Fauquier County
Groundwater Resources

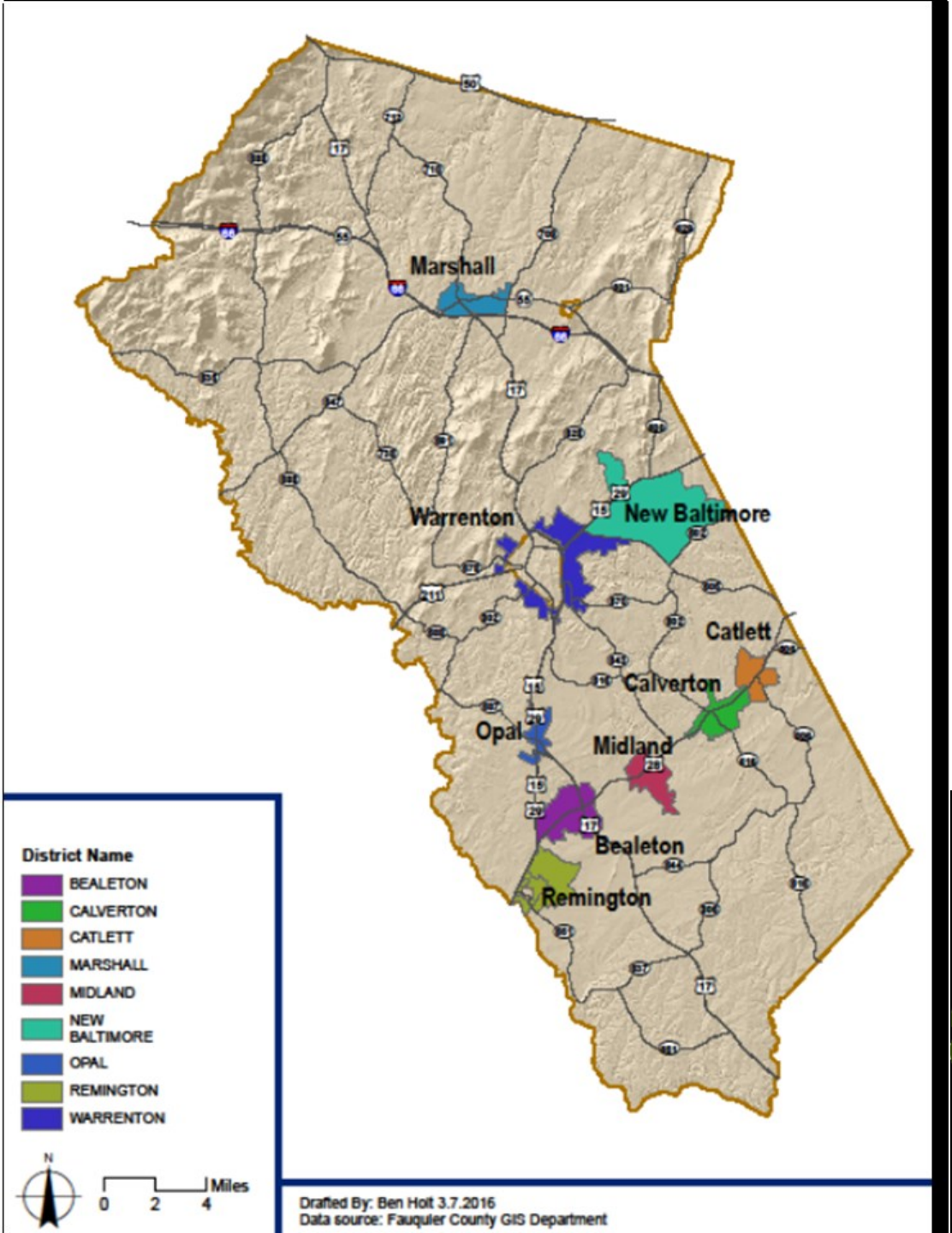
Potomac Watershed Roundtable
January 5, 2018

History of Water Resources in Fauquier County

- Fauquier County is organized on a “service district” concept which contemplates public services (public water and sewer) in urbanized areas of the County while the remainder of the County is to remain rural and agricultural in its nature.
- The County has nine designated service districts which, with the exception of the Town of Warrenton, are un-incorporated areas in which development is to be channeled.
- Each service district is to be to be provided public water and sewer by the Fauquier County Water and Sanitation Authority or in the case of the Warrenton Service District, the Town of Warrenton.

Tradition of Service Districts and Rural Areas

County Plan directs residential, industrial and commercial development into areas planned for growth (Service Districts) and strives to preserve the farmland and open space districts.



How Groundwater Became Paramount in the County

- In the 1990's the County's plan for water resources contemplated a reliance on both groundwater and surface water reservoirs.
- The County's comprehensive plan adopted in 1992 contemplated a mixed system of groundwater and surface water impoundments. The plan designated 9 separate reservoirs generating more than 24.07 million gallons per day. Of this 9 reservoirs only the combined Warrenton Lake and Airlie Reservoir has been constructed. While Germantown Lake was constructed as a park lake as of this date it has not been upgraded to a reservoir. As a result reservoirs only provide 2.0 mgd of capacity.

How Groundwater Became Paramount in the County (continued)

- In the late 1990's the Board of Supervisors in consultation with its groundwater consultant, Emery and Garrett, determined that it would rely solely on groundwater for the County's water needs.
- Based upon the decision of the Board of Supervisors eight of the County's 9 service districts are served by groundwater reliant systems.
- Those service districts are spread across the County's 651 square miles and in one of the County's three geological provinces, the Blue Ridge Anticlinorium, the Culpeper Basin and the Piedmont Province. Each province has a separate propensity for groundwater retention.

