USGS
WATER AVAILBILITY AND USE STUDIES

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USGS National Water Census

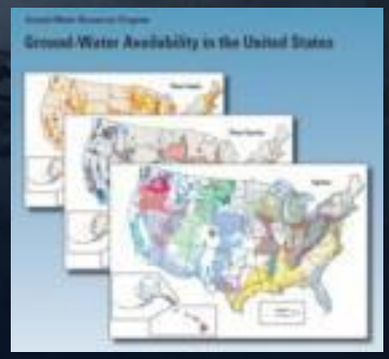
To place technical information and tools in the hands of stakeholders, allowing them to answer questions they face about water availability:

- Does the Nation have enough freshwater to meet both human and ecological needs?
- Will this water be present to meet future needs?

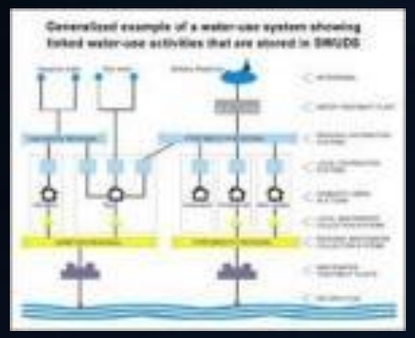
SECURE Water Act
Public Law 111-11, § 9507 and 9508

Focused Water Availability Assessments

Water Quality



Groundwater Resources



Water Use

Surface Water Trends, Precipitation, etc

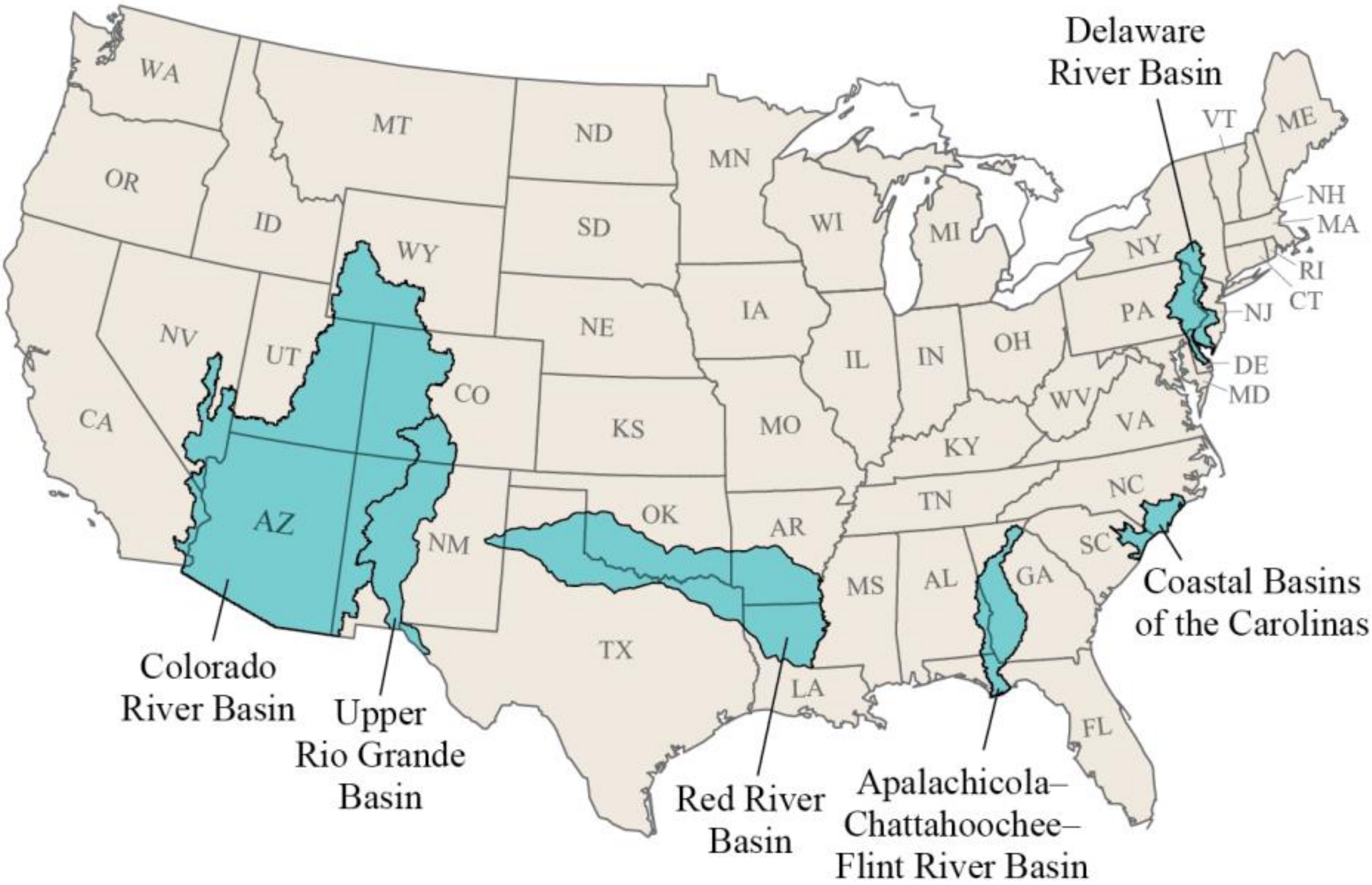
Eco Flows

Global Change

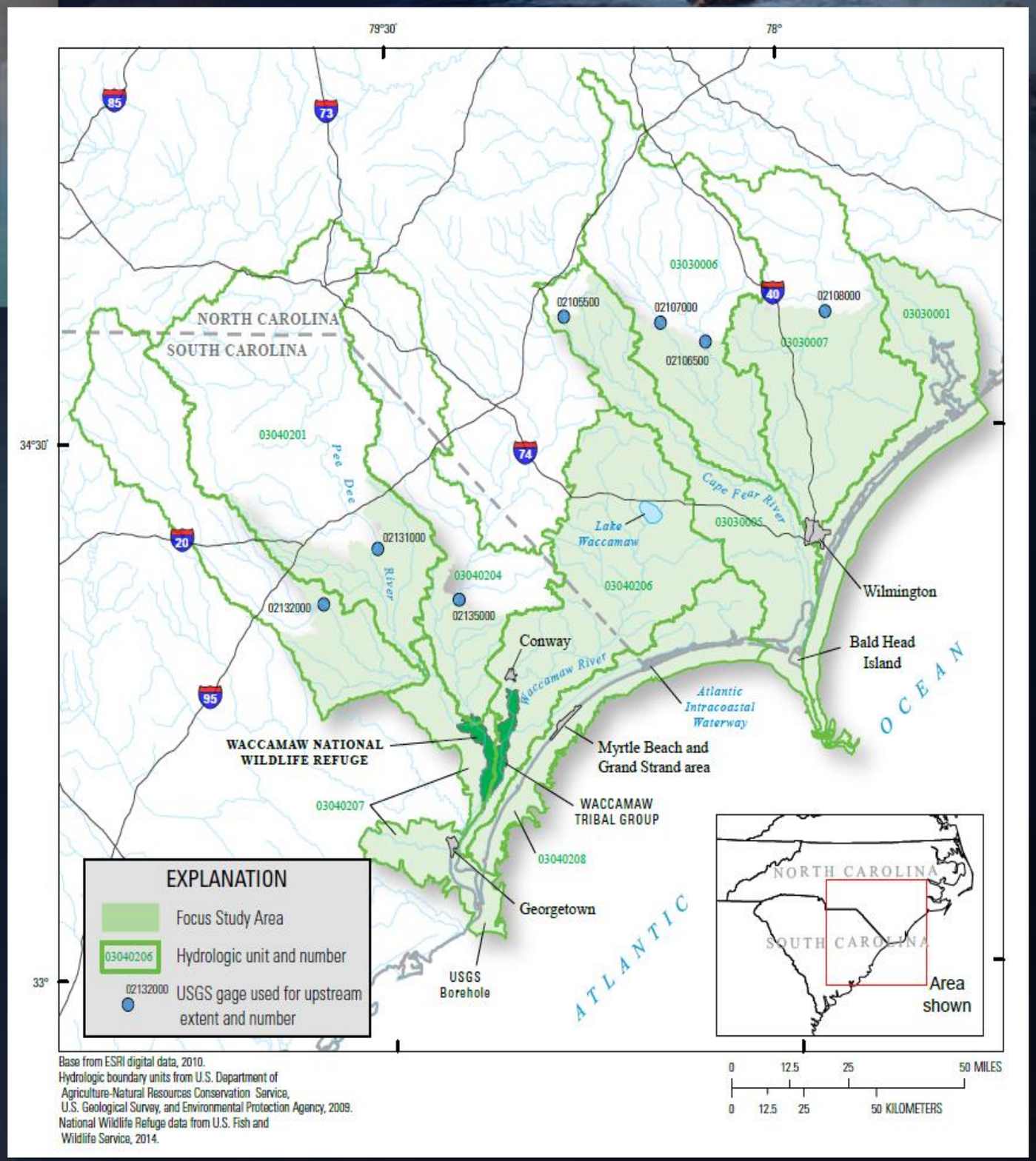
Defined Technical Questions to be Answered

State, Local, Regional Stakeholder Involvement

New (in 2016) and Existing Focus Area Studies



Coastal Carolinas Focus Area Study



- ✓ Ongoing/projected population increases in this land limited coastal region = higher population density and sharper interface between fresh and saltwater ecosystems.
- ✓ Frequent Droughts/Hurricanes
- ✓ Groundwater Capacity-use Area
- ✓ Sea-level rise, land-use change and climate change will impact
  - aquifer water levels; and
  - frequency, duration and magnitude of streamflow and salinity intrusion near water-supply intakes.

