A Prototype Scenario-Based Planning Support System (SB-PSS) to Model Water Consumption Spatial Distribution

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Introduction

- Water is used unsustainably in the United States, more so in some places than others
- This problem needs remediation in order for future generations to have access to water everywhere
- Climate change further threatens our water resources

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Research Purpose

The study aims to increase the awareness of water resource conservation among water consumers by promoting the idea "think globally, act locally, start with me!"

A water consumption model is built into a scenario-based planning support system (SB-PSS) to enable planners to illustrate water conservation alternatives in ways that are easily understood

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Planning Support Systems

- Stimulate plan making to set and achieve goals of conservation
- The scenario-based planning process works by creating a set of plausible scenarios and their possible outcomes

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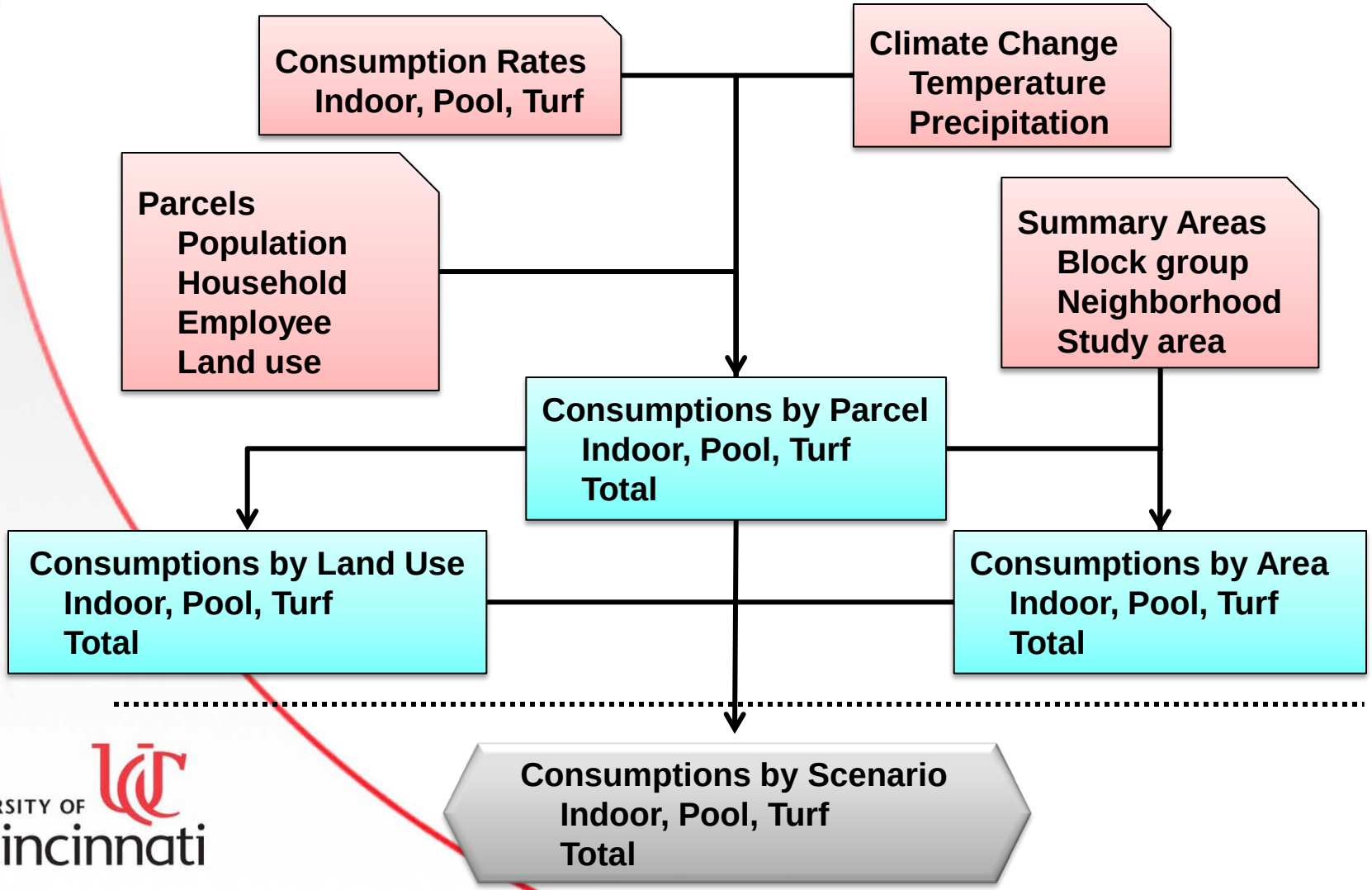
Water SB-PSS



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Methodology

Data Requirements

- GIS data
- Other forms of data (i.e. Current Population/ Employment, etc.)

