



DOVER
WATER WORKS

1888

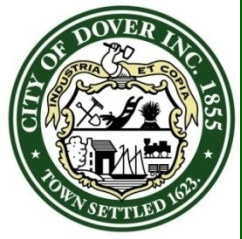
Public Water Supply Capacity

Joint Workshop

City Council & Planning Board

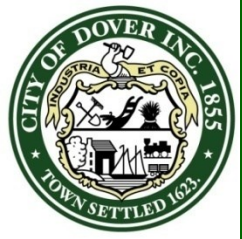
October 6, 2021

By: John Storer
Director of Community Services



Summary Points

- Dover doesn't have a water scarcity issue, we have a contaminated aquifer issue
 - Historic water use has actually decreased
 - In turn, water supply capacity has increased
 - Climate change is impacting regional drought conditions
 - Drought impacts supplies & resilience
 - Continue to explore additional sources, interconnections, and improvements
-
- Maybe 15 to 20 minutes for presentation
 - Encourage Q&A to address specific concerns



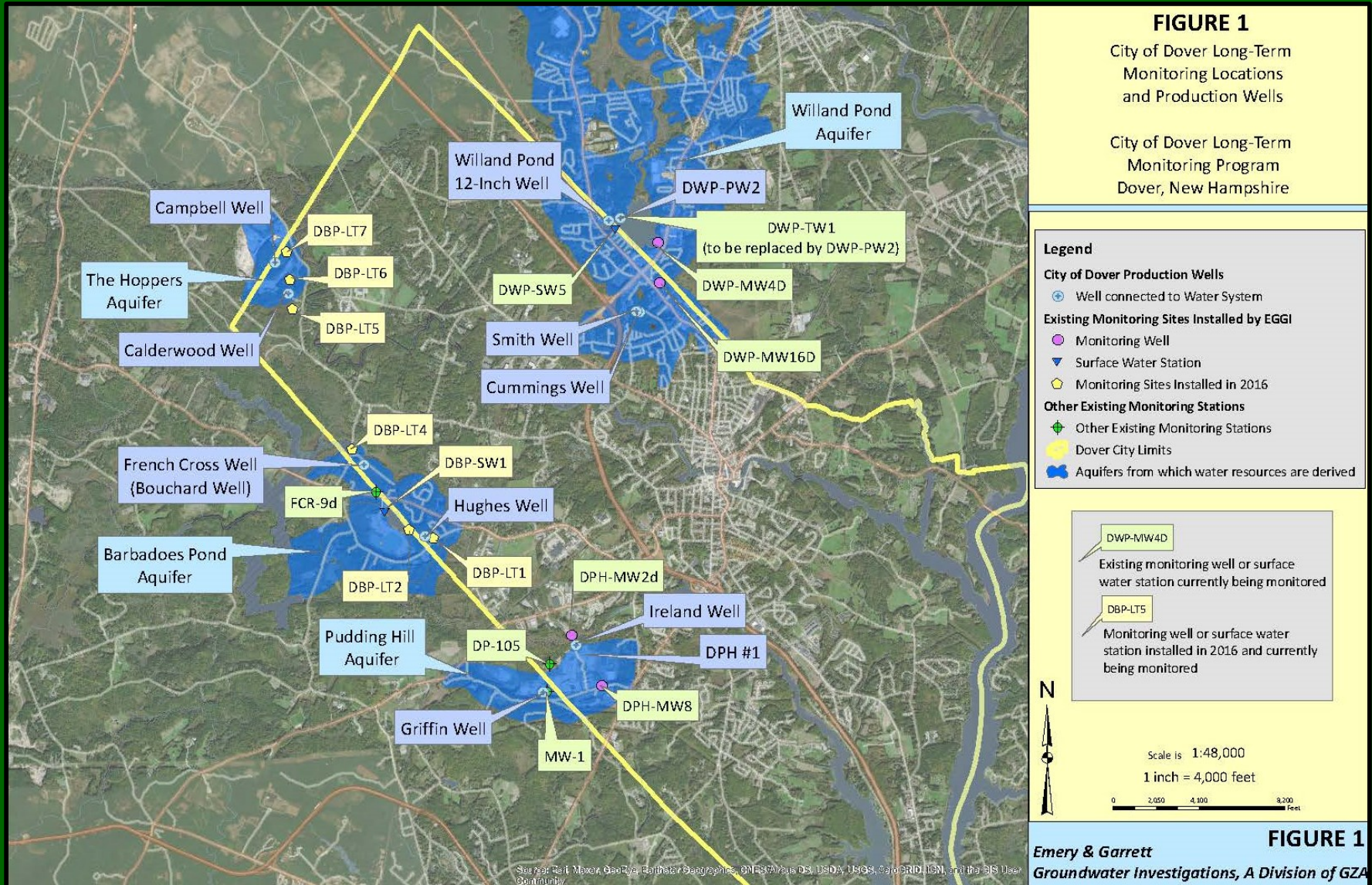
Overview of Water System

- 32,000 population (approx. 80% with public water)
- Avg around 1.8 to 2.4 MGD
- All groundwater
- 11 wells in 4 Aquifers
- 2 artificial recharge programs
- 3 treatment facilities
- 2 storage tanks
- 2 pressure zones
- 1 booster station
- 1 interconnect with Somersworth
- Approx. 780,000 lf water main
- Approx. Asset Value = \$200 Million



