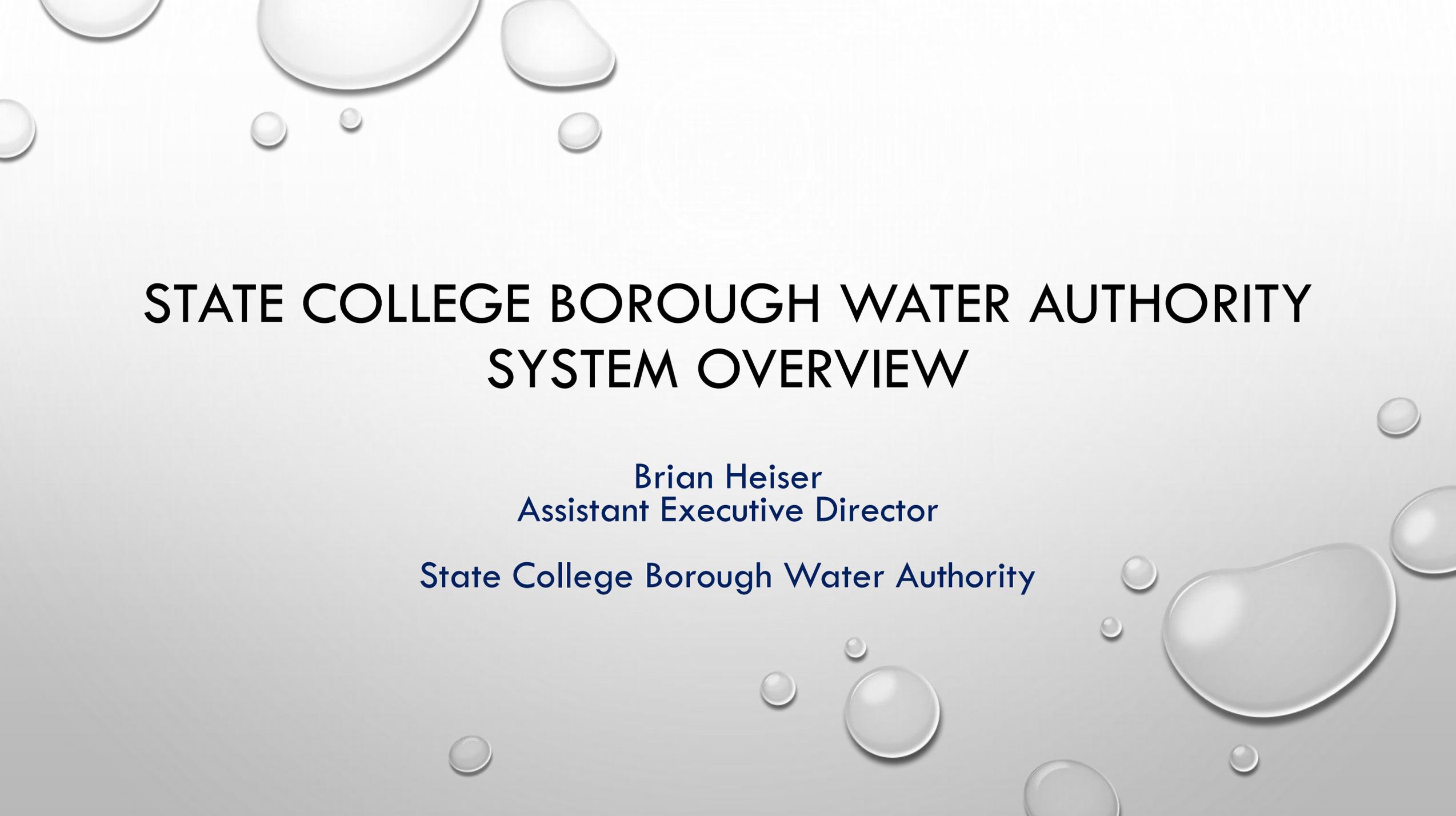
The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The text is centered on the slide.

STATE COLLEGE BOROUGH WATER AUTHORITY LAND DEVELOPMENT LEGAL AUTHORITY

Robert Mix, Esq.
Authority Solicitor

Lee, Green & Reiter, Inc.

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance.