Calculation

- Indoor Consumption
- Pool Consumption
- Turf Consumption

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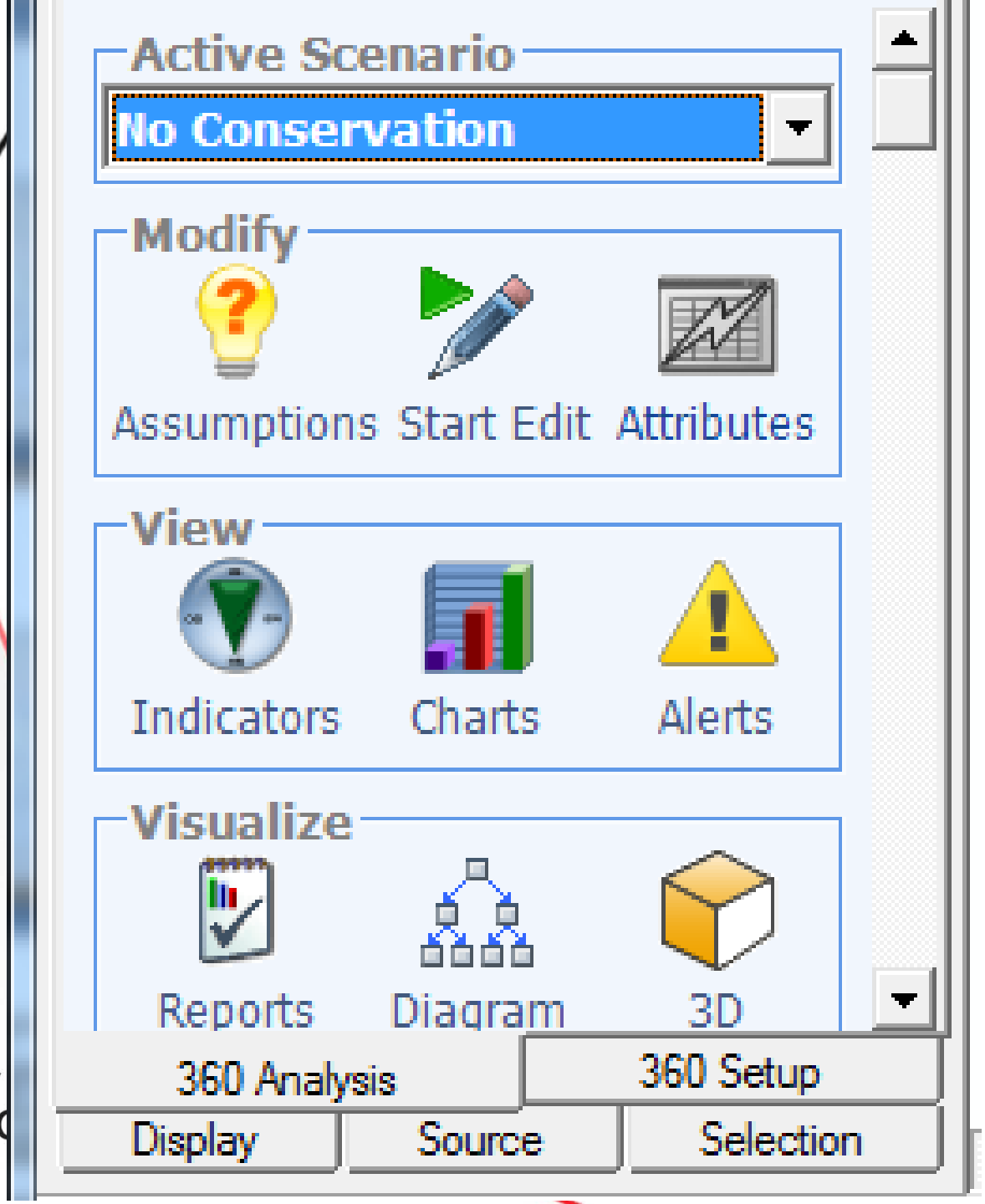
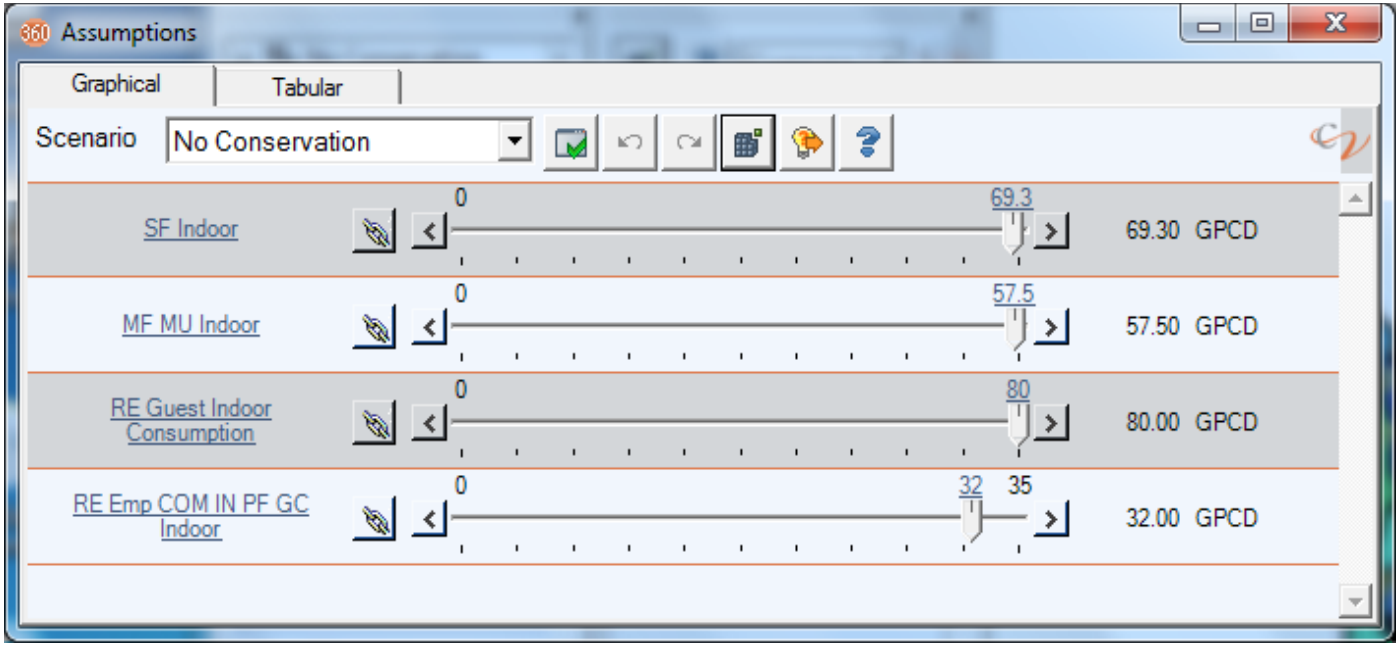
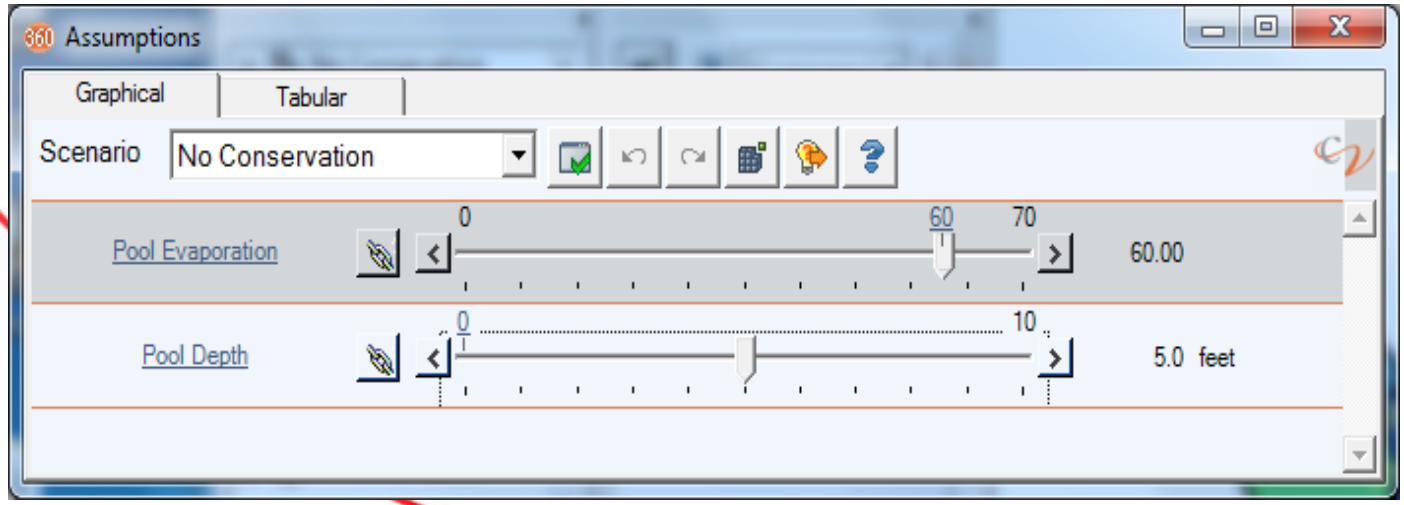