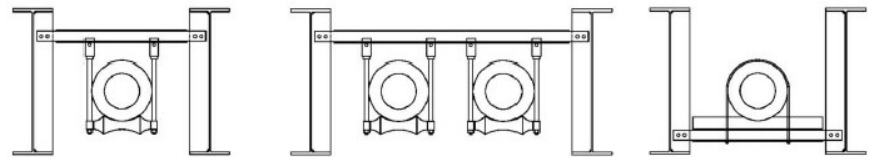


Dover Water System





Portsmouth Interconnect - Future



PIPE SUPPORT OPTIONS

DATE	BY	REVISION
2/2/2009	AS	1
2/2/2009	AS	2
2/2/2009	AS	3
2/2/2009	AS	4
2/2/2009	AS	5
2/2/2009	AS	6
2/2/2009	AS	7
2/2/2009	AS	8
2/2/2009	AS	9
2/2/2009	AS	10
2/2/2009	AS	11
2/2/2009	AS	12
2/2/2009	AS	13
2/2/2009	AS	14
2/2/2009	AS	15
2/2/2009	AS	16
2/2/2009	AS	17
2/2/2009	AS	18
2/2/2009	AS	19
2/2/2009	AS	20

Drawn by	AS
Checked by	AS
Approved by	AS
Book No.	1000
Project No.	1000
Sheet No.	1000
Scale	AS
Notes	AS

DATE	BY	REVISION
2/2/2009	AS	1
2/2/2009	AS	2
2/2/2009	AS	3
2/2/2009	AS	4
2/2/2009	AS	5
2/2/2009	AS	6
2/2/2009	AS	7
2/2/2009	AS	8
2/2/2009	AS	9
2/2/2009	AS	10
2/2/2009	AS	11
2/2/2009	AS	12
2/2/2009	AS	13
2/2/2009	AS	14
2/2/2009	AS	15
2/2/2009	AS	16
2/2/2009	AS	17
2/2/2009	AS	18
2/2/2009	AS	19
2/2/2009	AS	20

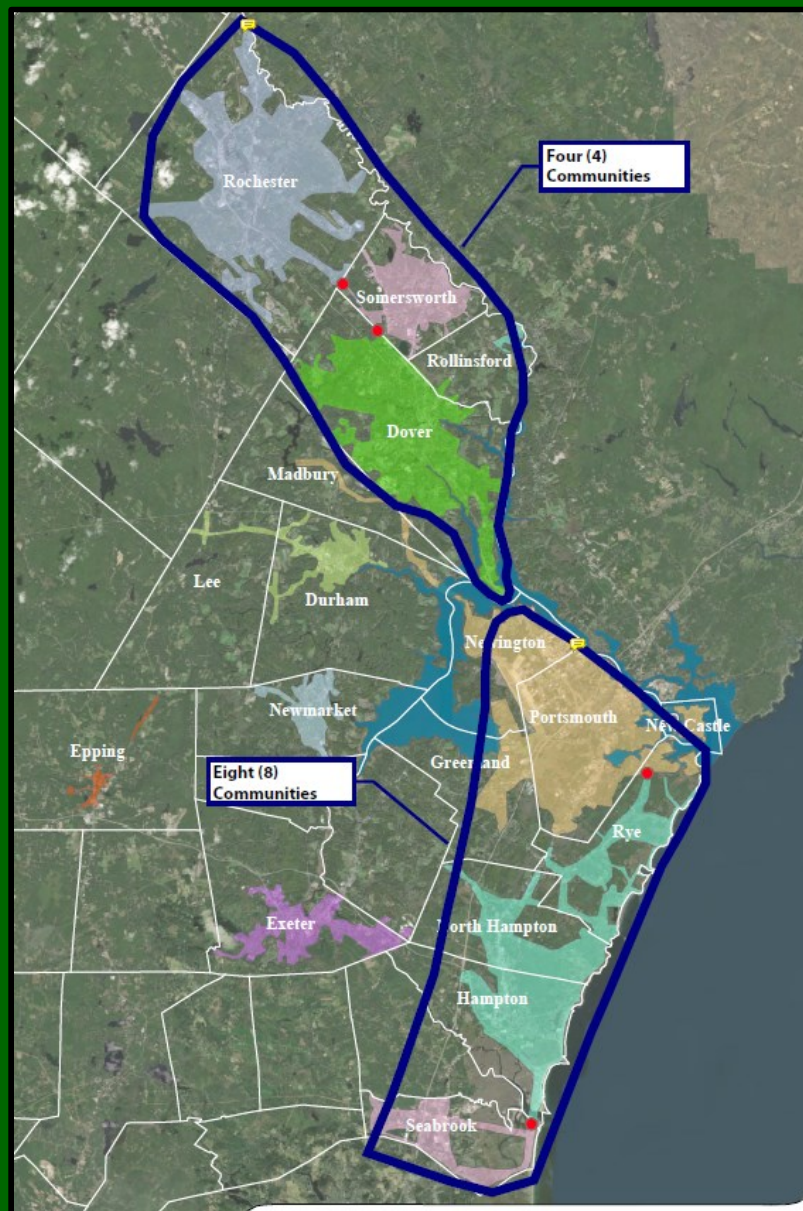


DOVER POINT INTERCONNECT #1
DOVER - PORTSMOUTH EMERGENCY WATER INTERCONNECTIONS
CITY OF DOVER
DOVER, NEW HAMPSHIRE

DATE	BY	REVISION
2/2/2009	AS	1
2/2/2009	AS	2
2/2/2009	AS	3
2/2/2009	AS	4
2/2/2009	AS	5
2/2/2009	AS	6
2/2/2009	AS	7
2/2/2009	AS	8
2/2/2009	AS	9
2/2/2009	AS	10
2/2/2009	AS	11
2/2/2009	AS	12
2/2/2009	AS	13
2/2/2009	AS	14
2/2/2009	AS	15
2/2/2009	AS	16
2/2/2009	AS	17
2/2/2009	AS	18
2/2/2009	AS	19
2/2/2009	AS	20