Groundwater Dependent

Fractured Flow System

- Highly variable from one location to another
- Higher degree of susceptibility to surface water contamination
- Influenced by a greater degree to surface conditions
- Higher probability of changing over time
- More challenging to understand and costly to manage

Groundwater Dependent

Fractured Flow System

Until 2000, County posed for development of surface water options including reservoirs

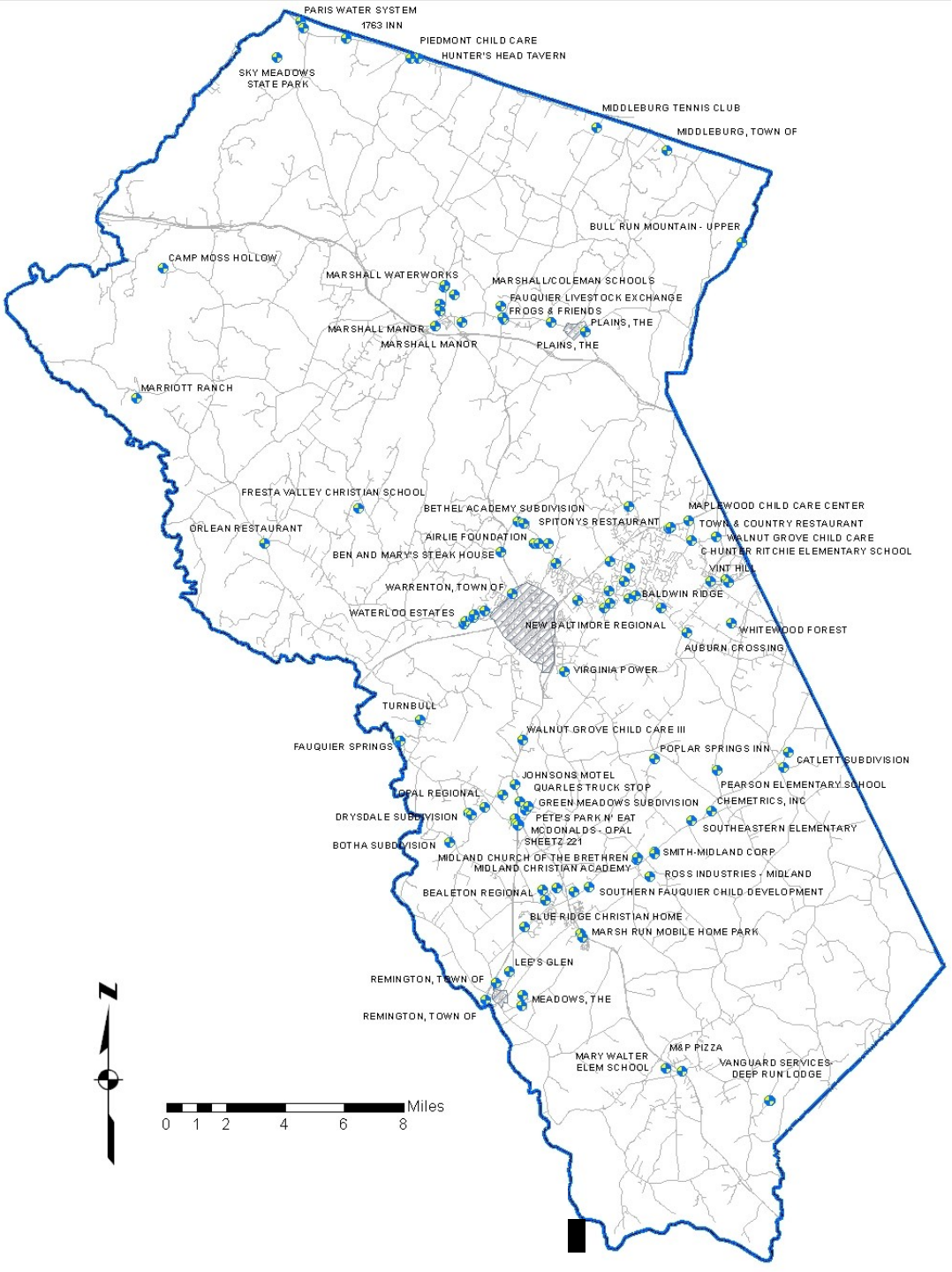
High costs, impacts on historic and environmental resources and public opposition pushed BOS to abandoned the idea in favor of groundwater

REASONS THE COUNTY IS TAKING A CLOSER LOOK AT GROUNDWATER

- During the earthquake of 2011 one public water supply well in the County's Bealeton Service District lost ½ of its capacity due to a shift in the subsurface geology.
- Wells in the Marshall, Bealeton and Warrenton Service Districts have seen man-made contamination requiring millions of dollars in remediation efforts to continue to use the wells.
- The need to protect aquifers and aquifer recharge areas from both contamination and development that would negatively affect recharge has become more apparent over the last few years.

