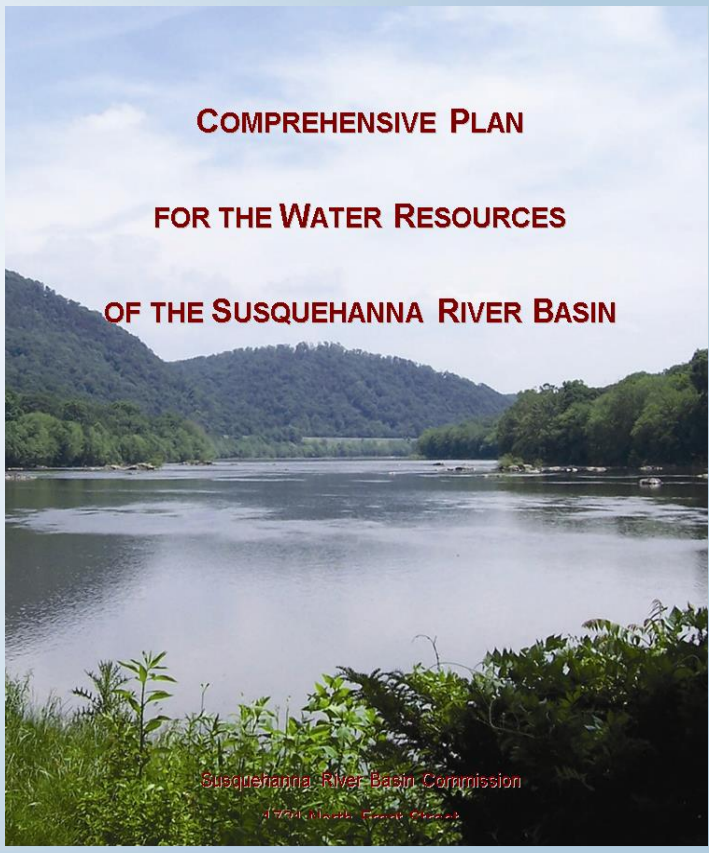
CUMULATIVE WATER USE & AVAILABILITY STUDY