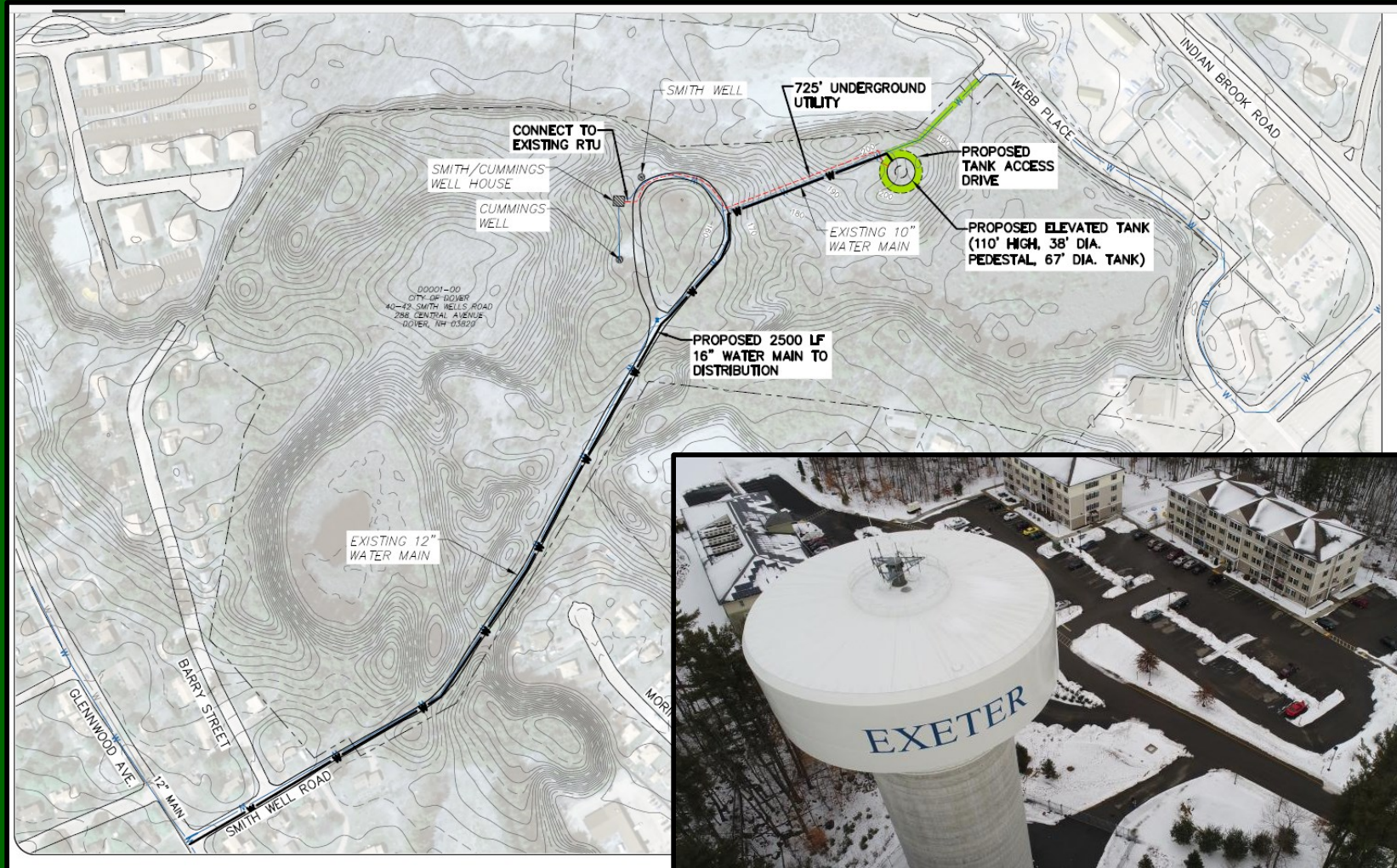


Regional Interconnections



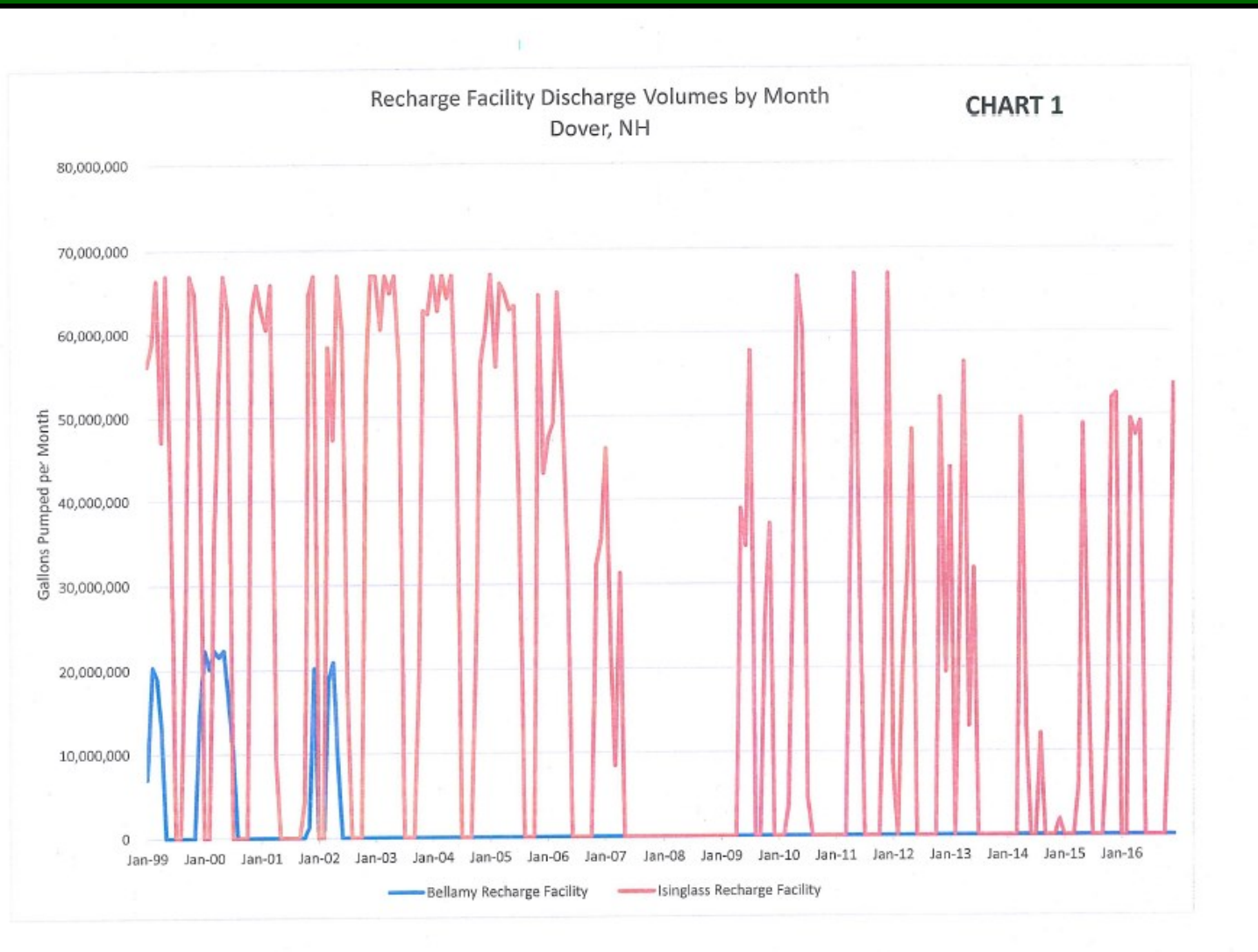


Increase Water Storage