STATE COLLEGE BOROUGH WATER AUTHORITY SYSTEM OVERVIEW

Brian Heiser
Assistant Executive Director

State College Borough Water Authority

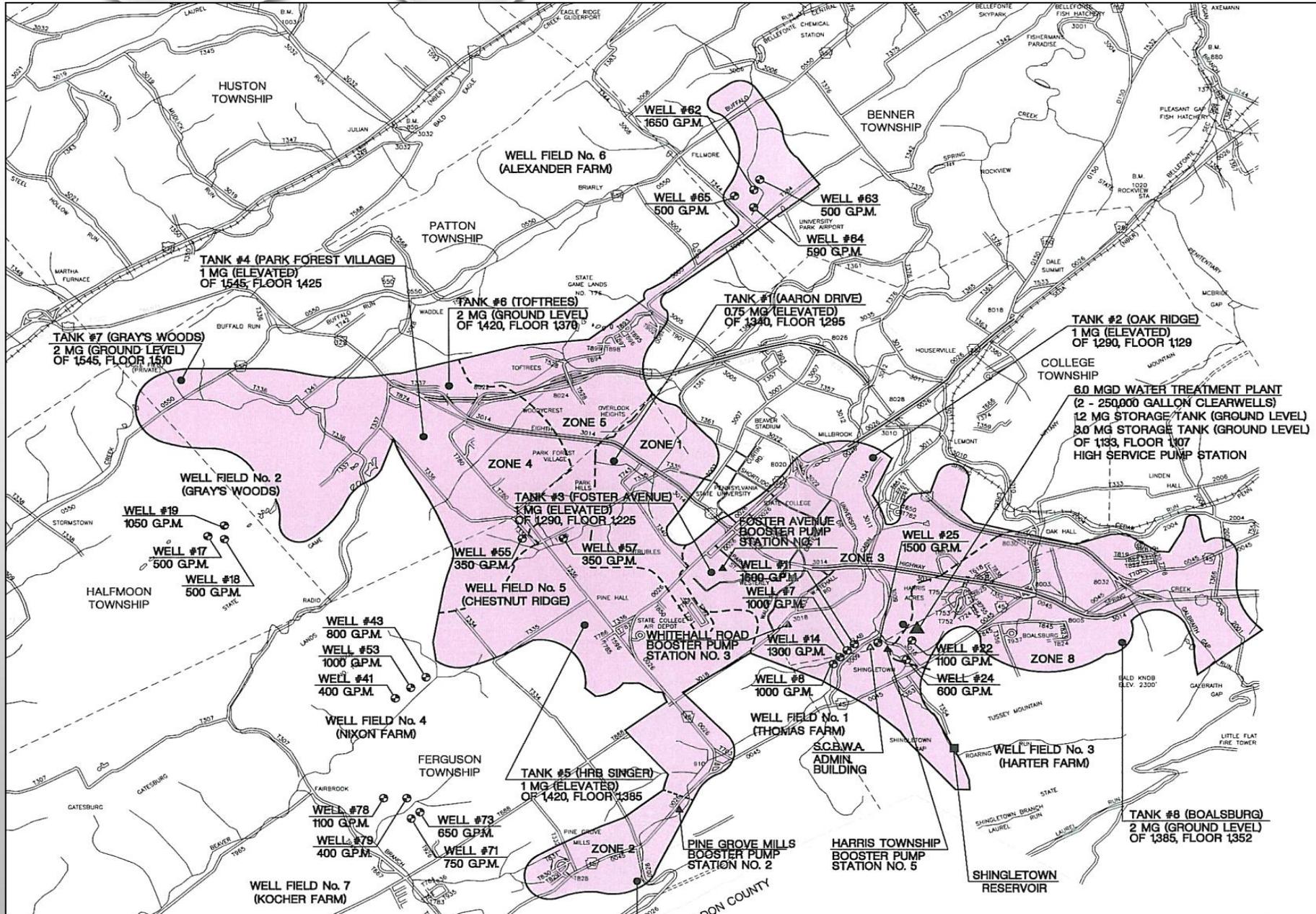
QUICK FACTS

- **Susquehanna River Basin Commission Withdrawal Limit: 9.1 MGD**
- **Average Daily Demand: 5.0 MGD**
- **Current Peak Day Demand: 6.2 MGD**
- **Current Minimum Day Demand: 3.6 MGD**
- **Customers: 14,700**
- **Estimated Population Served: 75,000**
- **Service Area: State College Boro & Benner, College, Ferguson, Harris, Patton Twps**

SOURCES OF SUPPLY

- Slab Cabin Run: 7.3 MGD (All Sources Filtered)
 - Shingletown Gap Reservoir - 2.00 MGD, Peak
 - Harter Well Field - 2.50 MGD, Peak
 - Thomas Well Field - 3.37 MGD, Peak
- Nixon Well Field: 3.00 MGD
- Kocher Well Field: Not to Exceed 25% of Total Demand
- Chestnut Ridge Well Field: 1.01 MGD
- Alexander Well Field: 4.70 MGD
- Grays Woods Well Field: 3.88 MGD

WATER SUPPLY, PUMPING AND TREATMENT FACILITIES MAP



WATER SUPPLY AND TREATMENT FACILITIES



7 Well Fields (23 Wells)



Woodside Water Treatment Plant (6 MGD)



Shingletown Reservoir



6 Pump Stations

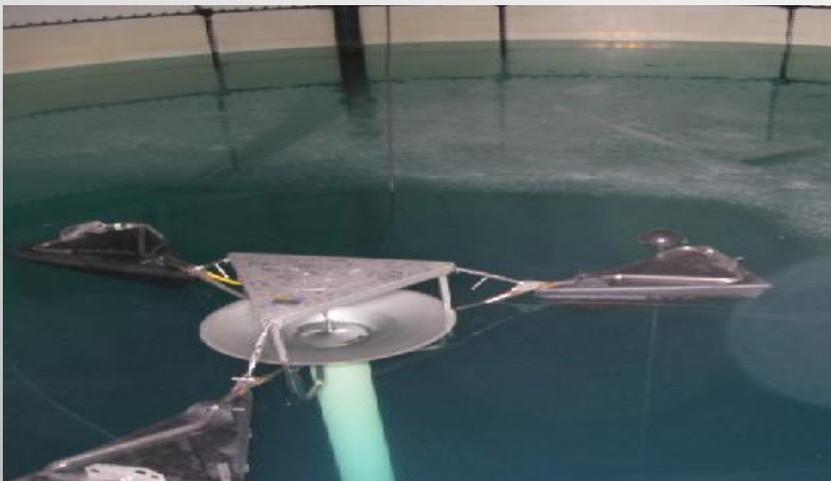
DISTRIBUTION, STORAGE & CUSTOMER FACILITIES



240 Miles of Pipe & 1,100 Fire Hydrants



14,700 Meters (Advanced Metering Infrastructure)



Tank Mixing Systems



13 Storage Tanks (15.75 MG)

WOODSIDE WATER TREATMENT FACILITY SOURCES

Raw Water Sources:

Shingletown Gap Reservoir – Seasonal

Harter Well Field – 3 Wells, GUDI

Thomas Well Field – 4 Wells, GUDI

Potential Sources of Contamination:

Agricultural Activities

Highway Runoff

On-Lot Septic Systems

Sinkholes



WOODSIDE WATER TREATMENT PROCESS

Treatment:

- Multi-Media Filters for Particle & Bacterial Removal
- Chemical Addition to Enhance Particle Removal
- Chlorine Disinfection

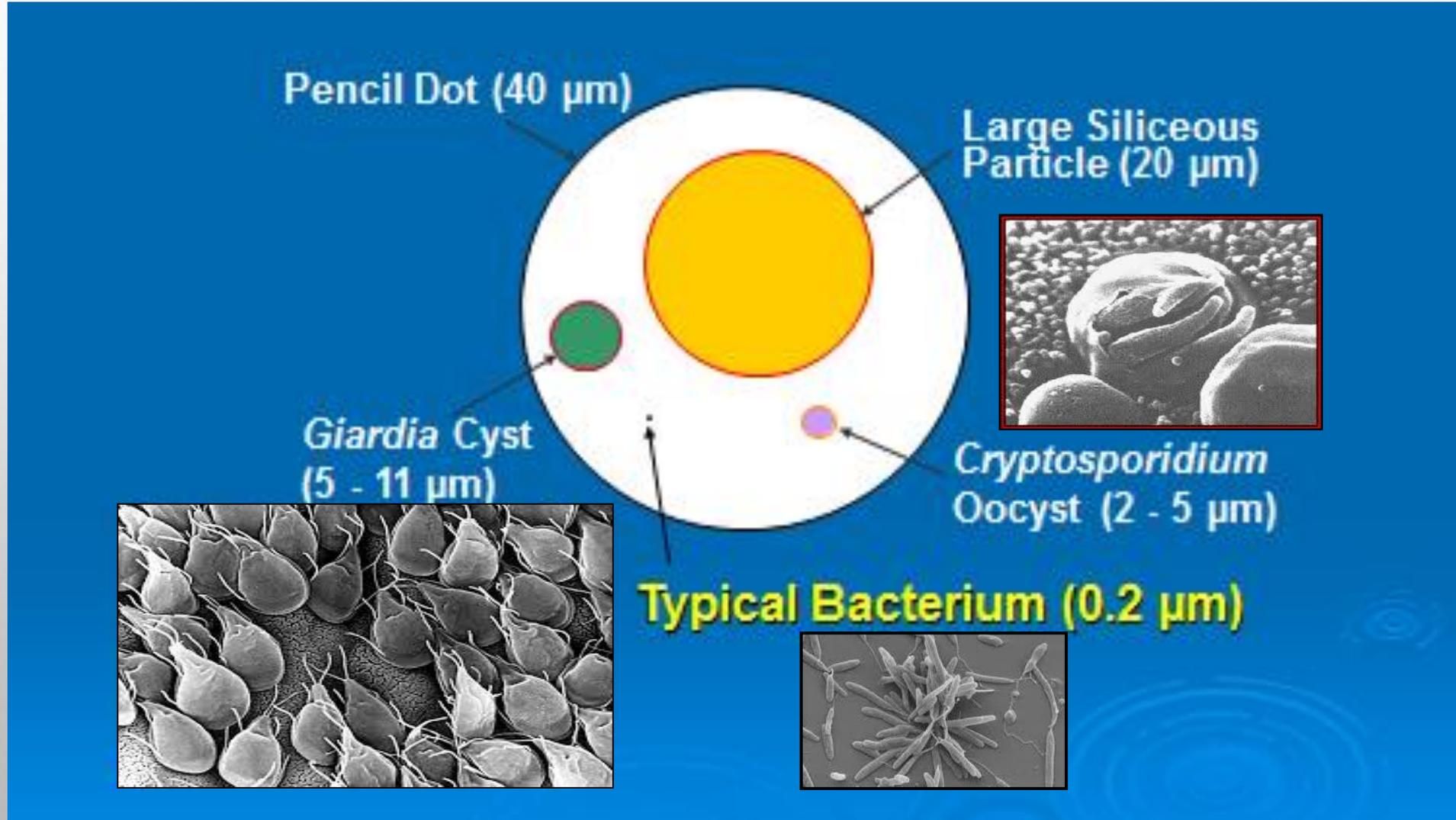
Production: 3.0 MGD (60% of total production)

