A Wed-based Spatial Decision Support System for Potomac Basin Consumptive Water-use

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Advisor: Patrick Reed
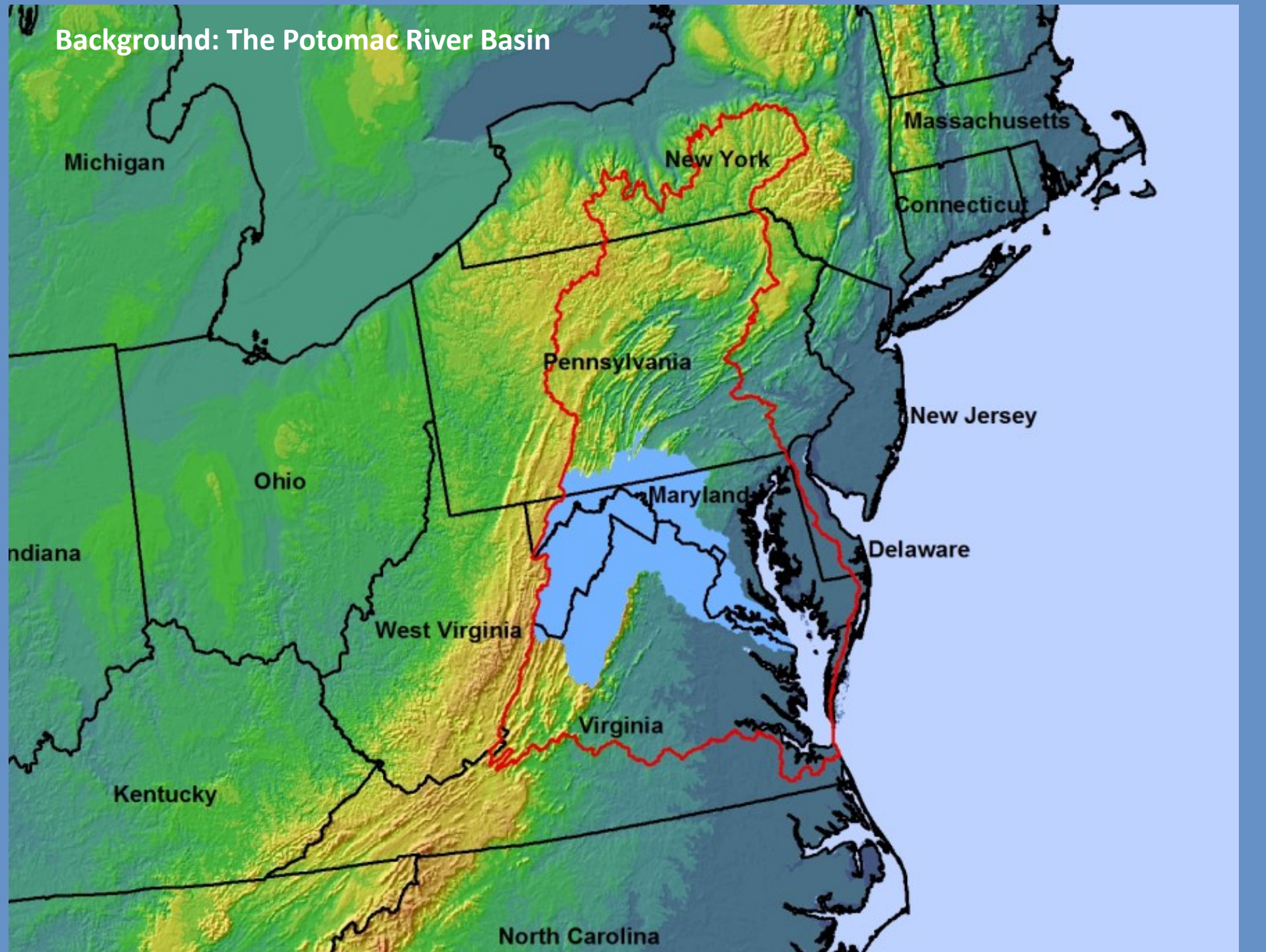
Background: The Potomac River & What is consumptive water use?