PA Agricultural Advisory Board

October 16, 2013

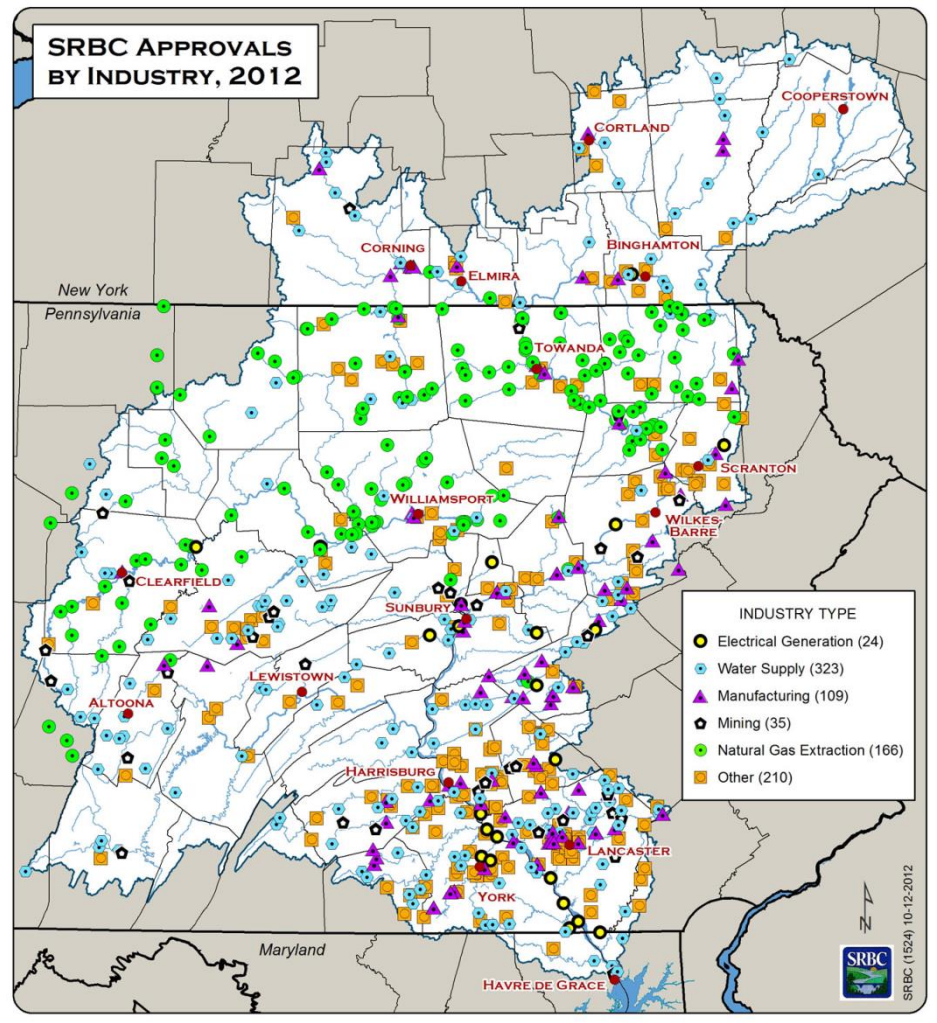
Purpose & Need

- Per major action under Water Supply PMA in Comp Plan:
  - Determine water availability through water budget assessments to establish sustainable limits for water development & protection of instream flow needs
- Influenced by PA State Water Plan & USGS Water Analysis Screening Tool



