

# **SURFACE AND GROUNDWATER NITRATE CONCENTRATIONS IN CHESTER COUNTY**



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**Chester County Water Resources Authority**

# ***OUTLINE***

- Introduction: CCWRA's Role in Water Resources
- Chester County USGS Water Monitoring Program
- Nitrates: What, Why, Where, and How Much
- Octoraro Watershed Surface and Groundwater Nitrate Data
- Homeowner Resources for Well Water Testing

# ***INTRODUCTION: CCWRA's ROLE***



Chester County Water Resources Authority

- 1961 - formed by Chester County Board of Commissioners for flood control and water resources management





# ***INTRODUCTION: CCWRA's ROLE***

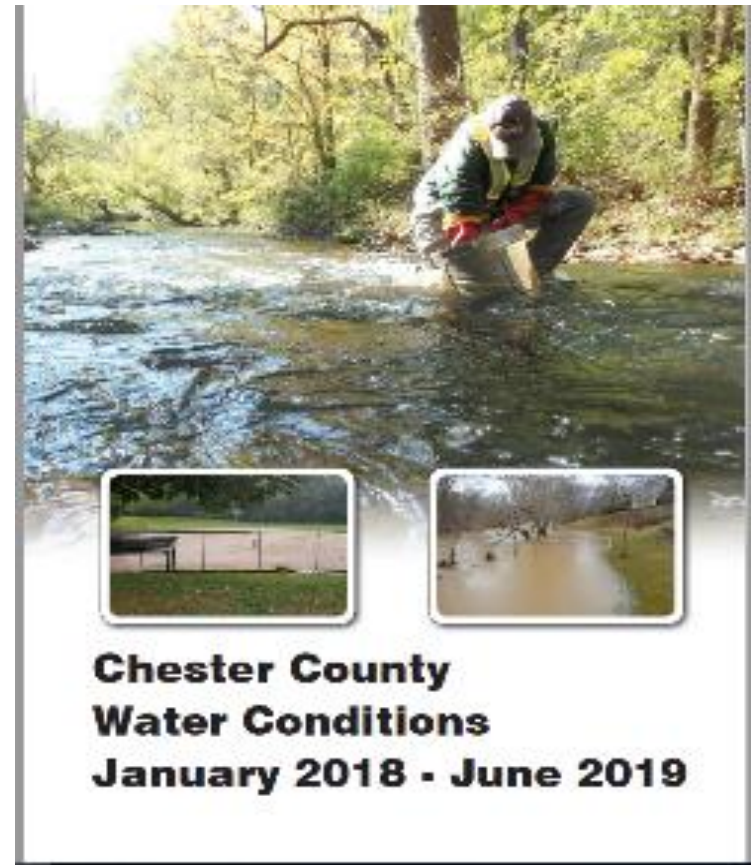
**CCWRA's operations and activities fall under four main programs...**

- Flood Protection
- Stormwater and Water Quality Improvement
- Sustainable Water Resources Management
- Water Information and Outreach



## Chester County-USGS Partnership

- 17 stream gages in or adjacent to Chester County
  - 6 sediment monitoring
  - 5 bacteria monitoring
  - 6 precipitation gages
- Annual water chemistry and biotic monitoring at 27 sites
- Monthly groundwater monitoring at approximately 24 wells per month





# USGS PARTNERSHIP



**Chester County received 55.2 inches of precipitation in 2020, which was 8.0 inches, or 17%, above the County's historic average of 47.2 inches.**

## Precipitation

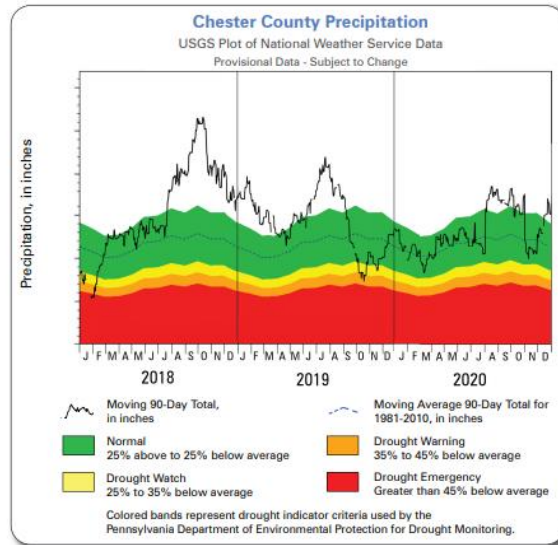
Rain and snow are the foundation of the water resources in the County.

### BACKGROUND

CCWRA closely monitors precipitation trends because precipitation levels exert a substantial influence on both the quantity and quality of surface waters and groundwater. Since rainfall patterns vary, and it is common to have periods of weeks with little to no rainfall, precipitation is often evaluated using cumulative rainfall over the preceding 90-days, measured in inches. Data collected by the National Weather Service (NWS) are used to determine if recent precipitation amounts are within normal levels, or if

the region is entering a drought watch, warning, or emergency.

Recent temporal variability in precipitation patterns illustrate the uncertainty in future local rainfall trends. This uncertainty highlights the need for adaptive stormwater and floodplain management and planning that considers the potential for more variability in precipitation amounts, stormwater runoff, and groundwater table levels, as noted by several studies (Maimone et al. 2019 & Shortle et al. 2015).



### KEY FINDINGS

- For the third year in a row, precipitation levels in Chester County were above average.
- According to the NWS, Chester County received 55.2 inches of precipitation in 2020, which is 8.0 inches above the historic County average of 47.2 inches per year.
- From January through July, the County generally received a normal volume of precipitation, with a cumulative 0.5-inch deficit for those seven months, which is only 2% below the normal precipitation levels.
- Tropical Storm Isaias brought between 4.3 and 5.8 inches to Chester County on August 4, 2020, with much of the total accumulation in a 6-hour period. See pages 6 & 7 for a detailed summary.
- In addition to that tropical storm in August, the County had rainfall surplus in both November and December.
- A final storm on December 24 - 25 resulted in 1.8 to 3.2 inches of rain to Chester County.