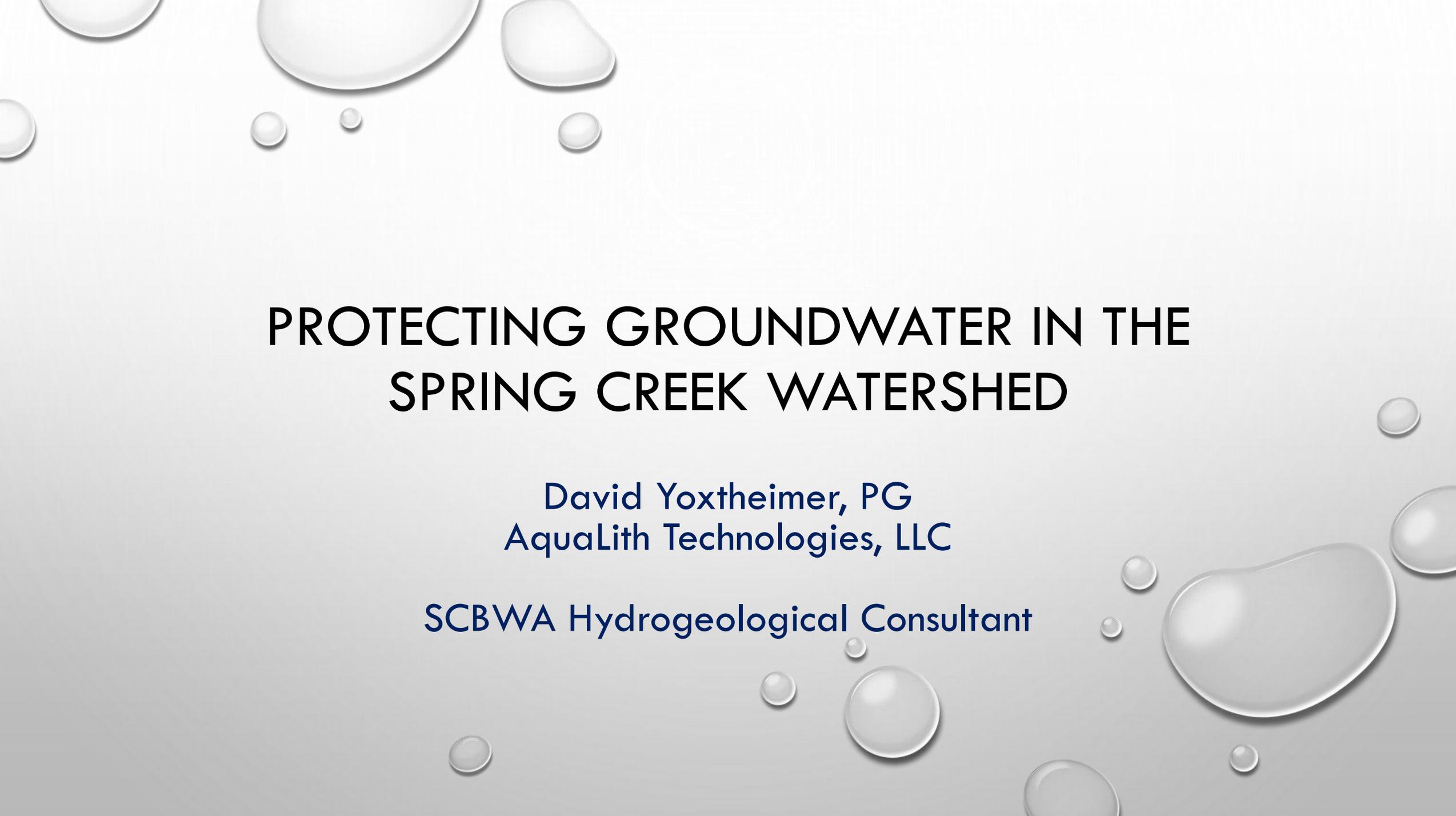
Age: Approaching 20 Years of Service

Condition: Upgrade Required in 5 to 10 Years



FILTRATION SYSTEM REMOVAL - RELATIVE PARTICLE SIZE



The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance.

PROTECTING GROUNDWATER IN THE SPRING CREEK WATERSHED

David Yoxtheimer, PG
AquaLith Technologies, LLC

SCBWA Hydrogeological Consultant

SPRING CREEK BASIN HYDROLOGIC CHARACTERISTICS



(Source: USGS, 2005)