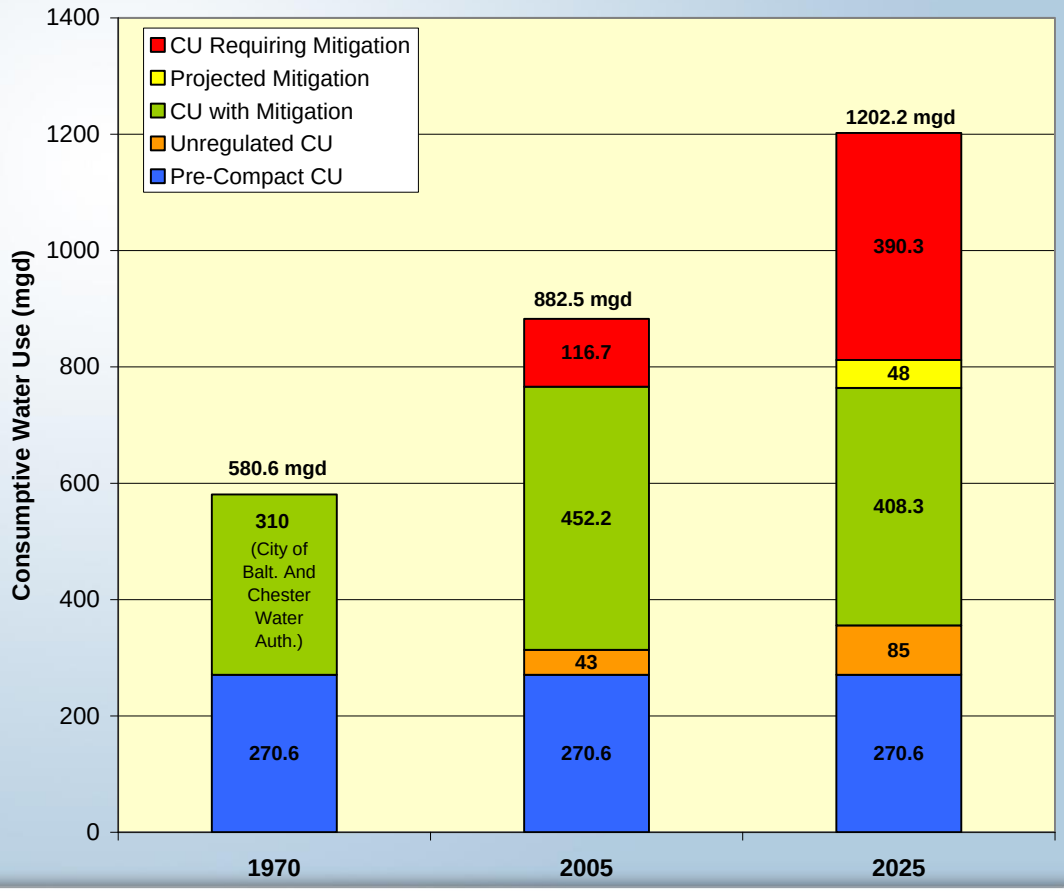
Scope

1. Quantify consumptive water use (CU) for basin watersheds
2. Determine water availability for basin watersheds
3. Develop interactive GIS-based assessment tool
4. Evaluate various protection, mitigation & enhancement (PM&E) measures



Water Use

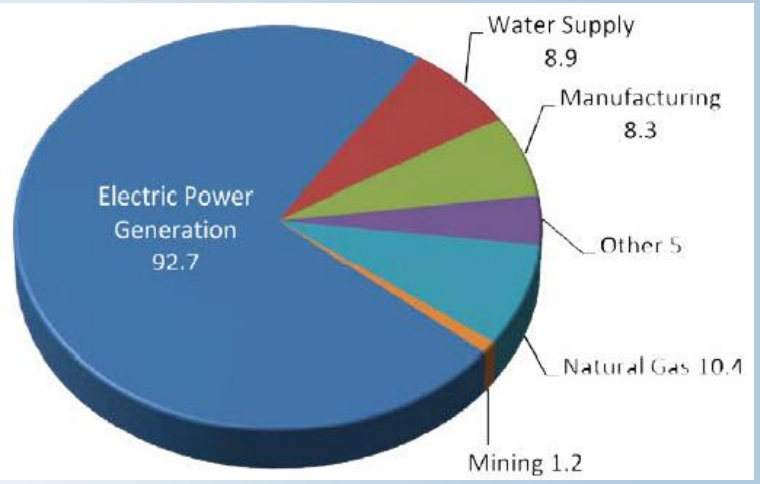
- Compile comprehensive, basin-wide water use data library
  - Integrate SRBC/state databases & develop estimates to fill gaps
- Standardize methodology for calculating cumulative CU at project & watershed scales
- Develop future CU projections using available population, energy demand & other published forecast information



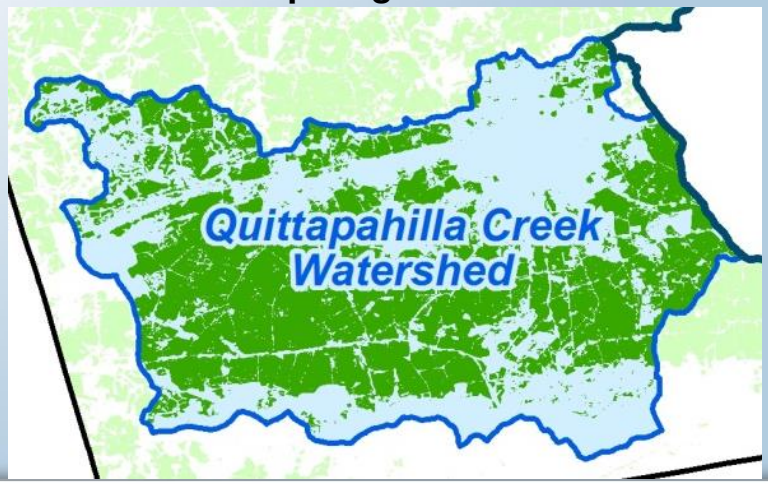
Water Use Data

- **SRBC** - approved & reported withdrawal & CU records
- **NY** - DOH public water supply sources & DEC withdrawal registrations
- **PA** - DEP WUDS withdrawal registrations
- **MD** - MDE withdrawal permits
- **Estimated** - self-supplied residential, crop irrigation, livestock, etc.