### Monthly Precipitation for Chester County, in inches

Month	Chester County Monthly Total	3-Month Total	Monthly Departure from Normal	3-Month Departure from Normal
January 2020	3.2	9.8	-0.2	-1.2
February 2020	2.9	10.9	0.0	0.7
March 2020	4.2	10.3	0.2	0.0
April 2020	5.8	12.9	1.9	2.1
May 2020	2.6	12.6	-1.6	0.5
June 2020	3.1	11.5	-0.9	-0.6
July 2020	4.8	10.5	0.1	-2.4
August 2020	10.2	18.1	6.4	5.6
September 2020	3.1	18.1	-1.6	4.9
October 2020	4.0	17.3	0.0	4.8
November 2020	5.8	12.9	2.1	0.5
December 2020	5.5	15.3	1.6	3.7
<b>Total for 2020</b>	<b>55.2</b>	<b>n/a</b>	<b>8.0</b>	<b>n/a</b>
Total for 2019	54.9	n/a	7.9	n/a
Total for 2018	69.8	n/a	22.7	n/a
Total for 2017	42.7	n/a	-4.3	n/a
Total for 2016	40.7	n/a	-6.5	n/a

Source: [National Weather Service's Middle Atlantic River Forecast Center](#)

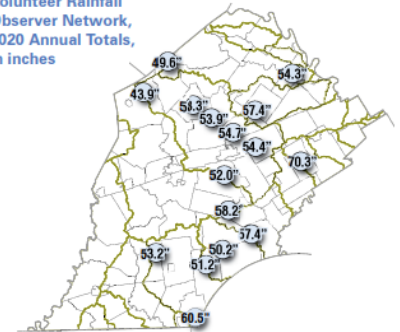
### CHESTER COUNTY VOLUNTEER RAINFALL OBSERVER NETWORK

Chester County is fortunate to have a network of 16 volunteers who report monthly rainfall totals through the Chester County Volunteer Rainfall Observer Network. The Volunteer Network began in the late 1970's. The volunteer observers keep track of daily rainfall and snowfall totals and submit their report at the end of each month to CCWRA.

These data supplement the data collected by the National Weather Service and help to identify patterns of precipitation distribution across the County. The average for the volunteer network is 54.6 inches which is close to the total of 55.2 inches reported by the National Weather Service.

Spatially, volunteer stations in the northwestern portion of the County received about 5 to 10 inches less rain than rest of the County, and the station in East Goshen Township in the eastern part of the County had the highest total at 70.3 inches recorded.

### Volunteer Rainfall Observer Network, 2020 Annual Totals, in inches



# USGS PARTNERSHIP



Search

- Surfacewater Biological & Chemical
- Precipitation
- Streamflow
- Groundwater
- Continuous Water Quality
- Bacteria

## Chester County Surfacewater Biological & Chemical Monitoring Network

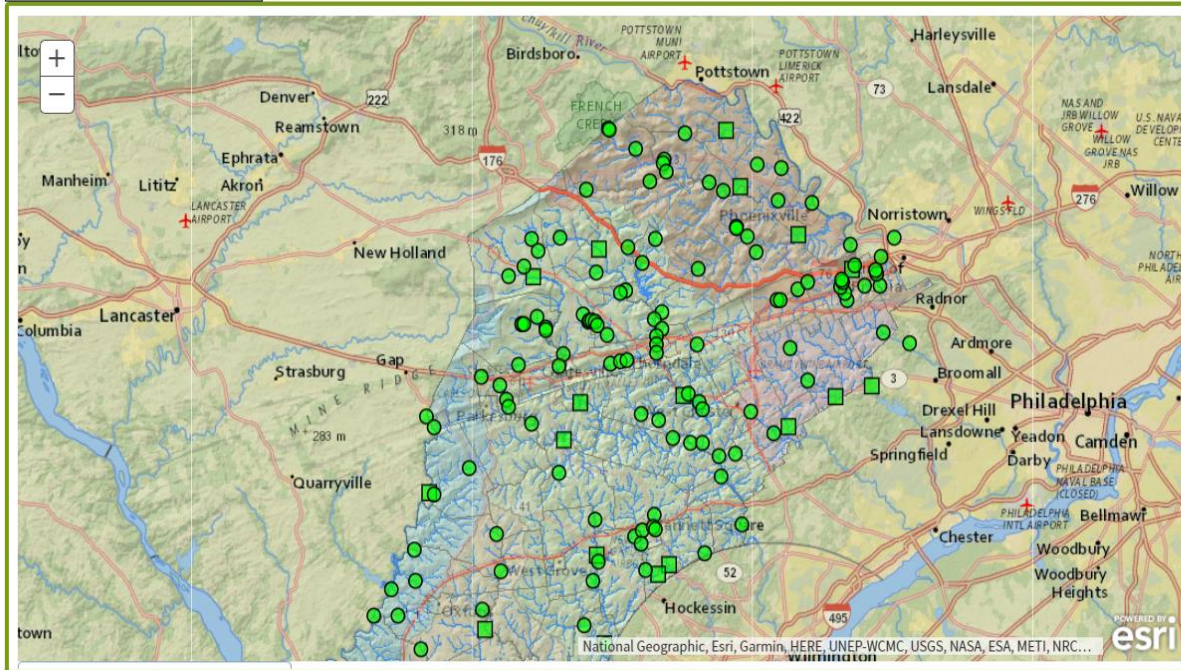
Sites Sampled Between 1998 - 2022  
(Move sliders to set time period of interest)



Site Type:

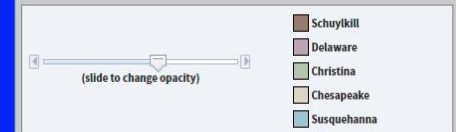
- Include Fixed Sites
- Include Flexible Sites

Filter sites by name:



(Click blue bar to show/hide)

### Major Watersheds



### Station List

#### Active Filters

Sample years: 1998 - 2022

Fixed Sites: yes

Flexible Sites: yes

Name filter:

### Fixed Sites

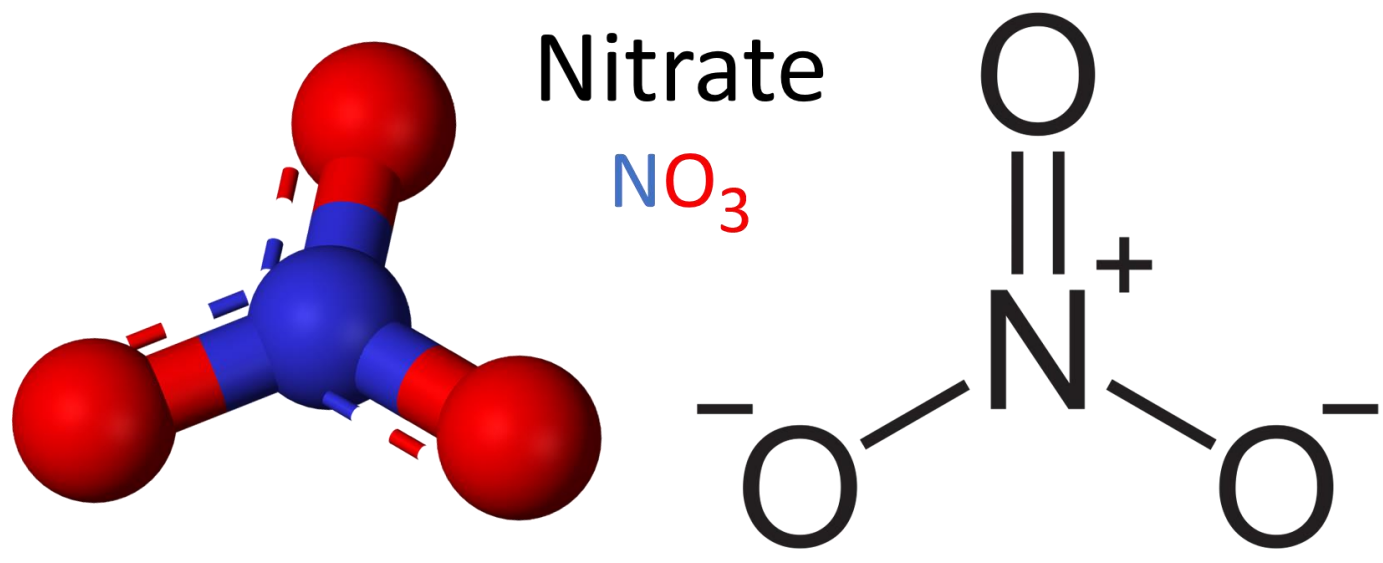
#### Schuylkill Basin:

- [01472080](#) Pigeon Creek near Slonaker, Pa.
- [01472157](#) French Creek near Phoenixville, Pa.
- [01472190](#) Pickering Creek near Phoenixville, Pa.
- [01473169](#) Valley Creek at PA Turnpike Br. near Valley Forge, Pa.

#### Delaware Basin:

- [01475850](#) Crum Creek near Newtown Square, Pa.

# NITRATE: WHAT IS IT?

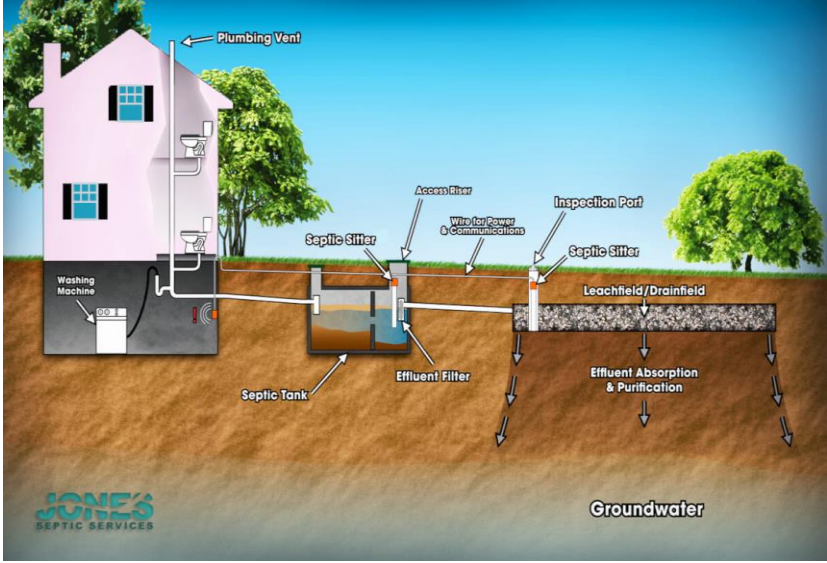




# NITRATE: WHY IS IT A CONCERN?

- High levels have been linked to a growing list of health concerns, including:
  - methemoglobinemia, also known as "blue-baby syndrome."
  - Increased heartrate, nausea, headaches, stomach cramps
- EPA's Drinking Water Standard: 10 mg/L