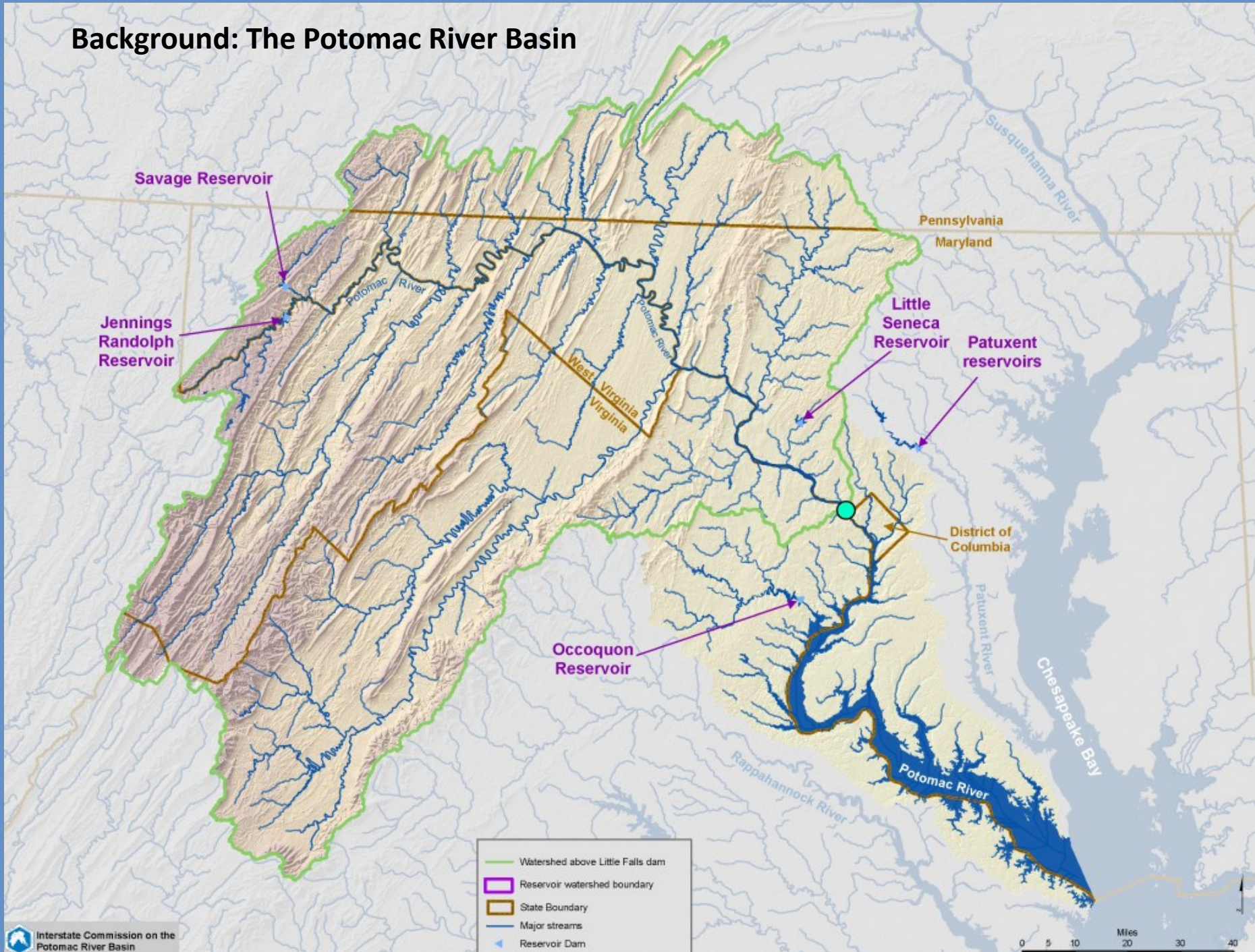**Goals and Objectives:** Creating a decision support system