Objectives and Scope

- Water-use -- develop water-use estimates at HUC-8 watershed scale and refine estimates for golf courses, public supply, thermoelectric and industrial sectors.

- Land-use change and water-demand forecast models

- Surface-water models -- evaluate potential changes in water availability and salinity in response to various water-use and climate-change scenarios

- Ecological (fish and invertebrate) response models to alterations in flow

- Groundwater flow model of surficial and deeper water-supply aquifers to simulate water-use and climate-change scenarios and susceptibility of saltwater encroachment and leakage from pumping

Expected Results/Deliverables of the CC FAS:

- More refined and representative water-use estimates at the HUC-8 levels from pts of diversion or withdrawal
- Future land-use change (urbanization) and water-demand predictions
- Modeling tools and water-availability predictions based on alternative land-use, water-use, and climate-change scenarios:
  - Surface-water models;
  - Ecological response models; and
  - Groundwater flow and saltwater intrusion models;

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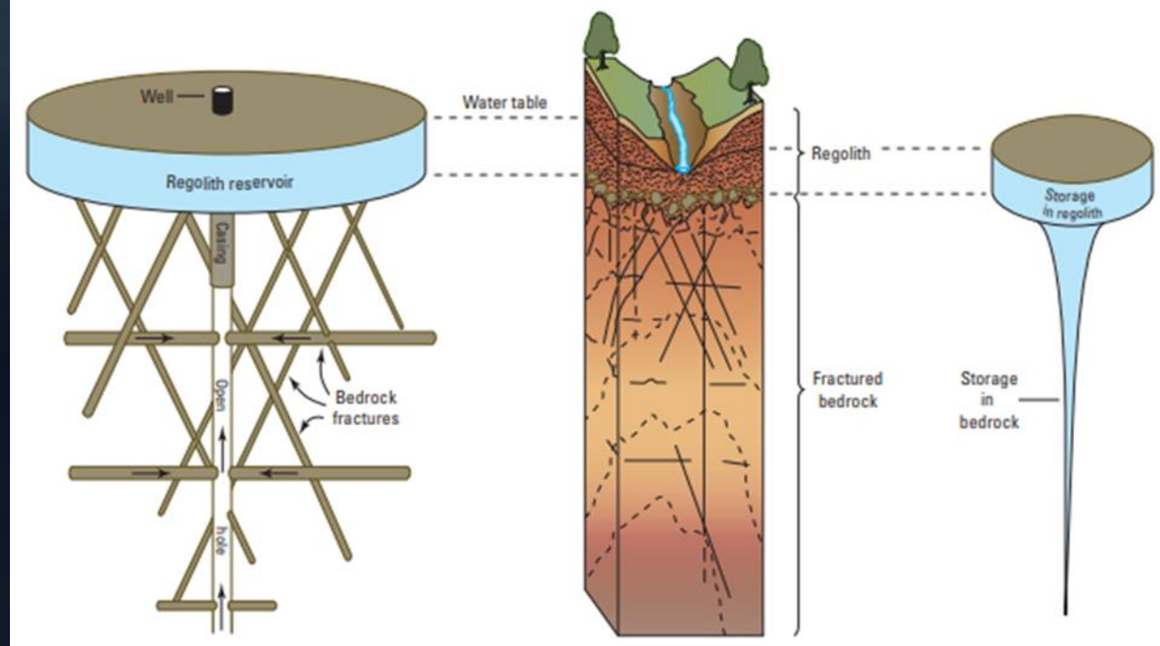
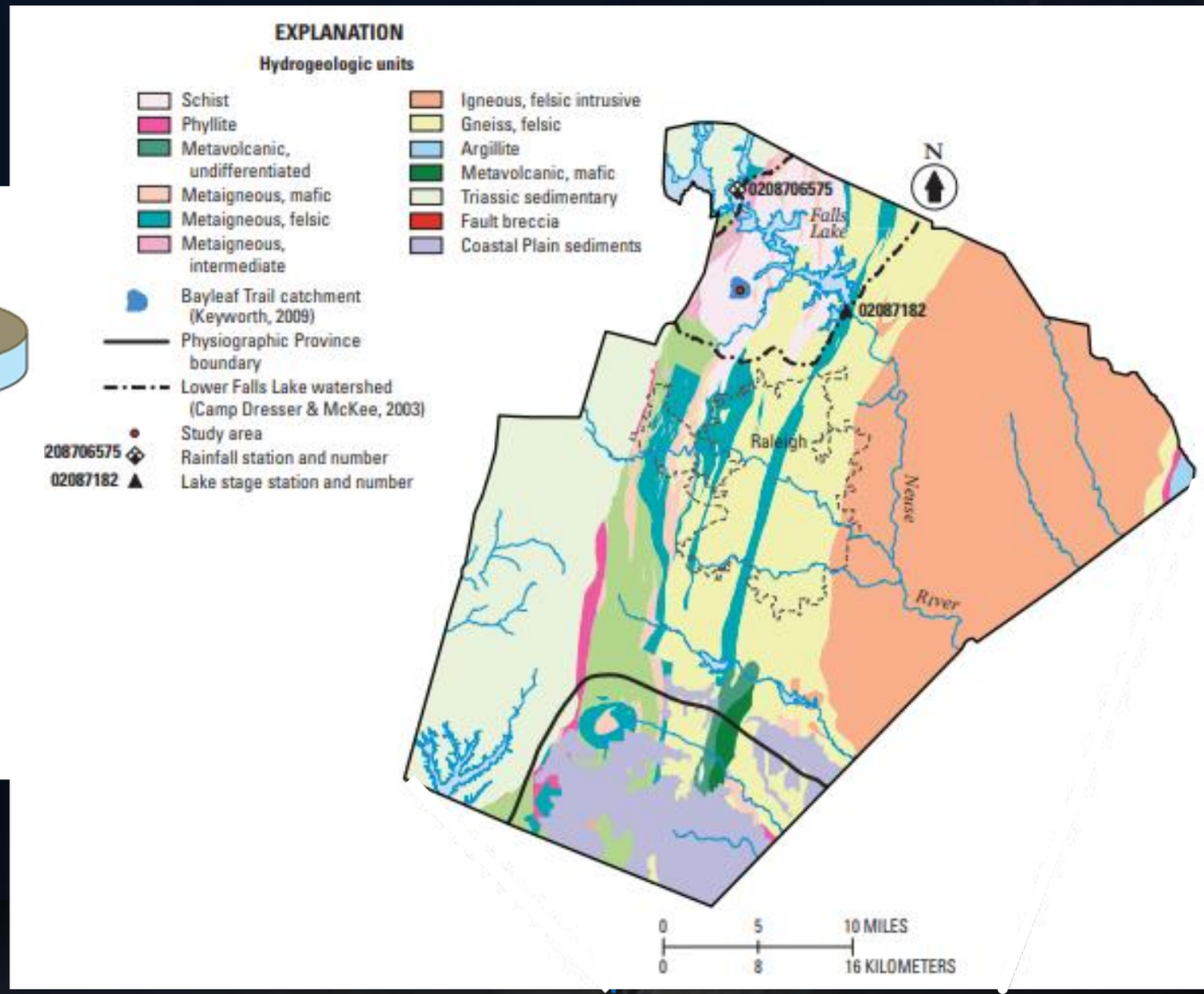
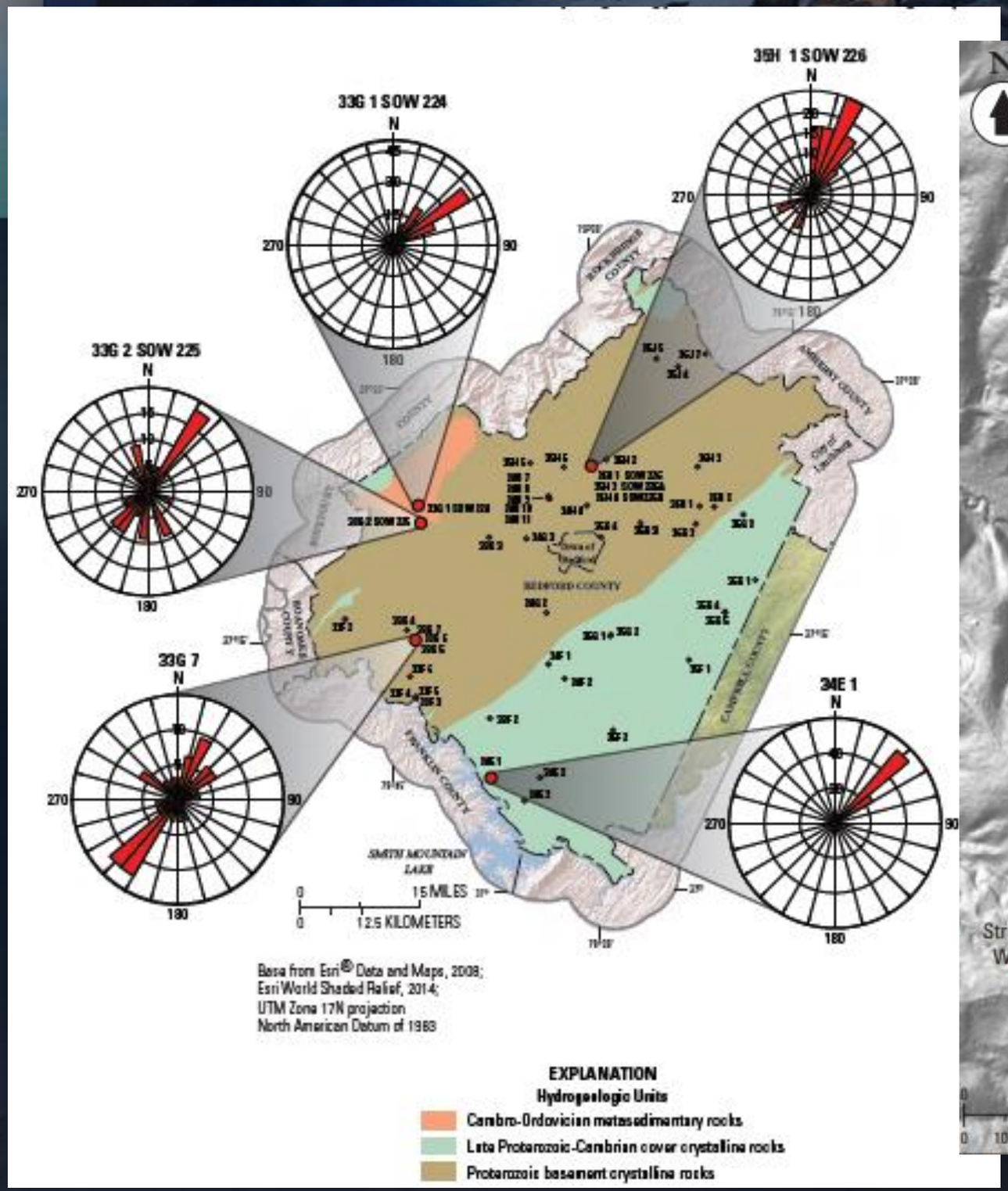
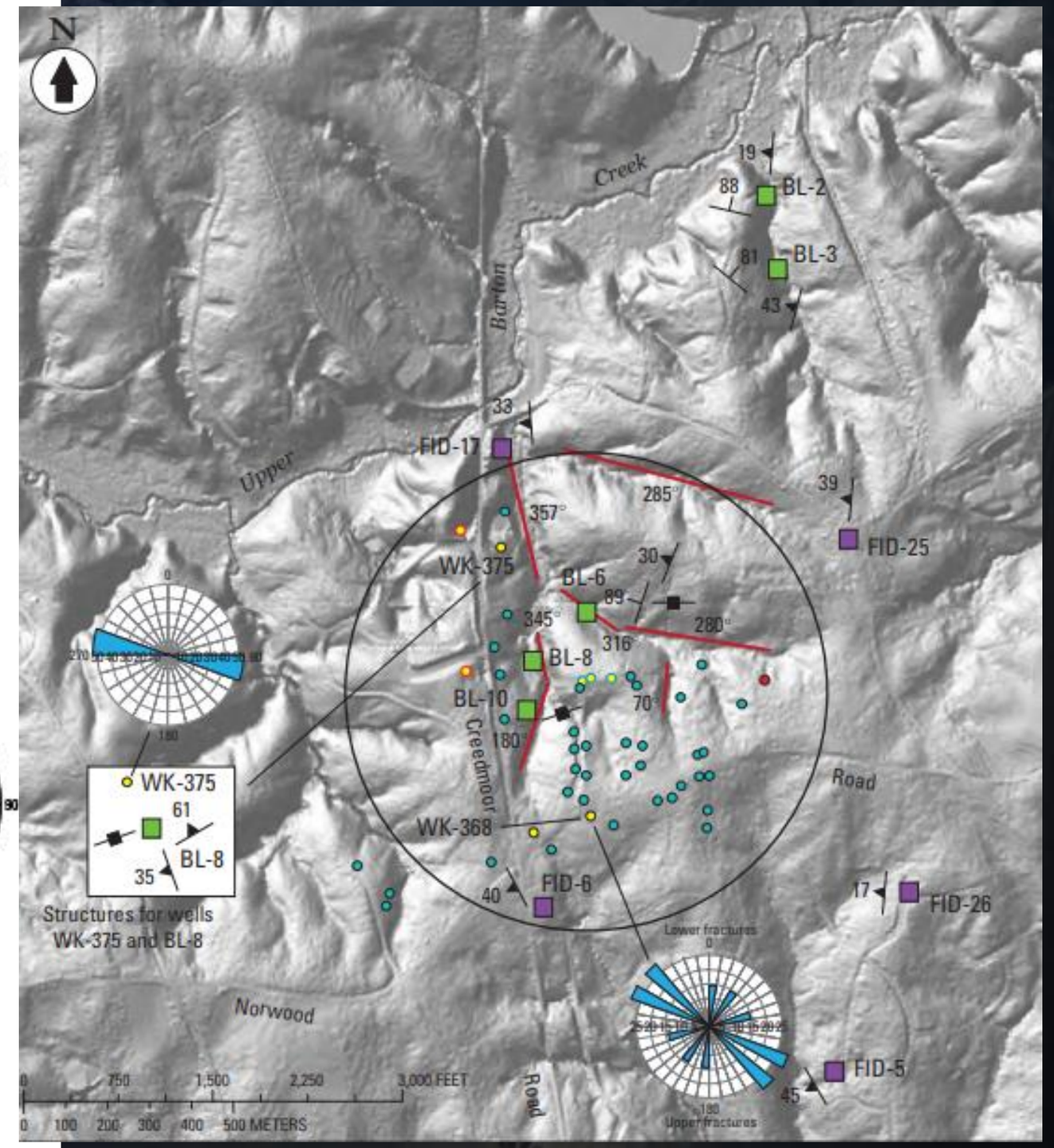
Groundwater Availability and Susceptibility in Wake County