# NITRATE: WHERE DOES IT COME FROM?

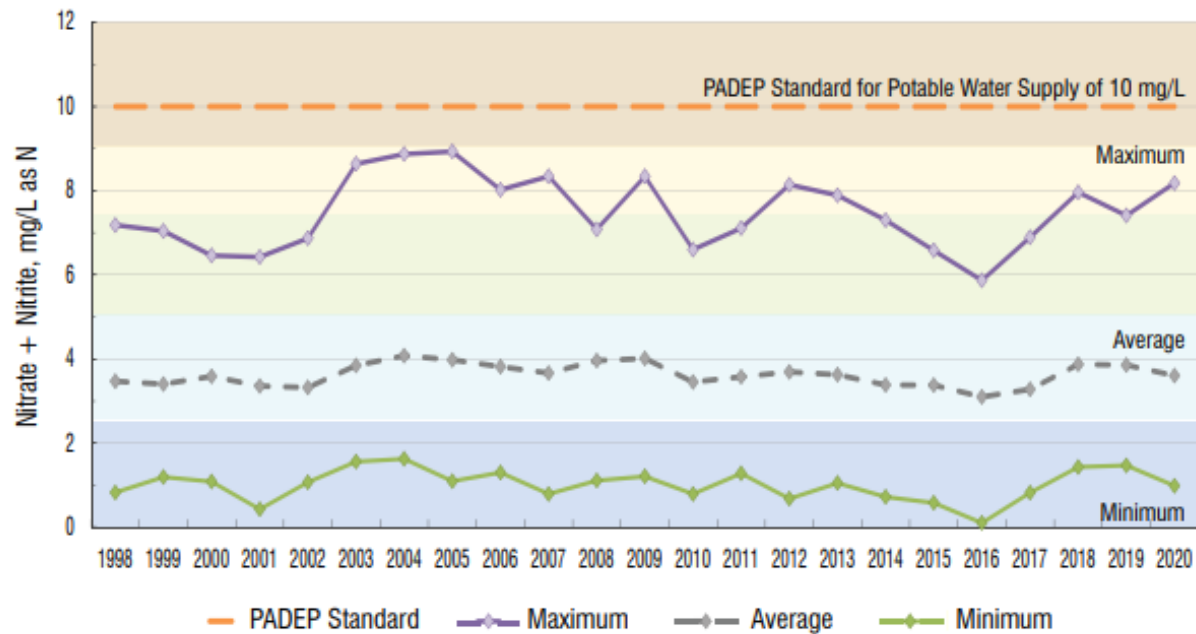


# NITRATE: LEVELS IN CHESTER COUNTY

## Nitrate + Nitrite

### Overall County-wide trends from 1998 - 2020

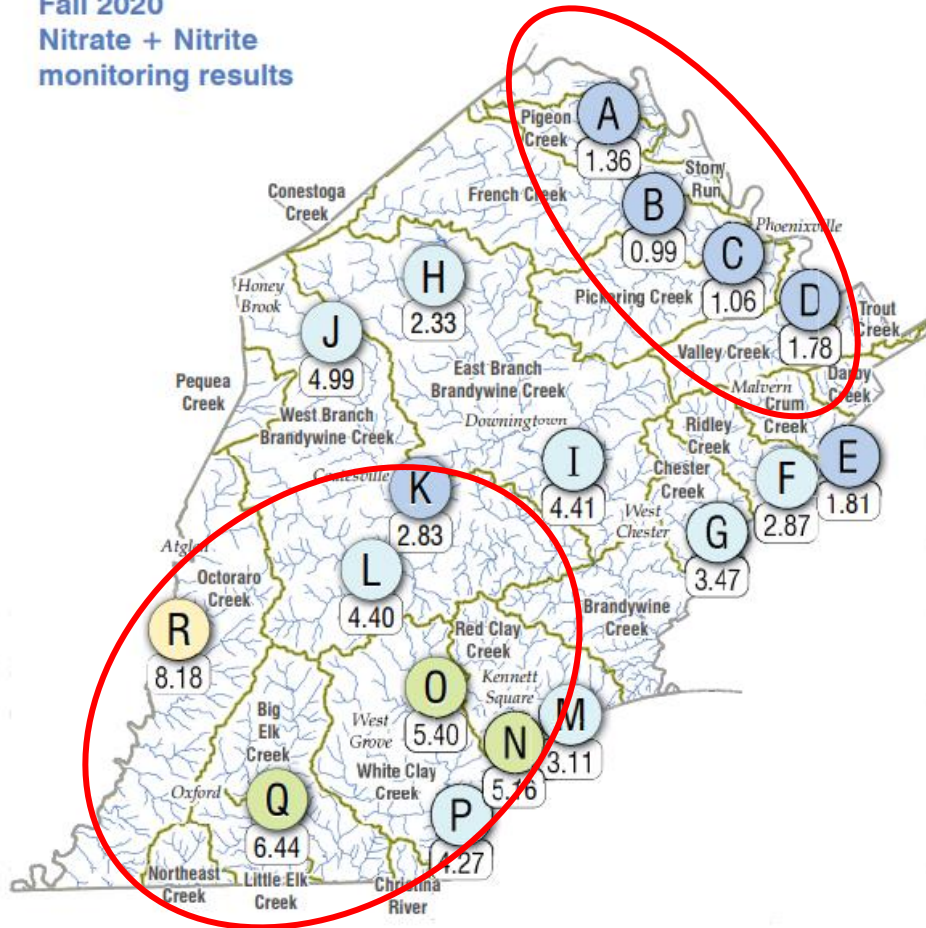
Combined County-wide maximum, minimum and average Nitrate + Nitrite values from 18 fixed sampling sites in Chester County (since 1998)





# NITRATE: WHERE ARE LEVELS HIGHEST?

Fall 2020  
Nitrate + Nitrite  
monitoring results



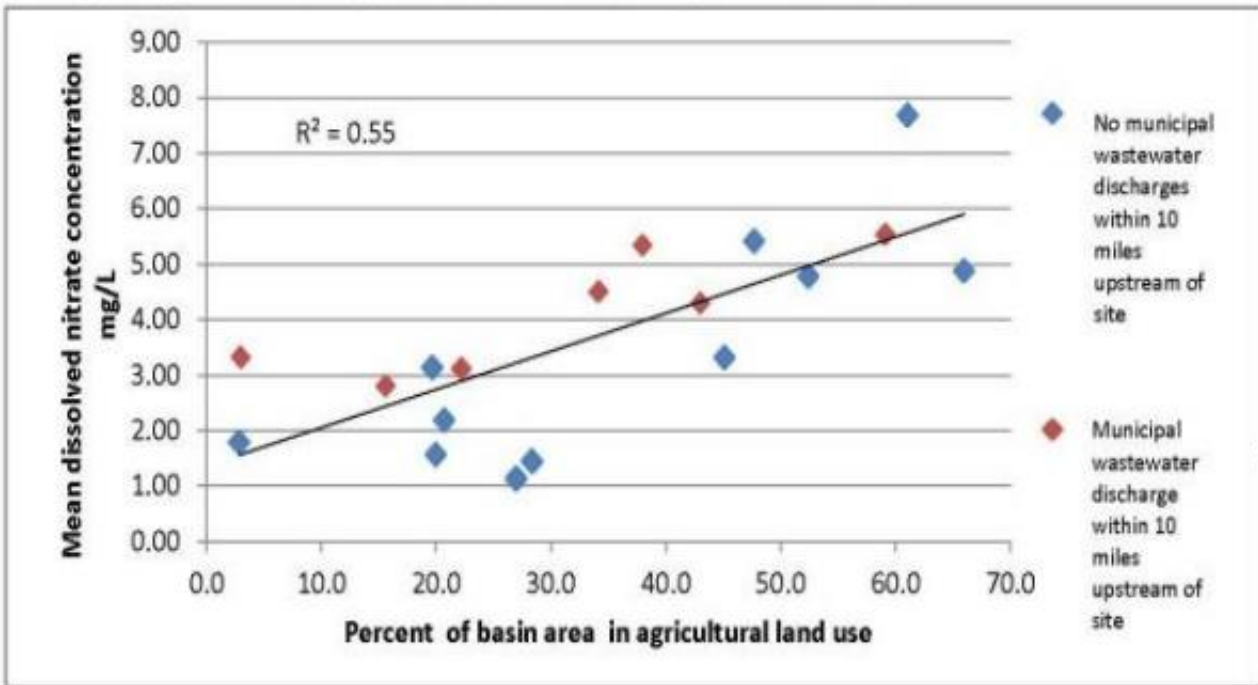
## Nitrate + Nitrite: Relative to 10 mg/L standard