Proposed Methodology: Open source architecture

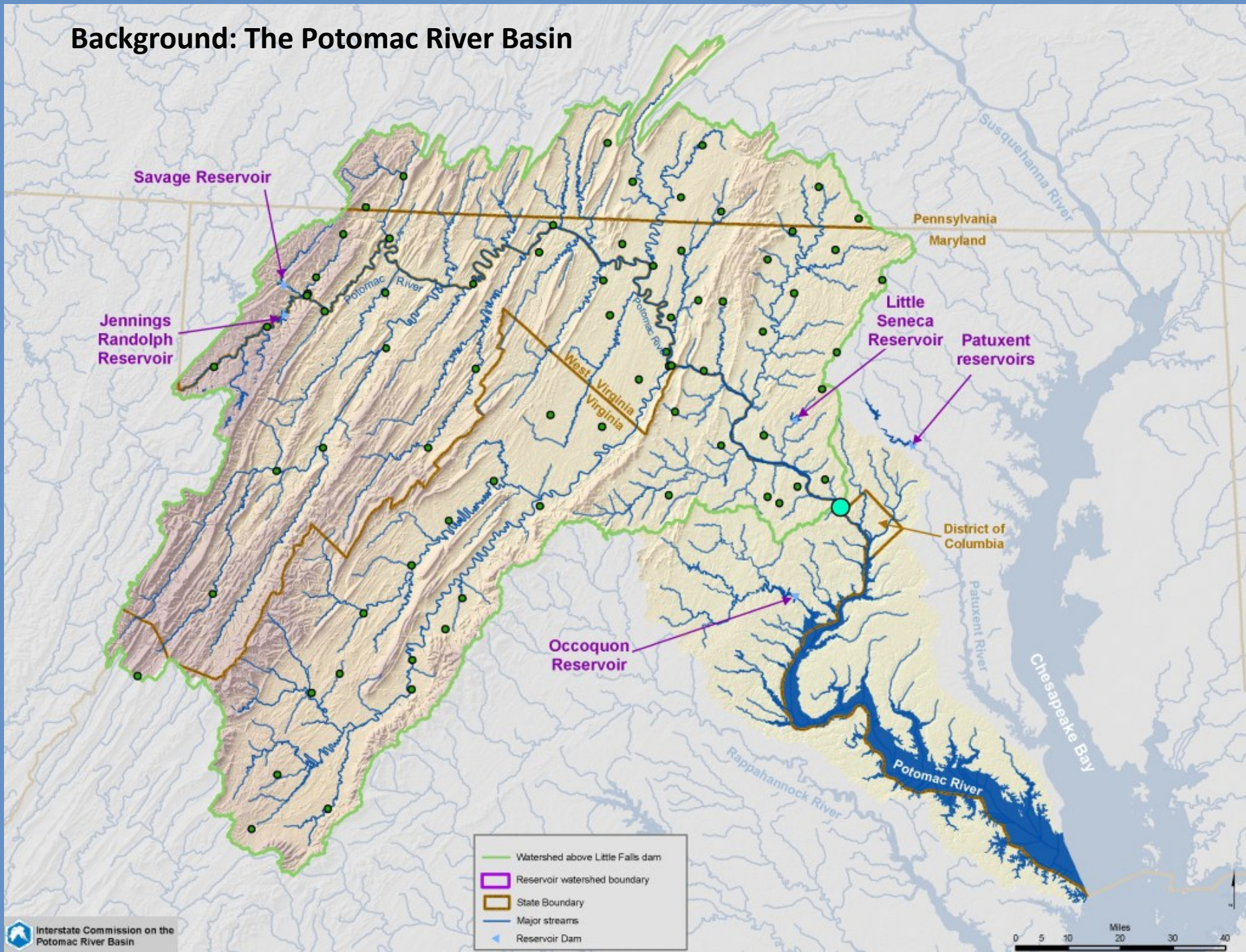**Project Timeline:** Develop application, develop topology

Background: The Potomac River Basin

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Savage Reservoir

Jennings Randolph Reservoir

Little Seneca Reservoir

Patuxent reservoirs

Occoquon Reservoir

Pennsylvania
Maryland

West Virginia
Virginia

District of Columbia

Potomac River

Susquehanna River

Patuxent River

Chesapeake Bay

Rappahannock River

Potomac River

Watershed above Little Falls dam
Reservoir watershed boundary
State Boundary
Major streams
Reservoir Dam

Miles
0 5 10   20   30   40

Interstate Commission on the Potomac River Basin

Background: The Potomac River Basin

Consumptive water use:

Part of water withdrawn (from streams or groundwater)

Water withdrawal pumping station on the Potomac River

Approx. 300 – 600 million gallons of water withdrawn per day

Consumptive water use:

Part of water withdrawn (from streams or groundwater) that is

- evaporated,

- transpired,

- incorporated into products or crops,

- consumed by humans or livestock,

- or otherwise removed from the immediate water environment"

Photo CC theogarver

Photo CC Michal_Brcak

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Photo CC Conanthelibrarian

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Photo CC sskennel

Photo CC Frank Peters

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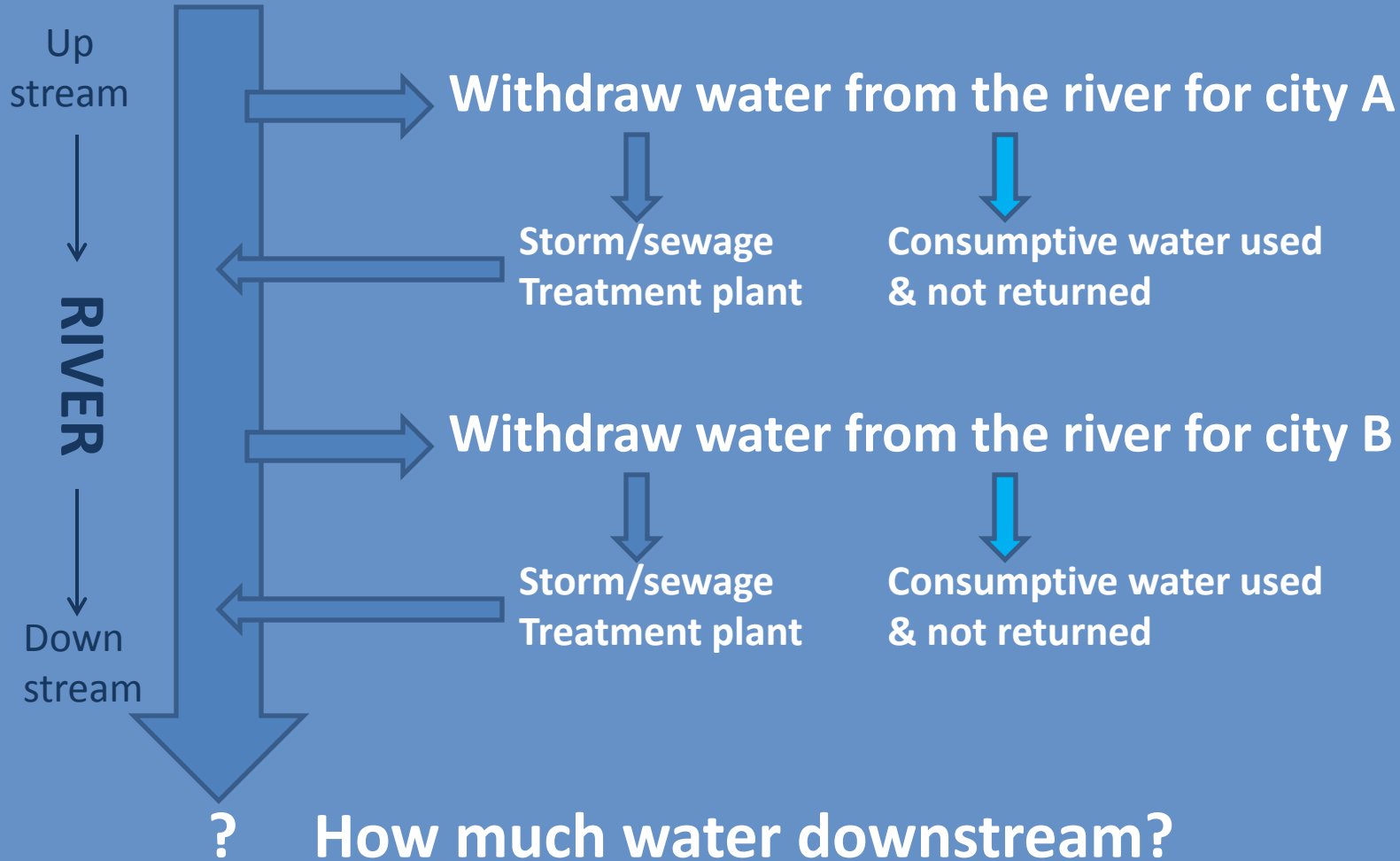

Photo: CC Joost Nelissen

Photo CC dipfan

Background: What is consumptive water use?

