



WATER SUPPLY UPDATE

City Council Workshop, Dover, New Hampshire

May 12, 2021

Presented by James Emery and Keith Pratt

**Emery & Garrett Groundwater Investigations, A Division of GZA
and Underwood Engineering, Inc.**

Status of NH Drought- Information

**Jamie Emery- Principal and SR.
Hydrogeologist EGGI/GZA**

United States Drought Monitor

[Current Map](#)

[Maps](#)

[Data](#)

[Summary](#)

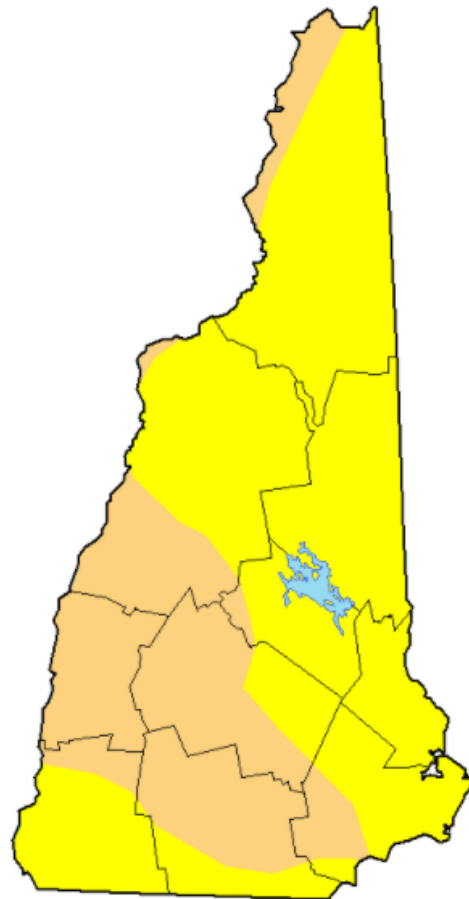
[About](#)

[Conditions & Outlooks](#)

[En Español](#)

[NADM](#)

New Hampshire



Map released: Thurs. May 6, 2021

Data valid: May 4, 2021 at 8 a.m. EDT

Intensity:

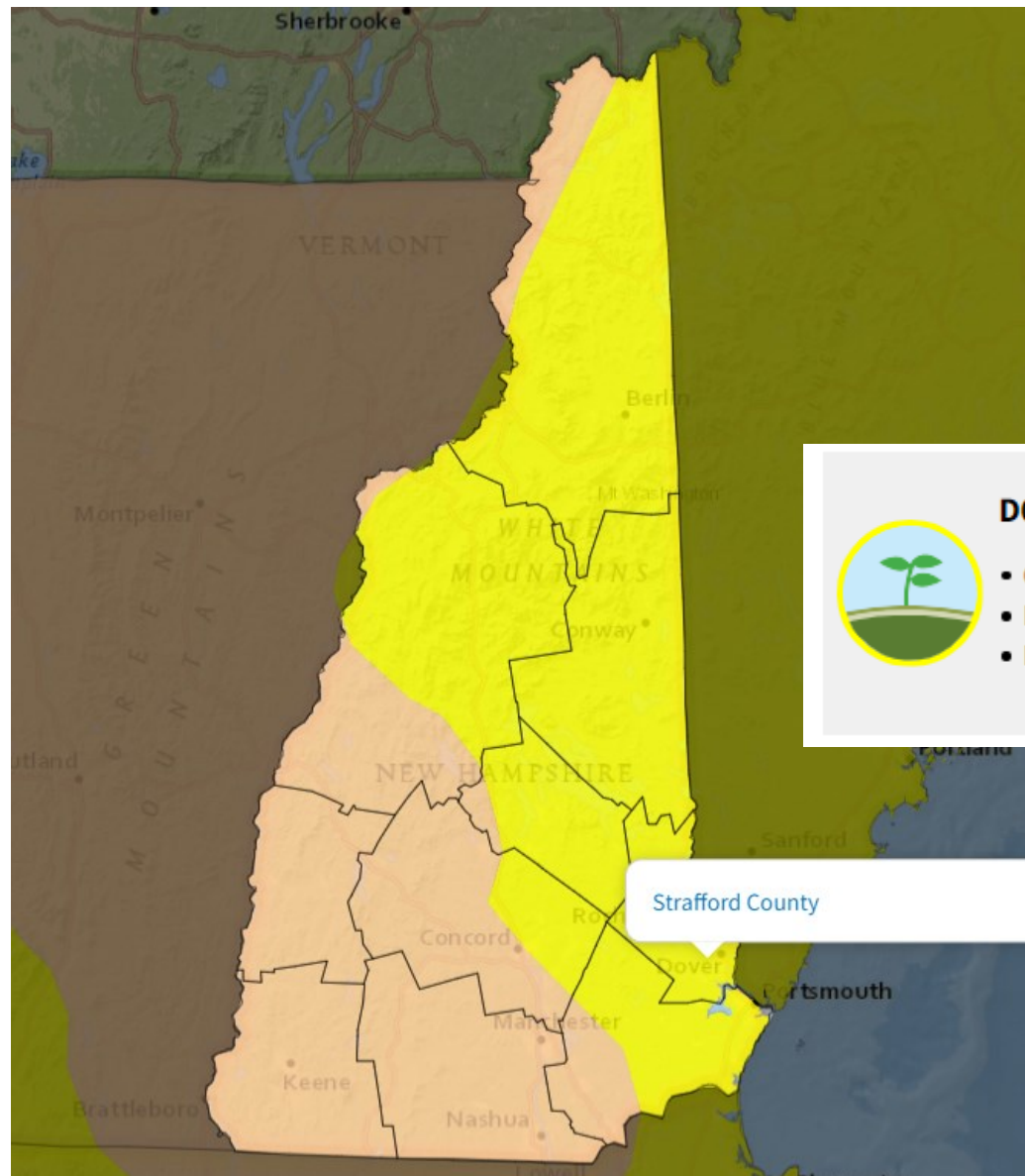
- ☐ None
- ☒ D0 (Abnormally Dry)
- ☐ D1 (Moderate Drought)
- ☐ D2 (Severe Drought)
- ☐ D3 (Extreme Drought)
- ☐ D4 (Exceptional Drought)
- ☐ No Data

Author(s):

David Simeral, Western Regional Climate Center

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying **text summary** for forecast statements.*

Emery & Garrett Groundwater Investigations, A Division of GZA



D0 - Abnormally Dry

- Crop growth is stunted; planting is delayed
- Fire danger is elevated; spring fire season starts early
- Lawns brown early; gardens begin to wilt

100.00%
 of Strafford
 County
 (D0-D4)

Statistics

Statistics type:

Cumulative Percent Area

Display:

Statistics

Export table:

CSV

XLS

Week	Date	None	D0-D4	D1-D4	D2-D4	D3-D4	D4	DSCI
Current	2021-05-04	0.00	100.00	32.88	0.00	0.00	0.00	133
Last Week	2021-04-27	0.00	100.00	42.54	0.00	0.00	0.00	143
3 Months Ago	2021-02-02	47.55	52.45	14.93	0.00	0.00	0.00	67
Start of Calendar Year	2020-12-29	51.64	48.36	12.20	0.00	0.00	0.00	61
Start of Water Year	2020-09-29	0.00	100.00	100.00	95.06	10.59	0.00	306
One Year Ago	2020-05-05	100.00	0.00	0.00	0.00	0.00	0.00	0

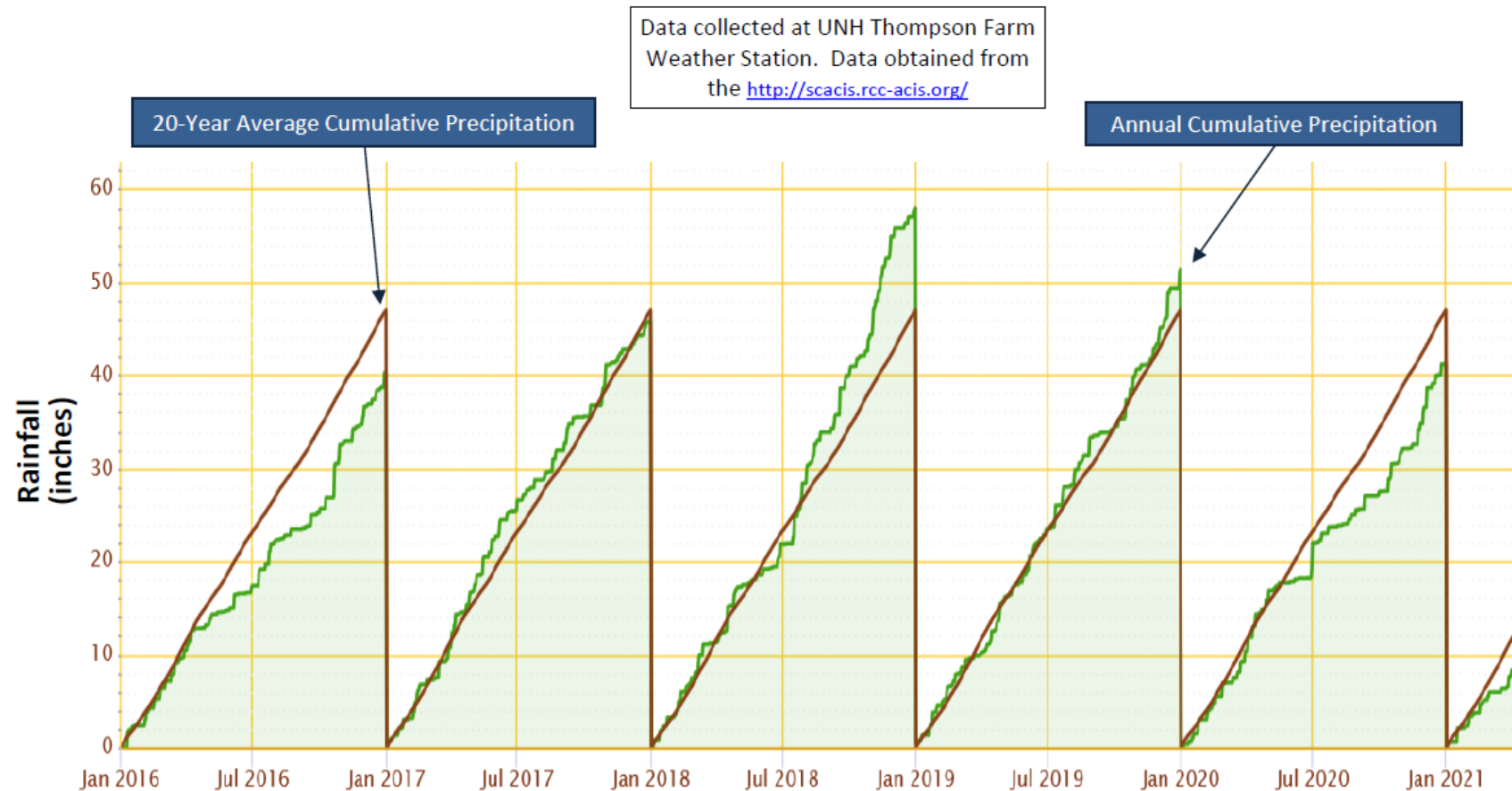
Estimated Population in Drought Areas: 566,676