2012 Reported CU (mgd)



Crop Irrigation Area



Water Use Data: Status

- Top 5 reference gage watersheds in MGD

Reference Watershed	DA	CU	Irrigation	Livestock	Self-Supplied	Total
Big Wapwallopen Creek	44	19.9	0.040	0.00100	0.07	20.01
Solomon Creek	15.7	18.8	0.001	0.00003	0.01	18.78
Mahantango Creek	162	14.7	0.130	0.20000	0.11	15.15
Conestoga River	324	10.8	1.130	1.90000	1.03	14.90
Conodoguinet Creek	470	10.2	0.700	1.10000	0.70	12.65

Water Availability

Streamflow Statistics

- To be used as benchmarks for defining water availability indices
- Total of 44 streamflow statistics computed:
  - 7Q10
  - Mean annual baseflow
  - 2-, 5-, 10-, 25- & 50-year baseflow (5)
  - Monthly median flow (12)
  - Monthly P75 (12)
  - Monthly P95 (12)
  - ADF

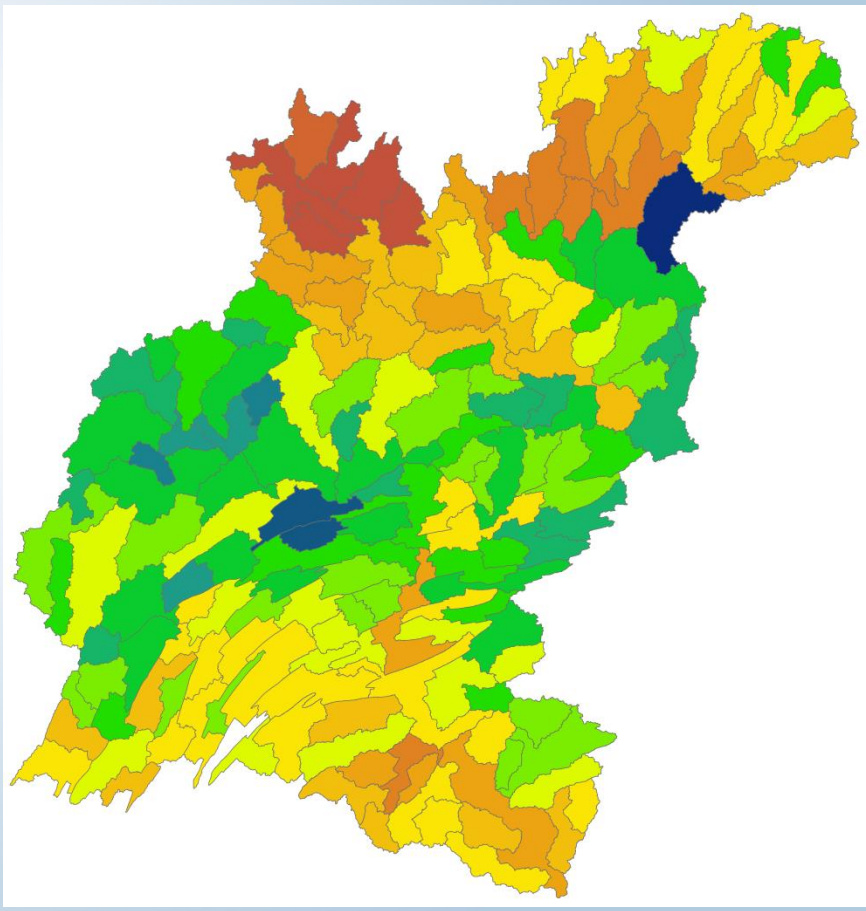
Water Availability

Regional Regression

- Development of regional regression equations:
  - Select reference gages
  - Generate basin characteristics for reference gages
    - Wide range used initially. Limited set in final equations - many highly correlated.
  - Compute streamflow statistics for reference gages
- Application of regional regression equations:
  - Estimate streamflow statistics for ungaged areas throughout basin
    - Including WBD-10's throughout basin