Why is knowing consumptive water use important?

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Why is knowing consumptive water use important?

Up stream

RIVER

Withdraw water from the river for city A

Storm/sewage Treatment plant

Consumptive water used & not returned

Withdraw water from the river for city B

Storm/sewage Treatment plant

Consumptive water used & not returned

Down stream

?   How much water downstream?

Goals and Objective: Creating A Spatial Decision Support System

Two main objectives:

1. **Create pilot web-based spatial decision support mapping system**
   - provide consumptive use and stream flow information for water resource managers to help make sound resource decisions

   - consumptive use information for each watershed is at first only derived by subtracting discharge flow data from withdrawal data

   - utilize existing watersheds for which stream flow data exists (no dynamic watershed delineation)

2. **Expand and develop spatial database to include conveyance-node watershed topology**

   - system to more easily track water usage interactions between permitted withdrawals, users, distribution systems, and dischargers

Goals and Objective: Creating A Spatial Decision Support System

Has this been done before?

USGS – StreamStats

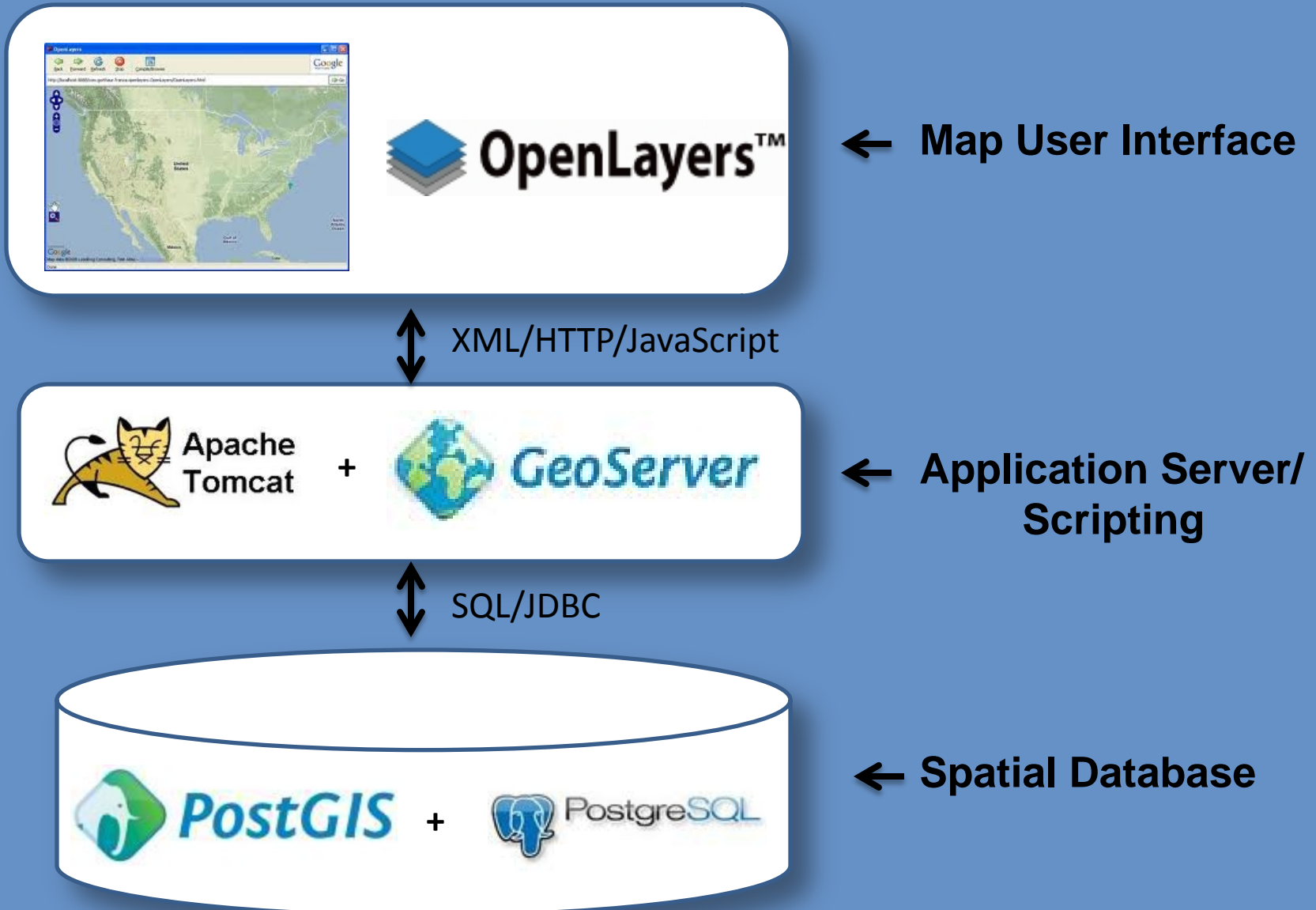Great Lakes Commission Water Resources Management Decision Support System (WRMDSS)