- Below 2.5 mg/L (below 25%) | 6 sites
- From 2.5 to 5.0 mg/L (25% - 50%) | 8 sites
- From 5.0 to 7.5 mg/L (50% - 75%) | 3 sites
- From 7.5 to 9.0 mg/L (75% - 90%) | 1 sites
- Above 9.0 mg/L (90% and up) | 0 sites

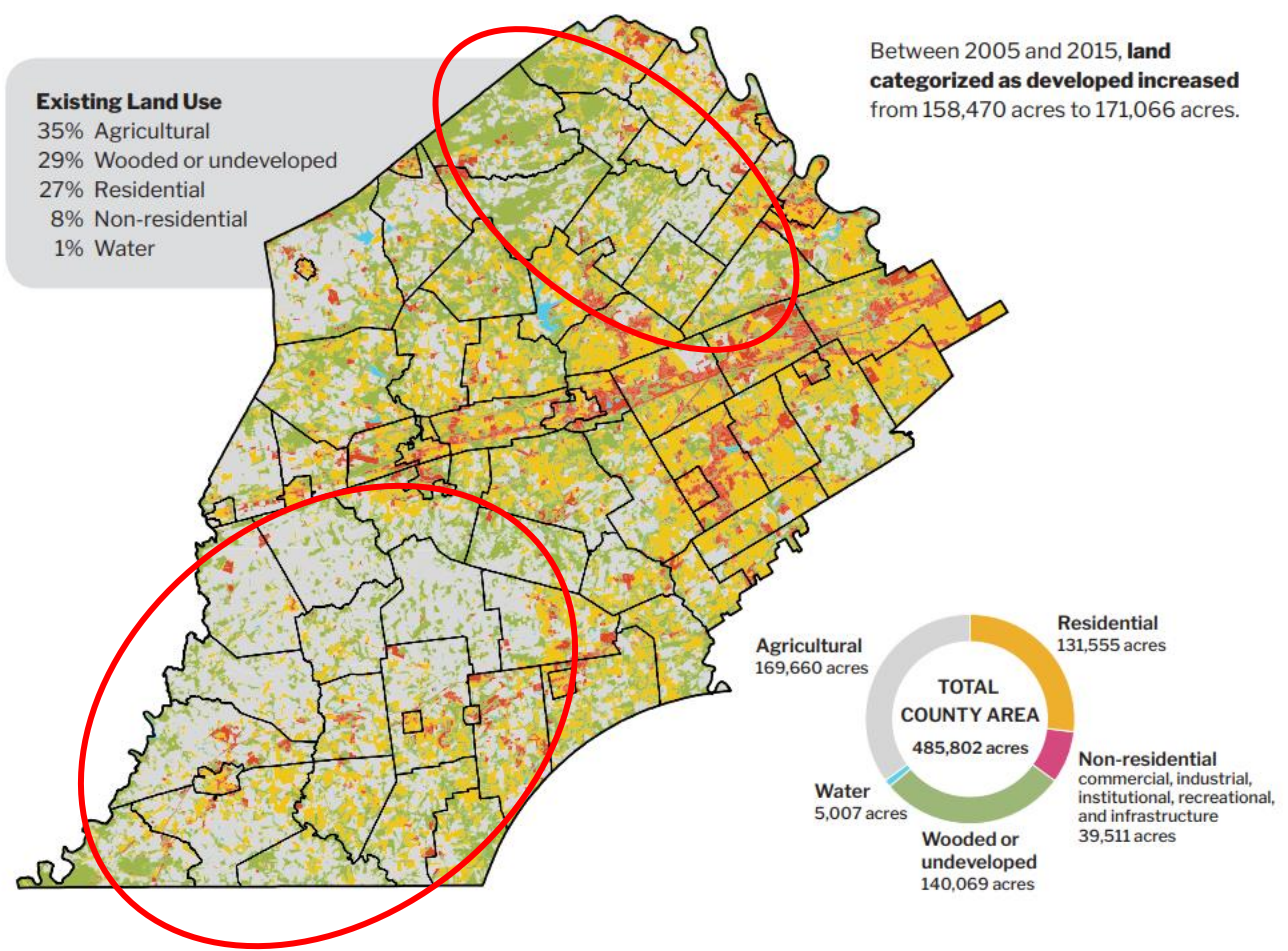
Map ID	Location	Nitrate + Nitrite, mg/L as N
A	Pigeon Creek near Slonaker	1.36
B	French Creek near Phoenixville	0.99
C	Pickering Creek near Phoenixville	1.06
D	Valley Creek at PA Turnpike near Valley Forge	1.78
E	Crum Creek at Newtown Square	1.81
F	Ridley Creek at Rt. 3 near Willistown	2.87
G	East Branch Chester Creek at Westtown	3.47
H	East Branch Brandywine Creek at Glenmoore	2.33
I	East Branch Brandywine Creek below Downingtown	4.41
J	West Branch Brandywine Creek near Honey Brook	4.99
K	West Branch Brandywine Creek at Modena	2.83
L	Buck Run at Doe Run	4.40
M	East Branch Red Clay Creek near Five Points	3.11
N	West Branch Red Clay Creek near Kennett Square	5.16
O	East Branch White Clay Creek at Avondale	5.40
P	Middle Branch White Clay Creek near Avondale	4.27
Q	Big Elk Creek at Maple Grove	6.44
R	East Branch Octoraro Creek near Steelville	8.18

# NITRATE: WHERE ARE LEVELS HIGHEST?

Figure 8. Relation between percent of basin area in agricultural land use and mean dissolved nitrate concentration from samples collected at 18 fixed-location sites in the Stream Conditions of Chester County Biological Monitoring Network, Chester County, Pa. 1998-2009.