Active Scenario
No Conservation
Modify
Assumptions
Start Edit
Attributes
View
Indicators
Charts
Alerts
Visualize
Reports
Diagram
3D
360 Analysis
360 Setup
Display
Source
Selection

SB-PSS Inputs – Consumption Rates

Indoor: Per capita by Land use



Pool



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SB-PSS Inputs – Consumption Rates

Turf by month

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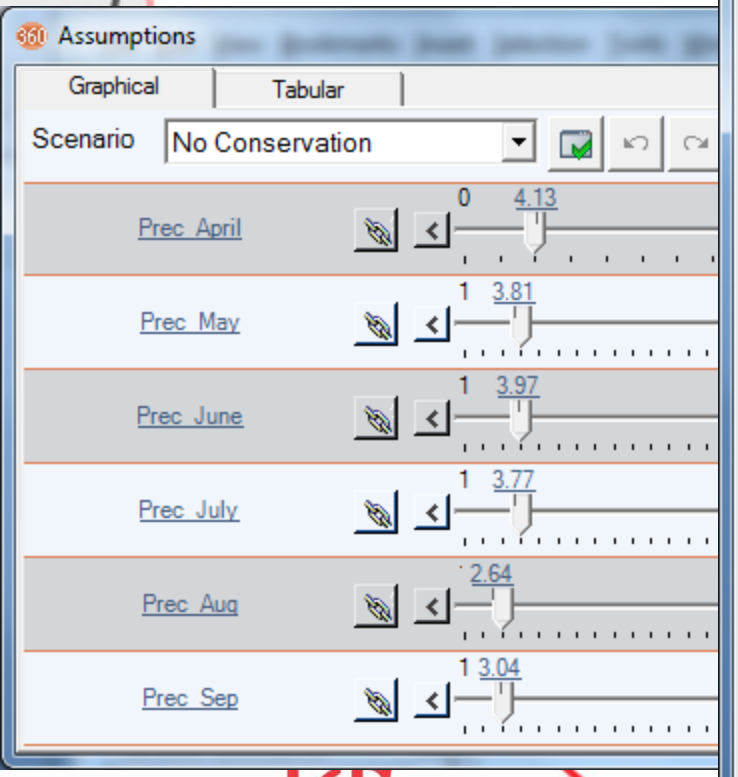
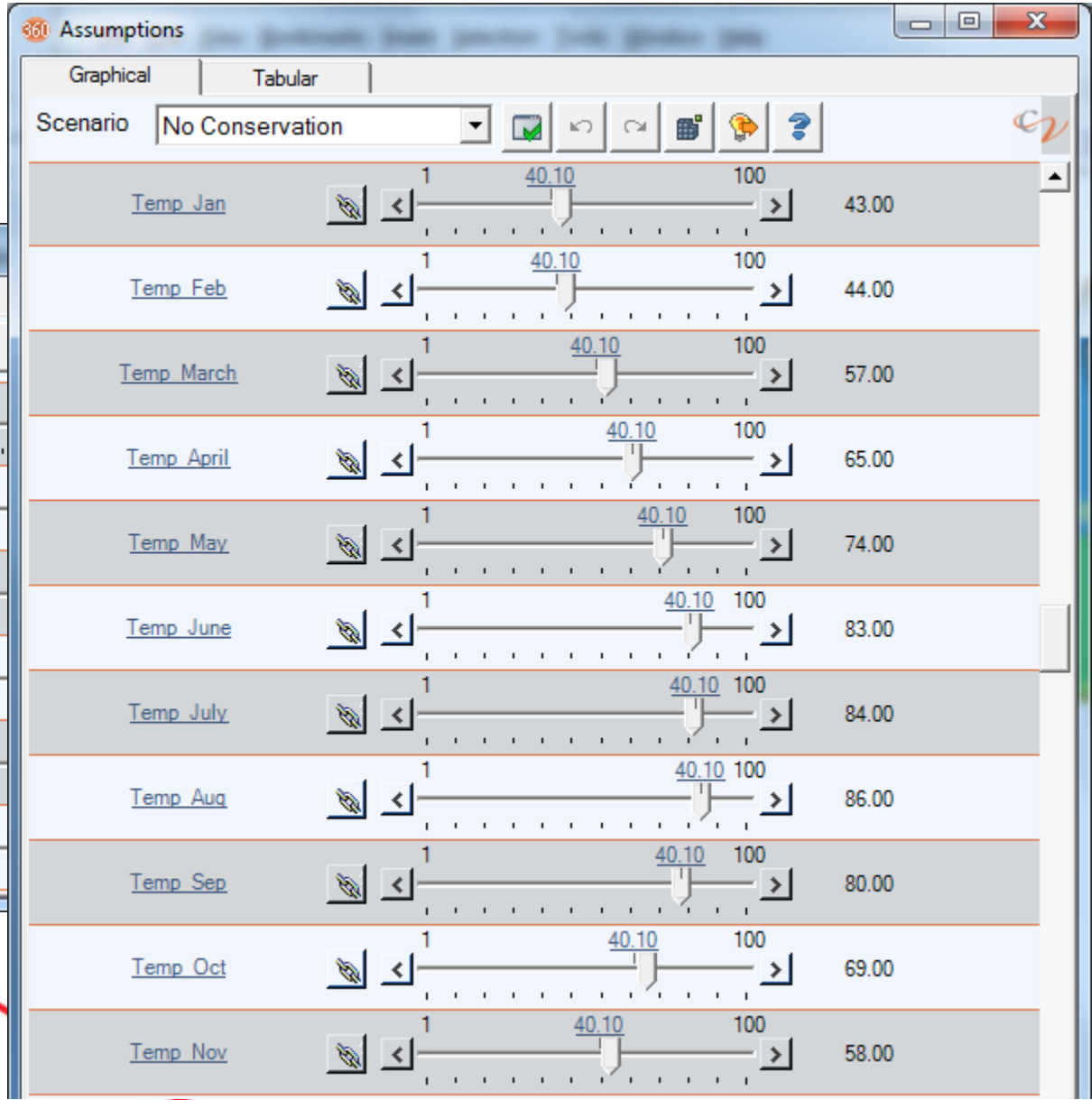
SB-PSS Inputs – Precip. & Temp.