Artificial Recharge in 2 Aquifers

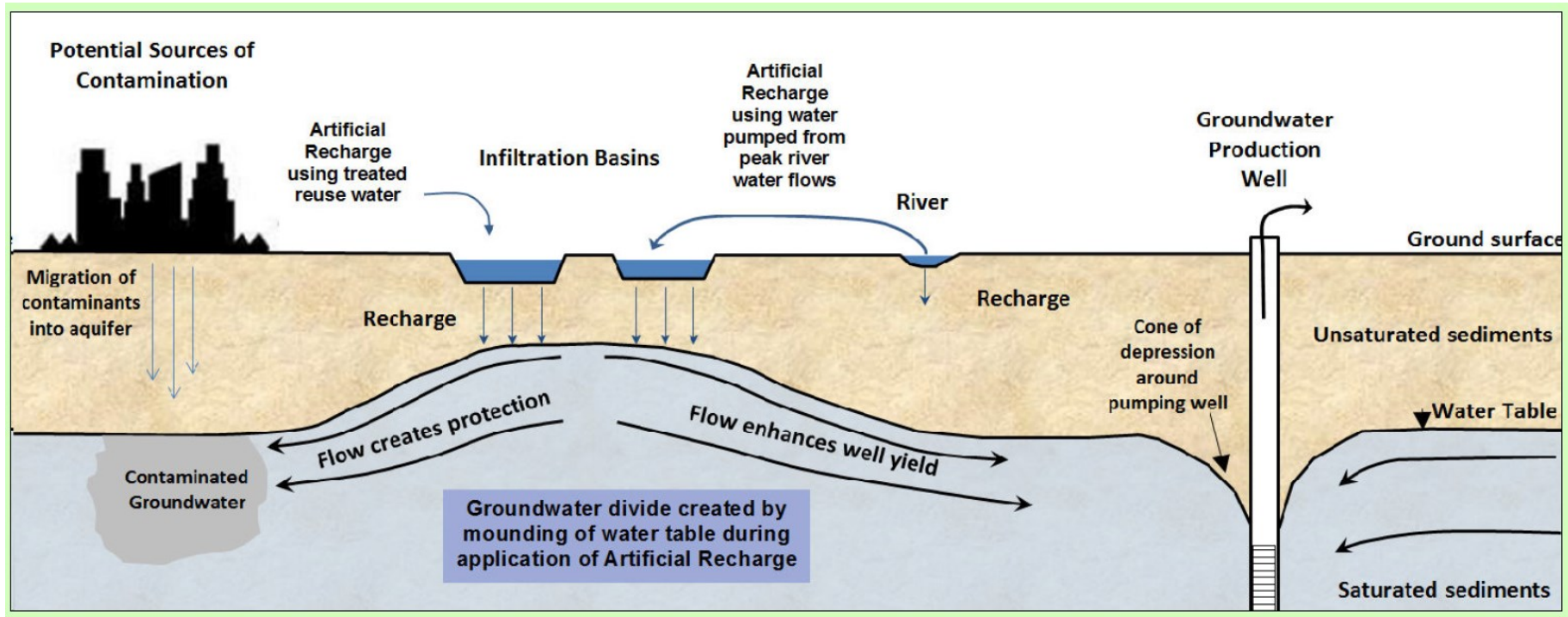


DOI: 10.1002/eqe.2494