West Virginia Water Withdrawal Guidance Tool

Michigan Water Withdrawal Assessment Tool

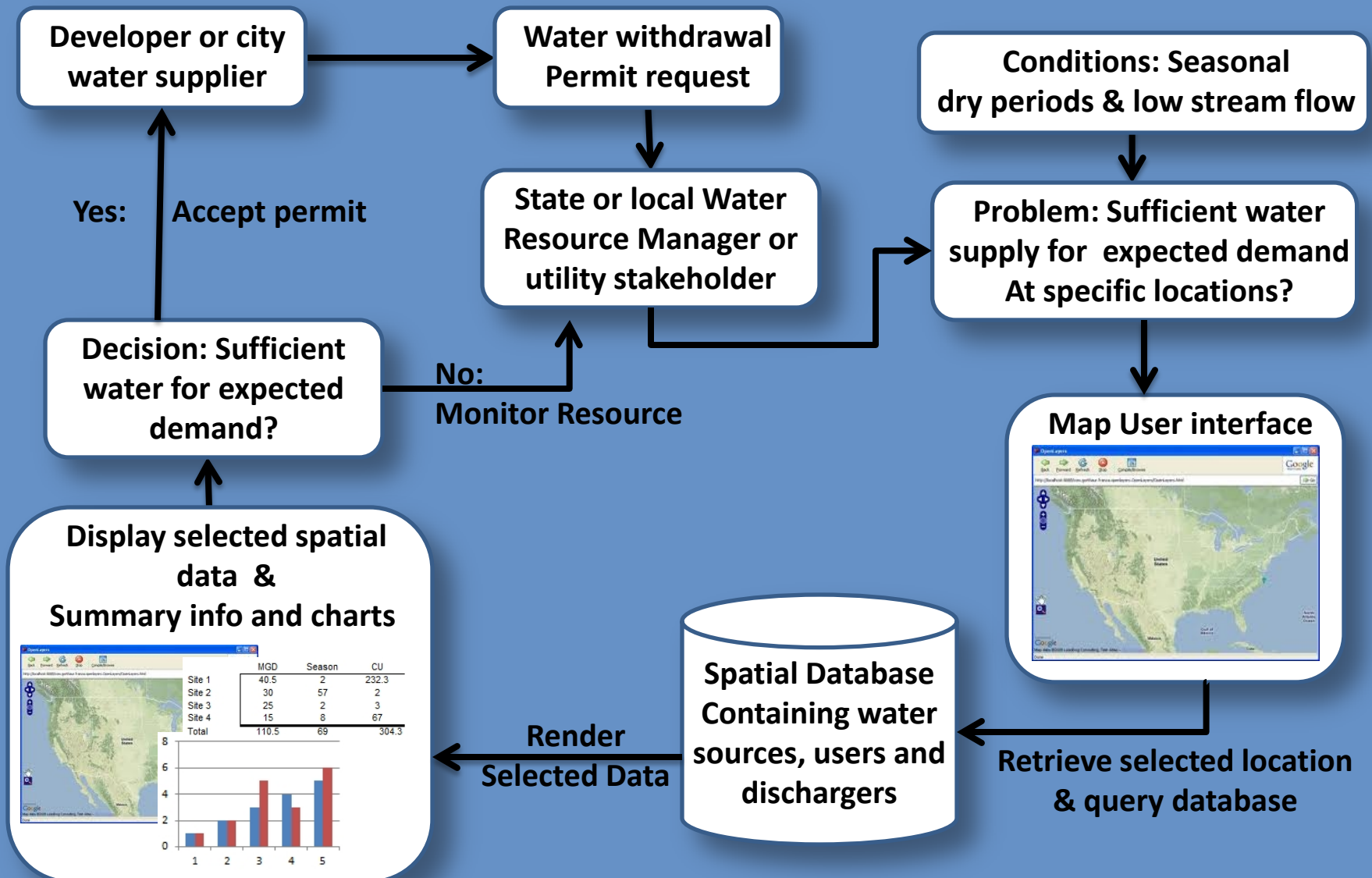Colorado Basin Watershed Flow Evaluation Tool Project