By month





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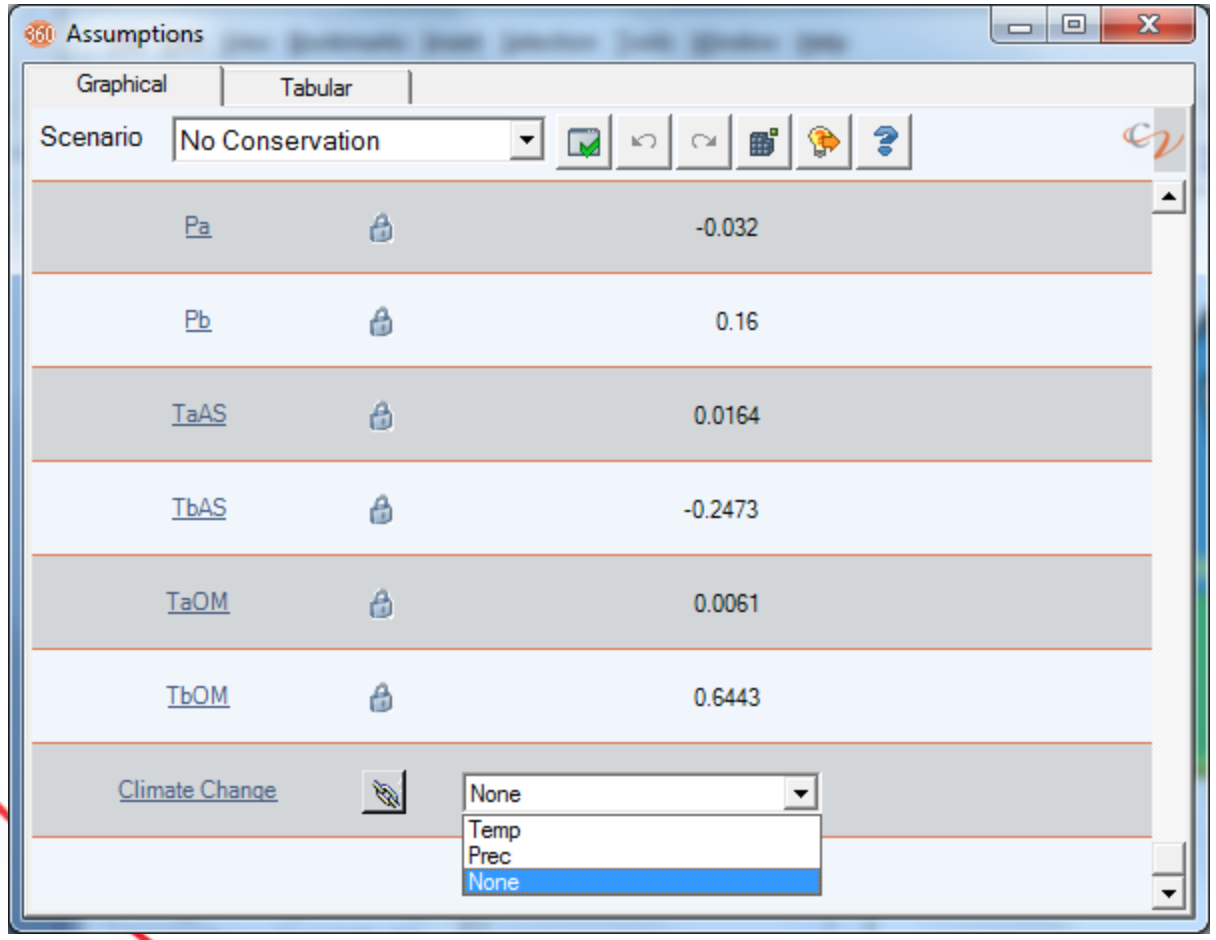
SB-PSS Inputs – Climate Change



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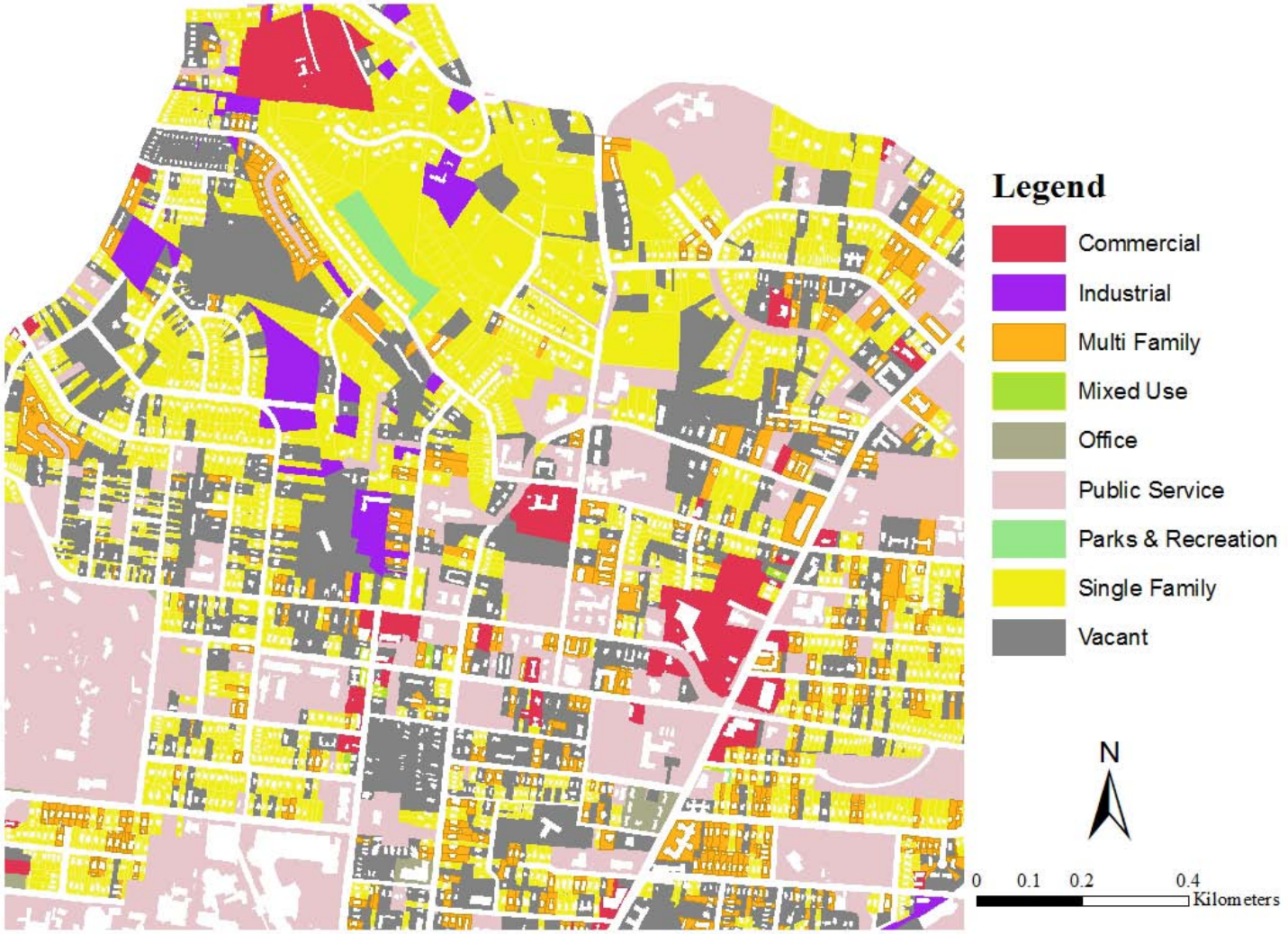
Land Use