View More Statistics

Northeast

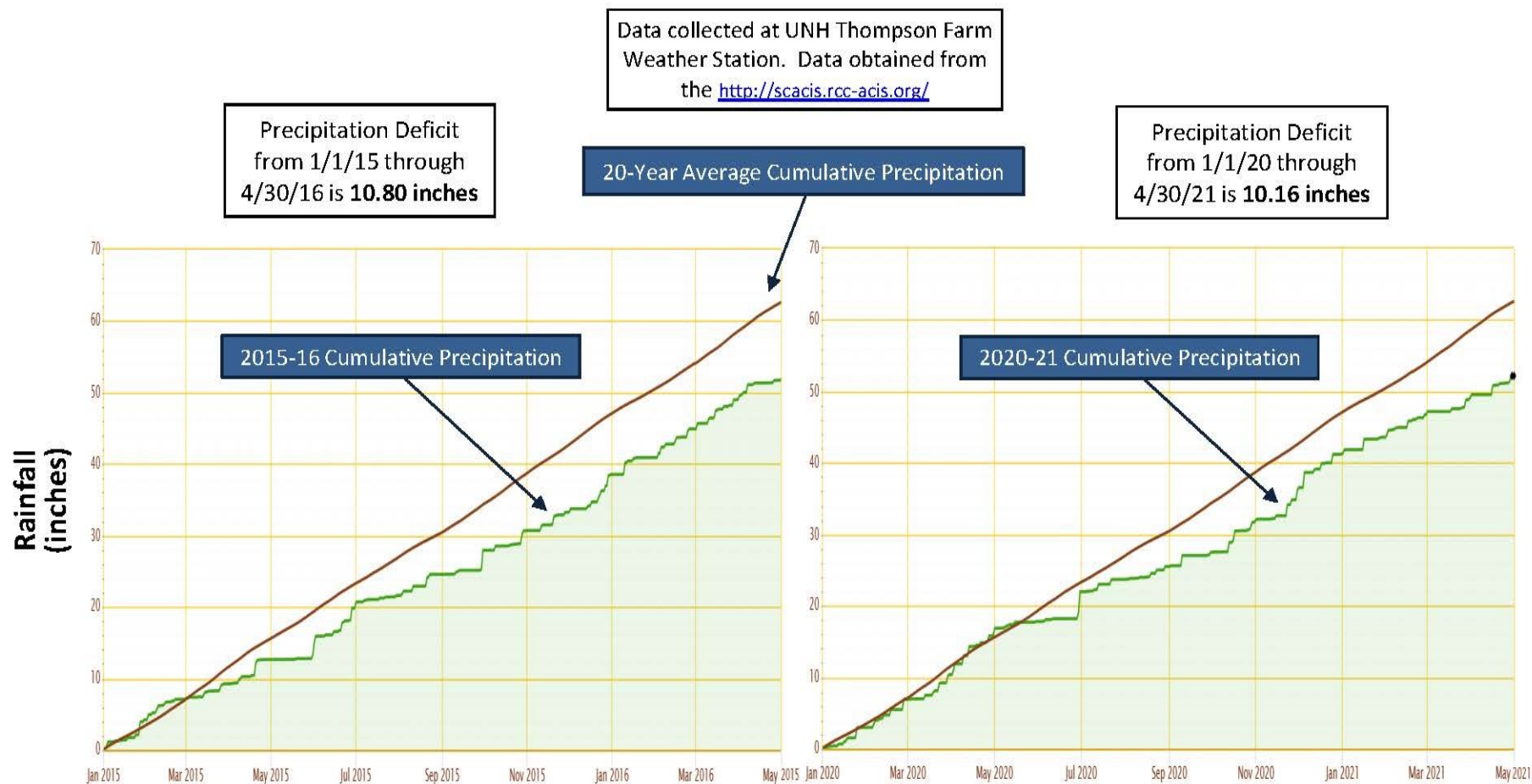
- Precipitation fell across most of the Northeast this week, but amounts varied considerably. An inch or more was observed across parts of northern New England, and there were patchy areas of 0.5-1.0 inch, with many other areas receiving less than 0.5 inch.
- Dry topsoil percentages improved slightly but were still high in New Hampshire (55%), Connecticut (28%), and Massachusetts (26%).
- 2021 –Limited Water restrictions are now in effect in several Towns in Vermont and Mass.

Comparison of Yearly Accumulated Precipitation to 20-Year Average Accumulated Precipitation

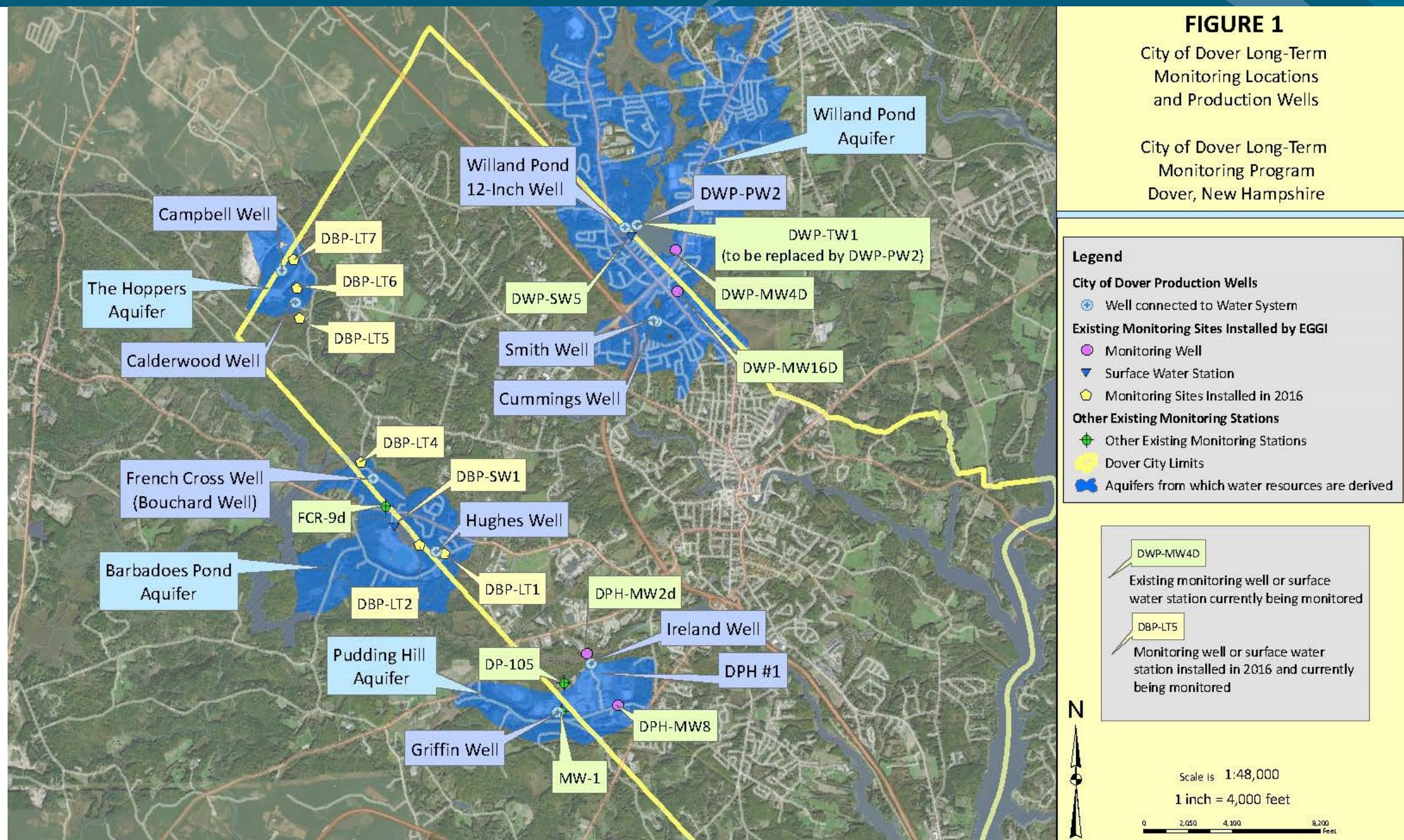


Thompson Farm, Durham, New Hampshire

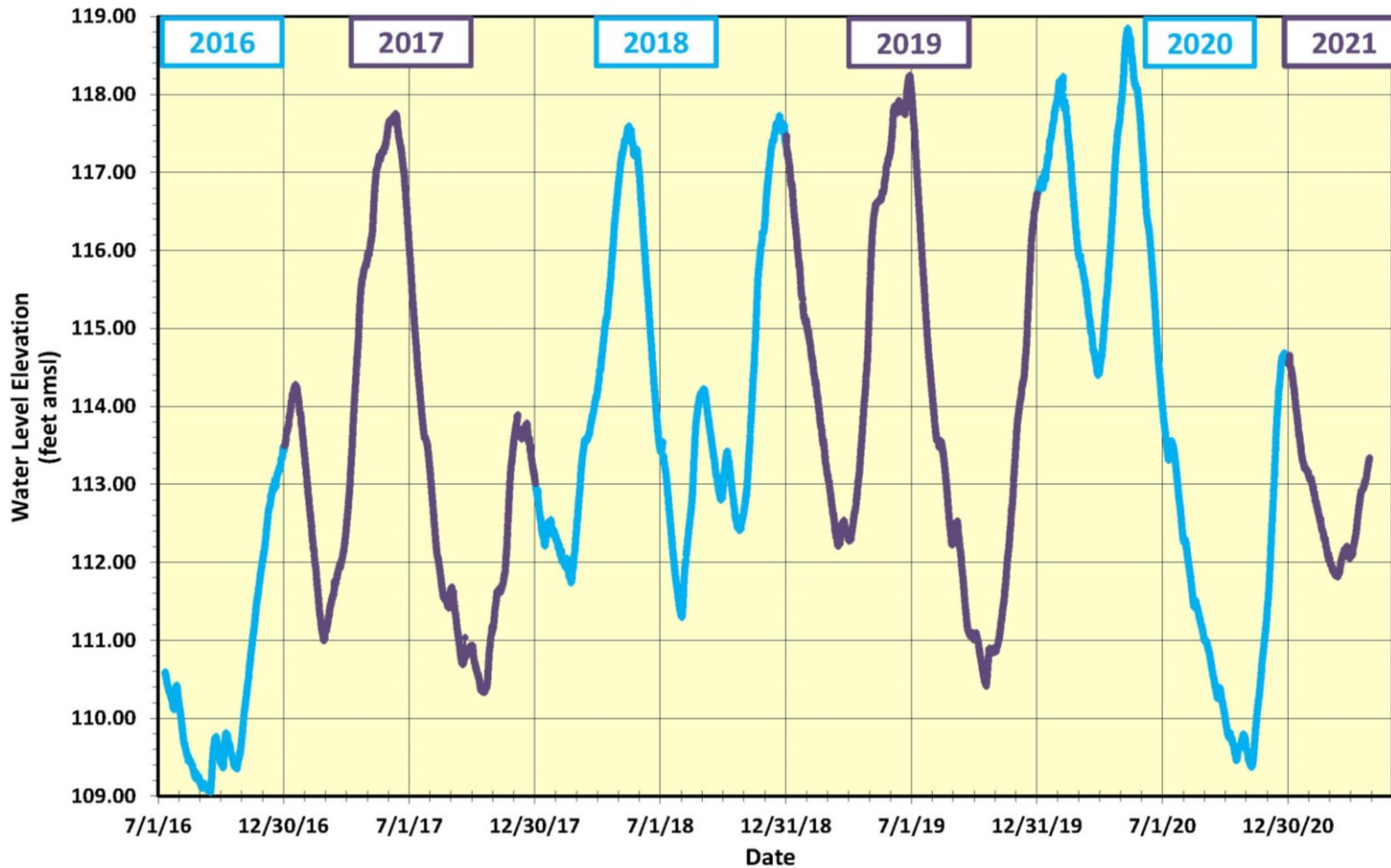
Comparison of 2015/2016 Drought and 2020/2021 Drought to 20-Year Average Accumulated Precipitation