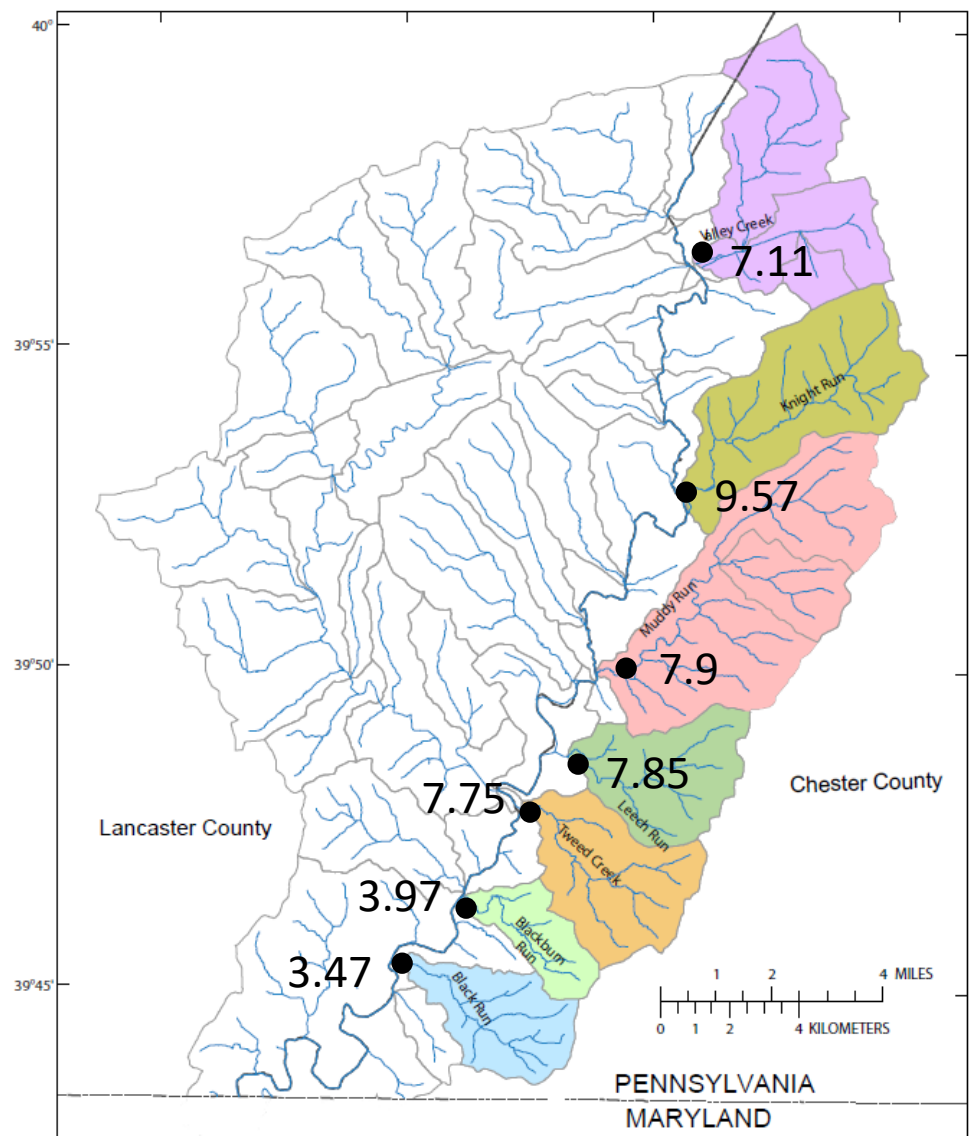
# NITRATE: WHERE ARE LEVELS HIGHEST?