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Dynamic Attributes – Indoor Water Consumption

Daily indoor water consumption for the k^{th} month & land use type u

$$WC^{i}_{k,u} = WR^{i}_{u} * N_p * Adj_k$$

WR^{i}_{u} = per capita Indoor daily water usage rate for land use type u

N_p = Number of people/employees/guests

Adj_k = Climate change adjustment for the k^{th} month

Monthly indoor water consumption for the k^{th} month

$$WC^{im}_{k} = WC_{idk} * D_k$$

WC^{im}_{k} = indoor water consumption for the k^{th} month

D_k = number of days in the k^{th} month

Annual indoor water consumption

$$WC^{iy} = \sum WC^{im}_{k}, \text{ for } k = 1 \ldots 12$$

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Dynamic Attributes – Turf Water Consumption

Monthly turf water consumption

$$WC^{tm}_k = WR^t_k * A^t * Adj_k$$

WC^{tm}_k = turf water consumption for the k^{th} month, k = 1, 2, … 12

WR^t_k = turf water usage rate per unit area for the k^{th} month

A^t = turf area (square feet)

Annual turf water consumption

$$WC^{ty} = \sum WC^{tm}_k, \text{ for } k = 1 \ldots 12$$

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Dynamic Attributes – Pool & Total Water Consumption

Annual pool water consumption

$$WC^{py} = V^{p} + E^{p} * A^{p}$$

V^{p} = volume of a pool (gallons)

E^{p} = annual pool evaporation rate (gallons per square foot)

A^{p} = pool surface area (square foot)

Total annual water consumption

$$WC = WC^{iy} + WC^{ty} + WC^{py}$$

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Indoor Conservation Methods

Indoor Conservation	Total amount conserved(Gallons per Capita per day)
Toilets	10.3
Shower heads	2.8
Faucets	0.1
Bath	0
Clothes Washers	5
Leaks	5.5
Dishwashers	0.3
Other	0
Sum	24

Land Use	Total Amount conserved (Gallons per Capita per day)	Indoor Conservation Methods Used
Multi-Family	19	Toilets, Shower heads, Faucets, Leaks, Dishwashers
Commercial	15.9	Toilets, Faucets, Leaks
Industrial	15.9	Toilets, Faucets, Leaks
Resort and Casino Employee	15.9	Toilets, Faucets, Leaks
Resort and Casino Guest	21.2	Toilets, Faucets, Leaks, Clothes Washers, Dishwashers
Golf Course	15.9	Toilets, Faucets, Leaks
Public Facility	15.9	Toilets, Faucets, Leaks
Single Family	24	All Methods

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Scenarios

No Conservation

Pool Cover Utilization

50% Xeriscape

100% Xeriscape Conversion

Indoor Conservation

Indoor Conservation with Climate Change

All Conservation

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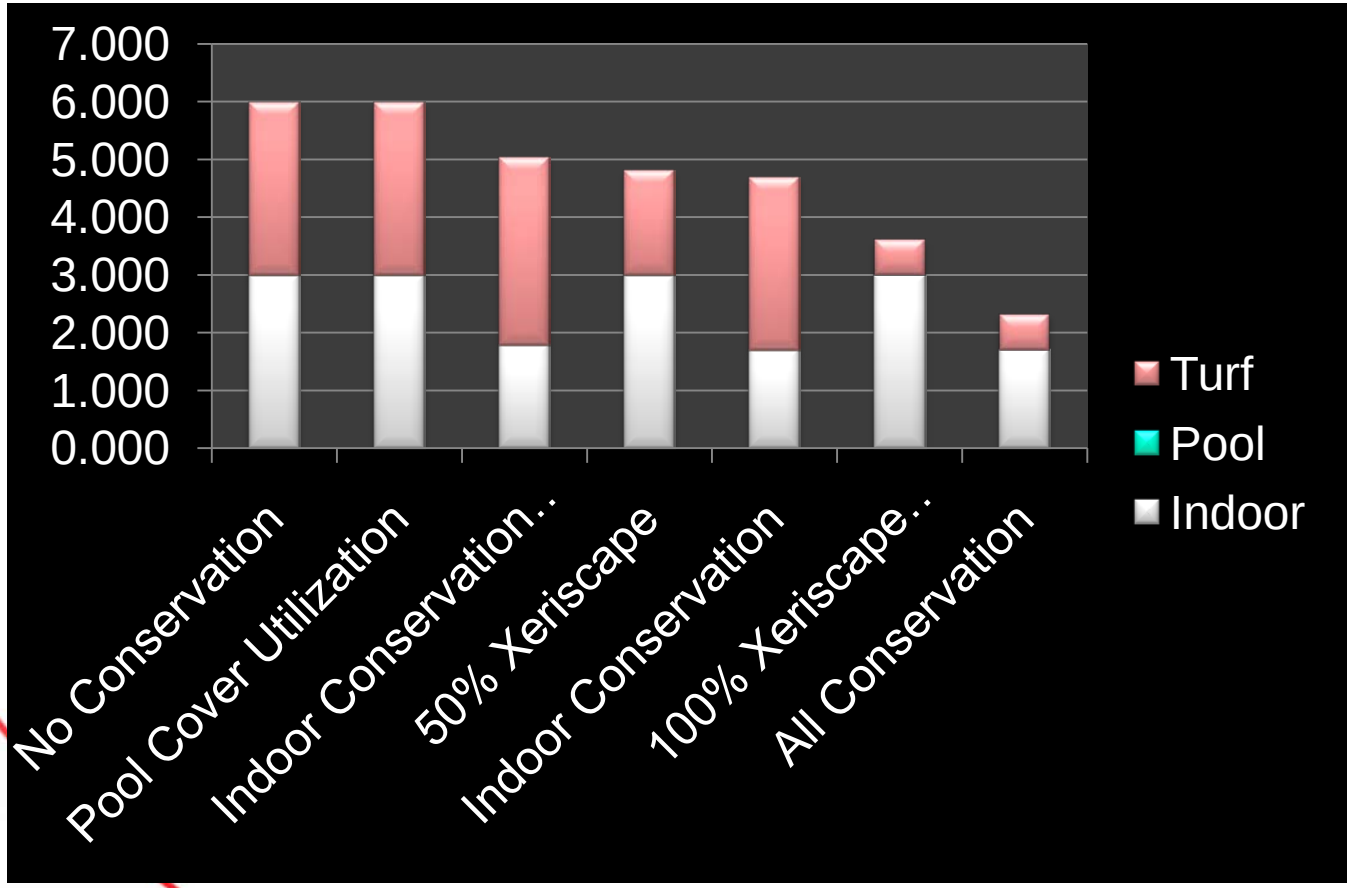
Water Conservation Scenarios