Artificial Recharge Bellamy River



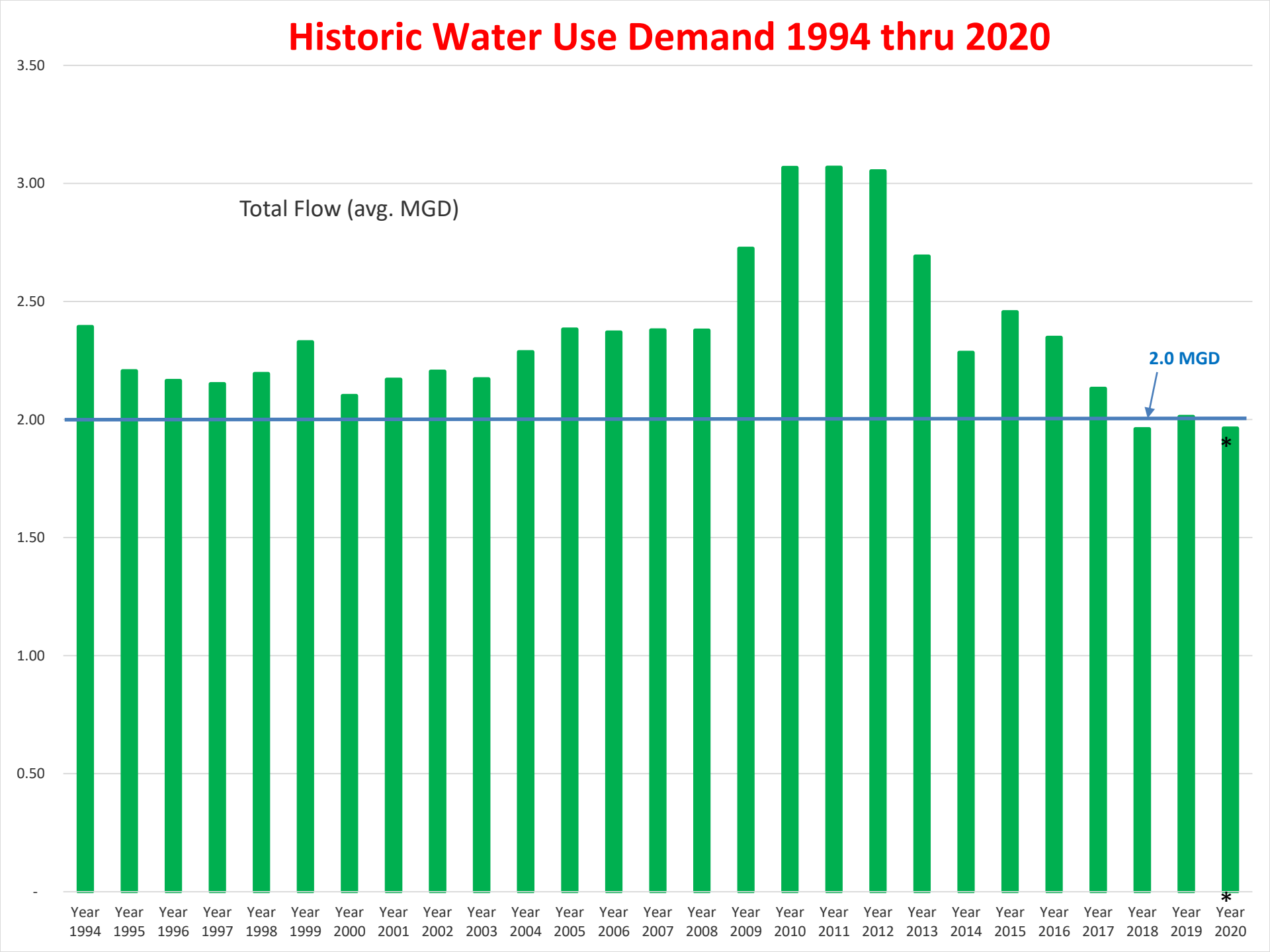


Historic Water Use Demand 1994 thru 2020

Total Flow (avg. MGD)