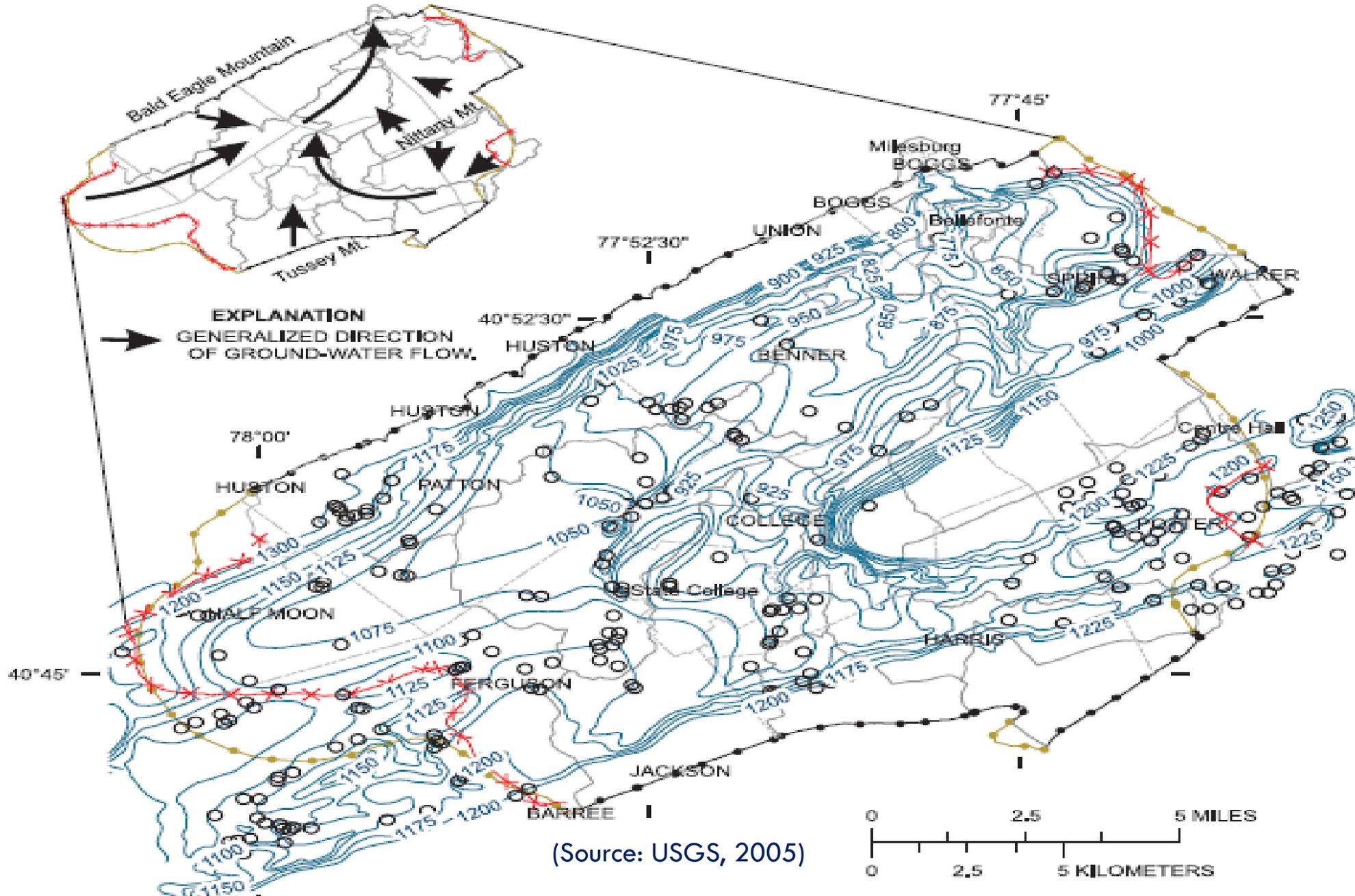
- THE BASIN DRAINS 175 SQ. MI. INCLUDING 29 SQ. MI. WITHIN SPRUCE CREEK VIA GROUNDWATER DIVERSION
- AVERAGE GROUNDWATER RECHARGE RATE OF ABOUT 734,000 GALLONS PER DAY PER SQ. MI.
- AVERAGE BASEFLOW OF ~125 MILLION GALLONS/DAY AT MILESBURG
- PUBLIC WATER SUPPLIES WITHDRAW ~7-8% OF TOTAL GROUNDWATER RECHARGE FROM THE BASIN (9-10 MGD), MOST OF IT IS RETURNED VIA WASTEWATER TREATMENT PLANTS

GROUNDWATER IN THE SPRING CREEK BASIN

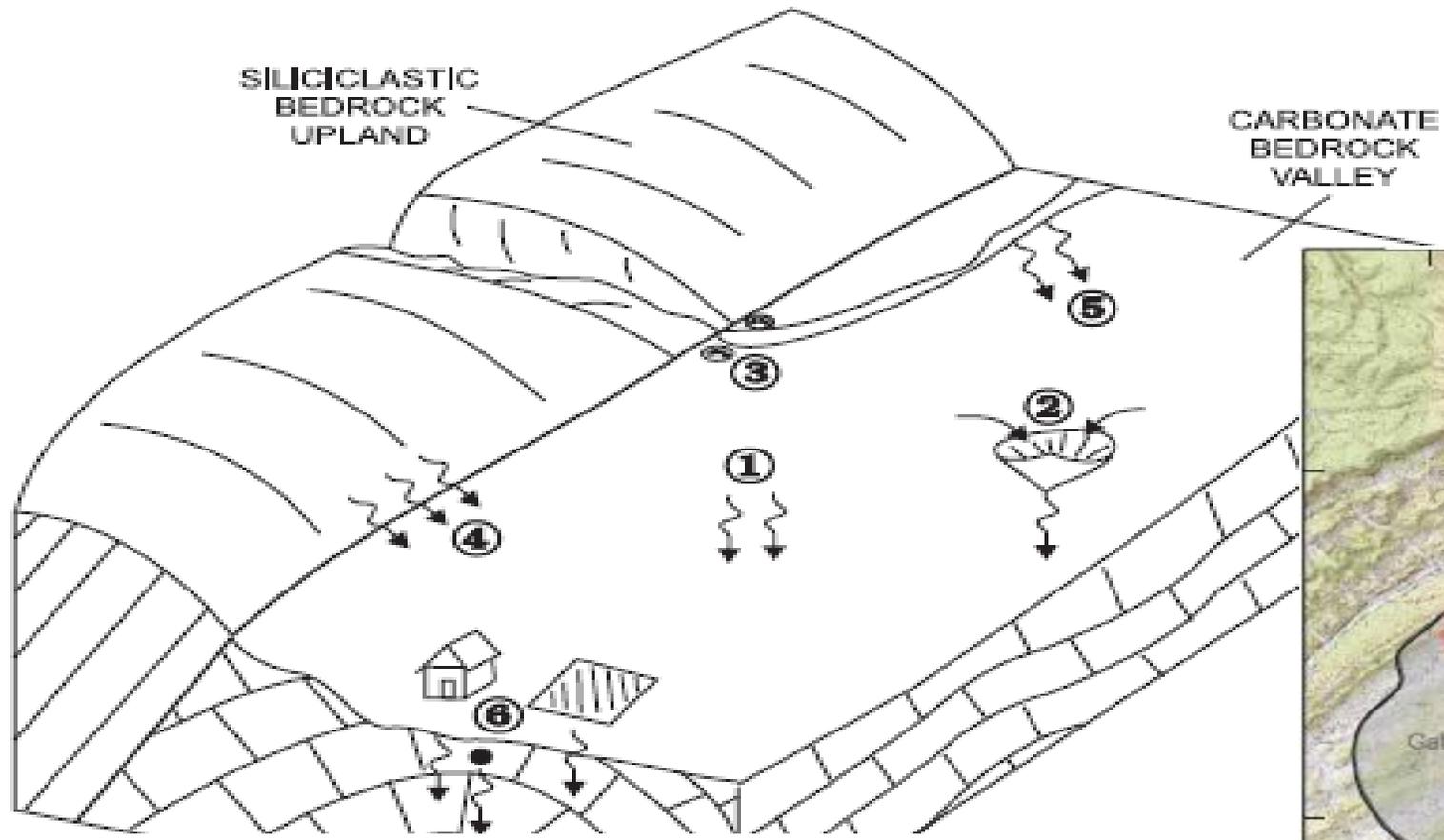
- GROUNDWATER IS THE PRIMARY SOURCE OF DRINKING WATER IN THE SPRING CREEK BASIN (>95%)
- BASE FLOW IN SPRING CREEK SUSTAINS 86% OF ITS FLOW
- THE FRACTURED, KARSTIFIED CARBONATE BEDROCK AQUIFERS THAT UNDERLIE THE VALLEY FLOOR PROVIDE PROLIFIC WATER SUPPLIES....YET ARE VULNERABLE TO DEGRADATION
- MOUNTAIN RIDGES AND SLOPES REPRESENT ABOUT 22% OF THE BASIN'S AREA WHILE MOUNTAIN RUNOFF REPRESENTS AT LEAST 33% OF SPRING CREEK'S FLOW