Water Availability

- Identify methods used regionally & nationally to determine water availability for water resources management
- Test preferred methodologies on pilot watersheds & refine
- Apply selected methodology(s) to determine water availability for watersheds basin-wide



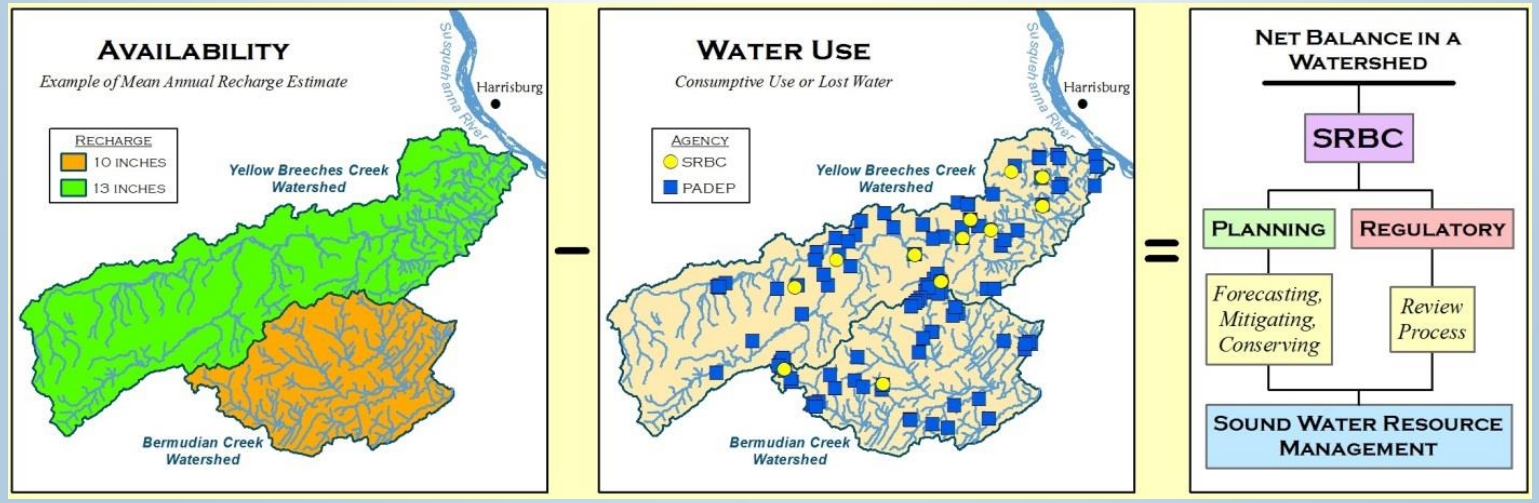
Water Availability

Conceptual Approaches

1. Baseflow recurrence interval
   - 2, 5, 10, 25, and 50-year baseflow recurrence intervals represent a range of climatic conditions
     - SRBC GWMP: 10-year baseflow
2. Low flow margin of safety
   - Define based on margin of two low flow statistics
     - NJ Highlands Council: $P50_{Sept}$ – 7Q10
3. Range of Variability Approach (RVA)
   - Define based on acceptable limits of hydrologic alteration
     - TNC Ecosystem Flow Recommendations for SRB