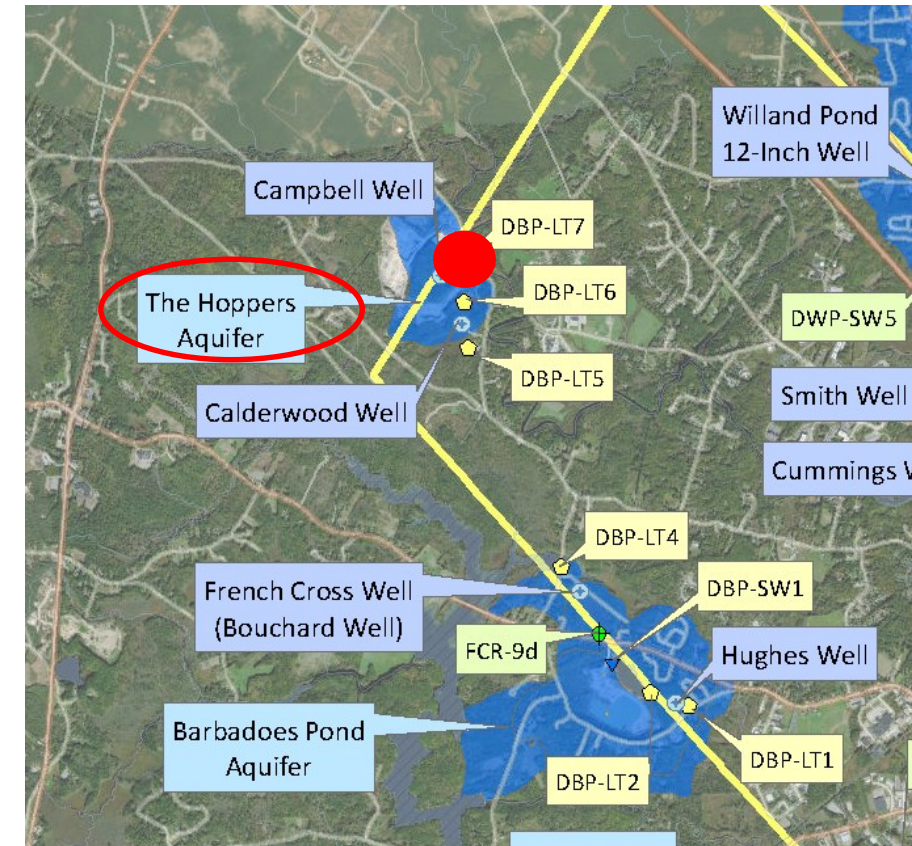
Thompson Farm, Durham, New Hampshire



The Hoppers Aquifer Monitoring Well LT7

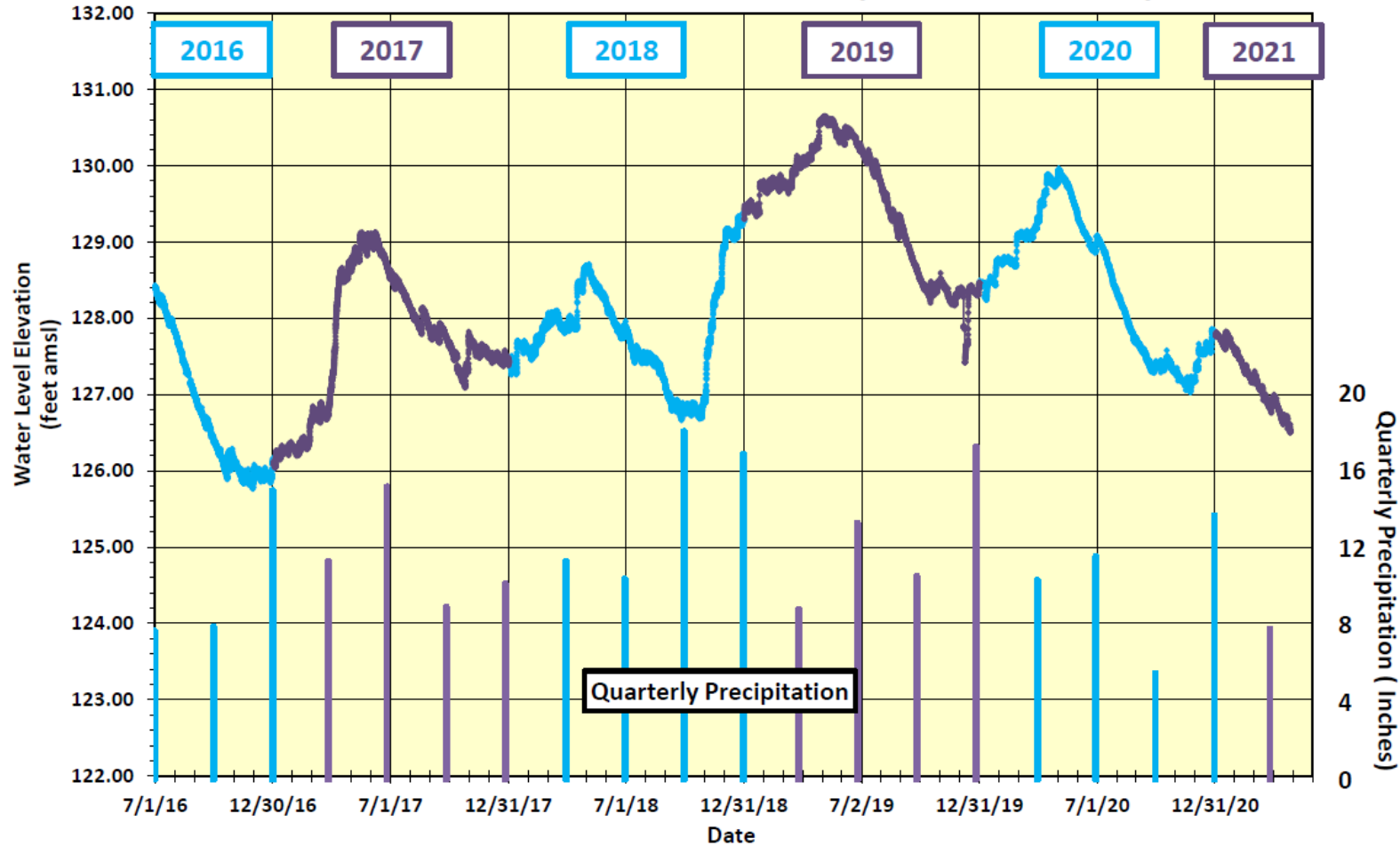


Plot of Water Level Elevation versus Time for July 11, 2016 to April 27, 2021
 Long-Term Groundwater Monitoring Program
 Dover, New Hampshire



Barbadoes Pond Aquifer

Surface Water Station DBP-SW1 (Barbadoes Pond)



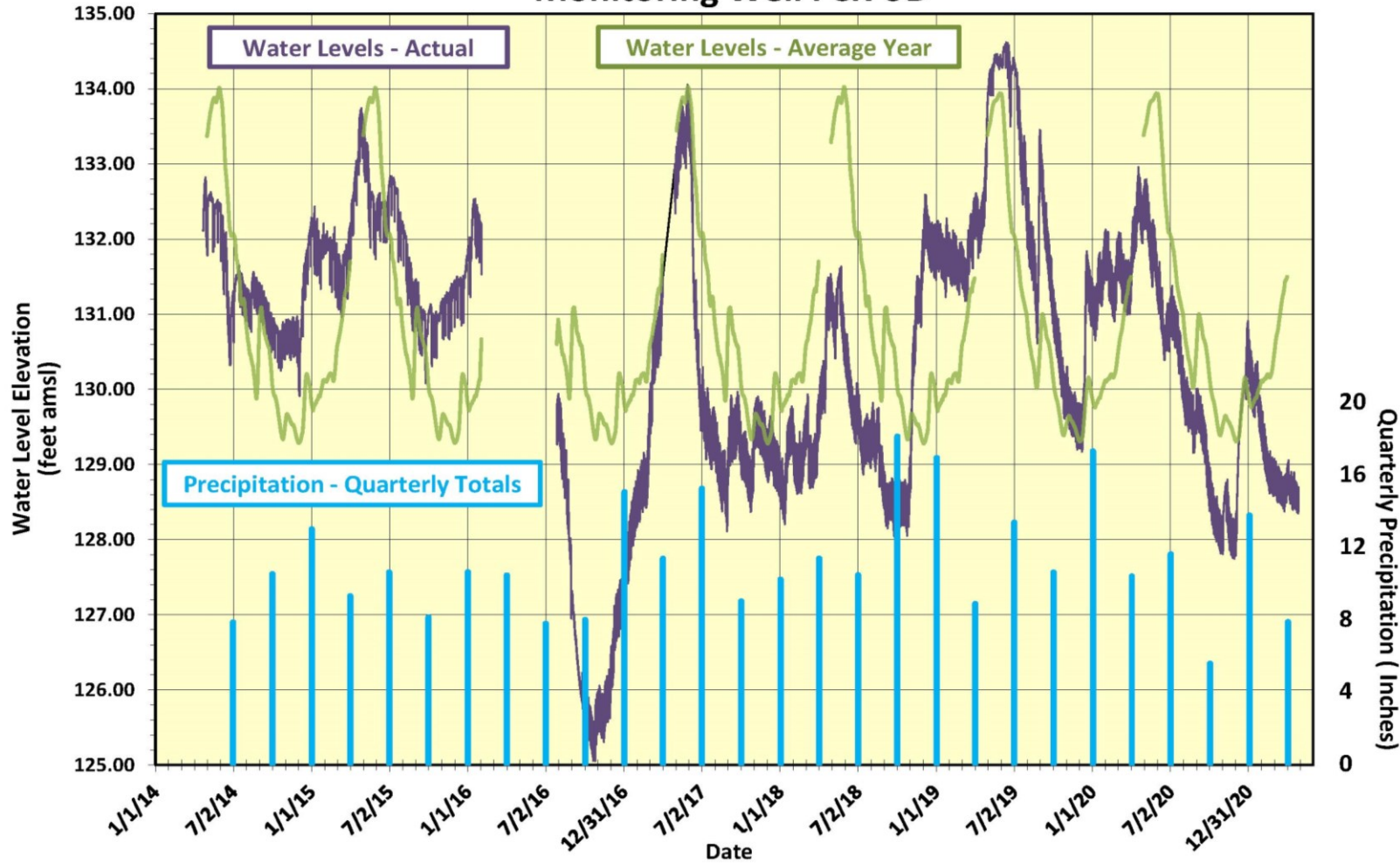
Plot of Water Level Elevation versus Time for July 1, 2016 to April 27, 2021