# NITRATES IN OCTORARO CREEK WATERSHED

2000

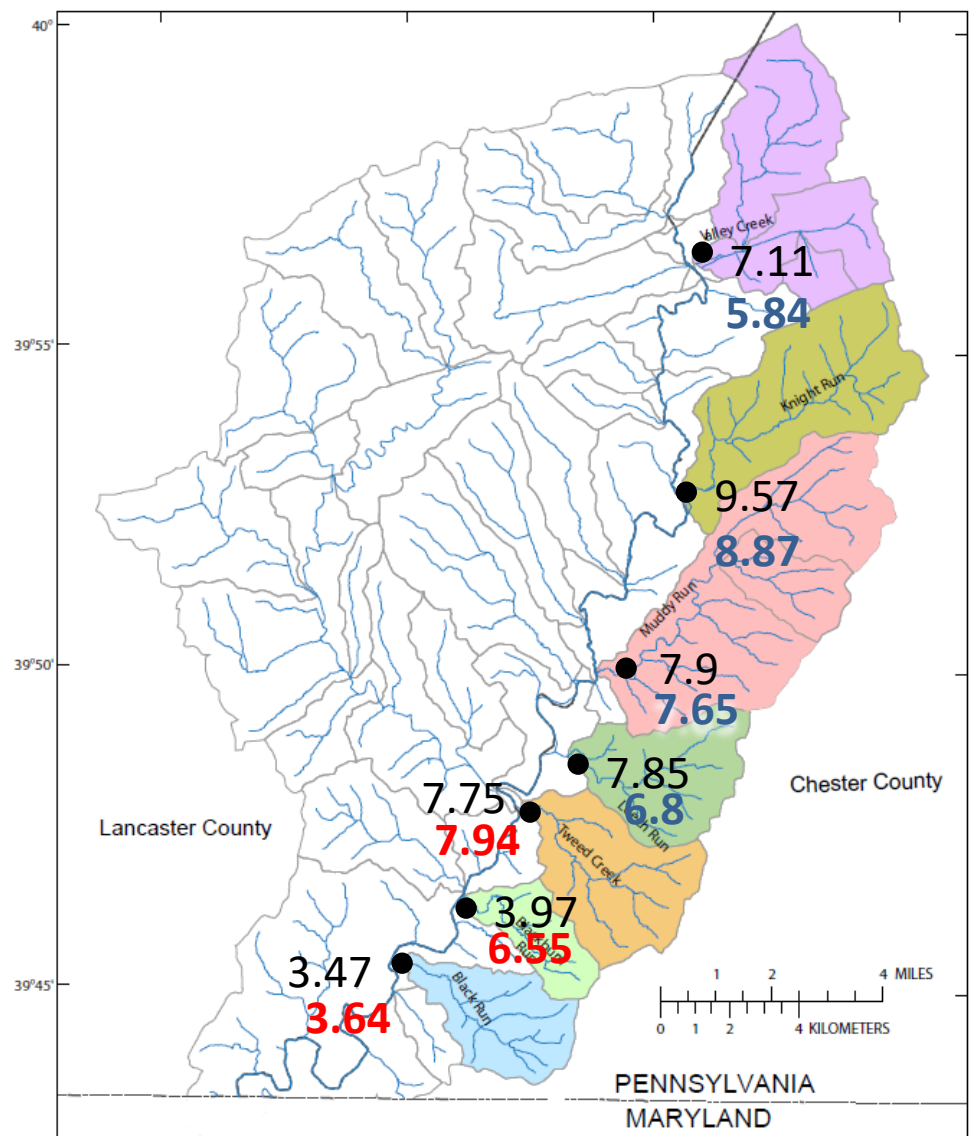


# NITRATES IN OCTORARO CREEK WATERSHED

## 2017

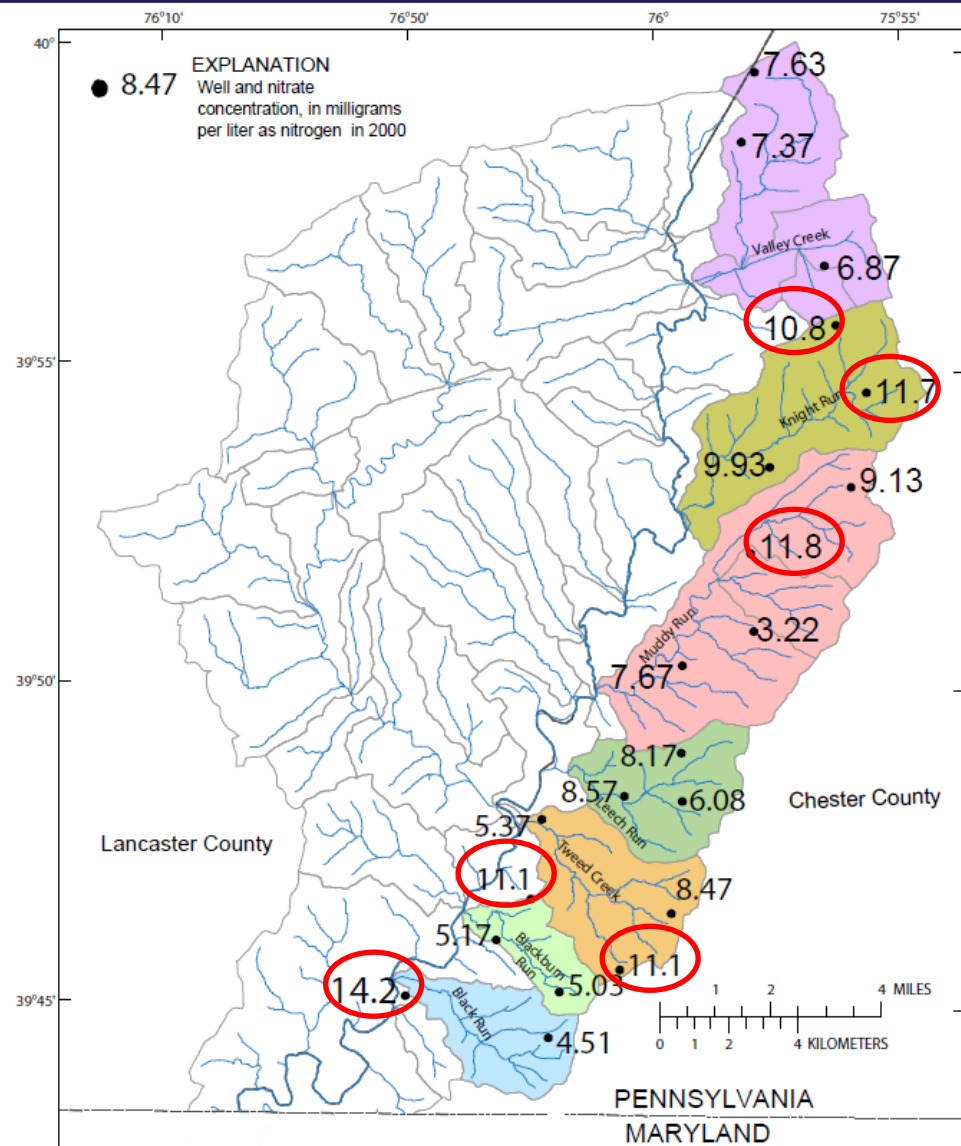
Baseflow  
2000 / 2017

- 7.11 / **5.84**
- 9.57 / **8.87**
- 7.9 / **7.85**
- 7.85 / **6.8**
- 7.75 / **7.94**
- 3.97 / **6.55**
- 3.47 / **3.64**