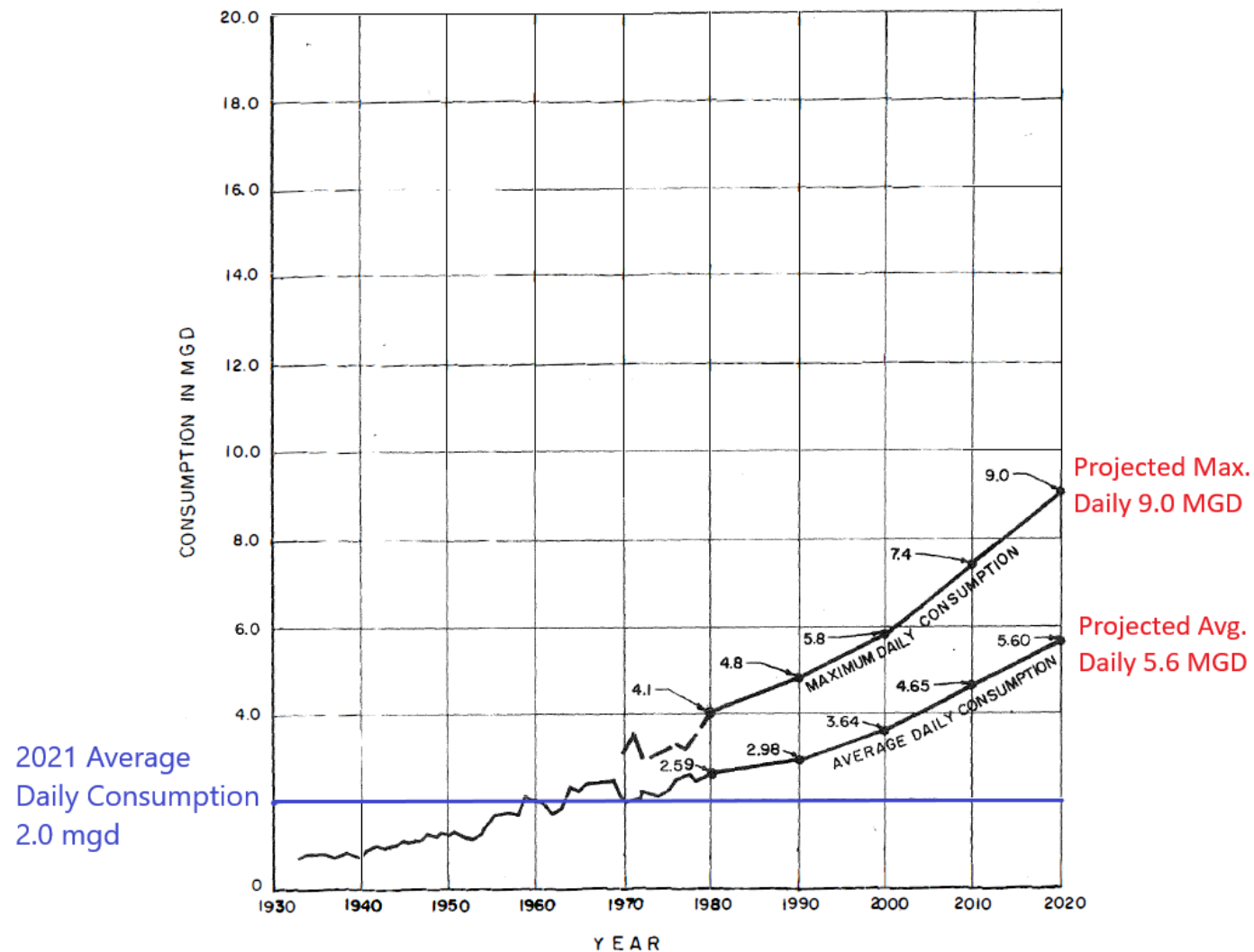
2.0 MGD

Year 1994 Year 1995 Year 1996 Year 1997 Year 1998 Year 1999 Year 2000 Year 2001 Year 2002 Year 2003 Year 2004 Year 2005 Year 2006 Year 2007 Year 2008 Year 2009 Year 2010 Year 2011 Year 2012 Year 2013 Year 2014 Year 2015 Year 2016 Year 2017 Year 2018 Year 2019 Year 2020 *





Dover Water System – Evaluated in 1979





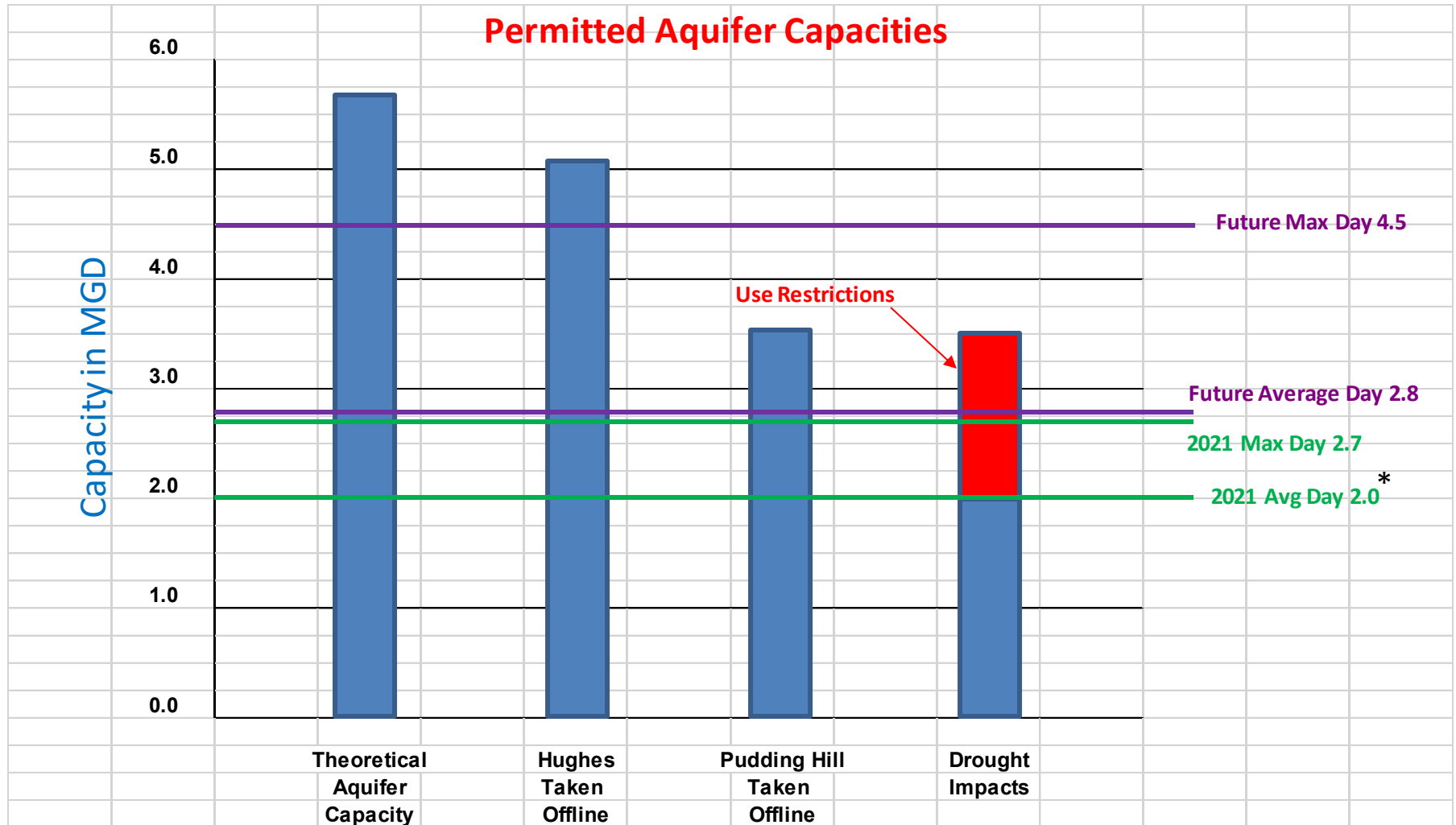
Dover Water System – Evaluated in 1988

TABLE II
HISTORIC WATER DEMAND

		Average Day Demand Per Year		Maximum Day Demand Per Year
1981	2021 Annual Average 1.96 MGD	2,234,651	2021 Max Day 2.73 MGD	2,815,300
1982		2,152,110		2,890,300
1983		2,196,878		2,971,100
1984		2,235,316		3,690,500
1985		2,590,534		3,714,500
1986		2,432,200		3,056,400
1987		2,517,599		3,397,700
1988		2,651,958		3,763,800