Long-Term Groundwater Monitoring Program

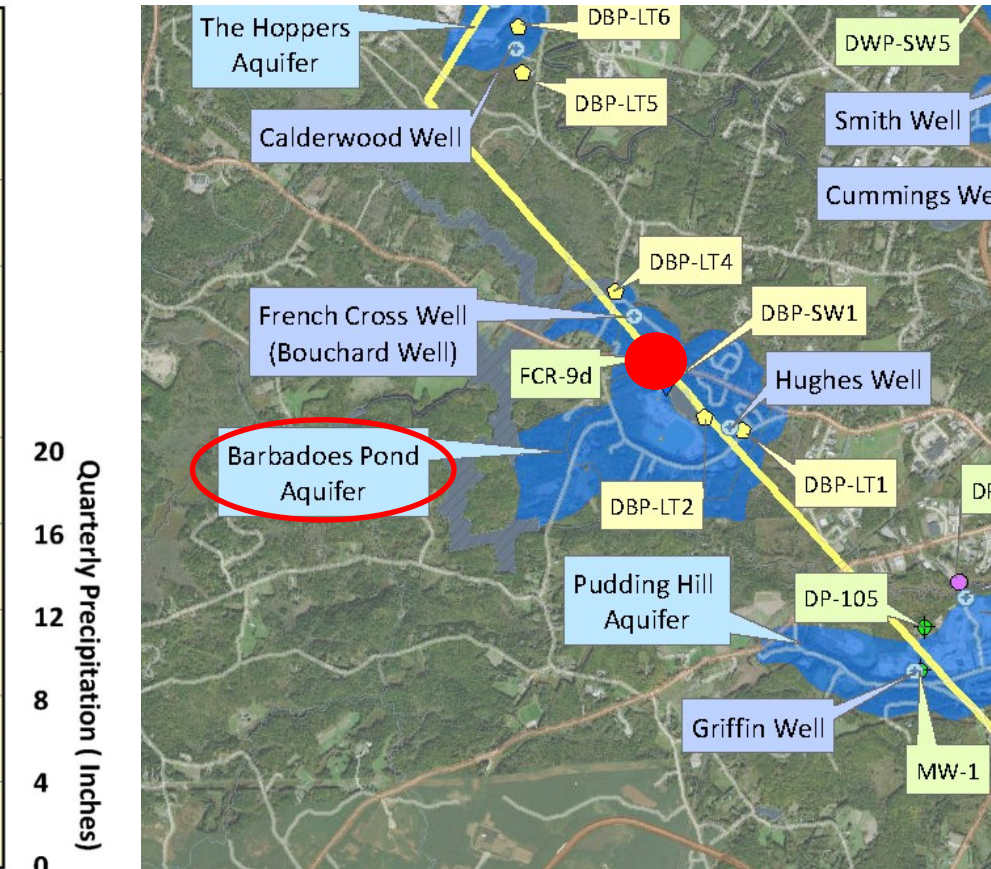
Dover, New Hampshire



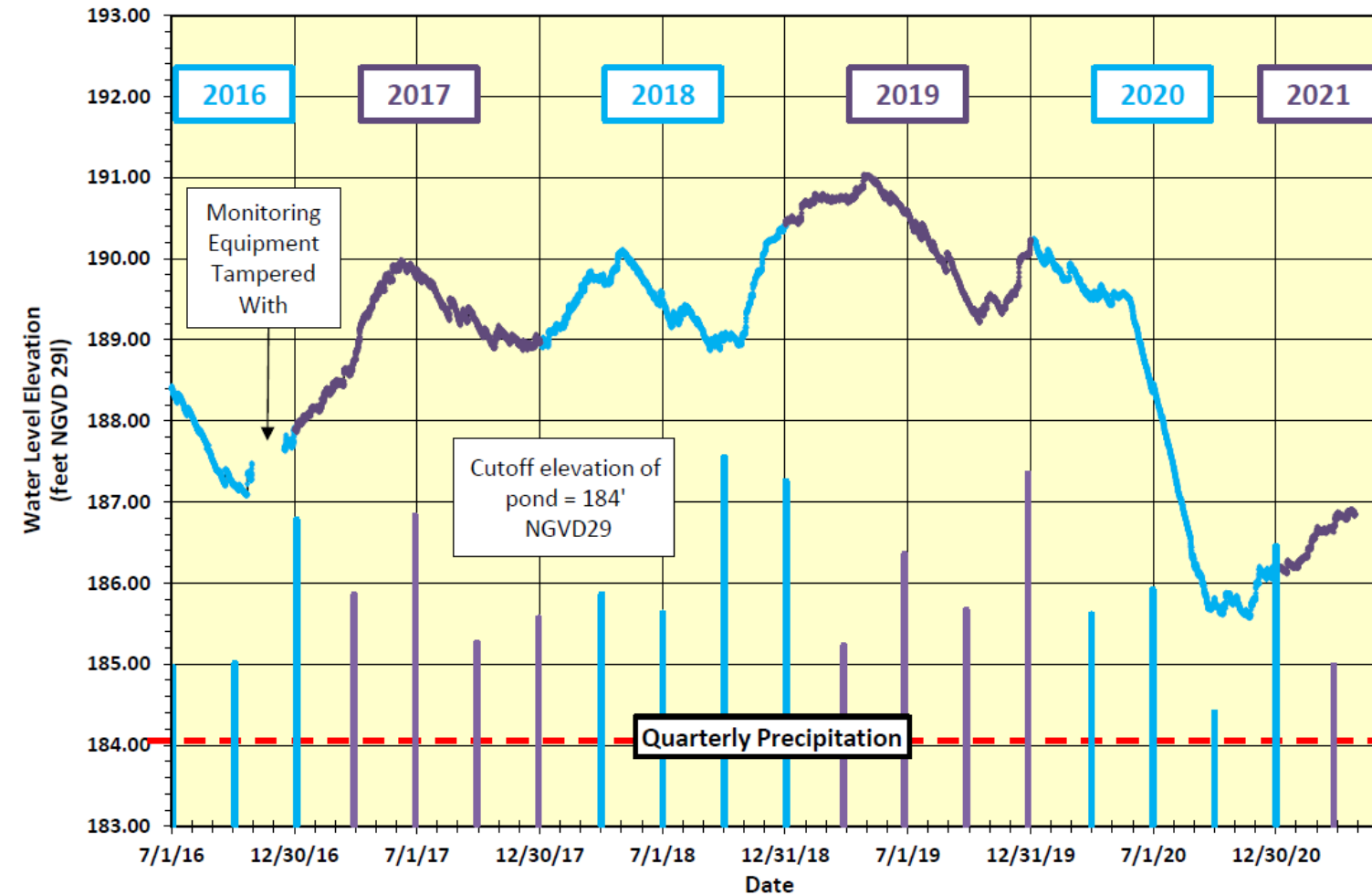
Barbadoes Pond Aquifer Monitoring Well FCR-9D



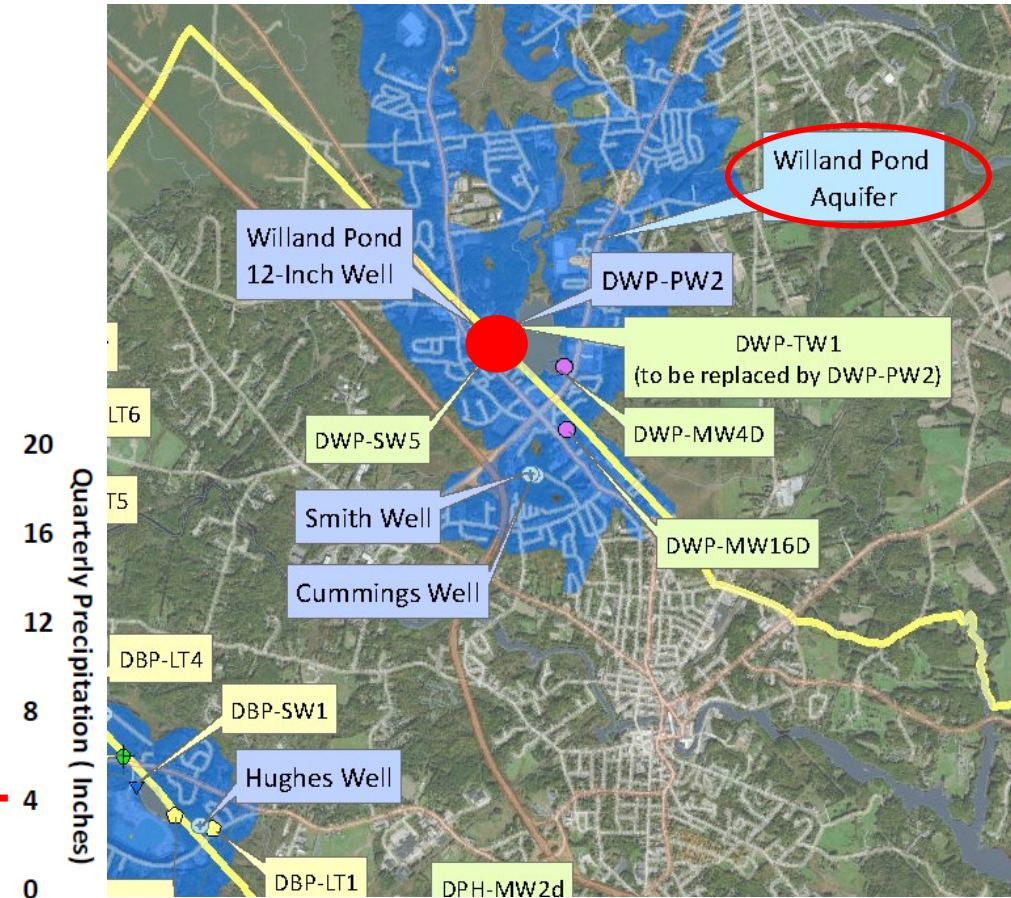
Plot of Water Level Elevation versus Time for July 27, 2016 to April 27, 2021
 Long-Term Groundwater Monitoring Program
 Dover, New Hampshire



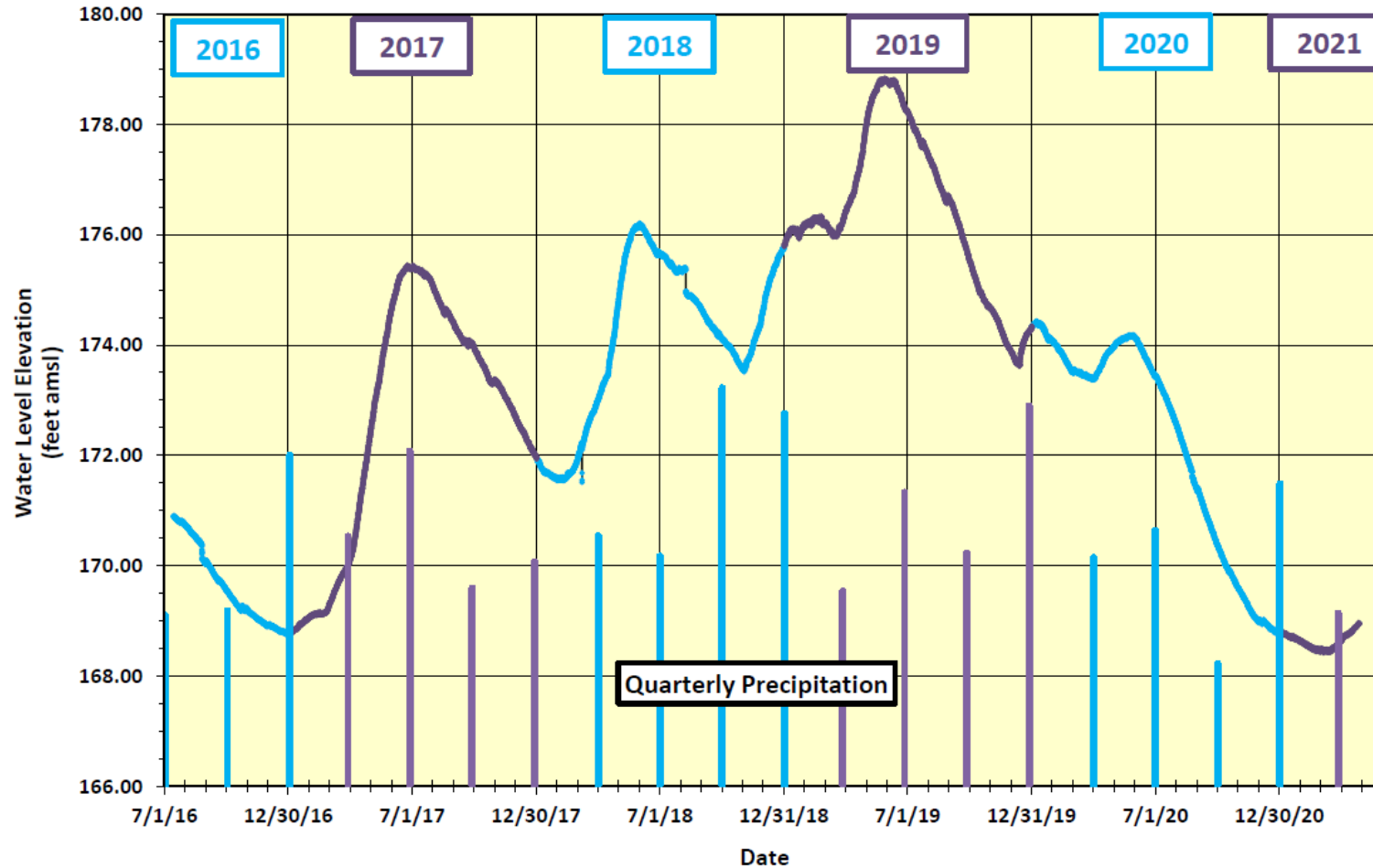
Willand Pond Aquifer Surface Water Station DWP-SW5



Plot of Water Level Elevation versus Time for July 1, 2016 to April 27, 2021
 Long-Term Groundwater Monitoring Program
 Dover, New Hampshire



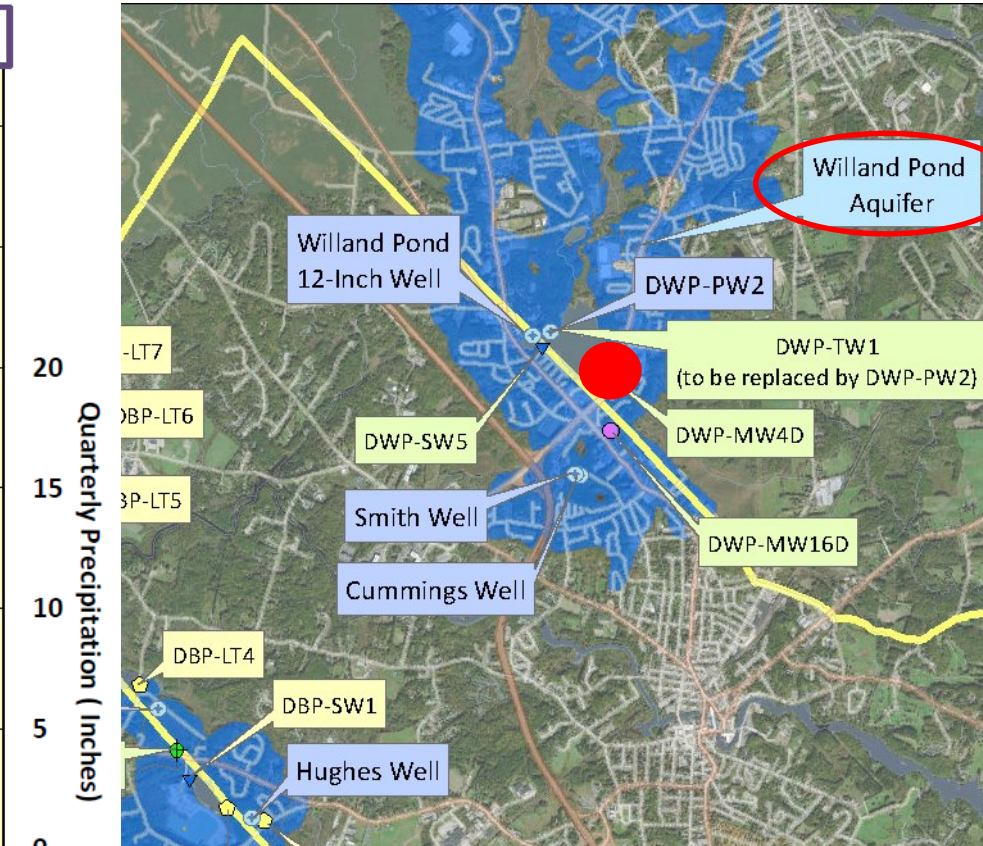
Willand Pond Aquifer Monitoring Well DWP-MW4D