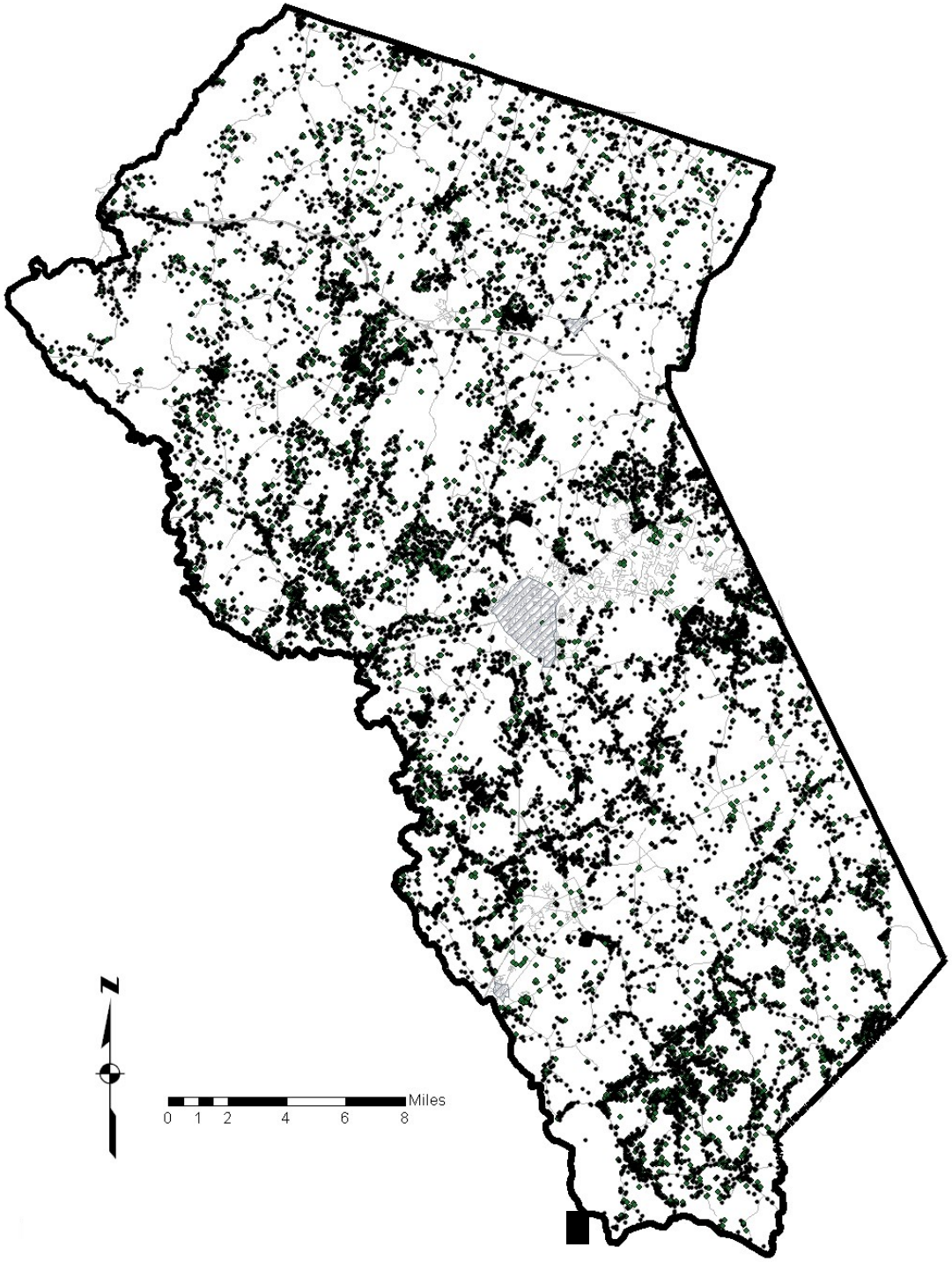
Groundwater Withdrawals

Community Water Systems



Groundwater Withdrawals

Total Residential Groundwater Withdrawal Points



Estimated Water Needs for Build-Out of Current Zoning

Service District	Existing Capacity (mgd)	Estimated Need Zoned Land (mgd)
Bealeton	0.5	0.969
Calverton	0	0.215
Catlett	0.031	0.205
Marshall	0.217	0.764
Midland	0	0.206
New Baltimore	1.442	1.655
Opal	0.088	0.316
Remington	0.047	0.500
Totals	2.175	4.830
Town of Warrenton	2	No analysis done

Estimated Water Needs for Build-Out of Current Land Use Plans

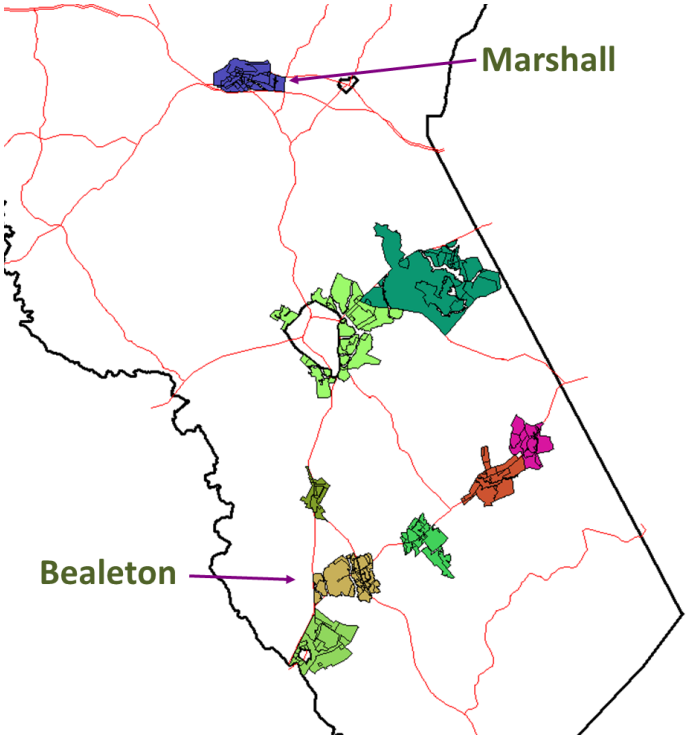
Service District	Existing Capacity (mgd)	Estimated Need Planned (mgd)
Bealeton	0.5	1.192
Calverton	0	0.530
Catlett	0.031	0.515
Marshall	0.217	1.268
Midland	0	0.421
New Baltimore	1.442	2.544
Opal	0.088	0.588
Remington	0.047	0.574
Totals	2.175	7.632
Town of Warrenton	2	No analysis done

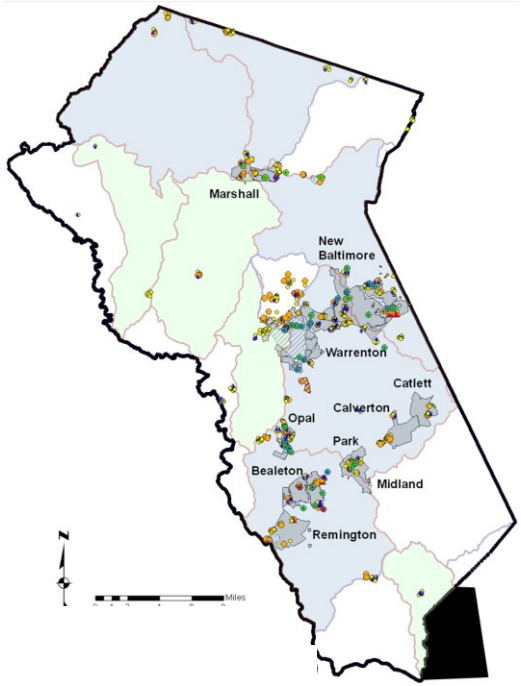
Groundwater Activities

- Mid-1990s to mid-2000s, series of hydrogeological investigations undertaken
  - Budget allocation discontinued during economic downturn; recently reestablished
- Water Supply Plan (2011) identified several supply needs
  - Identify critical areas for groundwater investigation, monitoring and protection based on projected growth and water use
  - Develop management strategies for protecting existing supplies
  - Establish program for long-term monitoring of groundwater resources