GIS-Based Assessment Tool

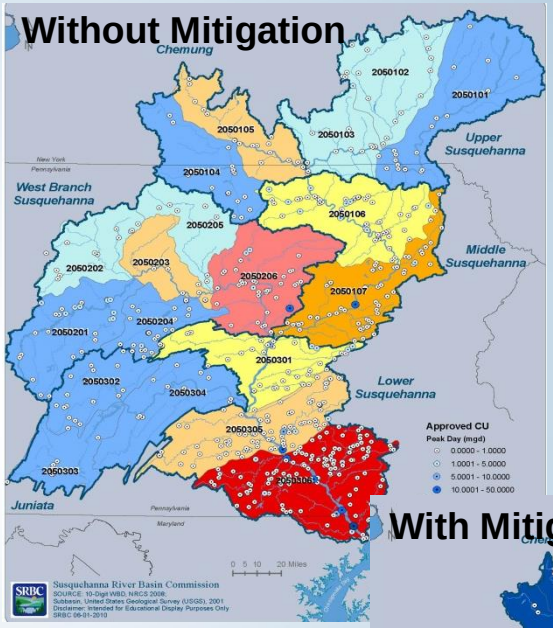
- Allow for watershed selection or pour-point delineation
- Calculate cumulative CU for watershed
- Calculate water availability for watershed
- Calculate net balance & generate report summarizing inputs

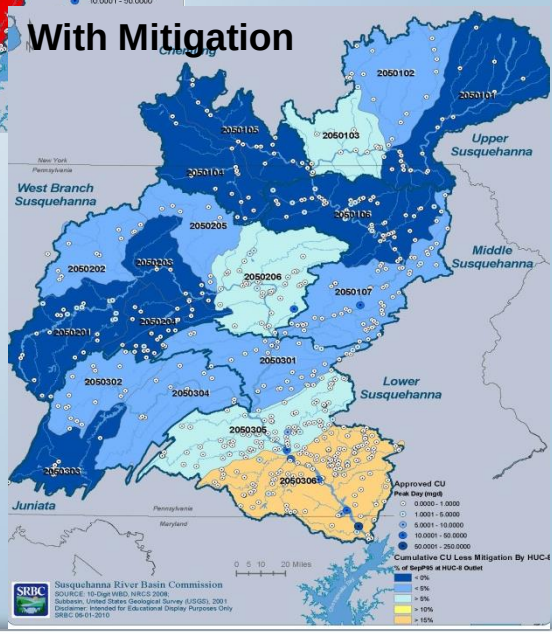


- Incorporate flexibility for evaluating various water use scenarios

Evaluate PM&E Measures

- Utilize tool to evaluate WRM alternatives
- Identify potentially stressed areas in basin
  - Assess various PM&E measures for stressed areas
  - Examples include addressing approved vs. reported use discrepancies, establishing watershed caps, implementing passby flows & conservation releases, providing CU mitigation releases, etc.