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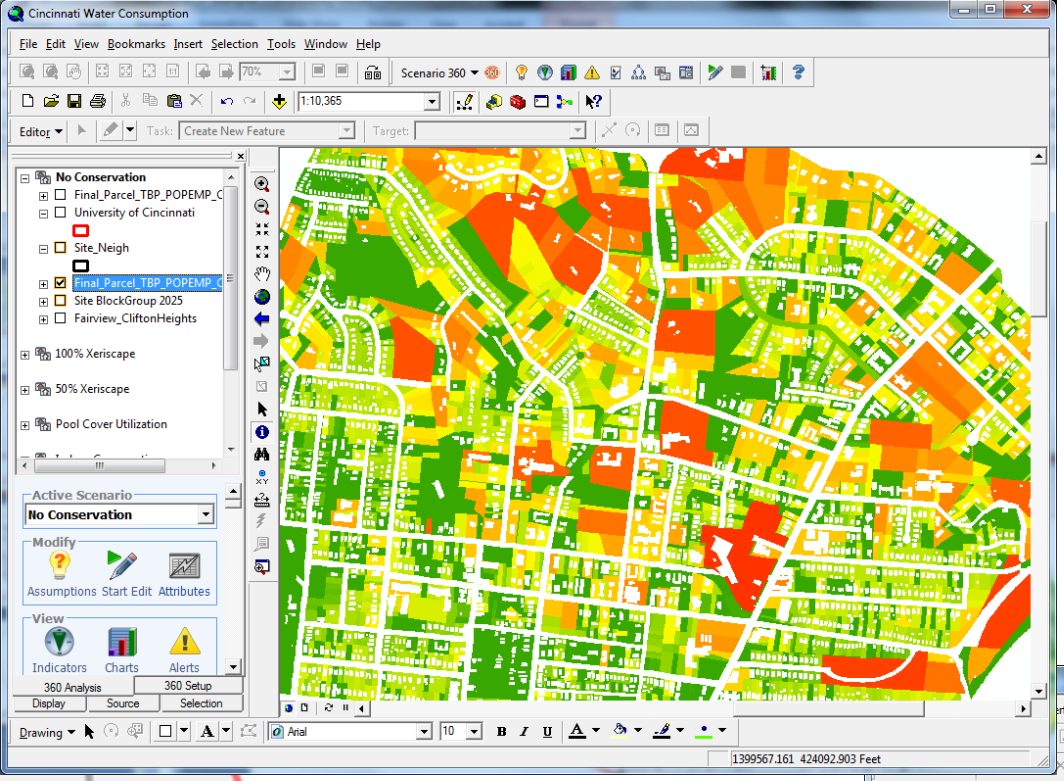
Total Water Consumption