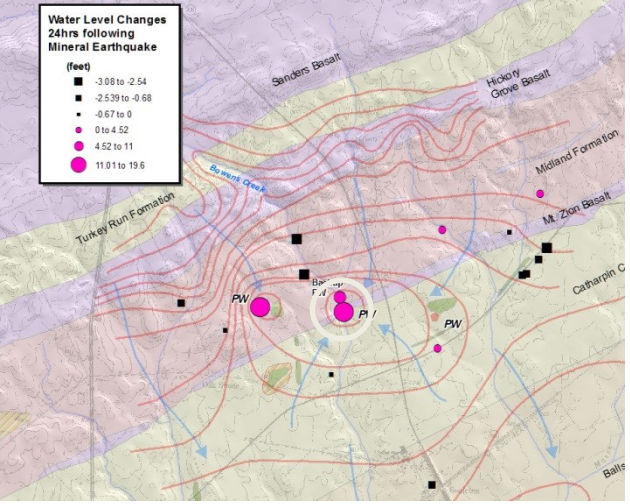
Groundwater Activities

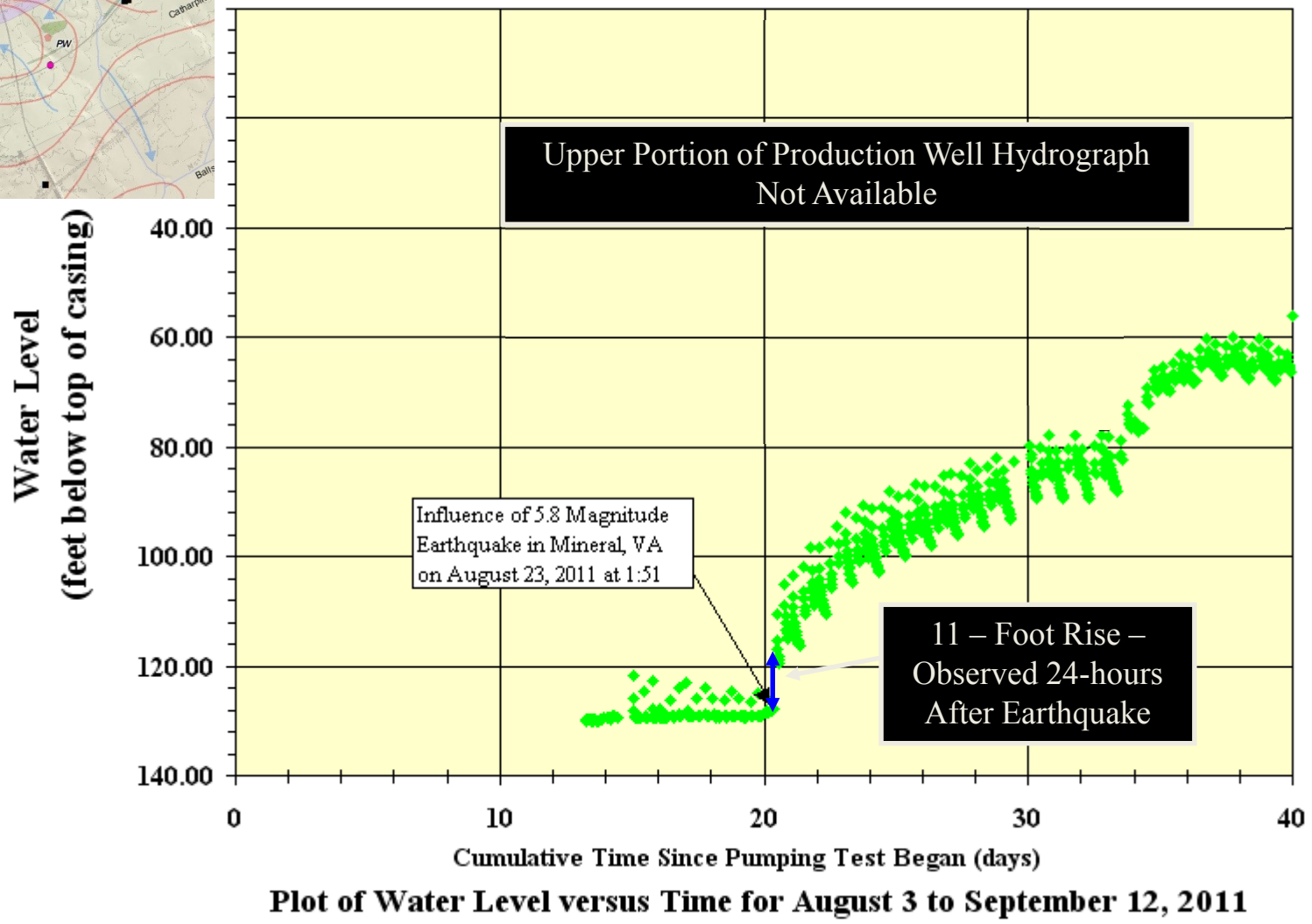
- Realization of Critical Need to be Proactive
  - Earthquake in Mineral and its effect in Bealeton
  - Diminishing water supply in Marshall
  - Potential Contaminant Threats

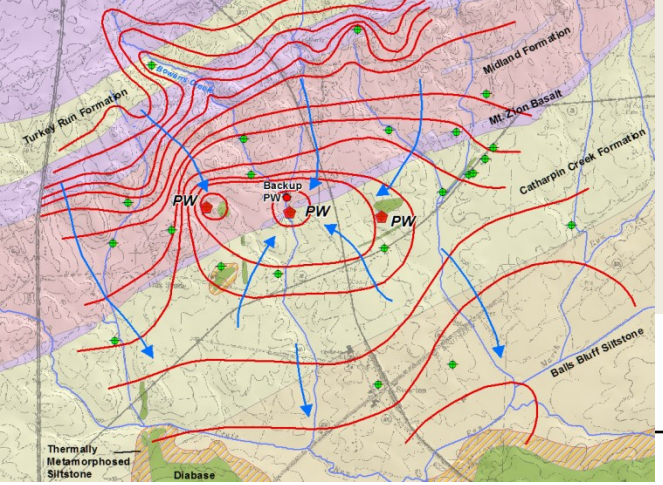




Bealeton Water Level Rise







~6,000 feet

PW 1 PW 2 PW 3

Non-Pumping/ Historic Water Table

Established Cone of Depression Refilled 10-20 feet Within 24-hours following the Earthquake.