…and others.

**Proposed Methodology:** **Open Source Geospatial Architecture**

← **Map User Interface**

XML/HTTP/JavaScript

← **Application Server/ Scripting**

SQL/JDBC

← **Spatial Database**

Proposed Methodology: Creating A Spatial Decision Support System

Developer or city water supplier → **Water withdrawal Permit request**

Conditions: Seasonal dry periods & low stream flow

Yes: **Accept permit**

State or local Water Resource Manager or utility stakeholder

Problem: Sufficient water supply for expected demand At specific locations?

Decision: Sufficient water for expected demand? → **No: Monitor Resource**

Map User interface

Display selected spatial data & Summary info and charts

	MGD	Season	CU
Site 1	40.5	2	232.3
Site 2	30	57	2
Site 3	25	2	3
Site 4	15	8	67
Total	110.5	69	304.3

Render Selected Data ← **Spatial Database Containing water sources, users and dischargers** ← **Retrieve selected location & query database**

Proposed Methodology: Pilot Open Source Architecture

Javascript takes map click and builds SQL statement
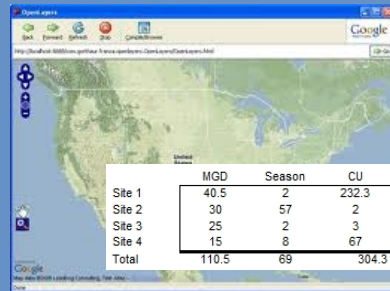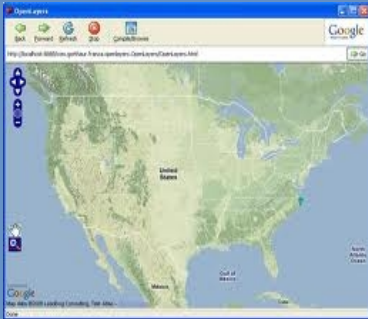
**SQL statement incorporated into JSP script and executed on the DB**

Execute SQL

GeoServer

PostGIS

Basic spatial database of withdrawals and discharges

Selected withdrawals and discharges returned

Selected features wrapped in GeoJson

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GeoJson tiles rendered Attributes from GeoJson features displayed and summarized on screen