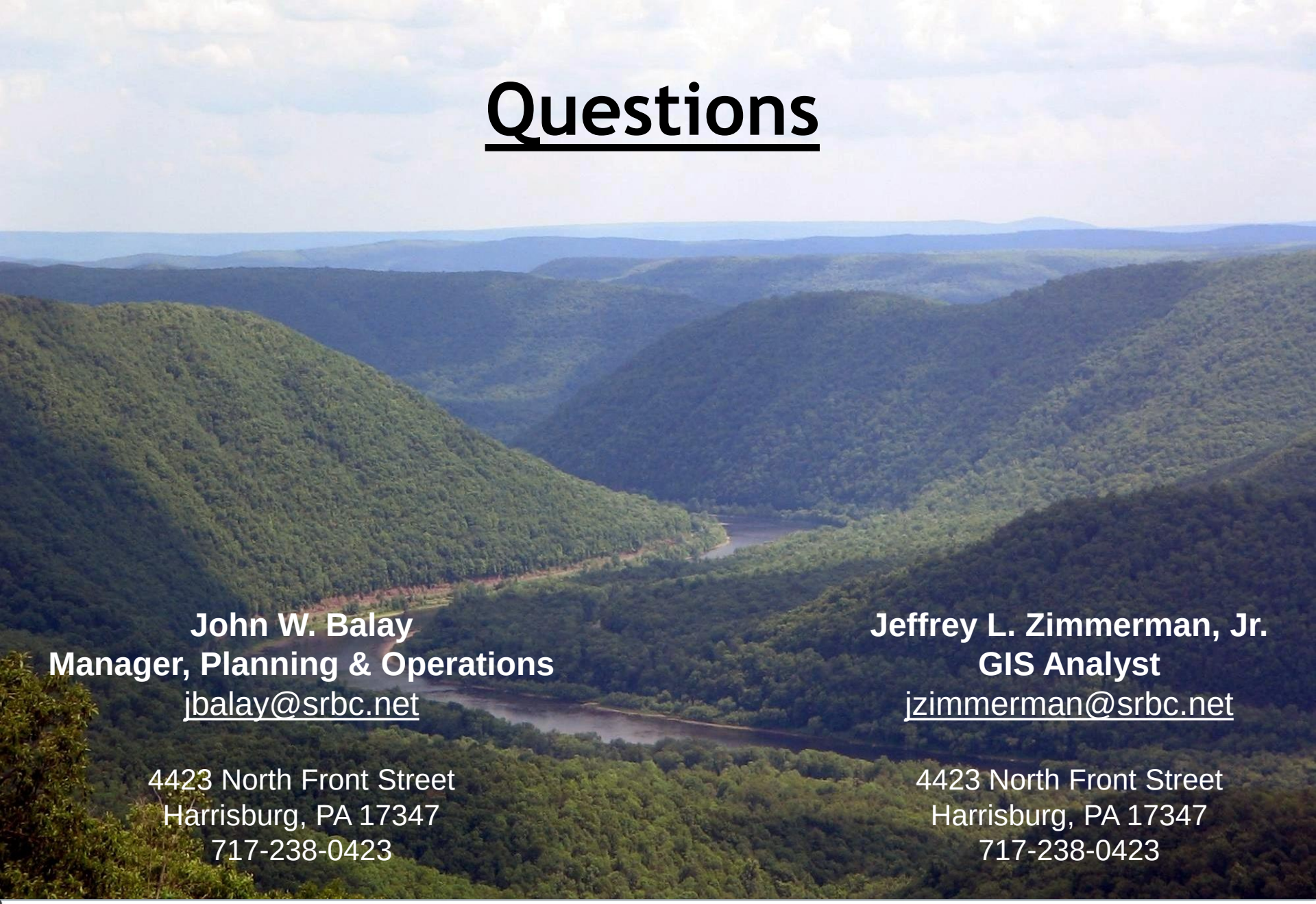




Next Steps

- Test/refine water availability determination methods
- Short-list water availability indices
- Develop water use projections
- Continue tool development work
- **Next Study Information Session - Nov. 4, 2013**

Questions



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Water Use Data
Estimated Records

- Agricultural - Livestock
  - USDA 2007 Ag Census data used to tabulate number of livestock by type for each county in basin
  - CU factors by livestock type taken from "Estimation of Agricultural Animal and Irrigated-Crop Consumptive Water Use in the Susquehanna River Basin for the Years 1970, 2000, and 2025"
  - Livestock CU per county attributed to row crop & hay/pasture landuse type in 2006 Chesapeake Bay landuse coverage per USGS OFR 2008-1106
  - Determined for study area based on change in area ratio assuming equal livestock distribution in row crop areas in each county

Water Use Data
Estimated Records

- Agricultural - Irrigation
  - USDA 2007 Ag Census data used to tabulate irrigated land for each county in basin
  - Estimated water applied by crop retrieved for each state using Ag Census Farm & Ranch Irrigation Surveys
  - USDA 2010 Cropland Data coverage used to spatially distribute irrigation water use across counties in basin
  - Determined for study area based on change in area ratio assuming equal irrigation distribution in irrigated crop areas in each county

USDA CENSUS OF AGRICULTURE
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Crop Irrigation Area