clear Selections on This Page



Flood Zone Map

Drainage Zone Map

Vulnerable Population Zone Map

Use the link on the left to view the critical areas maps. These maps will help you identify whether your project is in a climate impact hazard zone.

Using the Tool: Basic Steps

1. Select Project or Sector

- Bridge
- **Building** (new/**remodel**)
- Water System Component
- Electricity System
- Park/Green Space
- Roads (new/repair)

2. Enter Basic Information: *Project Title, Address, Your Department*

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Using the Tool: Basic Steps

3. Select Project Lifespan

- 2030
- **2050**
- 2100
- Beyond 2100

4. Determine Individual Hazard Zones: *Using the address, determine if your project is in the floodplain, or landslide area, or very low near the ocean coast?*

View Maps or GIS system

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Using the Tool: Basic Steps

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Microsoft Excel - Hue CIMPACT v1.7

Temperature Impacts

Project Type • Electricity distributi

Projected Impacts & Exposure

Projected Range of Impact

+1.1°C to +1.5 °C annual average temperature increase from 2031 to 2050.

Potential Exposure - Temperature

MODERATE potential for significant increased thermal stress for this project. Extended summer heat waves are more likely.

Temperature Project Sensitivity

Project Sensitivity: Temperature

The overall sensitivity of your project to temperature will be influenced by a number of factors. Key factors are outlined below. The tally provided at the bottom of this section will assist you in selecting an overall project sensitivity.

Factors to consider in determining overall sensitivity:

When determining the overall sensitivity of your project to temperature, consider the direct effects of higher temperature (and how the current design may or may not mitigate these) on the project or asset's function, its safety, and lifespan.

Function: Low

Safety: High

Lifespan: Moderate

It is important to consider other related factors as well. Three of these are listed below to assist you in determining your project's overall sensitivity to temperature. Feel free to consider other factors not listed here in your determination to overall sensitivity.

Financial/Cost:

How much more expensive would future maintenance and/or retrofit actions be to improve temperature resilience compared to design modifications or changes made now?

- High
- Moderate
- Low
- Don't Know

Environmental:

To what extent might nearby ecosystems be adversely affected by a project design that does not account for higher temperatures?

Human Health and Social Justice:

If the project does not adequately address the effects of higher temperatures, how severely might this affect under-served communities or at-risk segments of the populations, like the very young or elderly?


Discussion / Q&A

Thank You!

- Acknowledgements
  - **SEATTLE:** City of Seattle staff – Tracy Morgenstern, Hillary Papendick; Adaptation International – Sascha Peterson; Cascadia Staff - Shannon Donegan, Christy Shelton, Andrea Martin. Climate Impacts Group at The University of Washington.
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