Conceptual Model of Hydrogeologic System





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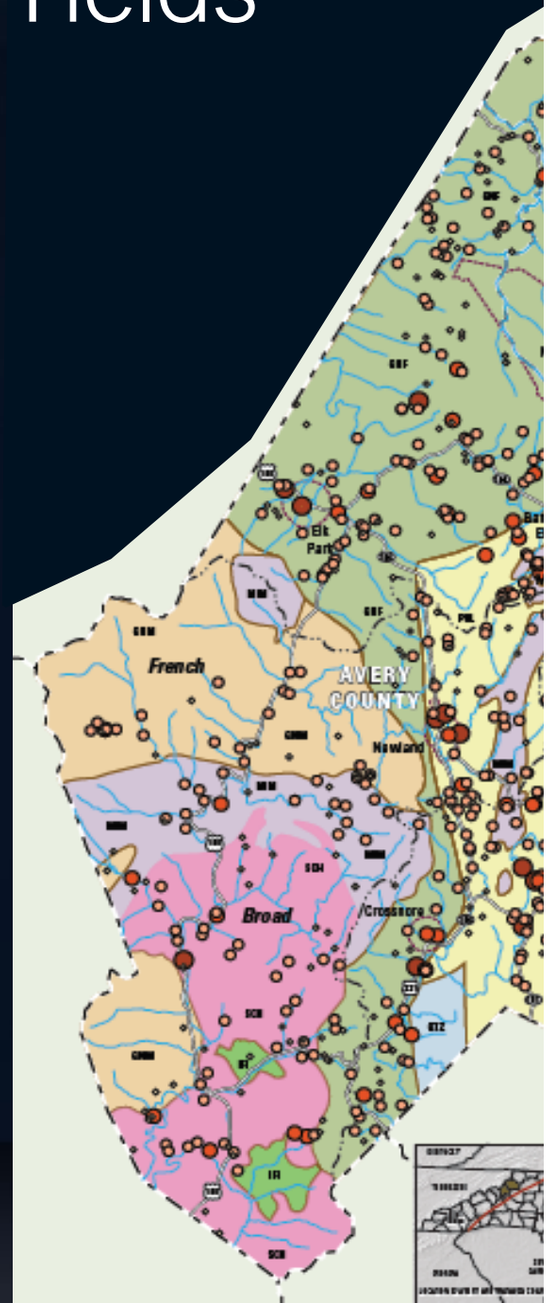
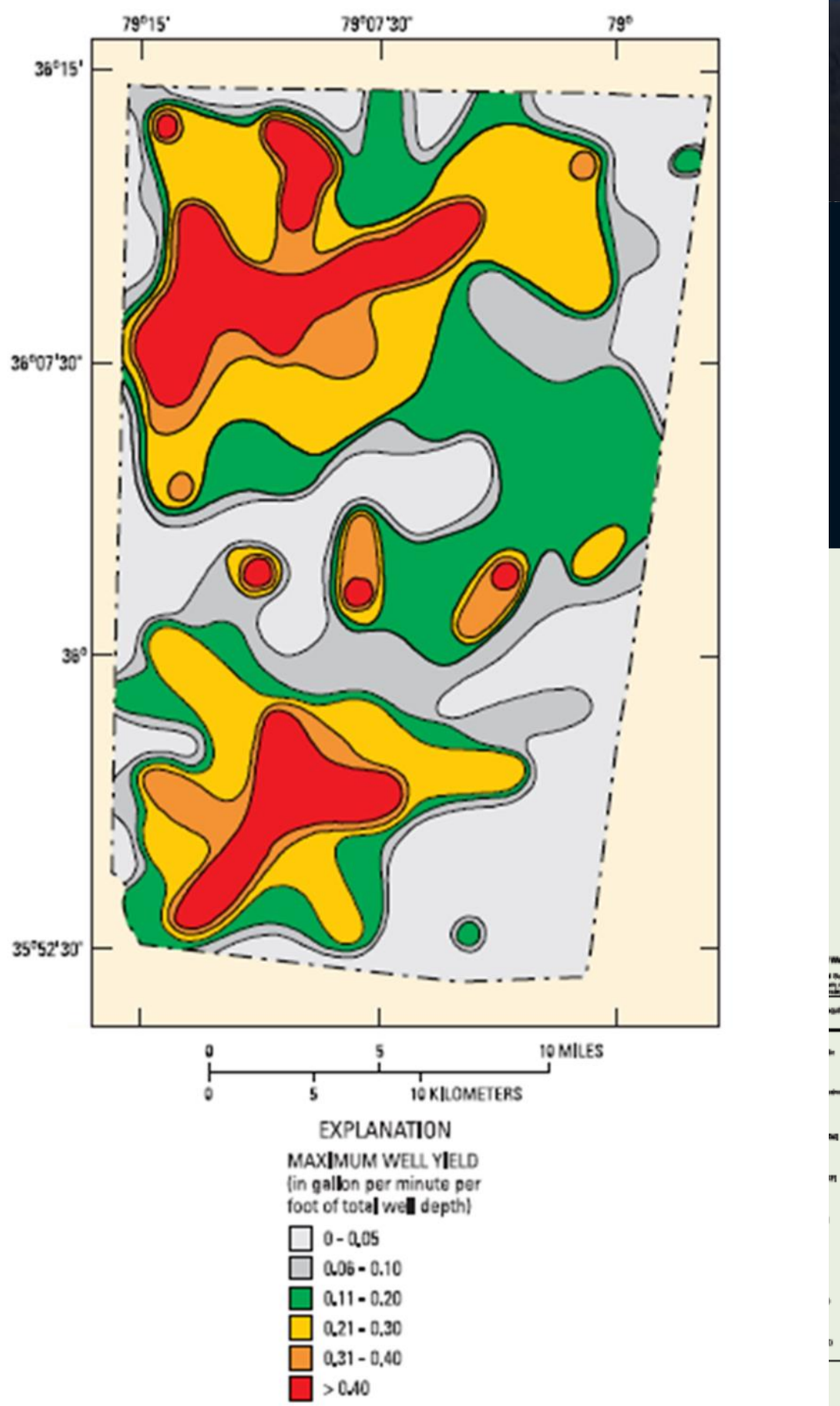
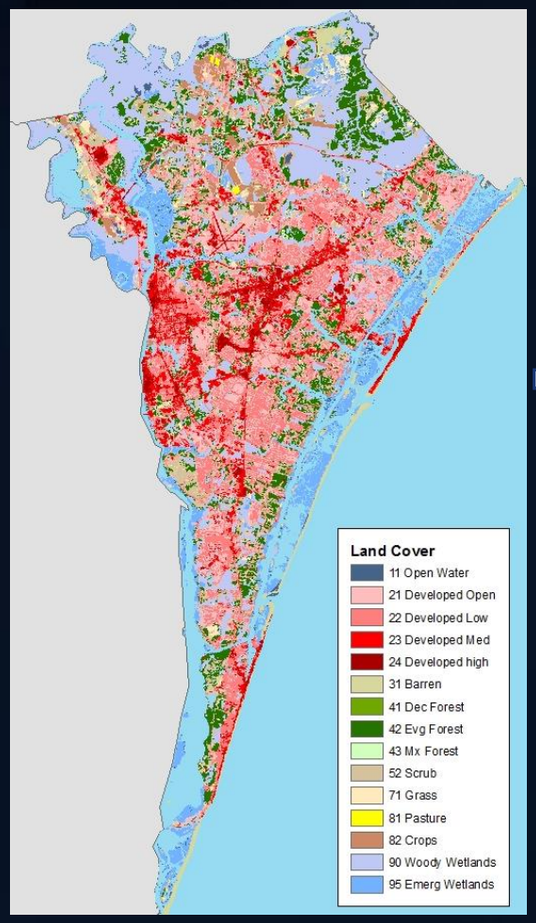
Water Availability – Mapping Distribution of Well Yields