Current Capacity Issues

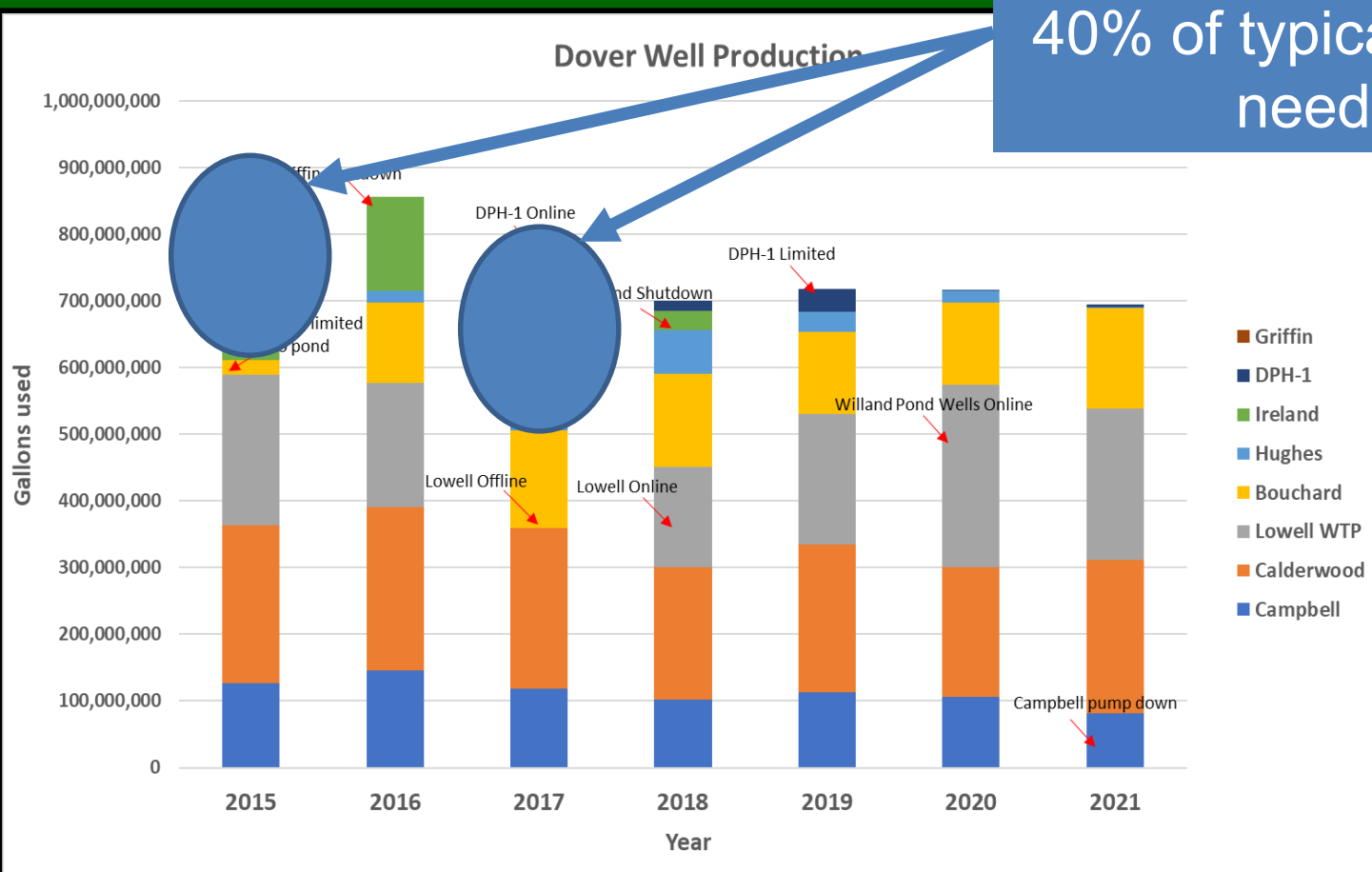
- 4 of 11 Wells offline
- Drought Impacts





Well Usage – Pudding Hill Aquifer (currently offline – contamination)

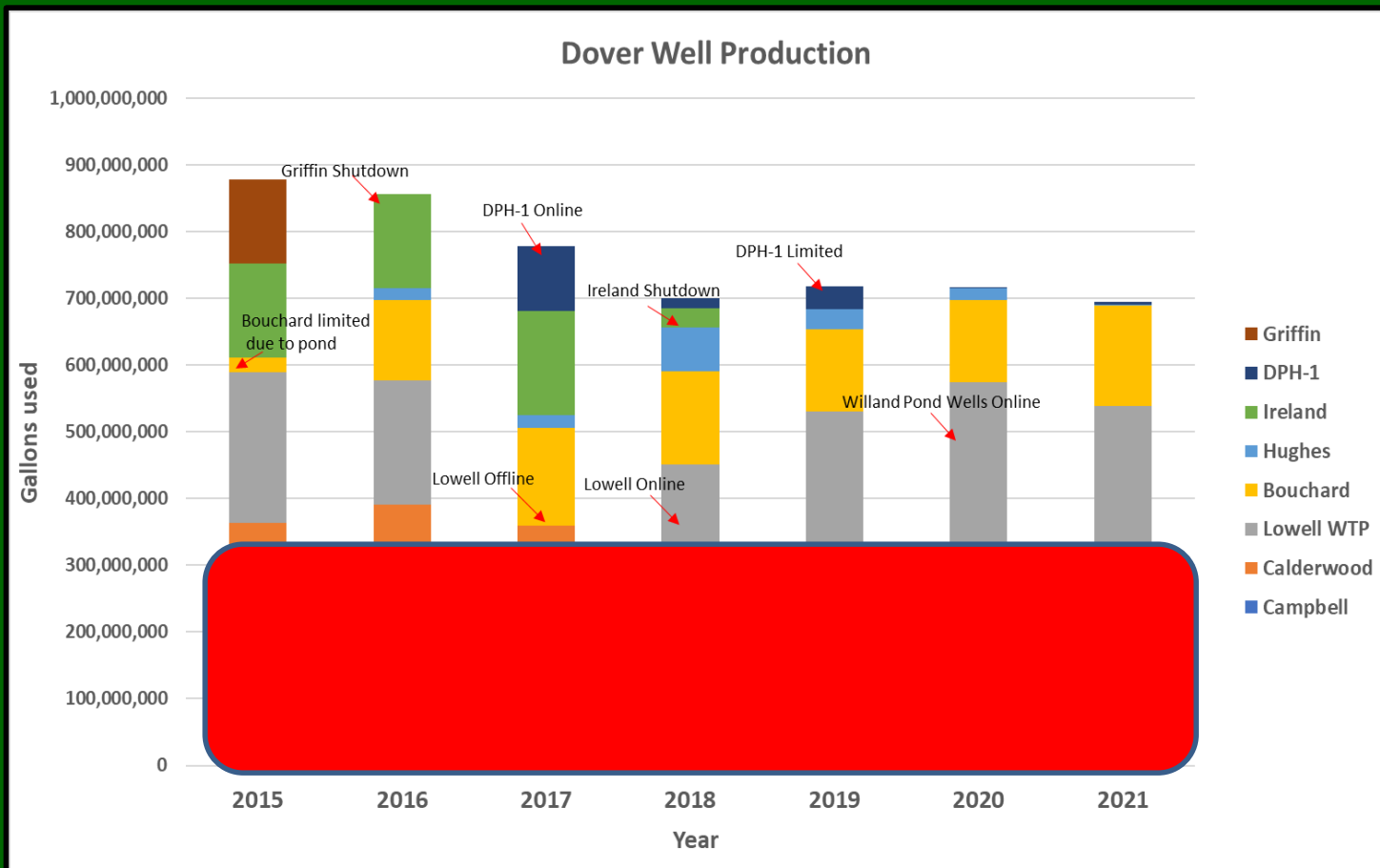
Capable of producing
40% of typical system
needs.