WATER TABLE MAP OF SPRING CREEK BASIN

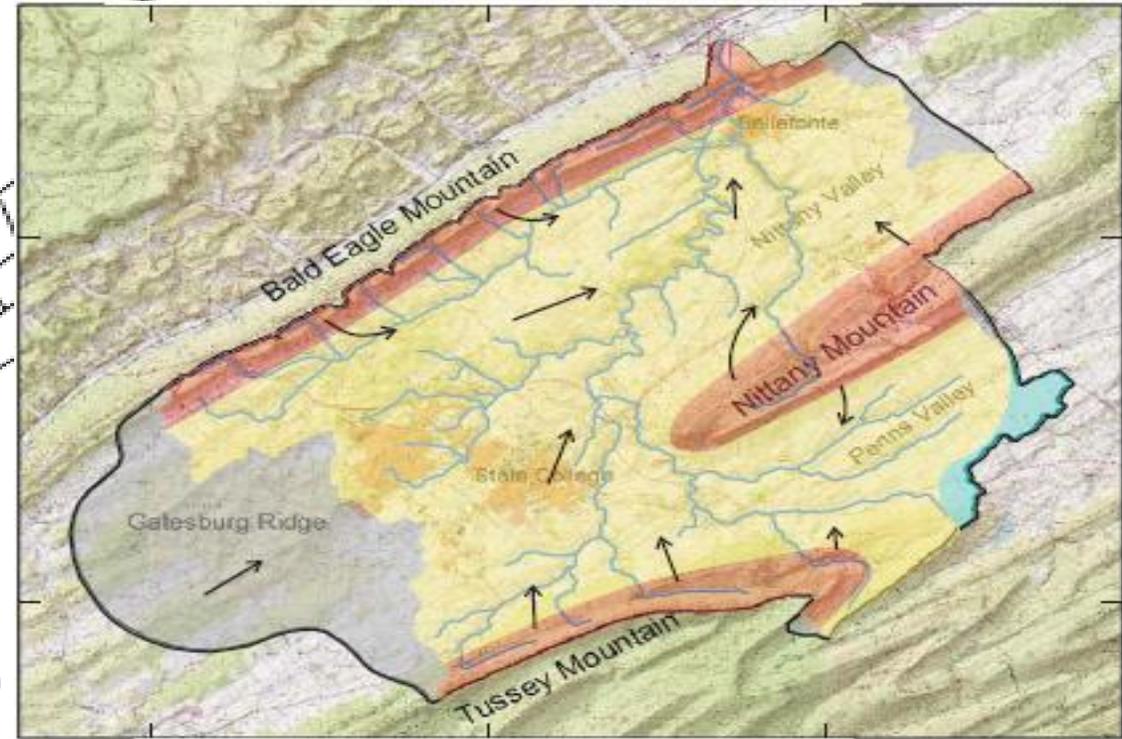


GROUNDWATER RECHARGE MECHANISMS IN SPRING CREEK



EXPLANATION

(Source: USGS, 2005)



EXPLANATION

- SILICICLASTIC-BEDROCK UPLANDS
- CARBONATE-BEDROCK VALLEYS
- AREA WITHIN SPRING CREEK SURFACE-WATER BASIN BUT NOT IN THE GROUND-WATER BASIN
- AREA WITHIN SPRING CREEK GROUND-WATER BASIN BUT NOT IN THE SURFACE-WATER BASIN

0 2.5 5 MILES

0 2.5 5 KILOMETERS

- ①** DIRECT INFILTRATION OF PRECIPITATION ON SOIL AND ROCK
- ②** CONCENTRATED STORMWATER RUNOFF FROM VALLEY INTO SINKHOLE
- ③** CONCENTRATED SURFACE RUNOFF FROM UPLANDS INTO SINKHOLE
- ④** DIFFUSE SURFACE RUNOFF FROM UPLANDS
- ⑤** STREAMFLOW LOSSES
- ⑥** LEAKAGE FROM UNDERGROUND PIPES, ON-LOT SEPTIC SYSTEMS, AND IRRIGATION PIPES