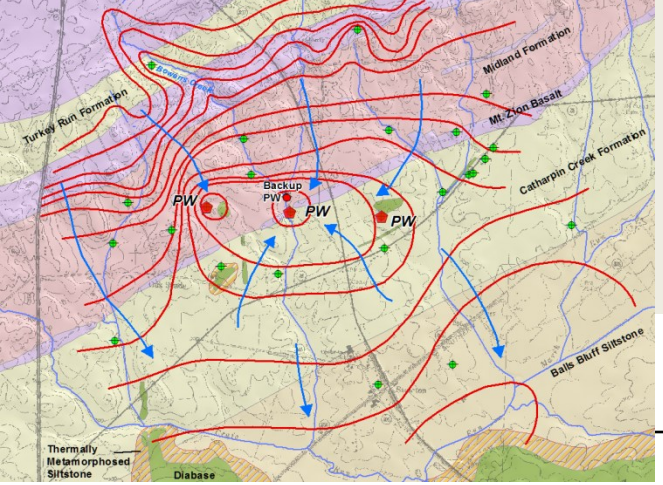
Pre-Earthquake Established Pumping-Induced Water Level Drawdown

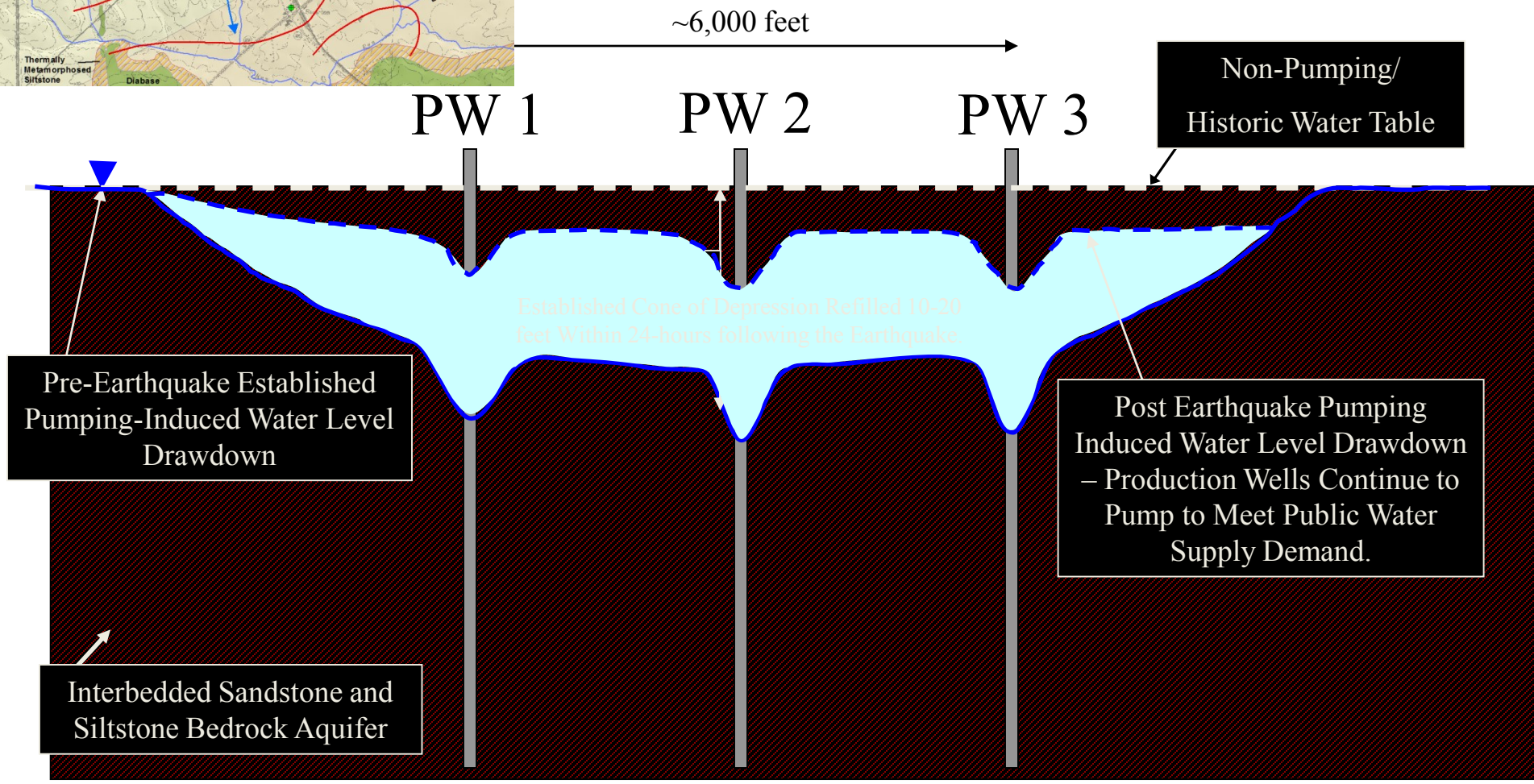
Post Earthquake Pumping Induced Water Level Drawdown – Production Wells Continue to Pump to Meet Public Water Supply Demand.

Interbedded Sandstone and Siltstone Bedrock Aquifer

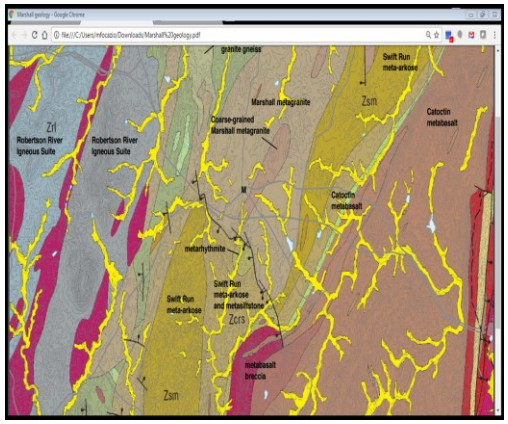
Emery & Garrett Groundwater Investigations, LLC