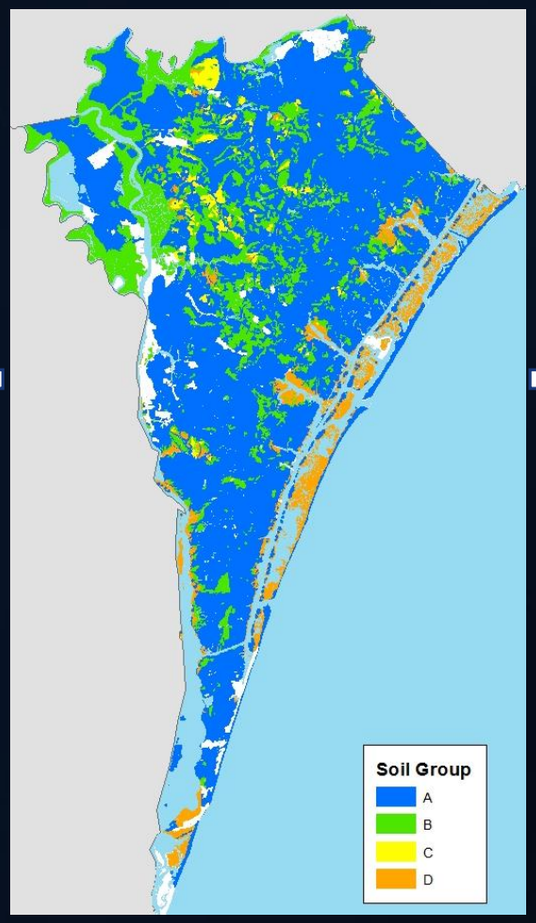


Soil-Water Balance (Recharge) Modeling

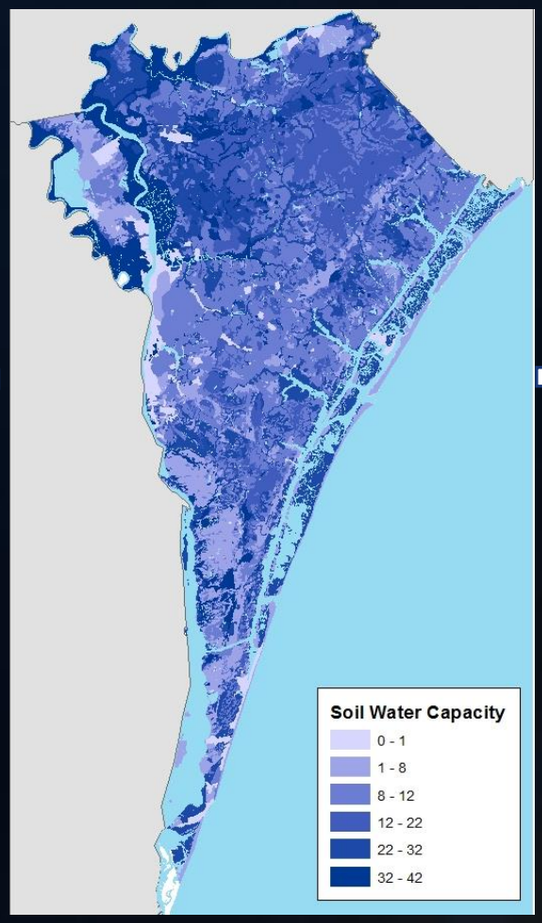
Rainfall and Temperature Data +…



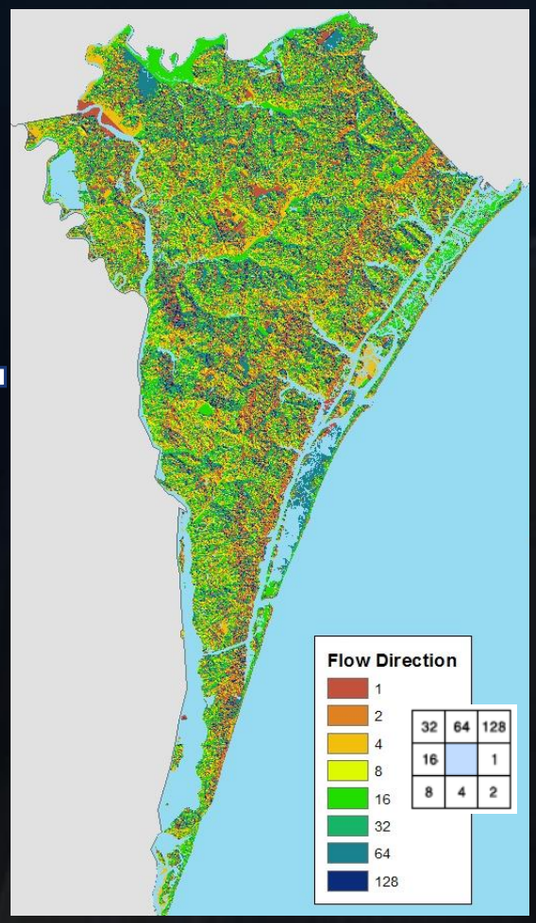
Land Use/Cover +
lookup table with runoff curve and root-zone depth