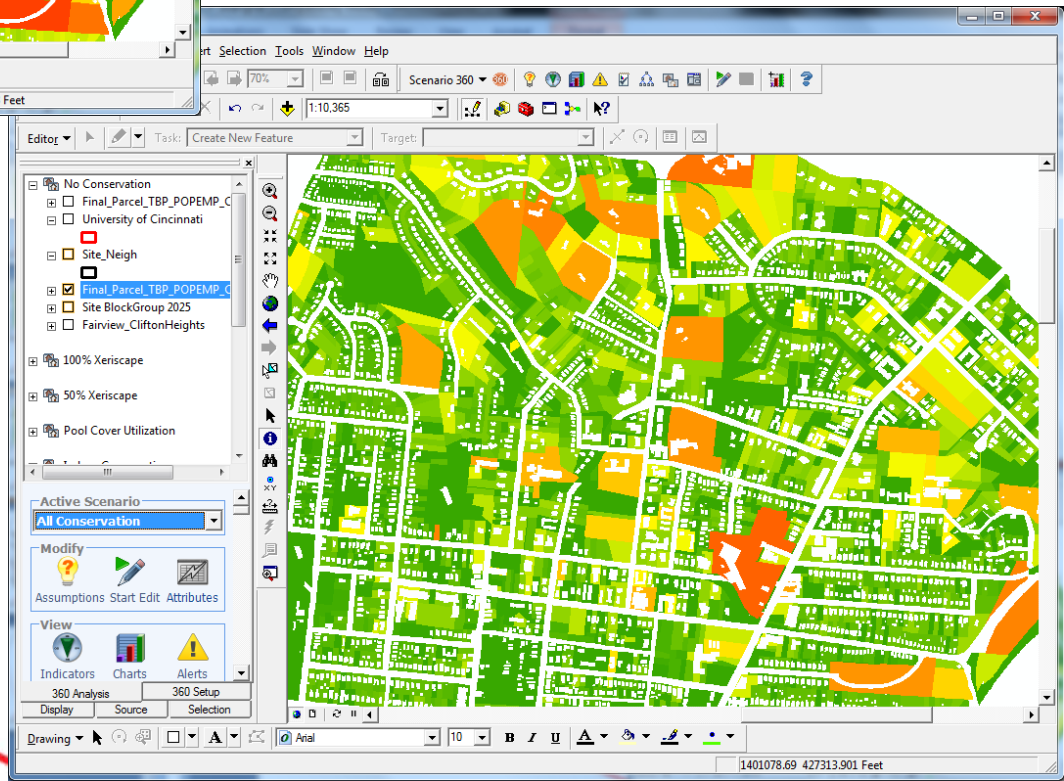


High

Low

All Conservation

No Conservation



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Conclusions

- A SB-PSS model can be created to show water conservation scenarios
- The All Conservation scenario had the largest drop in water consumption. Therefore multiple conservation opportunities are the best option
- This model gives citizens and decision makers the tools needed to make decision about water consumption
- They can decide on incentives or rebates to offer to reach a water conservation goal

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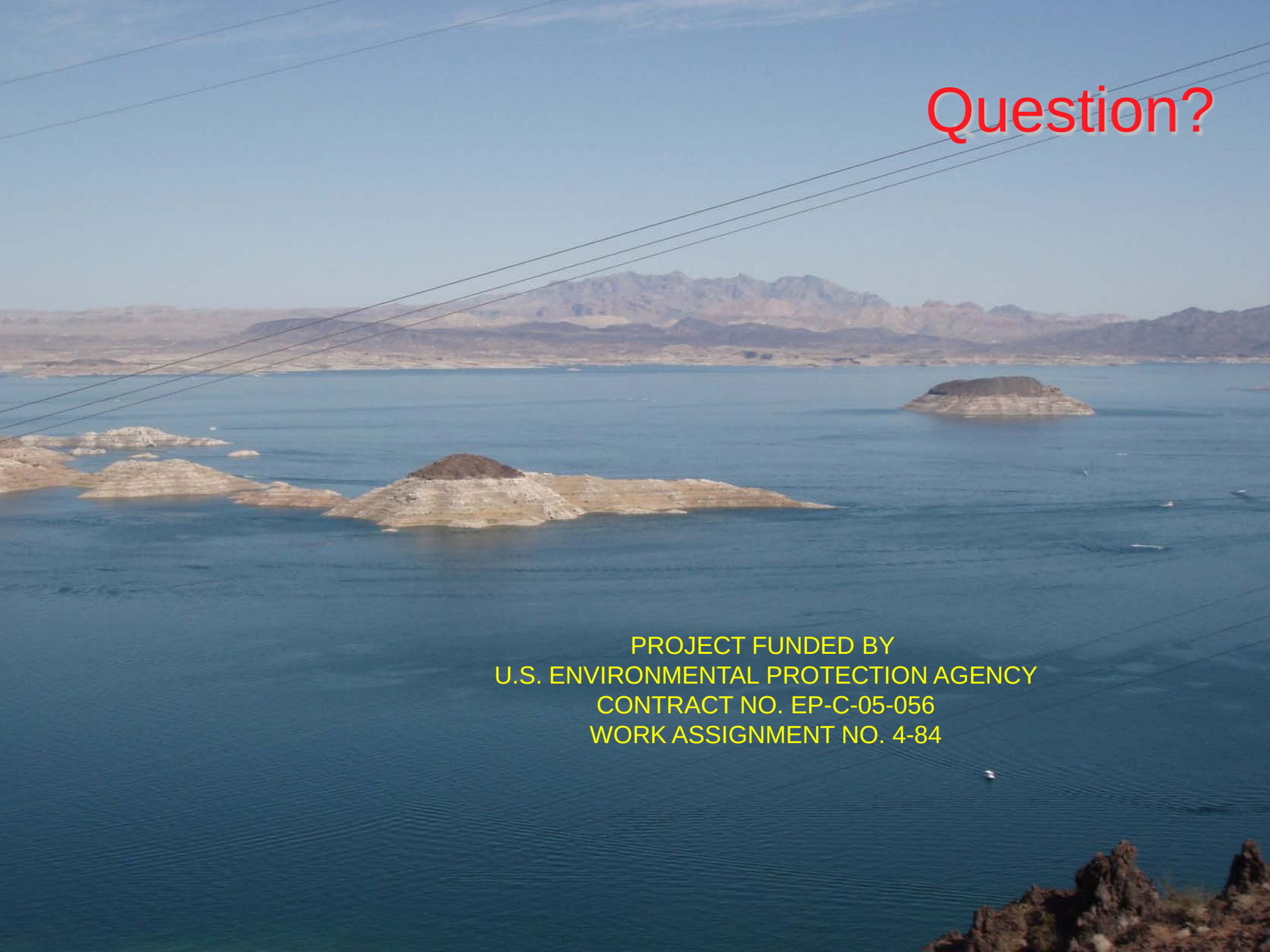

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