Proposed Methodology: Construct Conveyance-Node Watershed Topology Database
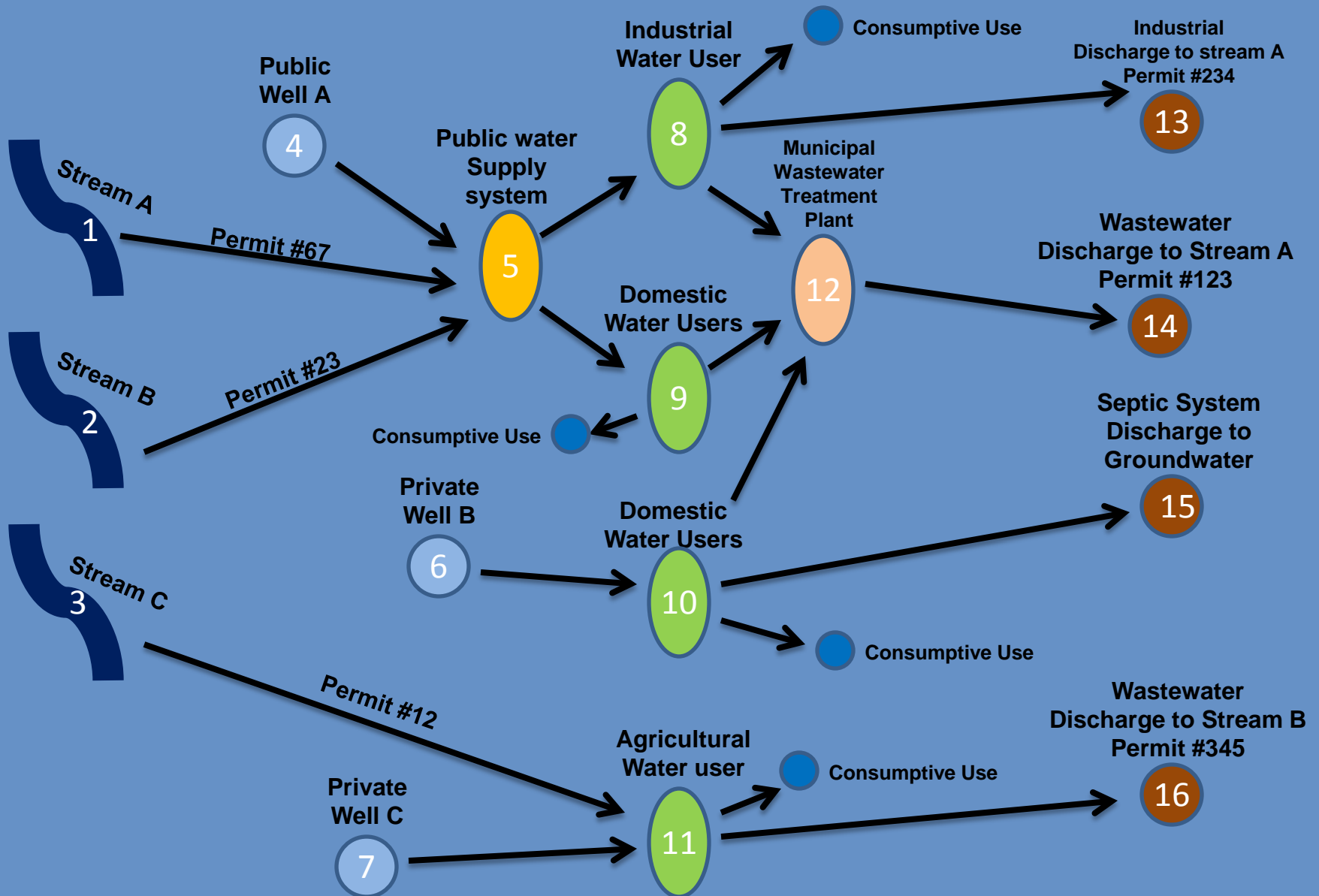
Project Timeline: Develop Application and Topology

Oct 2012 – January 2013:
- Develop basic mapping application capable of extracting consumptive use information from basic spatial database of withdrawals and discharges in the basin

February 2013 – April 2013
- Develop conveyance-node watershed topology database structure
- request additional data from state permitting agencies
- test conveyance-node watershed topology database structure with new data

May 2013 – July 2013
- If conveyance-node topology spatial database is successfully implemented, prepare paper for publishing; otherwise present findings to water resource agencies for review and comment

Anticipated Results: Application presented for review, stakeholder involvement

Pilot application developed
- application is presented to water utility managers, state and local agencies

- feedback is incorporated into refinements or changes to the application to better suit these stakeholders

Application presented to convince agencies to increase data reporting
- state permitting agencies require permit holders to report the amounts of water withdrawn and consumed, but many permit holders don't report it because it's not enforced. Enforcement issues are budget problems.

- Use the application to support state and local agency prioritization of permit withdrawal reporting

Questions?

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