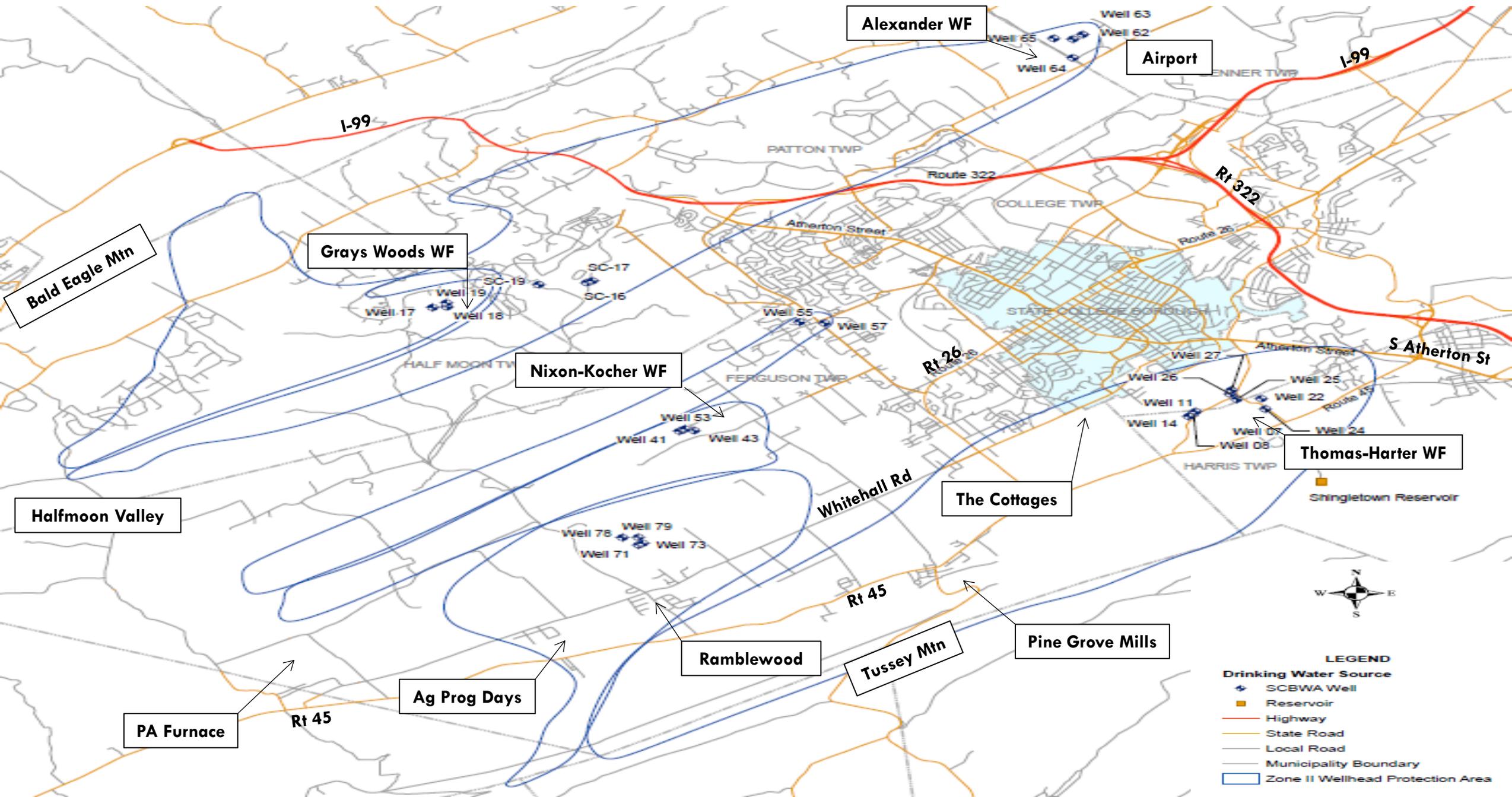
WELLHEAD PROTECTION AREA DELINEATION

PADEP defines three (3) Wellhead Protection Areas:

- Zone 1: 100-400' radius around each well which is dependent on pumping rate and aquifer characteristics. No activity can occur within this area and must be controlled by the public water supplier.
- Zone 2: Capture zone within the aquifer of each well/wellfield that can be estimated through groundwater flow modeling or through hydrogeologic mapping/interpretation
- Zone 3: Surface area that drains into the capture zone which is determined topographically

It is important to identify potential sources of contamination within source water protection areas and prevent impacts through Best Management Practices and zoning restrictions

ZONE 2 SCBWA WELLHEAD PROTECTION AREAS



LEGEND

Drinking Water Source

- ◆ SCBWA Well
- Reservoir
- Highway
- State Road
- Local Road
- Municipality Boundary
- Zone II Wellhead Protection Area