Hydrologic Soil Group



Soil Water Capacity +
lookup table with soil moisture retention



Surface Flow Direction

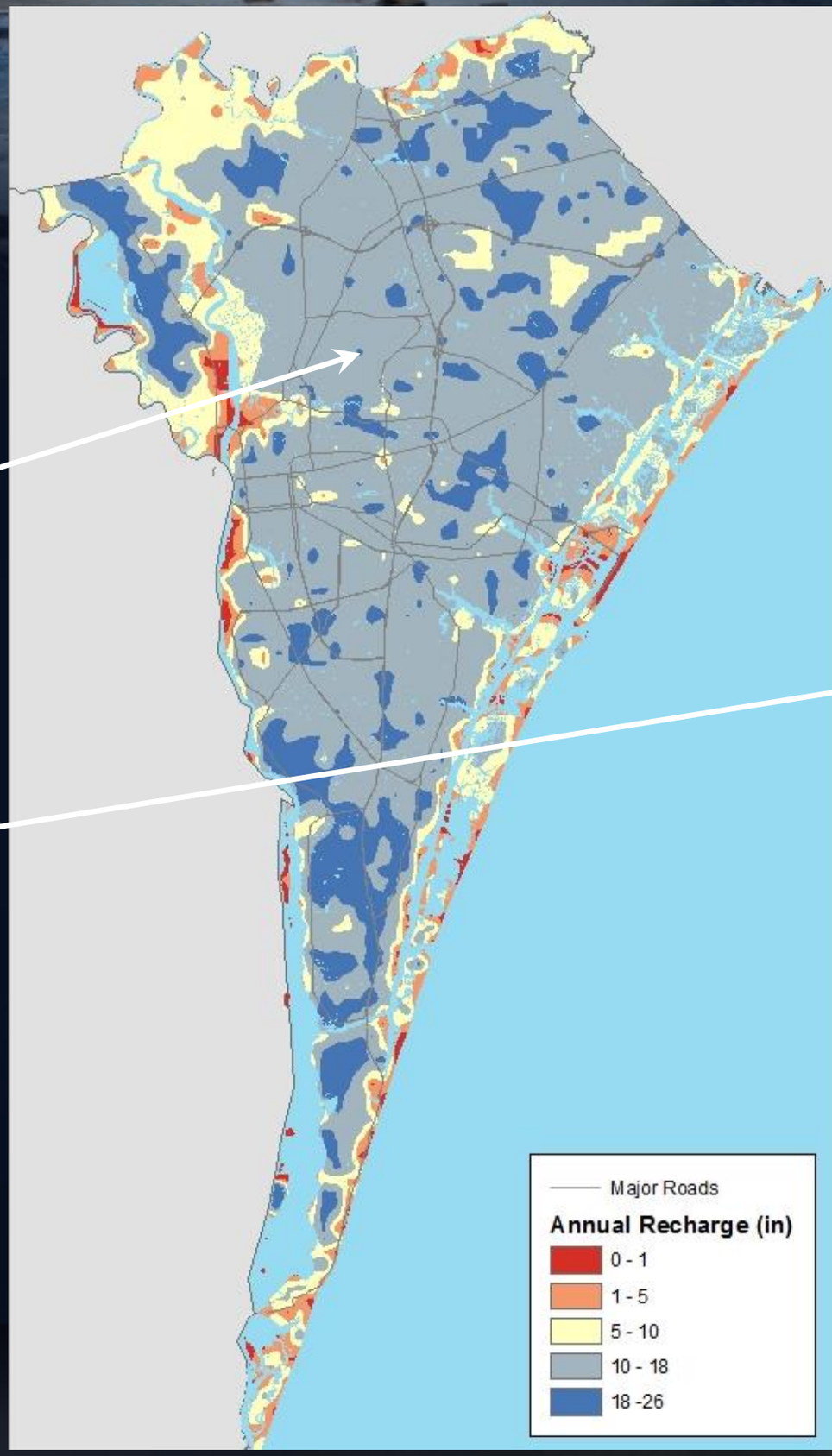
Soil-Water Balance (SWB) Model Output

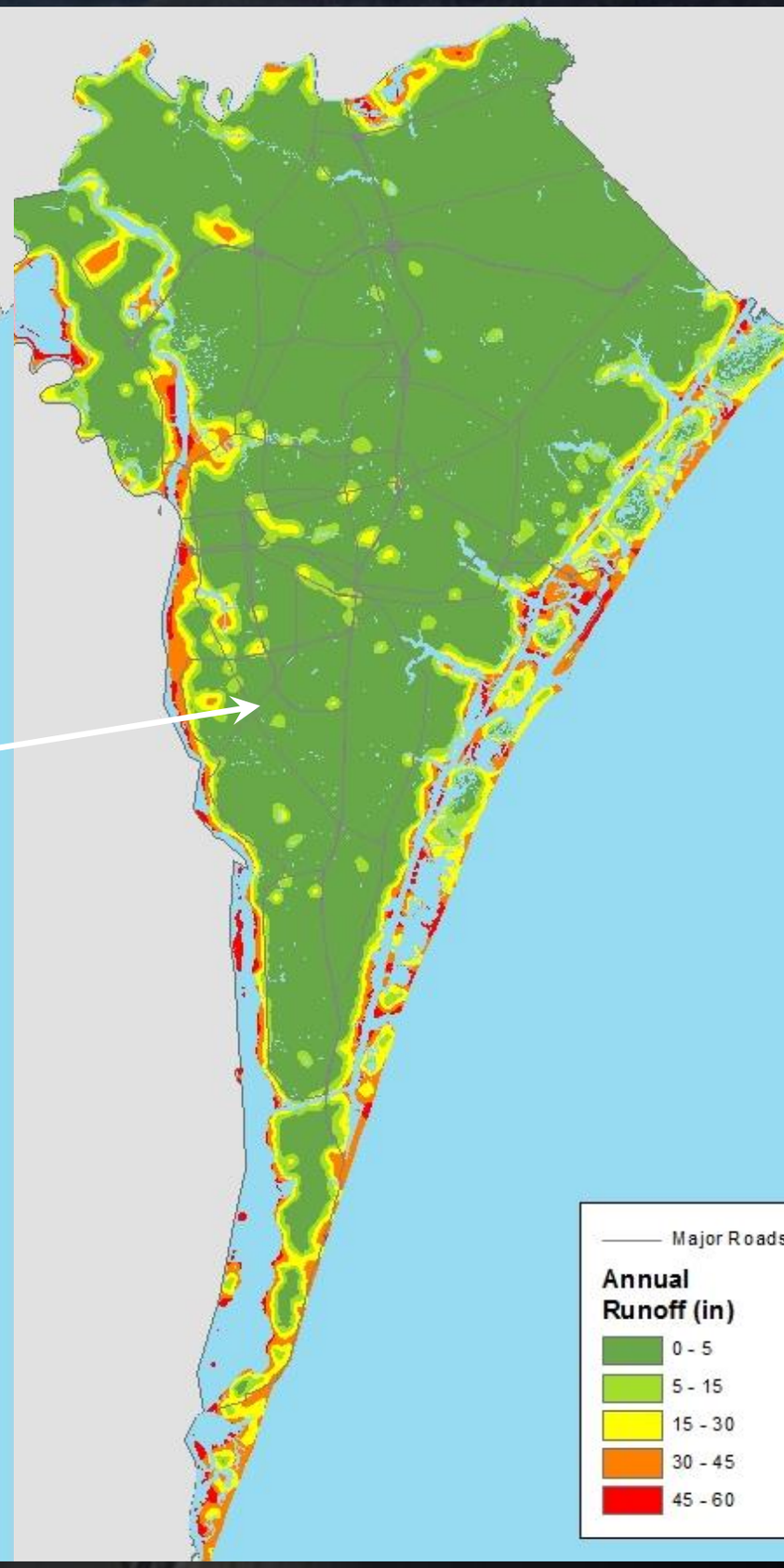
<u>Mean Annual Recharge Map</u>

- Upland/interstream areas, more sandy soils, up-gradient of wetlands

<u>Mean Annual Runoff Map</u>

- Areas along Cape Fear River, Intracoastal and Coastline, larger creeks





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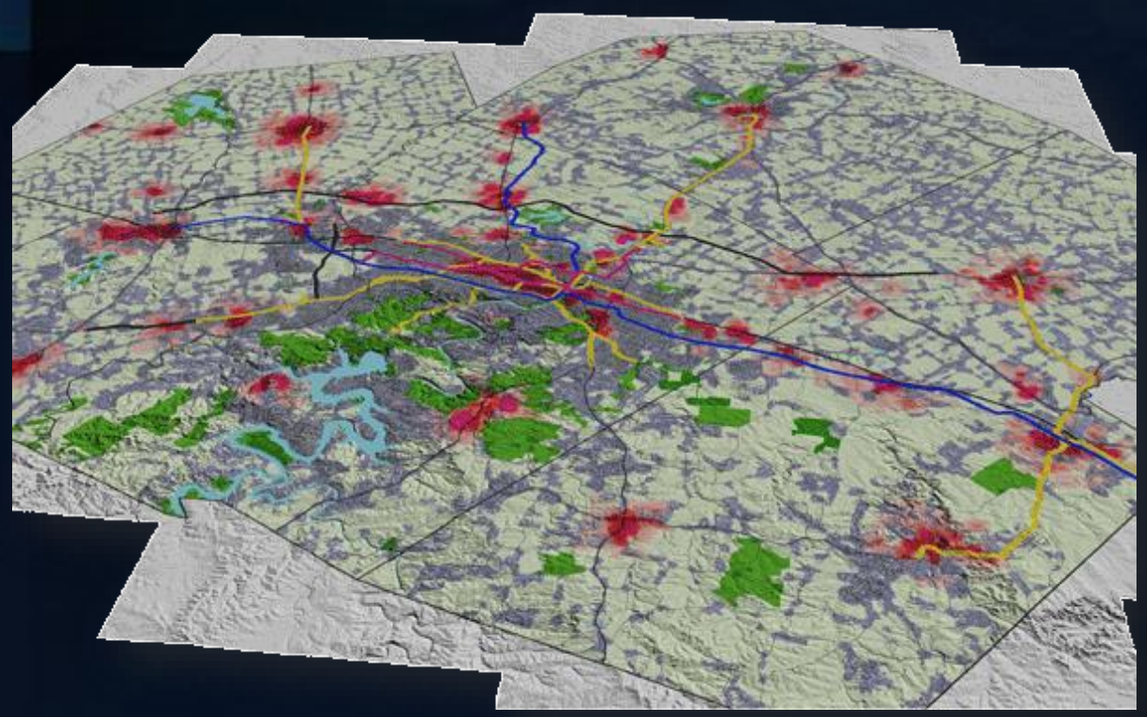
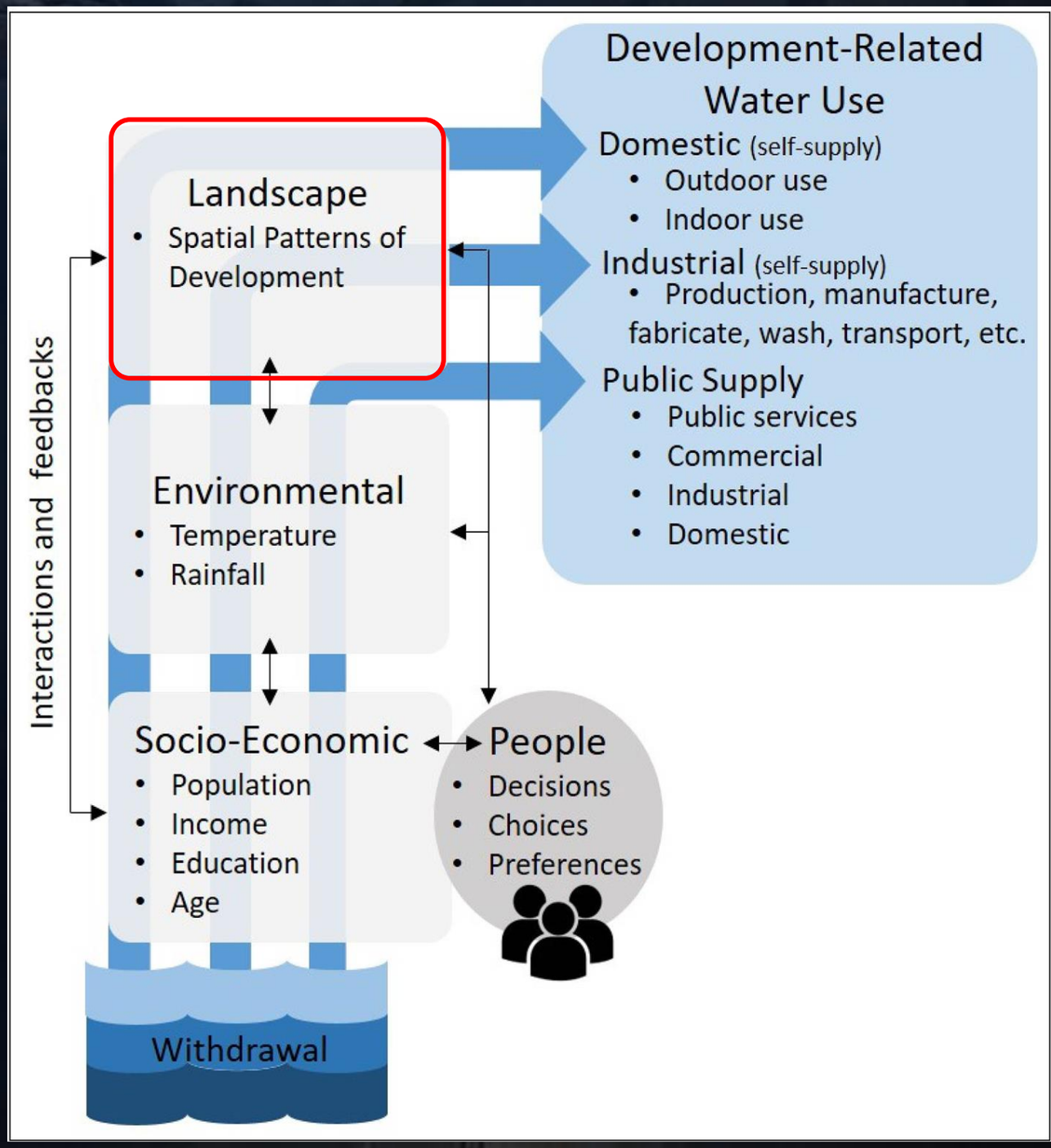
Land-change simulations



Lad change model: FUTure Urban-Regional Environment Simulation (FUTURES; Meentemeyer et al., 2013).