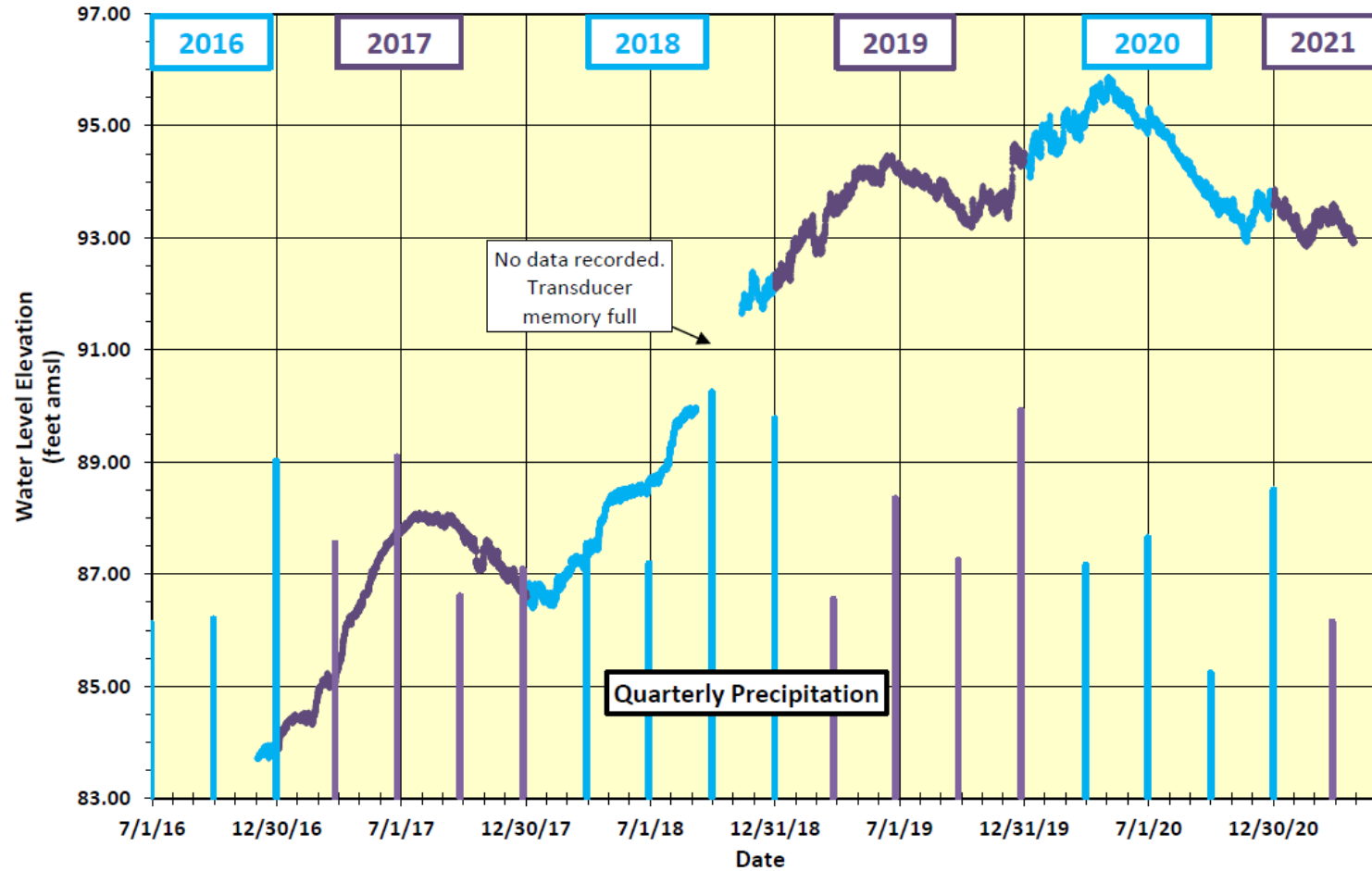
Plot of Water Level Elevation versus Time for July 14, 2016 to April 27, 2021

Long-Term Groundwater Monitoring Program

Dover, New Hampshire



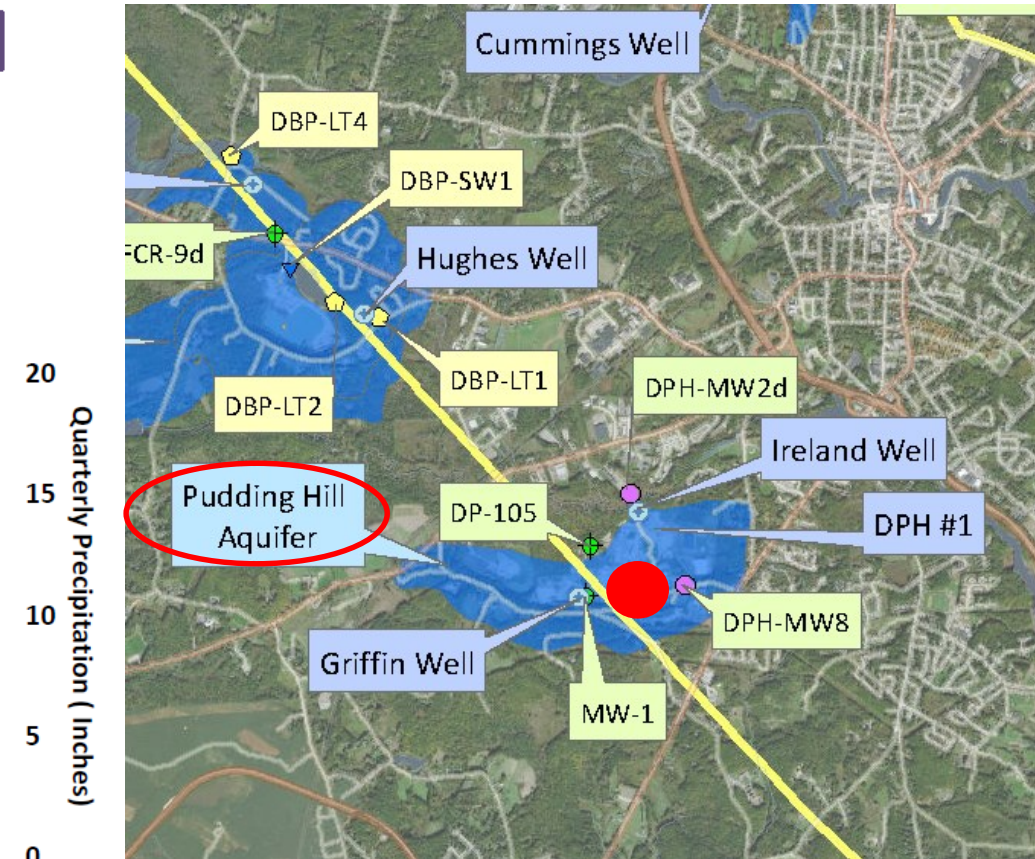
Pudding Hill Aquifer Monitoring Well DPH-MW6



Plot of Water Level Elevation versus Time for December 2, 2016 to April 27, 2021

Long-Term Groundwater Monitoring Program

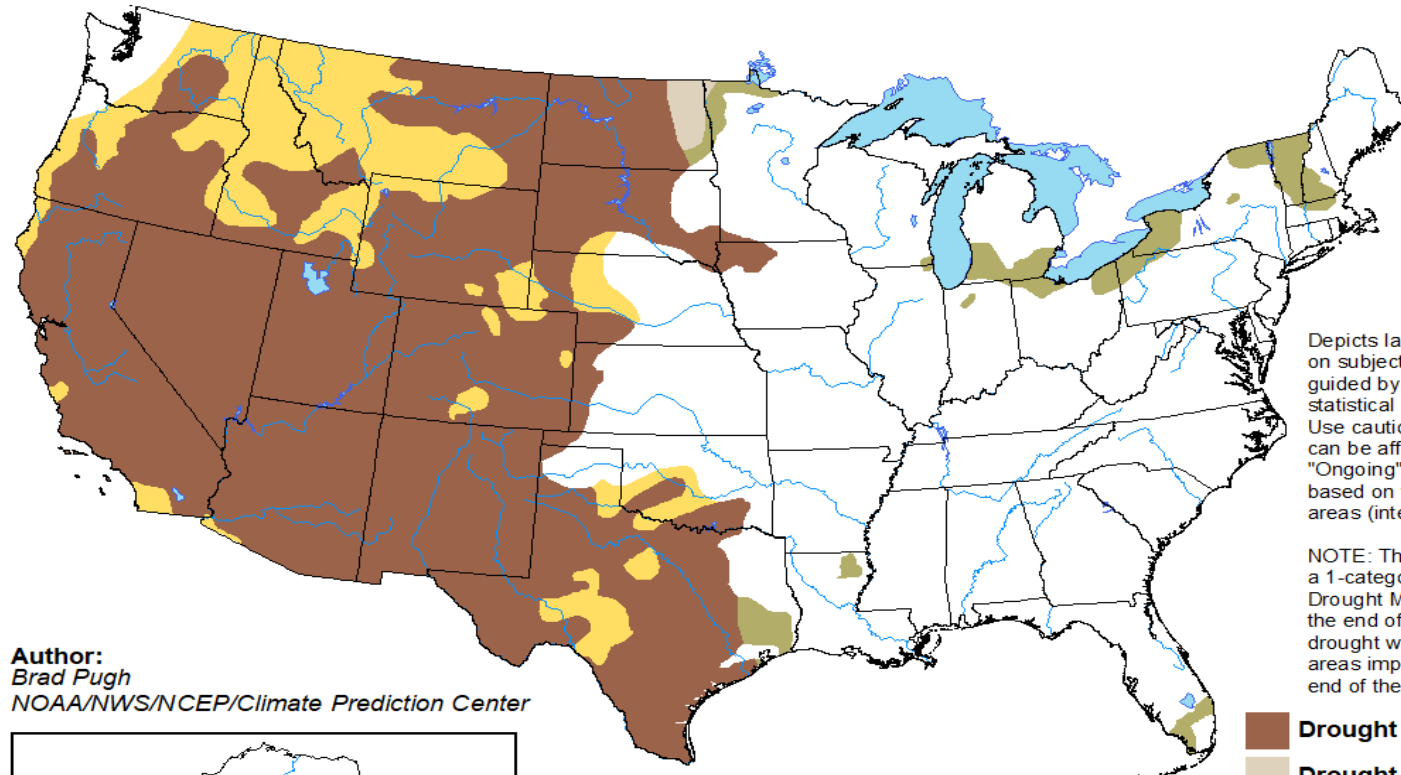
Dover, New Hampshire



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

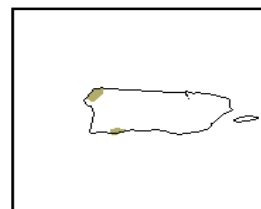
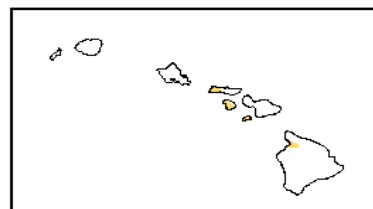
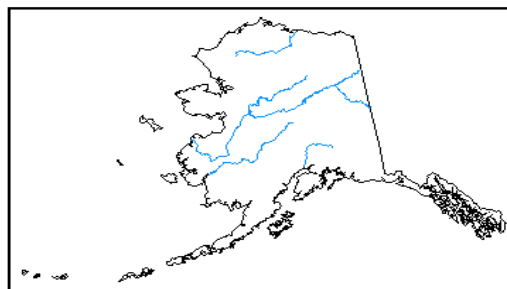
Valid for April 15 - July 31, 2021
Released April 15



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

Author:
Brad Pugh
NOAA/NWS/NCEP/Climate Prediction Center



- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely



<http://go.usa.gov/3eZ73>

Conclusions / Considerations / Drought

- Currently Dover is experiencing abnormally low rainfall and has had a precipitation deficit of over 10 inches between Jan 2020 and April 2021.
- Surface Water levels are currently low (Barbadoes and Willand Ponds), which is to be expected during abnormally dry conditions.
- Groundwater levels within the Hoppers Aquifer is currently near normal levels.
- Groundwater levels at the Willand Pond Aquifer and Barbadoes Pond Aquifer are lower than average and need to be continuously monitored carefully.

Conclusions / Considerations /Drought (Continued)

- The Pudding Hill Aquifer is nearly full because it has not been used (been offline) in several years.
- If water levels in all other Aquifers decline substantially due to summer-time dry periods or drought, it may become necessary to consider the use of pumping Well DPH #1 at the Pudding Hill Aquifer.
- At the present time, no additional water use restrictions are required, however, the possibility of implementing additional water use restrictions will need to be revisited in 30 days.



An Introduction to

Per- and Polyfluorinated Alkyl Substances

(PFAS)

for

The Dover City Council
City of Dover, New Hampshire

James Emery, Principal

Emery & Garrett Groundwater Investigations, A Division of GZA

Sources of PFAS



- Fire-fighting foams (AFFF)
 - Airports, training facilities, terminals
- Industrial facilities
 - Electroplating (mist suppressants)
 - Semiconductor manufacturing
 - Aerospace & electronic applications
 - Automobile Industry
- Landfills
 - Leachate
 - Consumer products
- Wastewater and Septic Drain Fields
 - Effluent discharges
 - Biosolids
- Consumer Products
 - Water Repellents
 - Stain-resistant textiles
 - Teflon cookware
 - Cosmetics

Where are PFAS Compounds Detected?