POTENTIAL CONTAMINATION SOURCES

TRANSPORTATION CORRIDORS: SPILLS, DEICING CHEMICALS

AGRICULTURE ACTIVITIES: FERTILIZERS, HERBICIDES, PESTICIDES, ANIMAL WASTE

SANITARY SEWERS: LINE BREAKS DISCHARGING UNTREATED SEWAGE

ON-LOT SEWAGE DISPOSAL SYSTEMS: FAILING SEPTIC TANKS AND DRAIN FIELD SYSTEMS

COMMERCIAL/RESIDENTIAL DEVELOPMENT: STORMWATER RUNOFF

SINKHOLE DEVELOPMENT: DIRECT PATHWAYS TO AQUIFERS

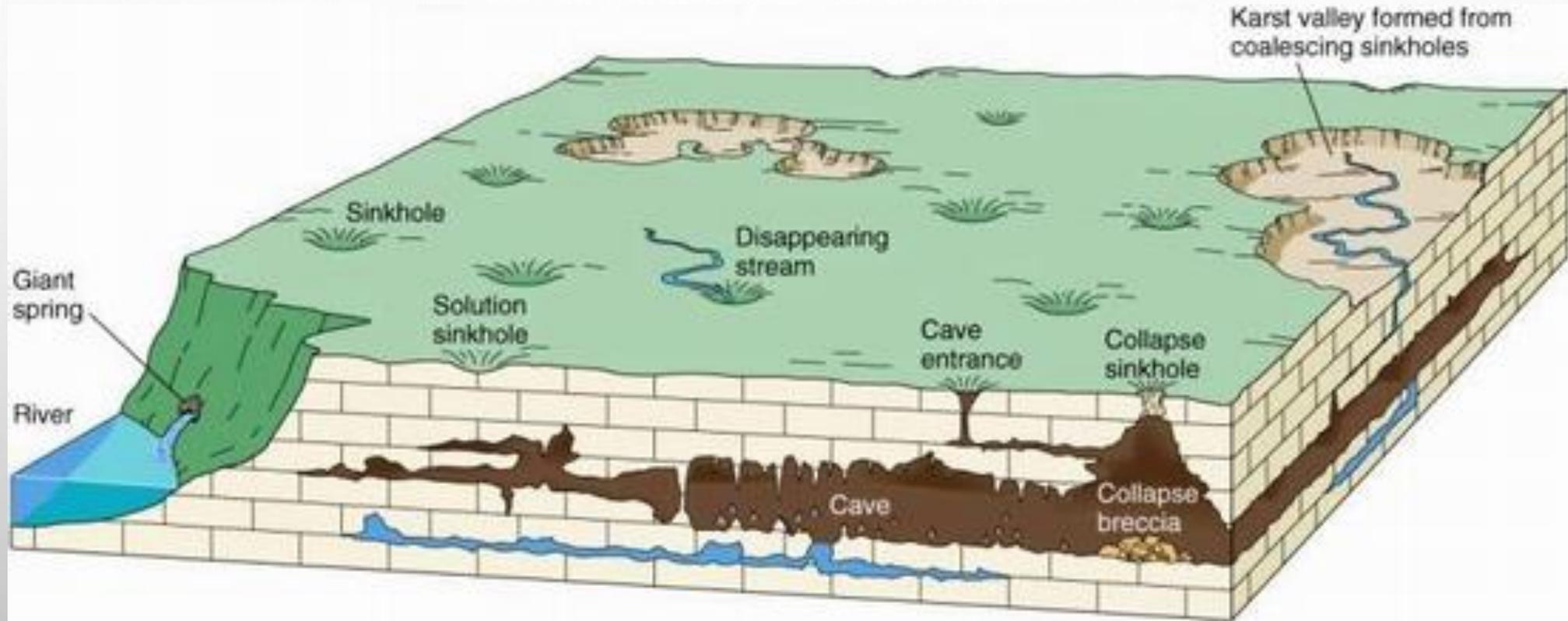
DUMPS: ILLEGAL DUMPS WITH MISCELLANEOUS CONTAMINANTS

DRINKING WATER PLANTS: CHLORINE

GARAGES/GAS STATIONS: UG STORAGE TANK PETROLEUM PRODUCT LEAKAGE

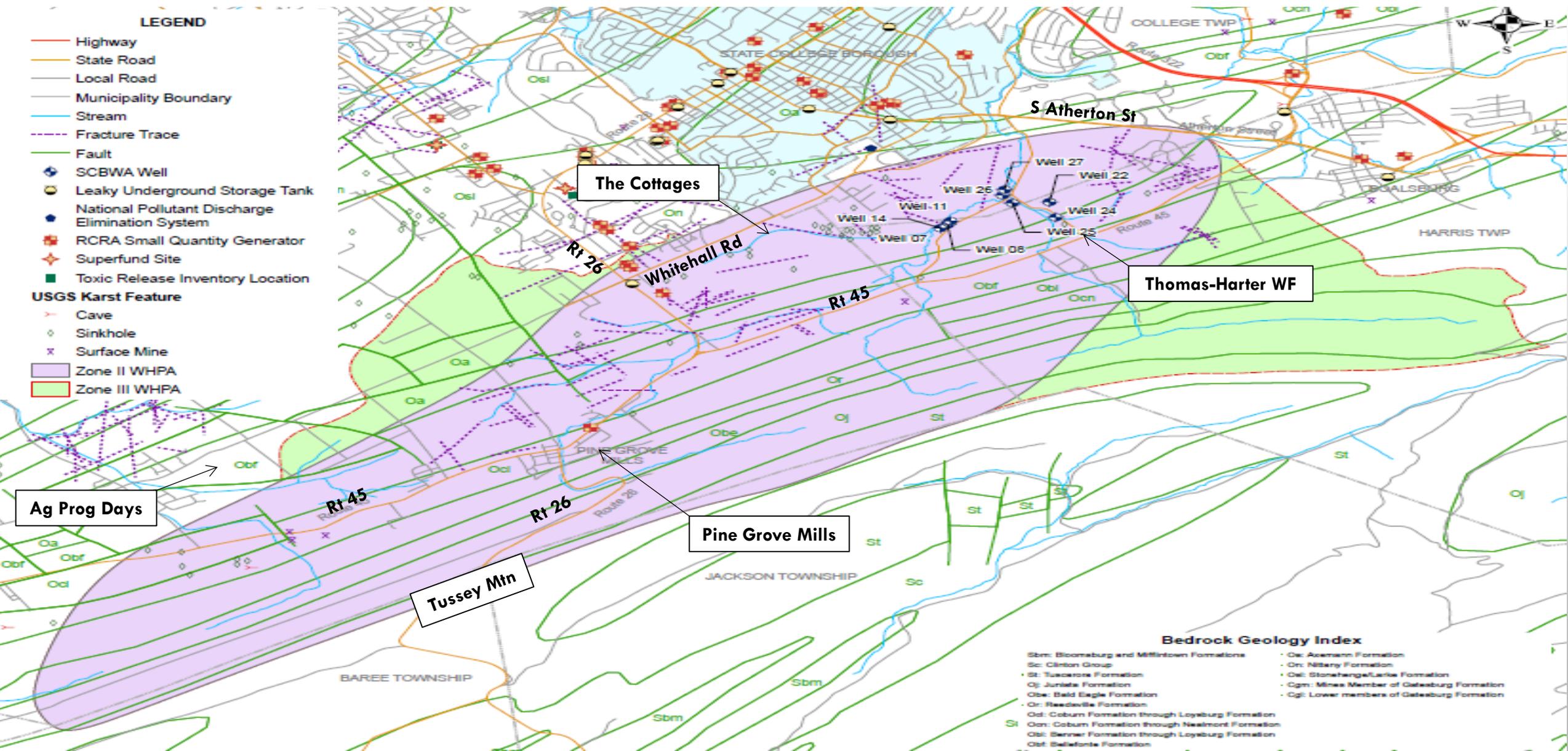
RCRA FACILITIES: RELEASE OF INDUSTRIAL COMPOUNDS

KARST SYSTEM – RECHARGE MECHANISM

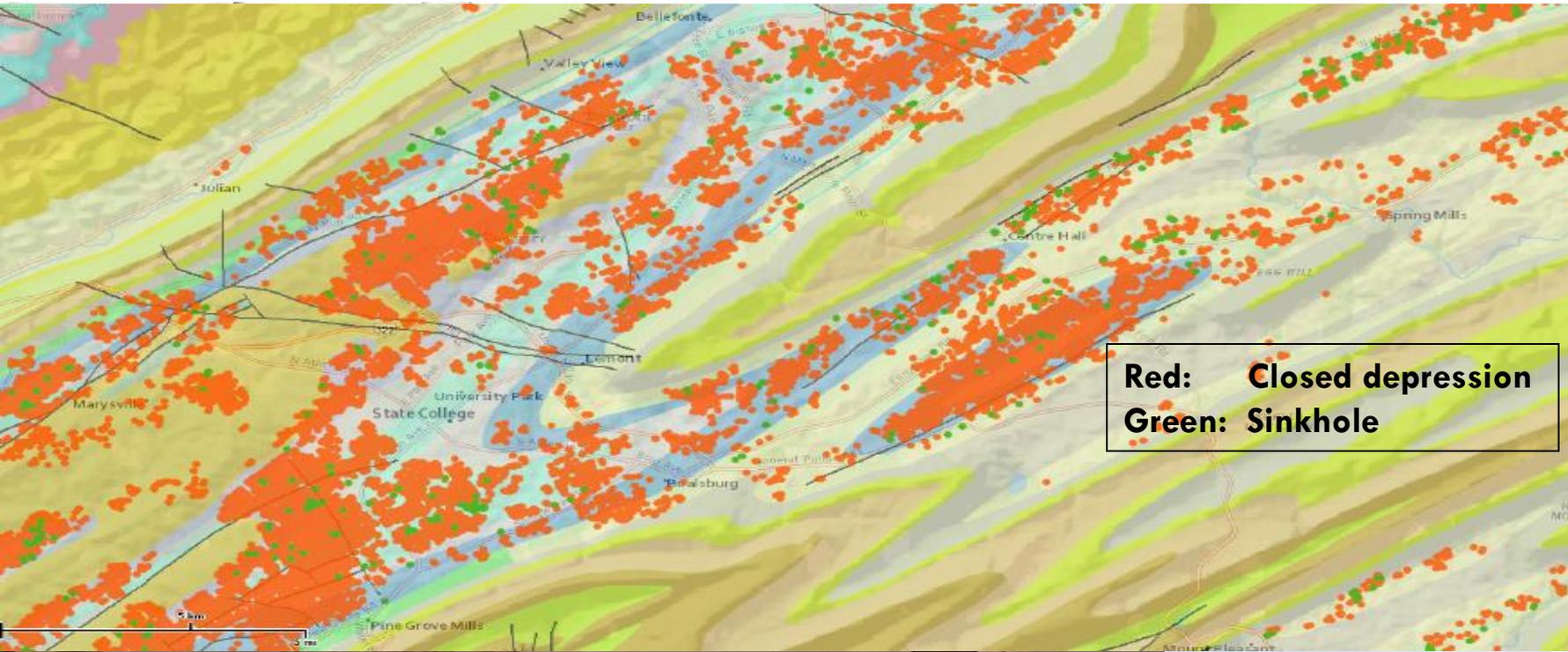


THE NATURE OF THE GROUNDWATER FLOW SYSTEM AND ITS MORE DIRECT CONNECTION TO THE SURFACE CAUSES KARST AREAS TO BE VULNERABLE TO GROUNDWATER CONTAMINATION FROM SURFACE SOURCES

ZONE 2 & 3 WELLHEAD PROTECTION AREAS FOR THOMAS HARTER WELLS - POTENTIAL CONTAMINATION SOURCES



STORMWATER, SOILS & SINKHOLES



THE COMBINATION OF KARST TERRAIN AND LAND USE CHANGES IN THE WRONG PLACES ON THE WRONG SOILS WITHOUT ADEQUATE STORMWATER MANAGEMENT PRACTICES CAN HAVE ADVERSE IMPACTS ON THE REGION'S WATER QUALITY.



