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CLIMATE CHANGE RESILIENCY AND STORM WATER MANAGEMENT: A FEDERAL SITE'S PERSPECTIVE



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EXECUTIVE ORDER 13653

PREPARING THE UNITED STATES FOR THE IMPACTS OF CLIMATE CHANGE

- Federal sites' sustainability efforts driven by Presidential Executive Orders
- EO13653 builds on earlier sustainability EO's, requires "*new strategies* to improve the Nation's preparedness and resilience"
 - Strong partnerships across government
 - Risk-informed decision-making
 - Adaptive learning (past is prologue...)
 - Preparedness planning

New Strategies – Vulnerability Assessment



- DOE is 5th largest Federal asset holder – 133 million square feet, 2.8 million acres
- Climate trends show increase in extreme events
- National Laboratories already experiencing Climate effects

New Strategies – Vulnerability Assessment

- Start thinking Climate...
- Programmatic: How would extreme Climate *directly* affect research programs?
- Operations: How would extreme events impact infrastructure, safety, emergency management?
- What is most sensitive?



Similar to
infrastructure
vulnerability
assessment



Climate Change Vulnerability Assessment – Key Elements?



- Establish context - timeframe, prioritize key facility functions, ID Lab critical functions, infrastructure
- Stakeholder interviews
- ID climate stressors
- Site-specific modeling to show how stressors actually would impact site
- ID, prioritize critical infrastructure and impacts from Climate
- Quantify Risk – ID potential solutions

Assessing Climate Vulnerability at Argonne

- Evaluation of Climate impact on Argonne's employees' ability to conduct their tasks safely and effectively
- Prioritize, categorize risks to assets: utilities, facilities, critical assets, natural resources
- Look at external risks
- Results form basis of Adaptation Plan – resiliency improvements



Assessing Climate Vulnerability at Argonne

U.S. Climate Resilience Toolkit

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Get Started Taking Action **Tools** Topics Expertise

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Cities Impacts & Adaptation Tool (CIAT)

Decision makers in the Great Lakes Region who are developing climate adaptation plans can use this tool to find a range of support and information.

Climate Projections

To identify climate division temperature and precipitation (2041-2070) for your city (1981-2010) for cities and may select either annual depending on your spee if you are con

The Cities Impacts & Adaptation Tool (CIAT) is an online climate adaptation planning support tool for decision makers at the municipal level in the Great Lakes region. The site provides local-scale data for cities with populations of 20,000 or higher, including current and projected climate trends, demographic and socioeconomic data, and descriptions of adaptation strategies pulled from existing planning documents for municipalities across North America. For any city in the database, the tool identifies a custom network of "climate peers" through an interactive map interface. Climate peers are cities whose current climate reflects the selected city's projected climate in 2041-2070.

Last modified: 13 October 2015 - 12:30pm

URL:
<http://graham.umich.edu/climate/ciat>

Webpage:
[Graham Sustainability Center Decision Tools](#)

Topic:
Ecosystem Vulnerability > [Water Resources](#)
Human Health > [Extreme Heat](#)
Water Resources > [Municipal Water Supply](#)

Documentation:
[CIAT Factsheet](#)

Training/Tutorials:
[CIAT Tutorial](#)
[YouTube Video](#)

Assessing Climate Vulnerability at Argonne

- NOAA U. S. Climate Toolkit
(<https://toolkit.climate.gov>)
- Vulnerability Assessment to employ Climate Change modeling and risk analyses expertise at Argonne



- **“Down-scale” continent- and regional-modeled effects to Argonne**

STORM WATER MANAGEMENT AND CLIMATE CHANGE RESILIENCE



Extreme Precipitation Events – Already Observed Risk

- All new construction LEED Gold
- Includes green infrastructure
- Some green infrastructure Clean Water Act permit-required
- Sustainability EO's drive most installations

Extreme Precipitation Events – Already Observed Risk

Installations at High-Flow Areas



Bioswale Receiving Parking Lot Runoff at New Advanced Protein Crystallization Facility



Bioswale in Large Parking Lot Manages Storm Water Prior to NPDES Outfall Discharge

Storm Water Modeling for Climate Change Resilience

- EO13653 (the “climate change” Executive Order) specifically recommends agencies conduct resilience assessments by establishing “strong partnerships” across government
- Another order, EO13690 (Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 2015)
 - Requires, among other things, that Federal agencies (DOE-Argonne) *conduct a hydrology study that is informed by expected changes in climate and land-use factors*

HYDROLOGIC MODEL

Hydrological Simulation Program FORTRAN

- HSPF is a continuous simulation model
- Used existing DuPage County HSPF model as a starting point (calibrated to Sawmill Creek)
- Argonne land-use refined from countywide scale
- Small scale catchments on Argonne property for future green infrastructure simulation
- Added hydrologic routing
- Routing of downspouts

HYDRAULIC MODEL

HEC-RAS

- Geometry of channel and structures from survey data and existing FEQ model from DuPage County
- CSGs for calibration



APPROACH

- More than 60 years of meteorological record from Argonne weather station
- Run HSPF simulation and produce timeseries of flows at outlet points
- Run PEAKFQ utility program (Bulletin 17B) for flood frequency analysis
- Run the HEC-RAS model with the 1% and 0.2% annual chance flood values
- Generate the flood profiles with HEC-RAS
- Map resulting inundation surface in GIS (ArcMap)

STREAM ASSESSMENT

Evaluation of erosion potential

- Qualitative stream assessment conducted in August 2015
- Stream channel and substrate conditions in project reaches
- Results used to evaluate erosion potential
- Shared with DuPage County for their watershed planning



APPLICATIONS—NOW AND LATER

- Floodplain maps for assessing current risk and reducing future risk
- Channel condition survey for erosion control
- Hydrologic model constructed at scale useful for simulating future land use and green infrastructure scenarios
- Hydrologic and hydraulic models can be rerun with future climate scenarios

QUESTIONS?