Resulted in Contamination with eColi





Quantity and Quality Issues

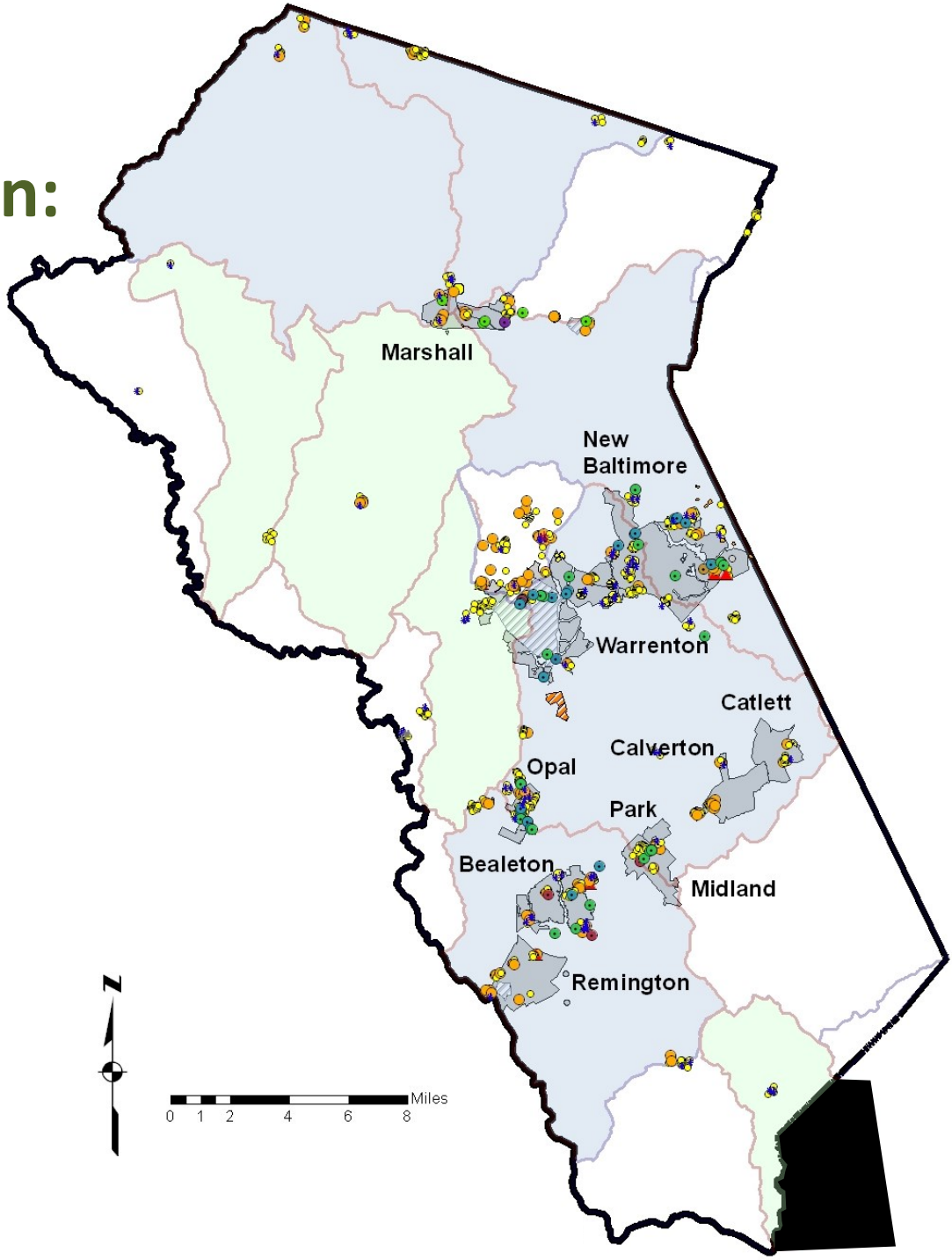


- Radium
- VOCs (TCE)
- Iron
- Manganese
- Bacteria

Source	GPM	GPD
Online		
Salem 4	50	72,000
17/66 (1 and 2)	150	217,200
Piedmont	13	18,720