- ❖ Air
- ❖ Soil
- ❖ Sediment
- ❖ Groundwater
- ❖ Surface Water



- ❖ Biota & bioaccumulation
- ❖ Plants
- ❖ Invertebrates
- ❖ Fish
- ❖ Humans



History of PFAS

PFAS ¹	Development Time Period							
	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s
PTFE	Invented	Non-Stick Coatings			Waterproof Fabrics			
PFOS		Initial Production	Stain & Water Resistant Products	Firefighting foam				U.S. Reduction of PFOS, PFOA, PFNA (and other select PFAS ²)
PFOA		Initial Production	Protective Coatings					
PFNA					Initial Production	Architectural Resins		
Fluoro-telomers					Initial Production	Firefighting Foams		
Dominant Process ³		Electrochemical Fluorination (ECF)						Fluoro-telomerization (shorter chain ECF)
Pre-Invention of Chemistry /			Initial Chemical Synthesis / Production			Commercial Products Introduced and Used		

2006 – EPA commitment to phase out PFOA & PFOS

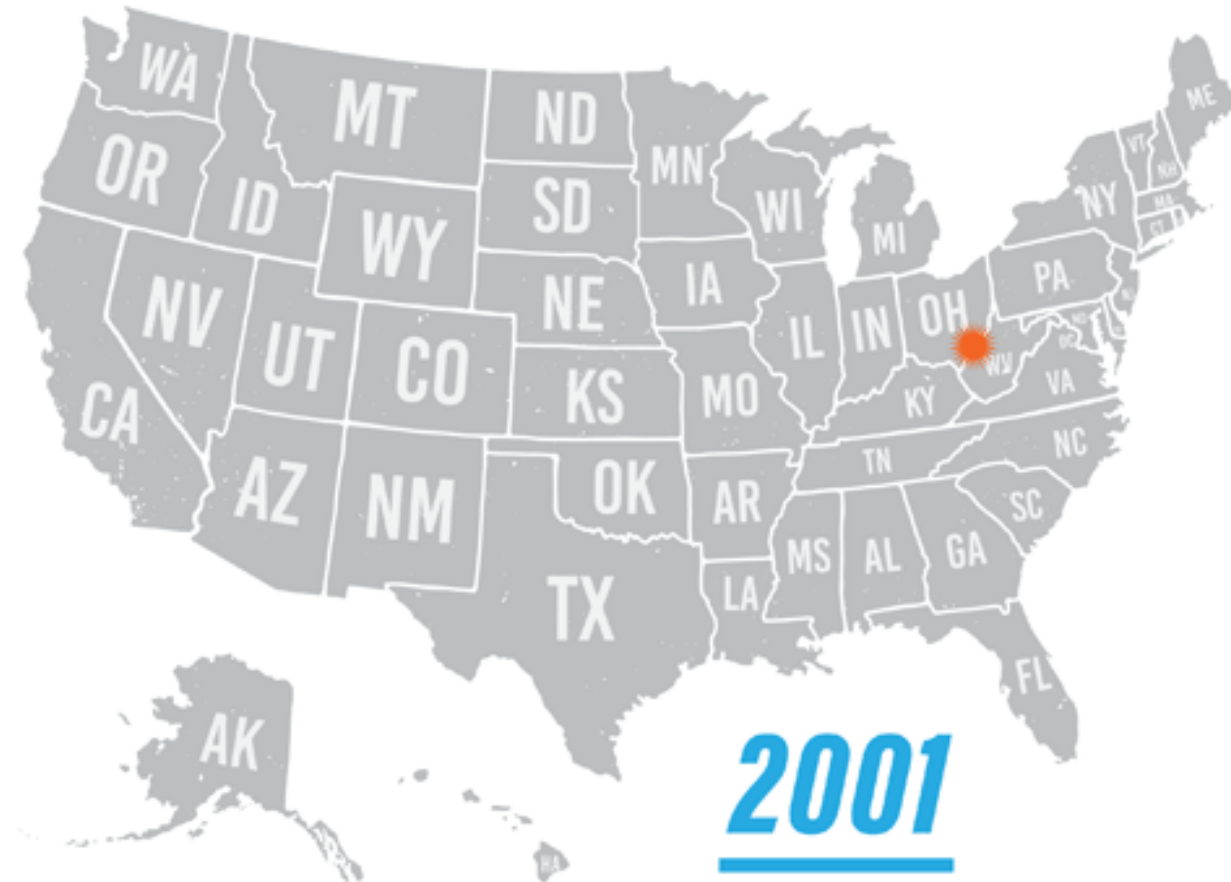
2010 - 95% reduction of PFOA & PFOS

2015 – PFOA & PFOS - fully phased out

Table 2 History and Use Fact Sheet

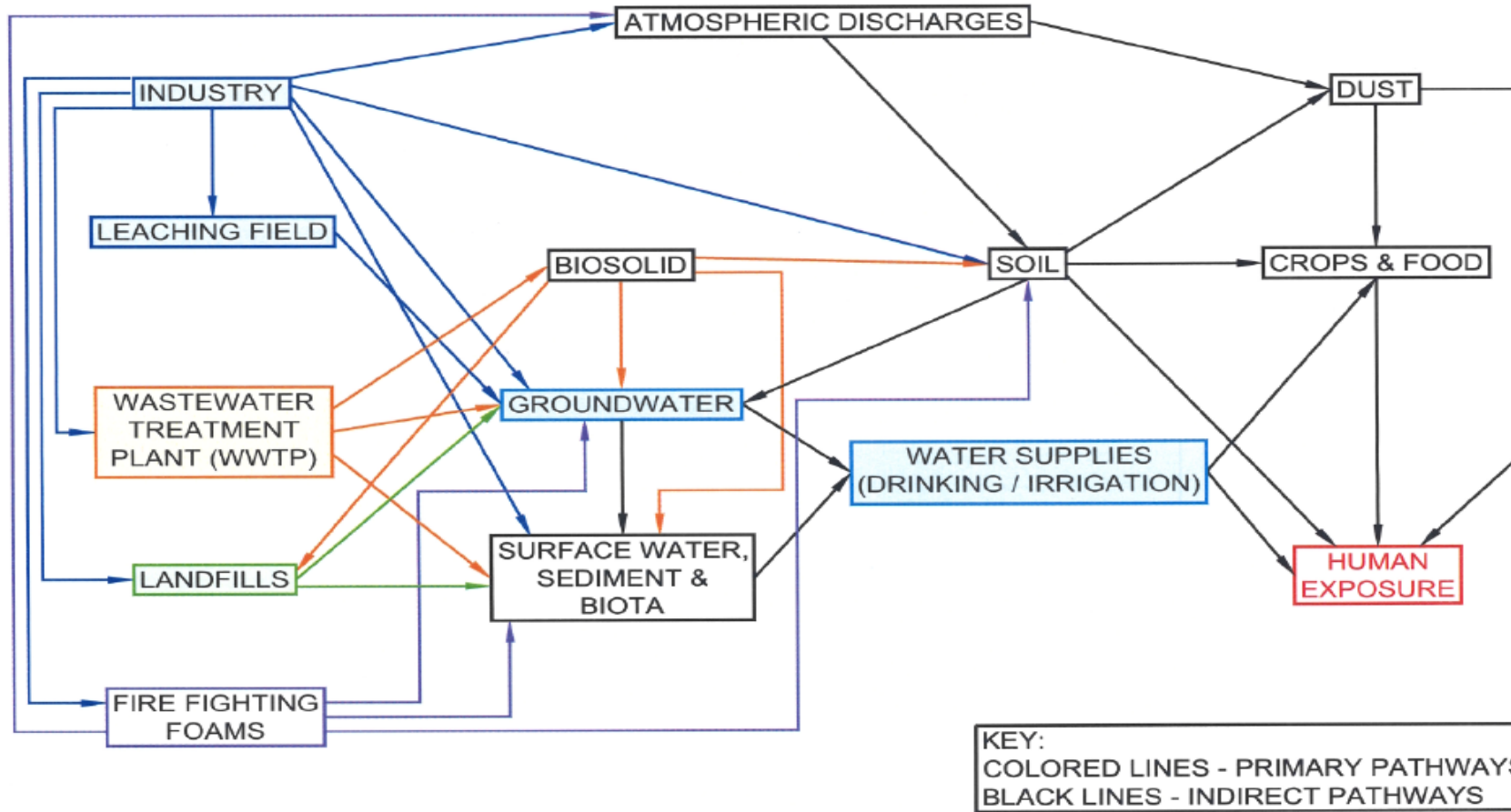


THE SPREAD OF TOXIC PFAS POLLUTION SITES

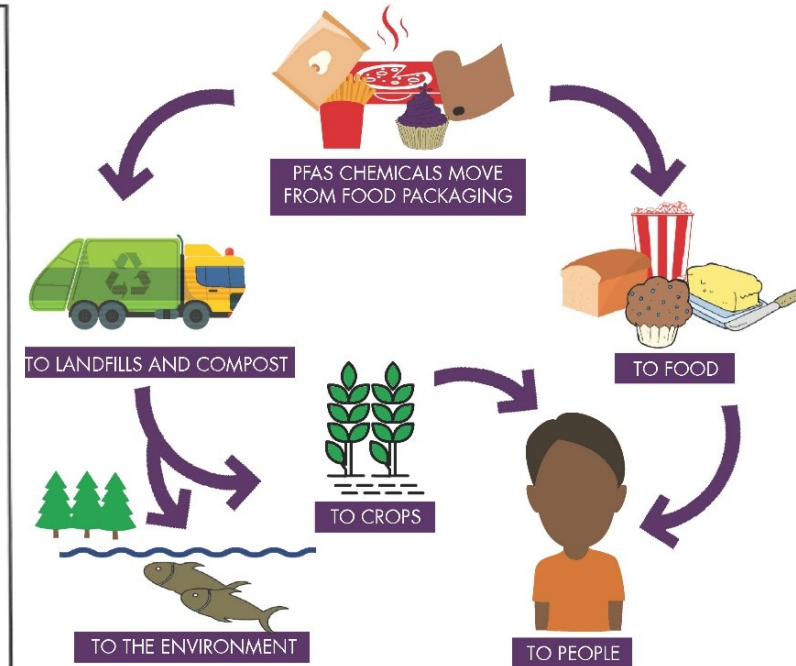


Exposure Routes

PFAS EXPOSURE PATHWAYS



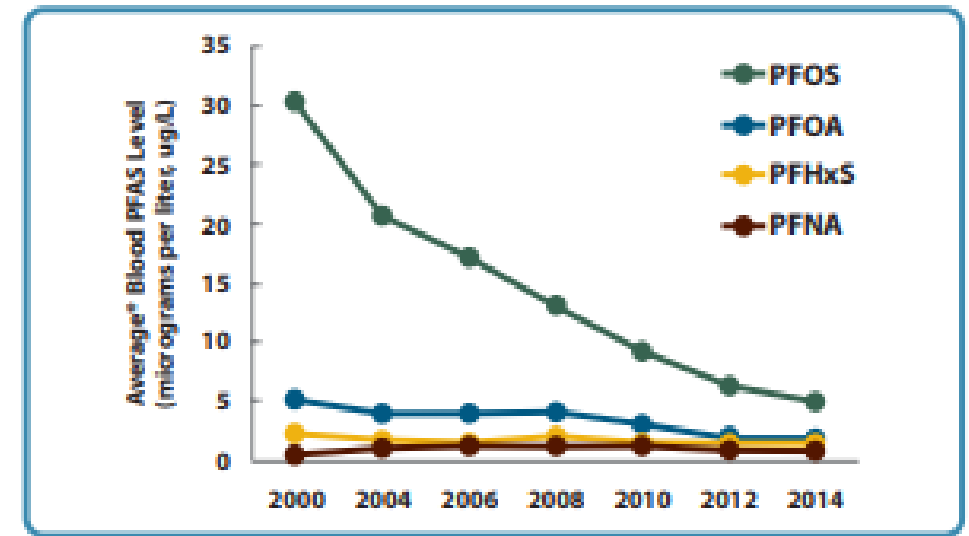
SOURCE: MODIFIED FROM - SCIENTIFIC EVIDENCE AND RECOMMENDATIONS FOR MANAGING PFAS CONTAMINATIONS IN MICHIGAN, DECEMBER 7, 2018.