LESSONS LEARNED FROM THE SCBWA SWP PROGRAM

- NON-POINT SOURCES OF CONTAMINATION (ROADS, SURFACE RUNOFF, AGRICULTURAL) ARE MORE OF A THREAT THAN POINT SOURCES
- CONTAMINANTS HAVE POTENTIAL TO MOVE THROUGH THE KARST AQUIFER RAPIDLY (100's -1000's of FEET PER DAY)
- REGIONAL WATER SUPPLY WELL FIELDS HAVE RELATIVELY LARGE RECHARGE AREAS WITH VARYING LAND USES WITHIN
- LONG-TERM MANAGEMENT OF VARYING LAND USES IN MULTIPLE MUNICIPALITIES CAN BE CHALLENGING, NEED REGIONAL COOPERATION
- THERE ARE EXAMPLES OF HISTORIC AND RECENT SURFACE ACTIVITIES THAT SHOW SIGNS OF IMPACTING WATER QUALITY: SMALL CHANGES IN LAND USE ADD UP TO MEASURABLE CUMULATIVE IMPACTS
- CONSIDER SOIL AND BEDROCK CONDITIONS TO GUIDE LAND USE
- OVERALL, THE REGION'S WATER SOURCES ARE HIGH QUALITY BUT WE NEED TO WORK HARD TO KEEP IT THAT WAY!



THE COTTAGES STORMWATER MANAGEMENT PLAN TECHNICAL REVIEW PROCESS

Mark Glenn, P.E., President
Gwin, Dobson & Foreman, Inc.

SCBWA Engineering Consultant

TECHNICAL REVIEW PROCESS

SCBWA was invited to participate in the technical review of the plans for the Toll Brothers “The Cottages” Planned Residential Development.

SCBWA input was provided in advisory capacity to the Township which is responsible for implementing and enforcing its zoning, land planning and site development ordinances.

Review was undertaken by SCBWA Source Water Protection Committee, SCBWA Staff, Authority Hydrogeologist and Authority Consulting Engineer

TECHNICAL REVIEW TEAM

Technical Review Team

- Team oversight by SCBWA Source Water Protection Committee
- Legal review and guidance by Robert Mix, Authority Solicitor
- Aquifer and geological impacts assessed by David Yoxtheimer, PG, Authority Hydrogeologist
- Site stormwater management system reviewed by Gwin, Dobson & Foreman, Authority Engineer
- Water system operational impacts assessed by SCBWA staff
- Site soils and stormwater detention input from Source Water Protection Committee team members

GUIDANCE DOCUMENTS

Reports, Manuals, Reference Standards & Ordinances

- 2007 SCWBA Source Water Protection Plan
- SCBWA Well Head Protection (WHP) Area Delineations
- PADEP Stormwater Management Best Management Practices Manual
- Ferguson Township Ordinance No. 990
- Ferguson Township Chapter 26 – Stormwater Management Ordinance

TECHNICAL REVIEW TIMELINE

Technical review comments were provided at the following plan review milestones:

- March 24, 2014: Planning Level Review
- October 9, 2014: Preliminary PRD Plan Review
- January 7, 2015: Preliminary PRD Plan Resubmission Review
- April 21, 2015: Final PRD Initial Plan Submission
- June 26, 2015: Final PRD Final Plan Submission

TECHNICAL REVIEW COMMENTS

Preliminary Determinations:

- The Cottages is located in the Zone 2 Well Head Protection (WHP) area of Thomas-Harter well field aquifer
- Note: SCBWA Zone 2 WHP area does not precisely correspond to Twp. “sensitive area” boundary (Nittany Geoscience, 1992, Exh. 1, Appendix B)
- Tributary of Slab Cabin Run bisects site (recharge mechanism for aquifer)
- Field investigations show rock outcrops and shallow bedrock; property bounded by sinkholes and fracture traces
- Water quality concerns: deicing agents, nitrates, oil/gas spills, soil migration, lawn chemicals
- Based on location in Zone 2 WHP area, Chapter 7.6 of DEP Stormwater Management BMP Manual for Well Head Protection areas was consulted

TECHNICAL REVIEW COMMENTS

SCBWA Technical Review Highlights

- Best Management Practices (BMPs): Activities or structural improvements that help reduce the quantity and improve the quality of stormwater runoff. BMPs include treatment requirements, operating procedures and practices to control site runoff
- Stormwater Management (SWM) Design: Use Pretreatment BMP's with amended soil layers for filtering pollutants
- Non-Structural BMP's – Maximize use of vegetated channels and buffers
- Existing Soils: Retain soil profile for natural stormwater filtering, where practicable
- Rock Excavation: Minimize excavation to prevent rock shattering and fracturing
- Drilling & Blasting: If required, prepare pre-blast plan & geological report
- Construction Practices: Prohibit compaction of swales, channels and basin bottoms

TECHNICAL REVIEW COMMENTS

SCBWA Technical Review Highlights

- **Geophysical Surveys:** Perform electrical resistivity testing to identify existing sinkholes and rock fractures as accelerated pathways to aquifer system
- **Stormwater Detention:** Decentralize SW detention throughout site, reconfigure detention basins sited in rock, retain soil as a base for amended soil layers
- **Sinkhole Development:** Repair details, contingency plans, notification protocols
- **Construction and Post-Construction Inspections:** SCBWA access
- **Monitoring Well:** Water Quality Monitoring installed down-gradient of site

(Refer to Detailed Technical Review at www.SCBWA.org under News/Meetings)

RECOMMENDED DECENTRALIZED SWM AND BMP PLAN



The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The main title is centered in the upper half of the slide.

TOWNSHIP LAND DEVELOPMENT RECOMMENDATIONS

Jason Grottini, Chairman
Source Water Protection Committee

State College Borough Water Authority

POLICY RECOMMENDATIONS

- Development of a new Well Head Protection Area Overlay District which corresponds to the delineated SCBWA Well Head Protection Zones (1, 2 & 3)
- In conjunction with the above, develop Regulated Land Uses and Activities permitted in the WHPA Overlay District
- As a Interested Stakeholder, Solicit Input and Participation of SCBWA in the Township Planning and Review Process

STANDARDS & PRACTICES RECOMMENDATIONS

Develop Specific Land Development Standards and Practices for Site Developments in WHPA Overlay Districts:

- Geological Reports & Investigations that Demonstrate Compliance
 - Identify closed depressions, sinkholes, outcrops, lineaments, faults & fracture traces, surface drainage into ground
- Geophysical Testing of Subsurface Conditions (sinkholes, fractures, etc)
- Decentralization of SWM Detention Facilities
- Maximize Use of Non-Structural BMP's
- Minimize Rock Disturbance and Limit Disturbance of Native Soils
- Reference PADEP BMP Guidance Manual for SWM Design Criteria

STANDARDS & PRACTICES RECOMMENDATIONS

Develop Specific Land Development Standards and Practices for Site Developments in WHPA Overlay Districts:

- Provisions for SCBWA Construction Inspection Access
- Develop Specifications for SWM Construction Practices & Performance
- Post Construction Monitoring and Inspection
- Township Engineer to Review SWM/BMP Plans in a Fashion Similar to SCBWA Review of The Cottages Plans
- Provisions for Developer to reimburse SCBWA-incurred costs