700,000 gpd needed for current zoning

Groundwater Protection: a critical issue



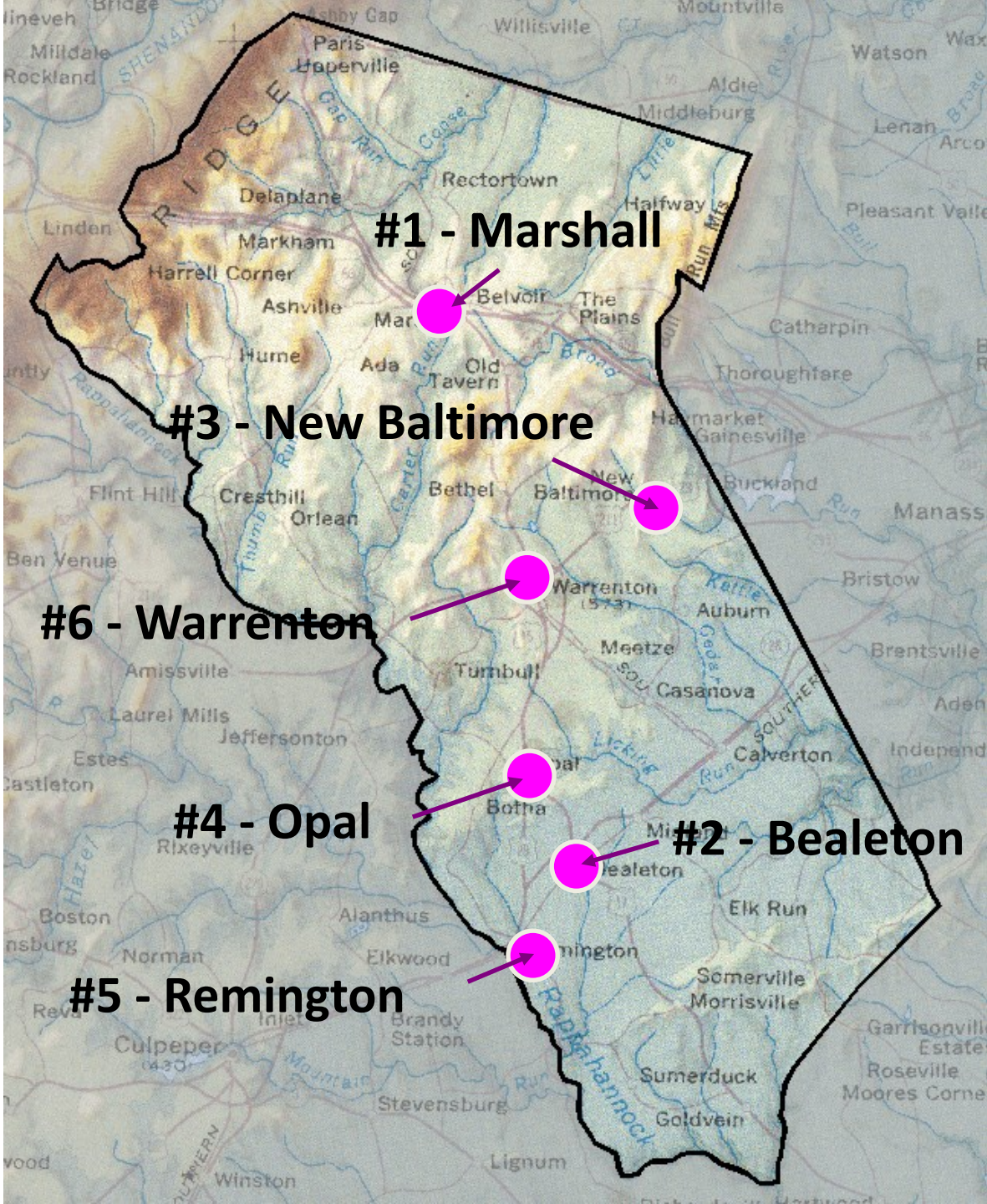
Legend

	Not Present	!	CERCLIS
	TMDL and IP	!	DOD
	TMDL but no IP	!	ENF
	High	!	ERNS
	Low	!	MINES
	Medium	!	RCRIS-SQG
#	High	!	SPILLS
(	Low	!	TRIS
(	Medium		VDH - Potential Conduits
(	X	Ú	Abandoned Wells
	landfill	r	Other Wells in Use
		r	Ponds, streams

Focused Efforts Needed

Based on Total Existing and Future Groundwater Use, Available Recharge and Potential Threats to Groundwater Quality – These Areas Require More Urgent Focused Efforts relative to:

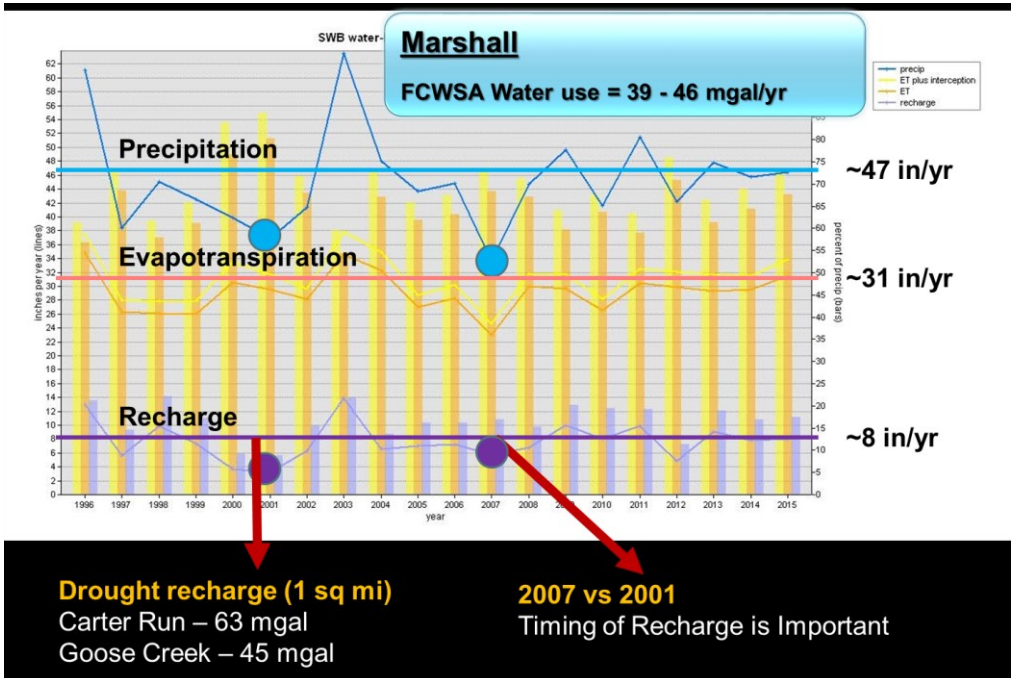
Groundwater Management
Groundwater Protection
Groundwater Monitoring



USGS Work

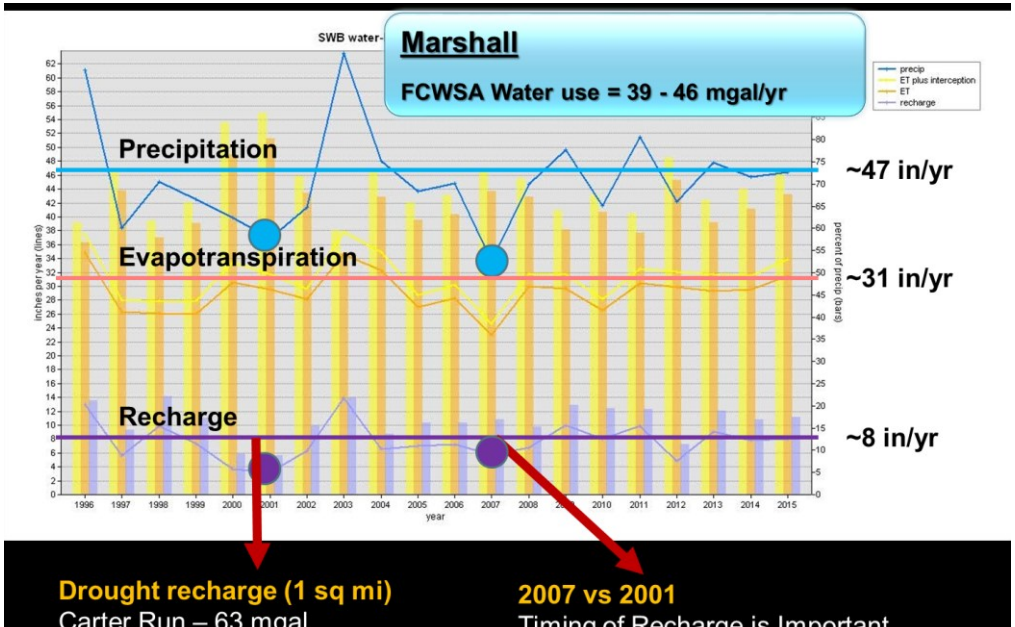
- 5 Year Project with USGS (2016)
  - Develop a Soil-Water Balance Model
  - Continuous Monitoring of Streams and Wells
  - Aquifer Resource Assessment