# NITRATES IN OCTORARO CREEK WATERSHED

2000





# NITRATES IN OCTORARO CREEK WATERSHED

## 2018

### Groundwater 2000 / 2018

7.63 / **8.05**

6.87 / **8.81**

10.8 / **13.1**

11.7 / **16.7**

9.93 / **15.6**

11.8 / **26.8**

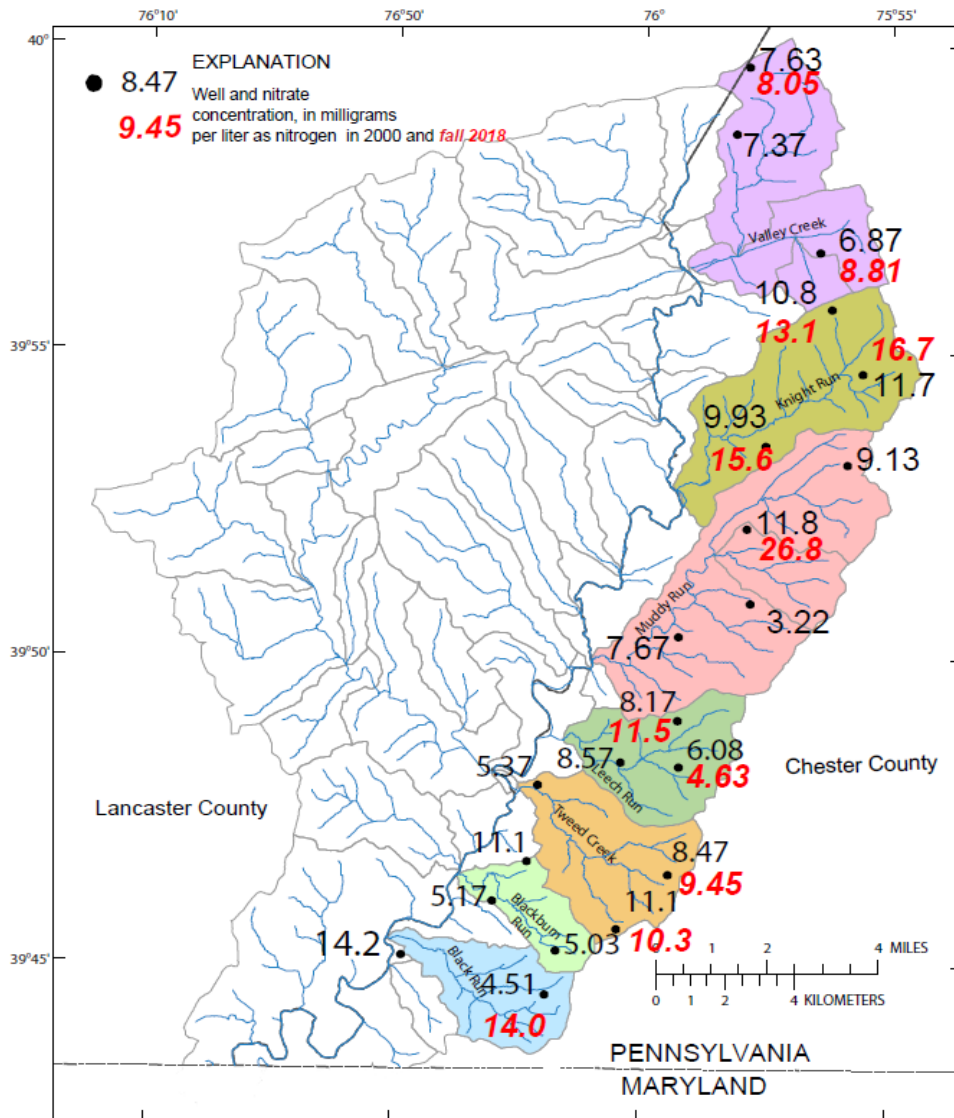
8.17 / **11.5**

6.08 / **4.63**

8.47 / **9.45**

11.1 / **10.3**

4.51 / **14.0**





# HOMEOWNER RESOURCES

[Home](#) › [Government](#) › [Departments](#) › [Health](#) › [Wells and Well Water Testing](#)

## Wells and Well Water Testing

- [Well Water Testing](#)
- [Chester County Well Regulations](#)
- [Fluoridated Water Supplies in Chester County](#)
- [Procedure for Well Installation](#)
- [What to do when your Well is not Producing Water](#)
- [Well Disinfection Procedure \(English & En Español\)](#)
- [Well Completion Form](#)
- [Conditions for Well Approval](#)
- [Well Decommission Form](#)
- [Request to Maintain/Water Source Replacement Form](#)
- [Compost Sock Sediment Trap](#)
- [Erosion and Sediment - Best Management Practices for Well Drilling and Aquifer Testing](#)
- [Concerns about TCE in Drinking Water](#)
- [Sewage Enforcement Officer coverage areas \(map\)](#)
- [Sewage and Well Fees](#)

[Contractor Information](#) - Well Drillers, Geothermal Contractors, Pump Installers, and Licensed Waste Haulers

[Home](#) › [Government](#) › [Departments](#) › [Health](#) › [Well Water Testing Labs in Chester County](#)

## Well Water Testing Labs in Chester County

**Brandywine Science Center, Inc.** - 610-444-9850  
204 Line Road  
Kennett Square, PA 19348

**H.O. Thompson Testing Lab** - 610-593-5030  
104 Valley View Drive  
Parkesburg, PA 19365

### Nearby Counties

#### Berks County

**M. J. Reider Associates Inc.** - 610-374-5129  
107 Angelica Street  
Reading, PA 19611

**Suburban Water Testing Labs, Inc.** - 610-375-8378  
1037 MacArthur Road  
Reading, PA 19605

#### Bucks County

**Analytical Laboratories, Inc.** - 215-723-6466  
4208 Old Bethlehem Pike  
Telford, PA 18969

**J. W. Testing, LLC** - 215-257-7542  
6 Audrey Lane  
Silverdale, PA 18962

# CONCLUSIONS

- Water conditions are not static: land use and environmental conditions can result in significant changes over time
- Education to homeowners on their risks and responsibilities is important
- Continued and targeted installation of best management practices is needed to reduce levels in streams and groundwater



# *Questions?*

*water@chesco.org*  
*chesco.org/water*  
610-344-5400