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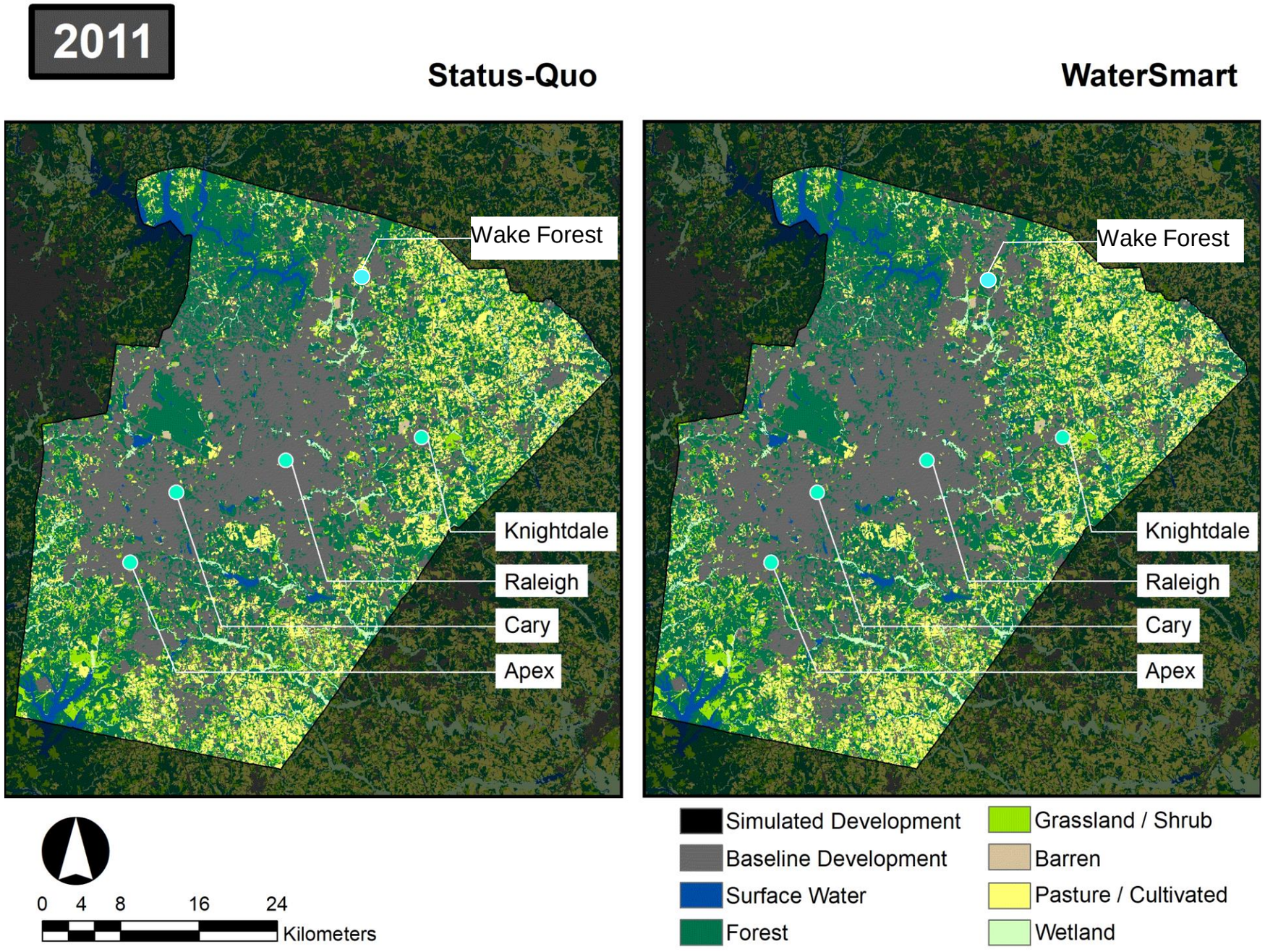
Two urbanization scenarios

Projected year: 2065

	Status-Quo
Population	2.1 M
Per capita land consumption	2.5 people/unit
Spatial patterns of development	historical pattern of growth
Protected areas	N/A

	WaterSmart
Population	2.1 M
Per capita land consumption	3 people/unit
Spatial patterns of development	infill (simple, cohesive patches)
Protected areas	riparian buffers, wetlands

Example simulation of progressive growth to the year 2065 for our two urbanization scenarios.



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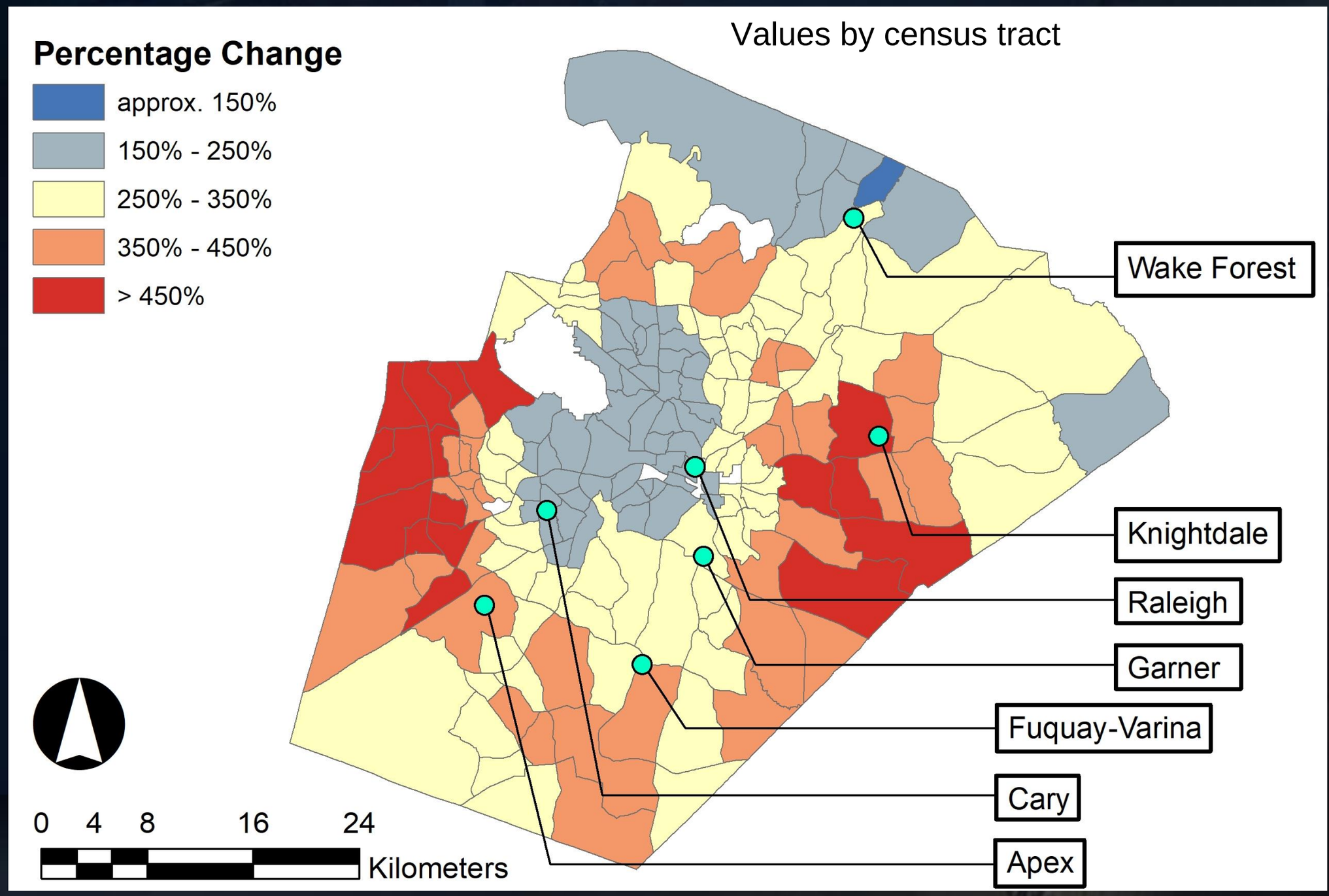
Predicted Percent Change in Water Demand: Wake County by 2065