- Long Term
  - Develop Groundwater Flow Model

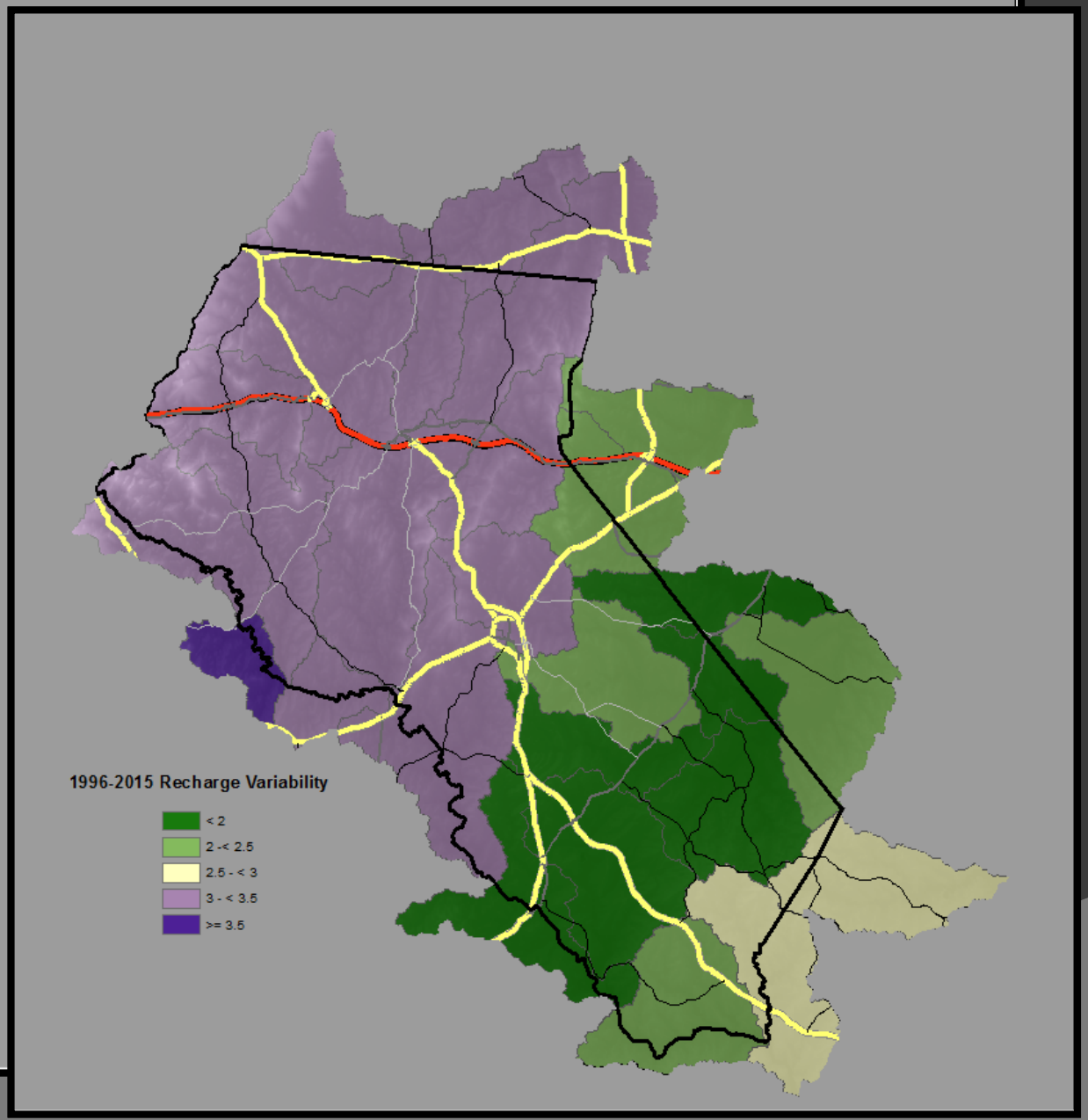


USGS Work

- Potential Uses
  - Scenario analysis and predictive modeling
    - Zoning changes and Service District boundary adjustment
    - Large drainfield siting assessments
  - Selection of stormwater BMPs
  - Defensible basis for future aquifer delineations
  - New water supply well location priortization
  - Wellhead protection zones
  - Contaminant Threat Assessment



Soil-Water Balance



Annual Precipitation
40-56 in/yr

20-yr average recharge
2-10 in/yr

Drought recharge
<2-6 in/yr

Differences amongst aquifers

USGS science for a changing world

Groundwater Protection Efforts

- Working to identify, prioritize and protect public well aquifers
- Studying aquifer sizes and recharge areas
- Developing land use ordinance to permit the imposition of overlay districts which would permit the additional requirements on development

Key Issues and Challenges

- It is critical that we locate and develop additional water resources in Marshall.
- Aside from Marshall, we meet our current water supply needs, but not much extra to meet situational or operational needs, or to address anticipated future needs.
- We currently have little understanding of the extent of our groundwater aquifers and their long term sustainability.
- The current approach in locating water supply wells within developing areas may not be the most effective given potential contamination issues, as well as future needs.
- Long-term strategic needs often take a lower priority to short-term operational needs.

Key Issues and Challenges

- Groundwater monitoring and wellhead protection have both strategic and operational benefit and are critical to ensuring long-term sustainability of our resources and to protect money invested already to develop these resources.

- Water re-use is an approach to be explored for our supply needs over time.

- Take a comprehensive approach as land-use decisions affecting a potential well site's suitability are often made long before the community explores its water supply expansion options.

- Groundwater supplies from wells are not static, they change over time and are influenced by outside events. They rarely improve with time. Understanding our groundwater supply is not finite is important to the long-term sustainability of these resources.