Human Health Effects Associated with PFAS

- Increased cholesterol
- Liver damage
- Reproductive/Developmental
 - Pregnancy-induced hypertension/preeclampsia
 - Decreased fertility
 - Decrease in birth weight
- Behavioral
- Increased risk of thyroid disease
- Immunologic effects
- Kidney and testicular cancer

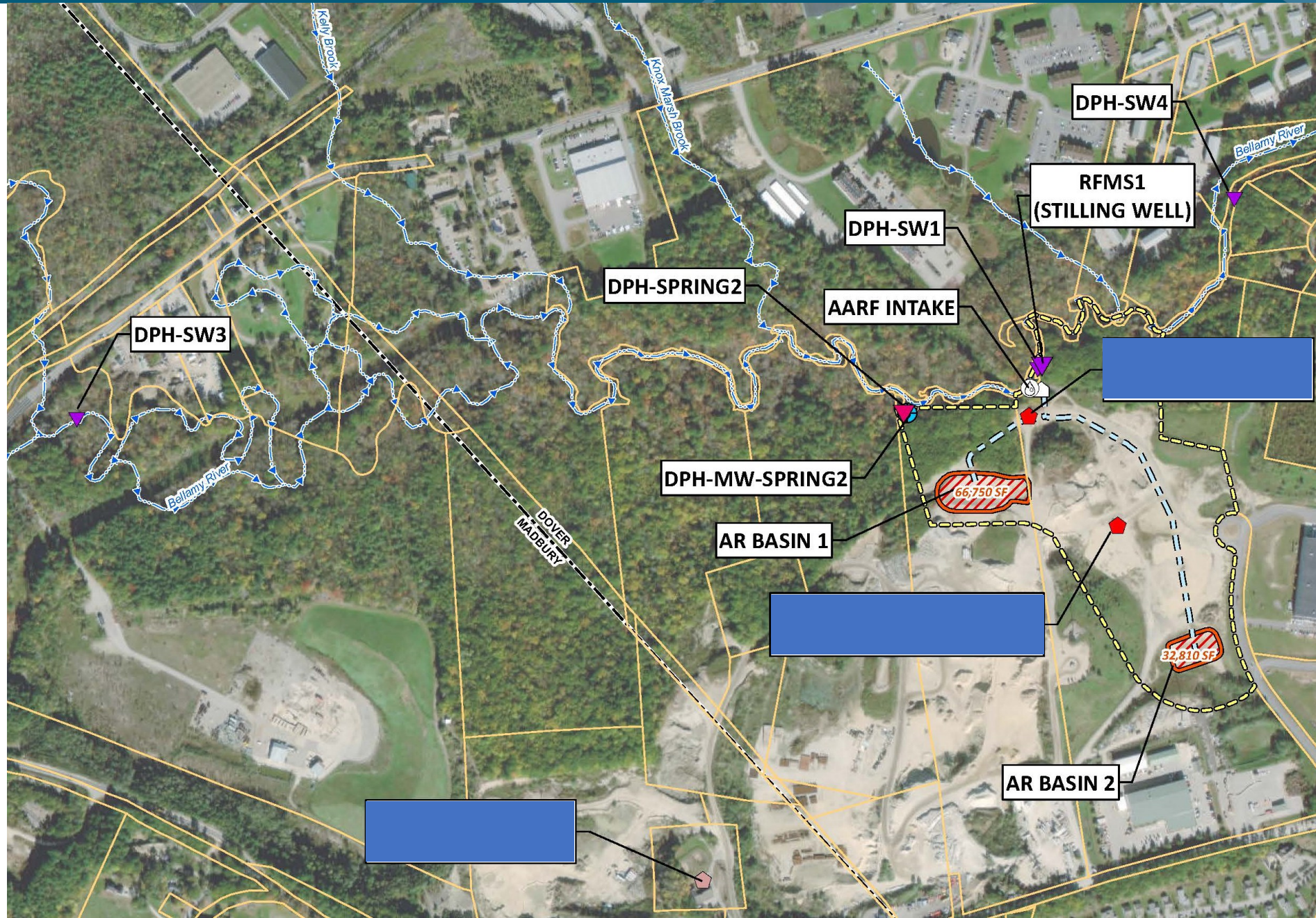
Blood Levels of the Most Common PFAS in People in the United States from 2000-2014

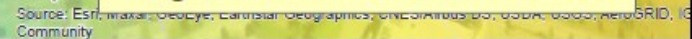


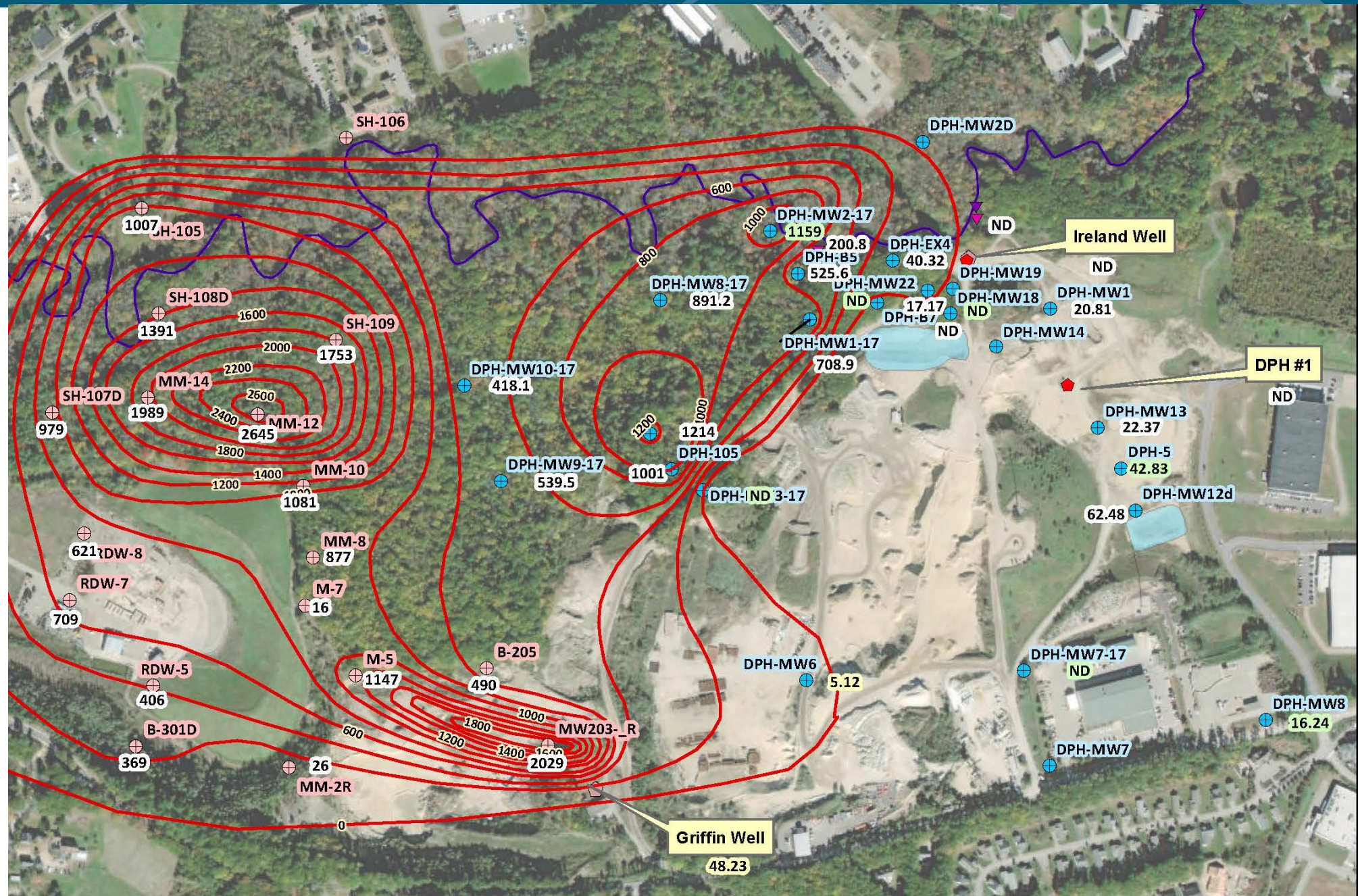
* Average = geometric mean

Data Source: Centers for Disease Control and Prevention. Fourth Report on Human Exposure to Environmental Chemicals, Updated Tables, (January 2017). Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

Pudding Hill Aquifer





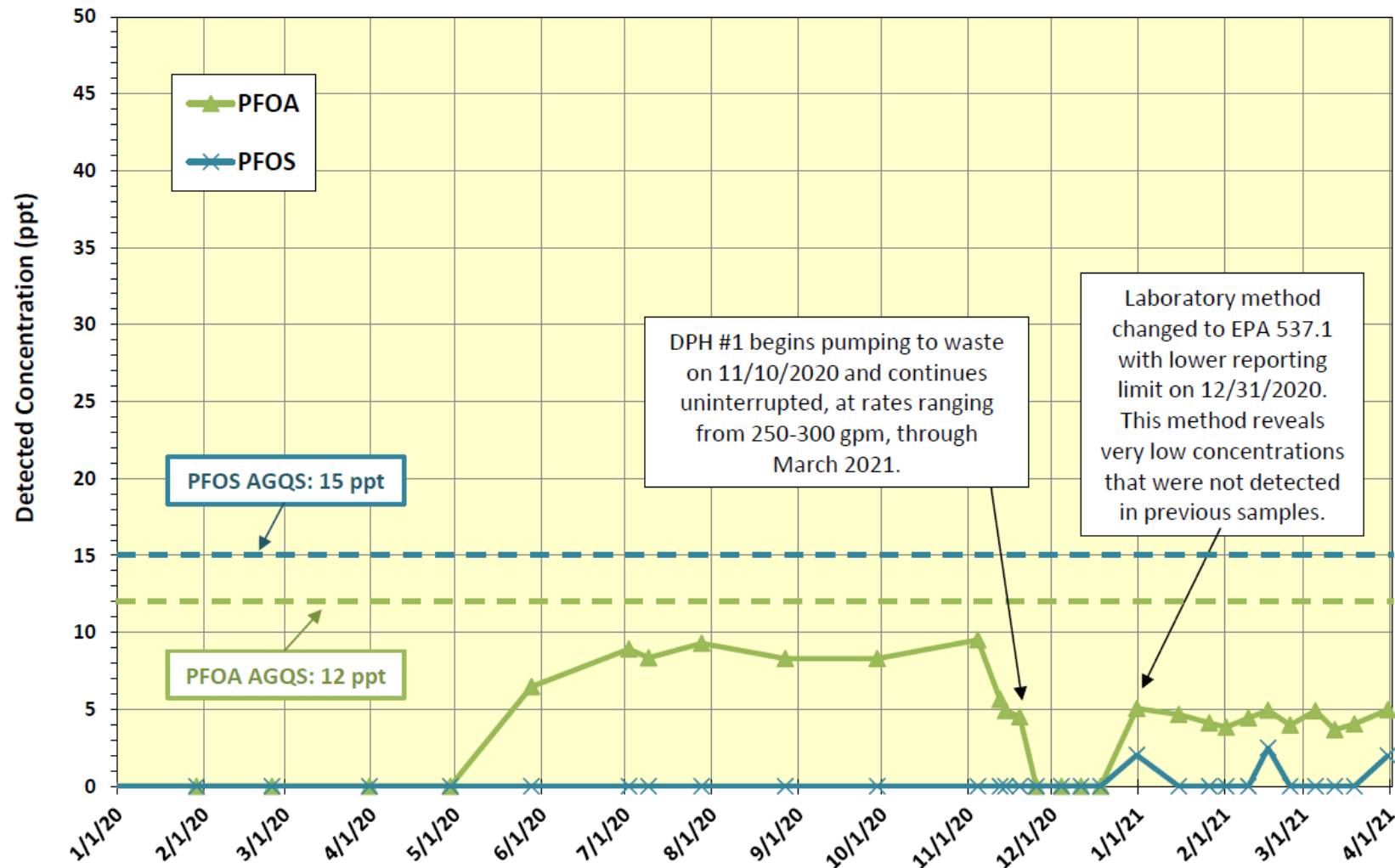


State PFAS Guidelines

States are issuing their own Drinking Water Standards:

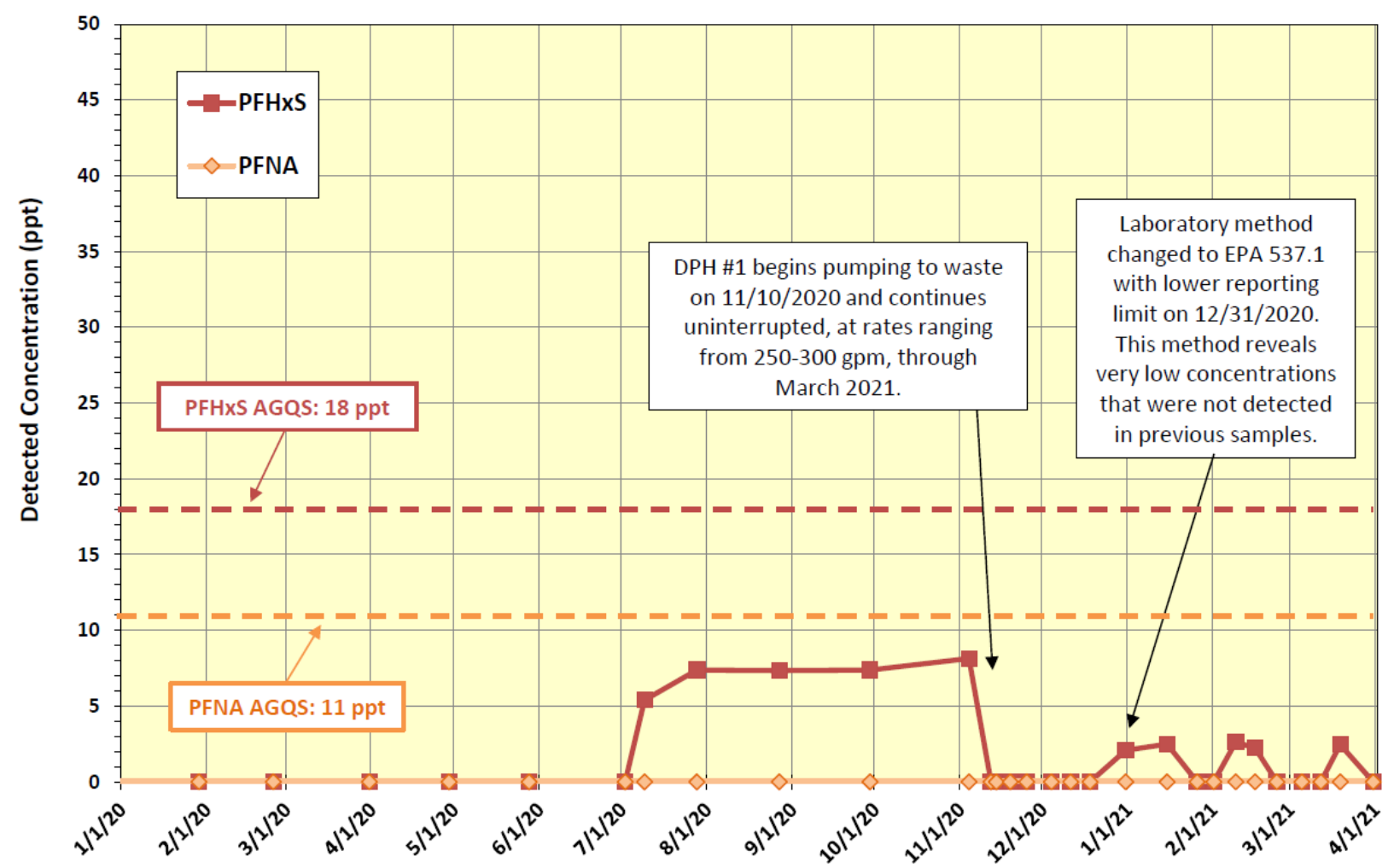
State	Standard/Guidance Nomenclature	Drinking Water Level (ppt)
Connecticut	Action Level (proposed 12/2016; currently under review by DPH)	70 sum total (PFOA, PFOS, PFNA, PFHxS, PFHpA)
Maine	Health Advisory (adopted EPA 2016 HAs for PFOA, PFOS in 12/206)	70 sum total (PFOA, PFOS)
Massachusetts	Maximum Contaminant Level (MCL) (published 10/2020)	20 sum total (PFOA, PFOS, PFNA, PFHxS, PFHpA, PFDA)
New Hampshire	MCL/Ambient Groundwater Standards	12 PFOA, 15 PFOS, 18 PFHxS, 11 PFNA
New Jersey	Drinking Water Quality Institute MCL (adopted 9/2018 for PFNA 4/2020 for PFOA, PFOS)	13 PFOS, PFNA 14 PFOA
New York	Drinking Water Council Rcommended MCL (proposed 7/2019; currently in rulemaking process)	10 PFOA, 10 PFAS
Rhode Island	Proposed MCL (proposed 2/2020; currently in rulemaking process)	2, 10, or 20 sum total (PFOA, PFOS, PFNA, PFDA, 0.15*PFHxS, 0.15*PFHpA)
Vermont	MCL (adopted 3/17/2020)	20 sum total (PFOA, PFOS, PFNA, PFHxS, PFHpA)

Production Well DPH #1



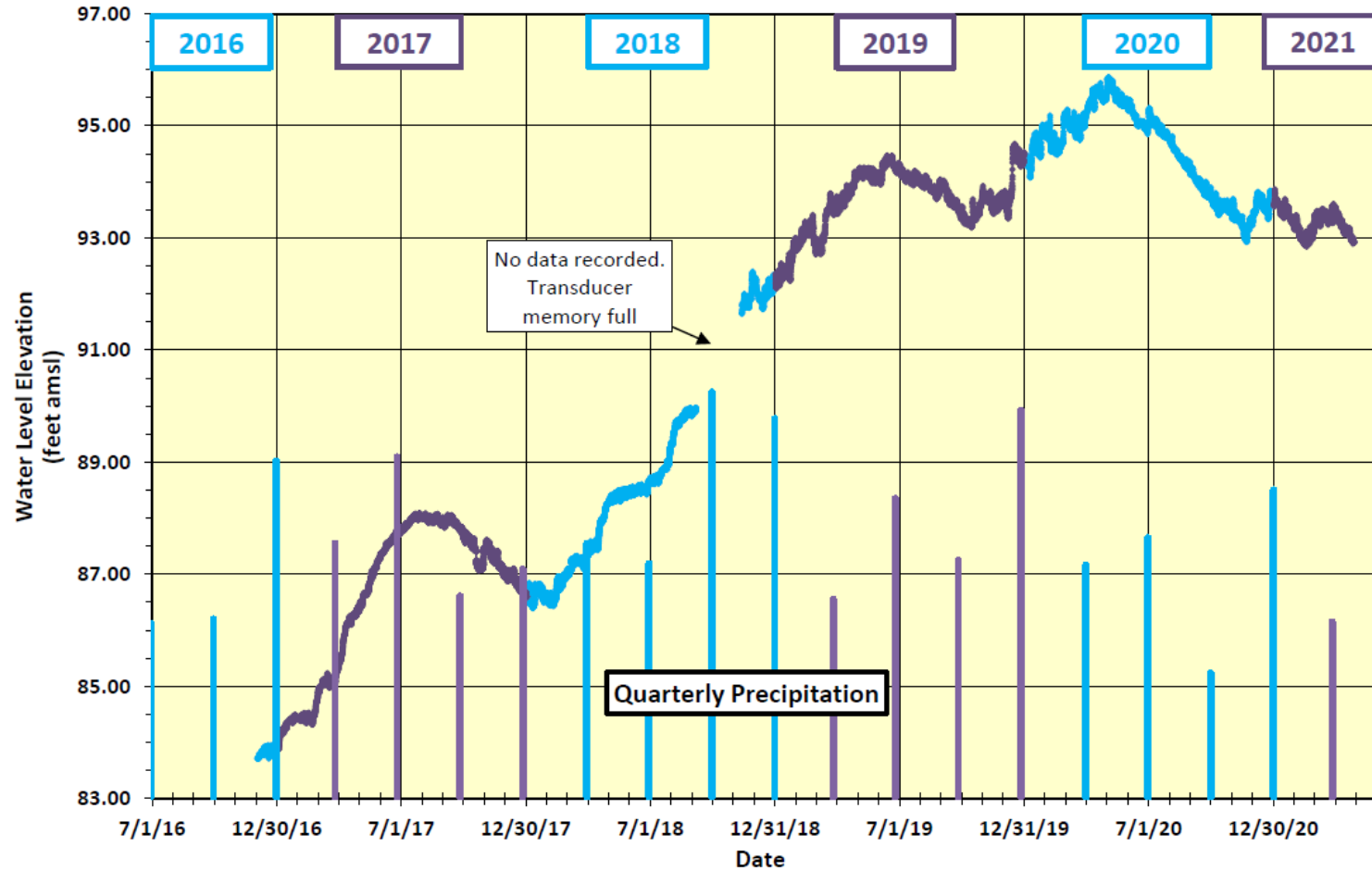
Plot of Recent PFAS Detections versus Time for January 29, 2020 to March 31, 2021
 Pudding Hill Aquifer, Dover, New Hampshire

Production Well DPH #1



Plot of Recent PFAS Detections versus Time for January 29, 2020 to March 31, 2021
Pudding Hill Aquifer, Dover, New Hampshire

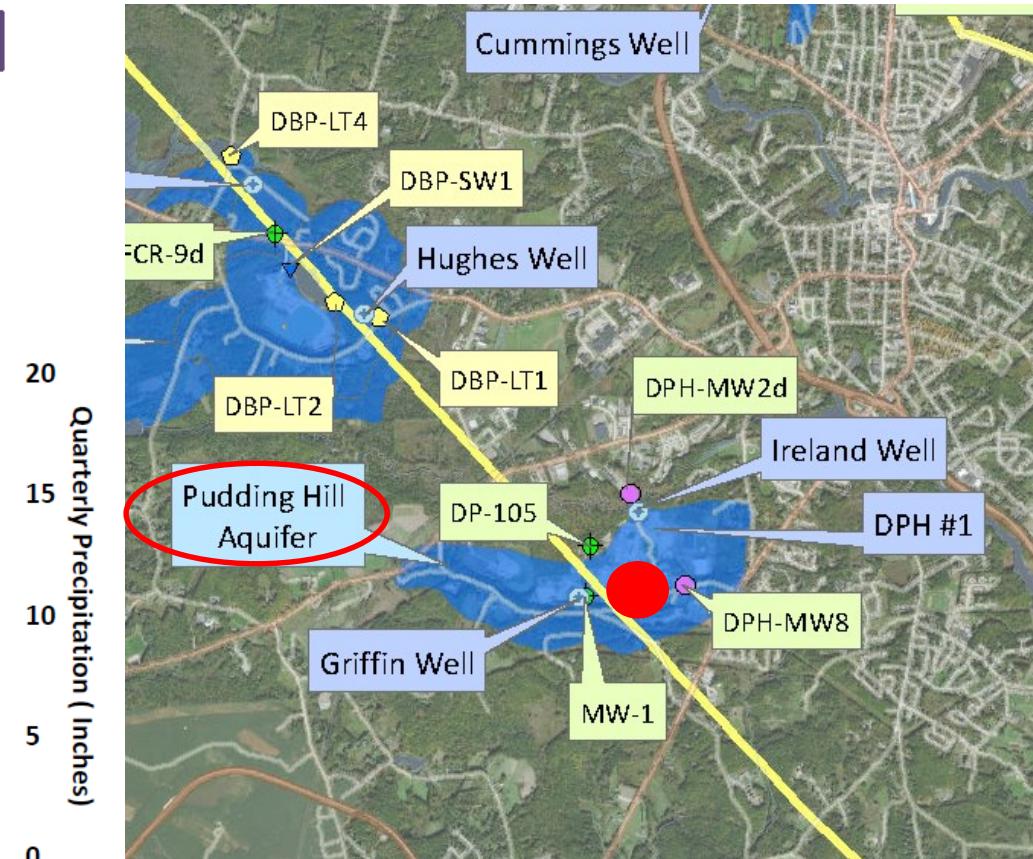
Pudding Hill Aquifer Monitoring Well DPH-MW6



Plot of Water Level Elevation versus Time for December 2, 2016 to April 27, 2021

Long-Term Groundwater Monitoring Program

Dover, New Hampshire



Conclusions / Considerations for Use of DPH #1

- The Pudding Hill Aquifer is essentially full (Aquifer water levels are high) as a result of not being pumped for the past several years.
- Well DPH #1 is fully permitted for use by NHDES and is allowed to pump up to 500 gallons per minute (720,000 gallons per day).
- The quality of the water produced from Well DPH #1 is excellent, except it has low levels of PFAS. All regulated PFAS levels are significantly below NH Drinking Water Standards at the present time.
- Other NH communities do have PFAS levels that **exceed** NH Drinking Water Standards, but they are able to blend water from other wells within the well field containing PFAS to maintain PFAS levels below Drinking Water Standards.

Conclusions / Considerations for use of DPH #1 (Continued)

- No one drinks distilled water. Some level of iron, manganese, chloride, fluoride, arsenic, radiologicals, and/or other water quality parameters are usually present in drinking water. However, if such compounds are present at substantially elevated levels, each would cause a health threat.
- There is currently no known health threat that will be posed to the public if Well DPH #1 was currently pumped and utilized to meet public water supply demands. This water meets all of the EPA and NHDES Drinking Water Quality Standards.
- If a drought were to persist and other well fields were substantially limited below their current capacity, the City may need to consider utilizing Well DPH #1 to meet daily water needs while putting in place additional water conservation measures.

END