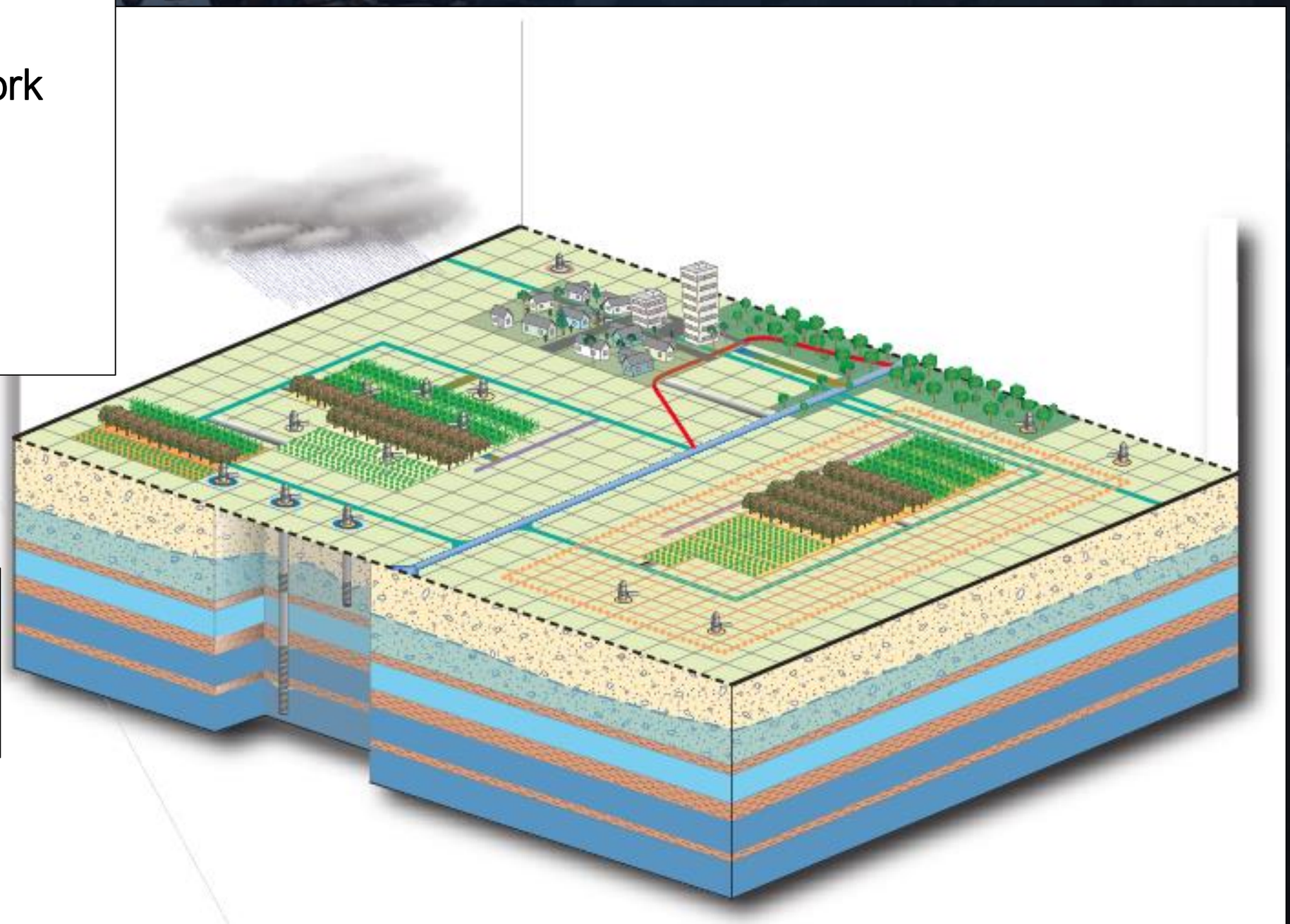
Groundwater Flow Modeling

Primary inputs:

- Model Grid
- Hydrogeologic Framework
- Aquifer Properties
- Recharge
- Observation Data
- Boundaries
- Wells – Water Use Data

Primary Outputs:

- Groundwater Levels
- Water Budgets



Representative GW Flow Model

Data Requirements

- Well records
- Water levels
- Water-quality data
- Geophysical logs
- Streamflow data
- Climate data
  - Daily min/max temperature
  - Precipitation
- Water-use data

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Questions/Discussion

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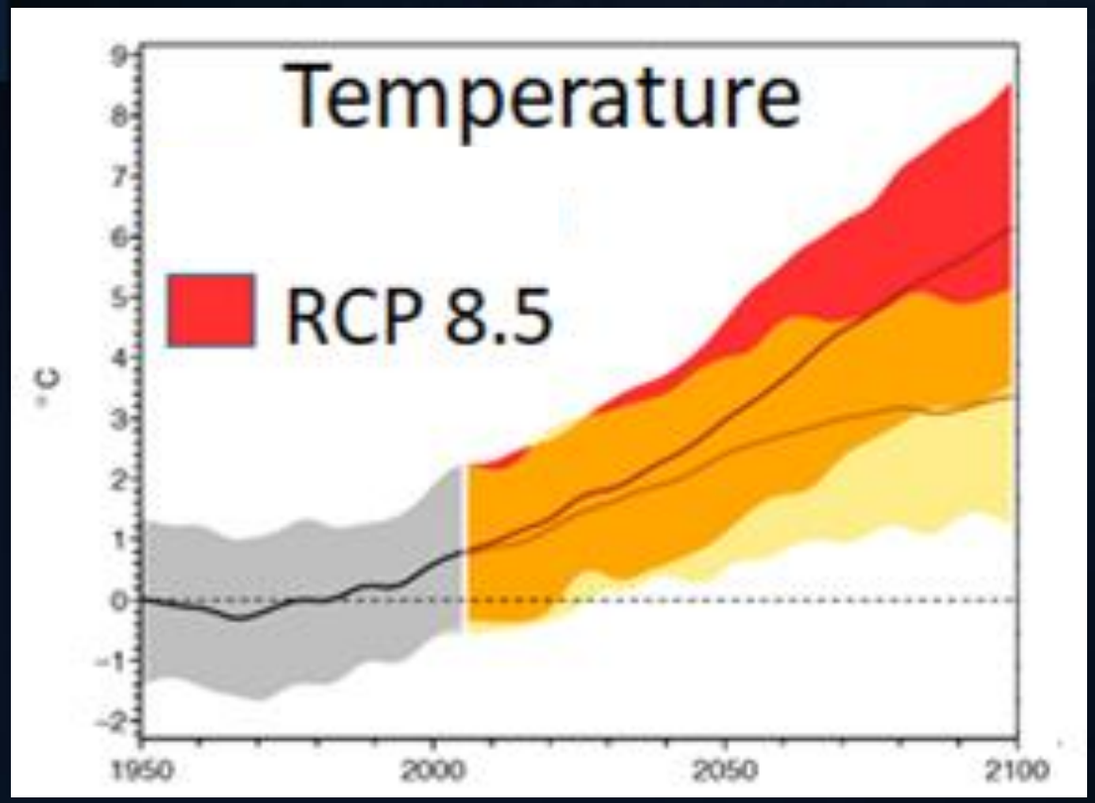
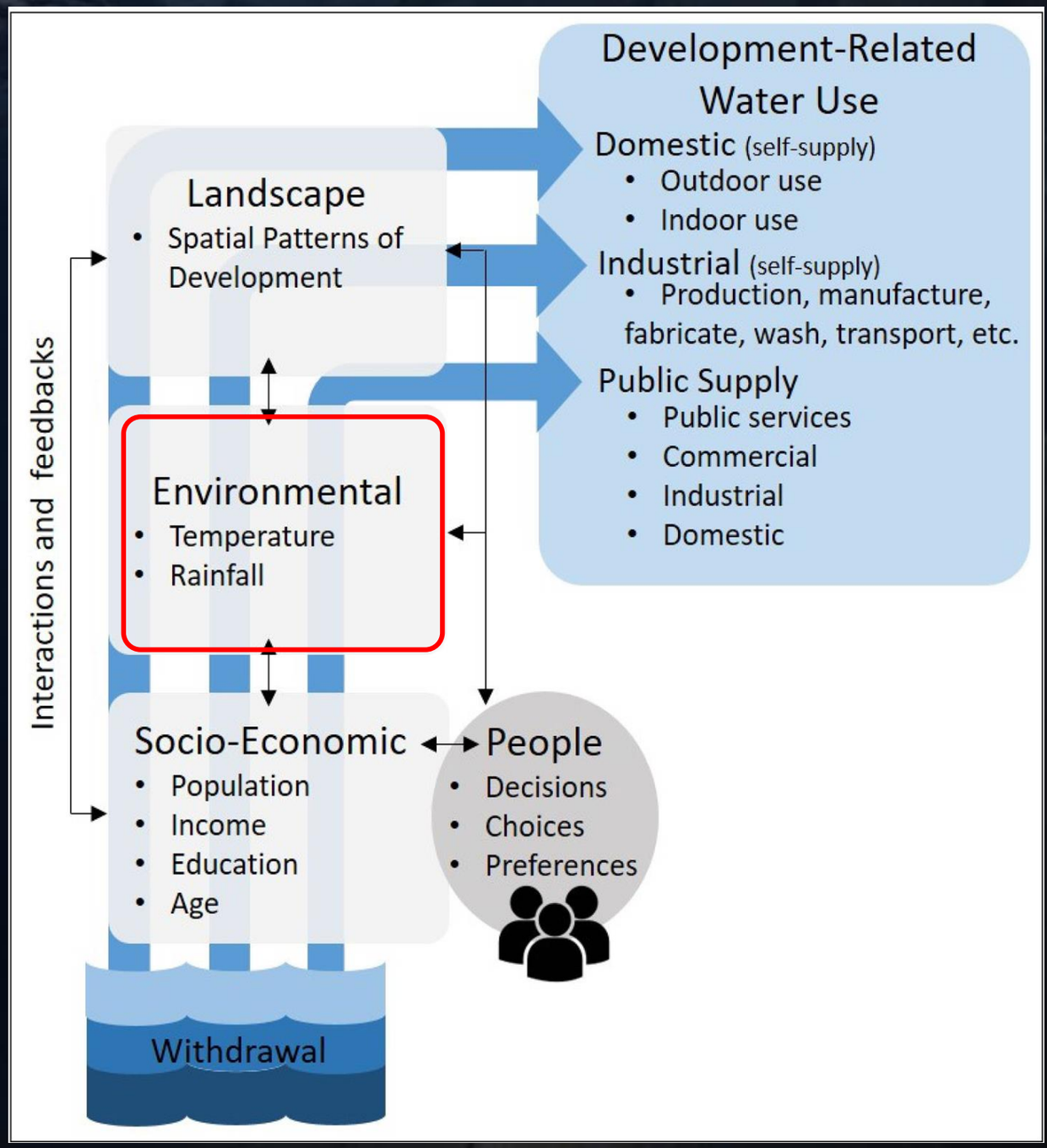
Emission trajectory





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Population growth

Population Data: State population projections