1994 Pudding Hill Aquifer produced 42.3% of all water

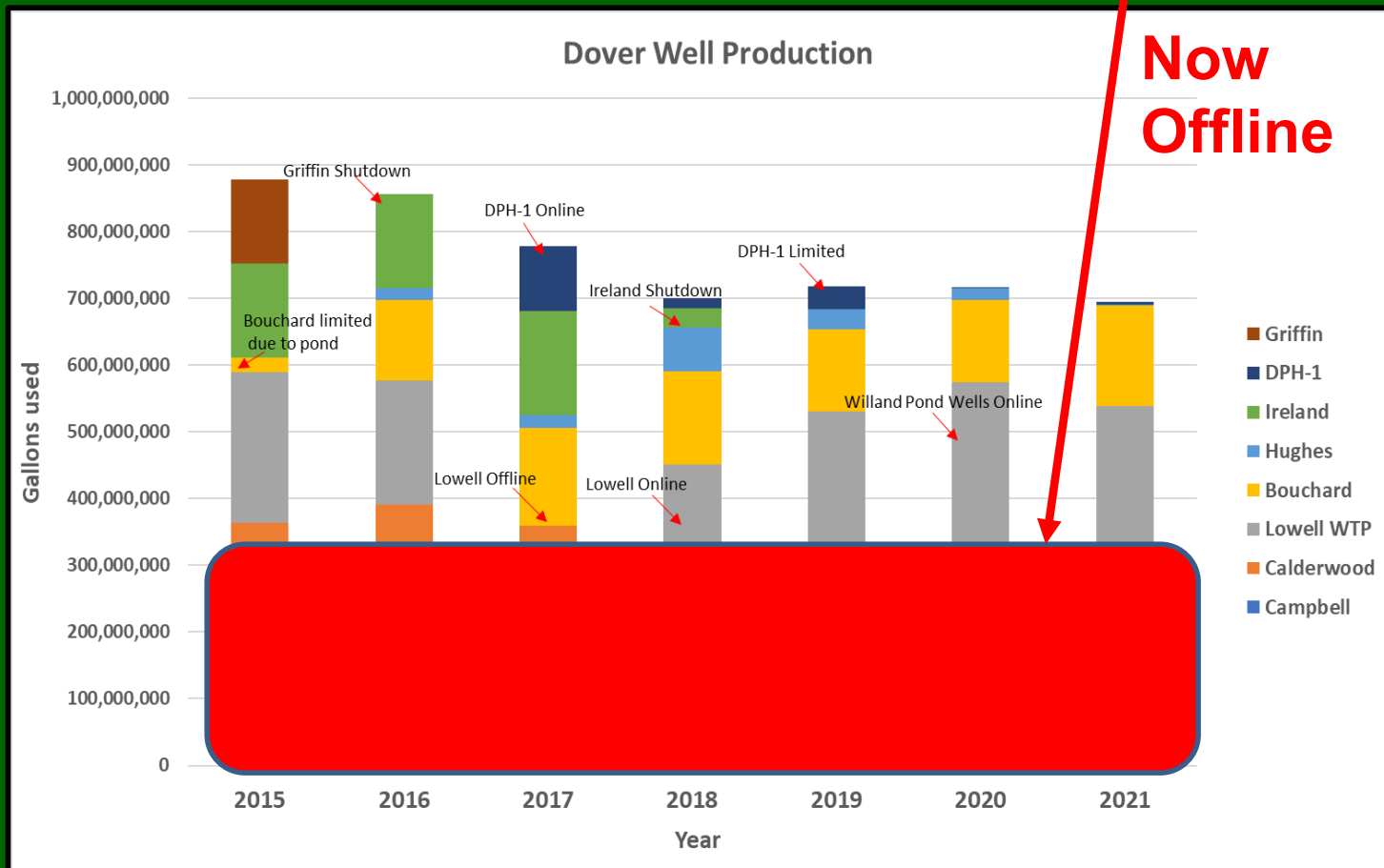
1995 Pudding Hill Aquifer produced 44.6% of all water





1994 Pudding Hill Aquifer produced 42.3% of all water

1995 Pudding Hill Aquifer produced 44.6% of all water





Pudding Hill – PFAS Contaminants

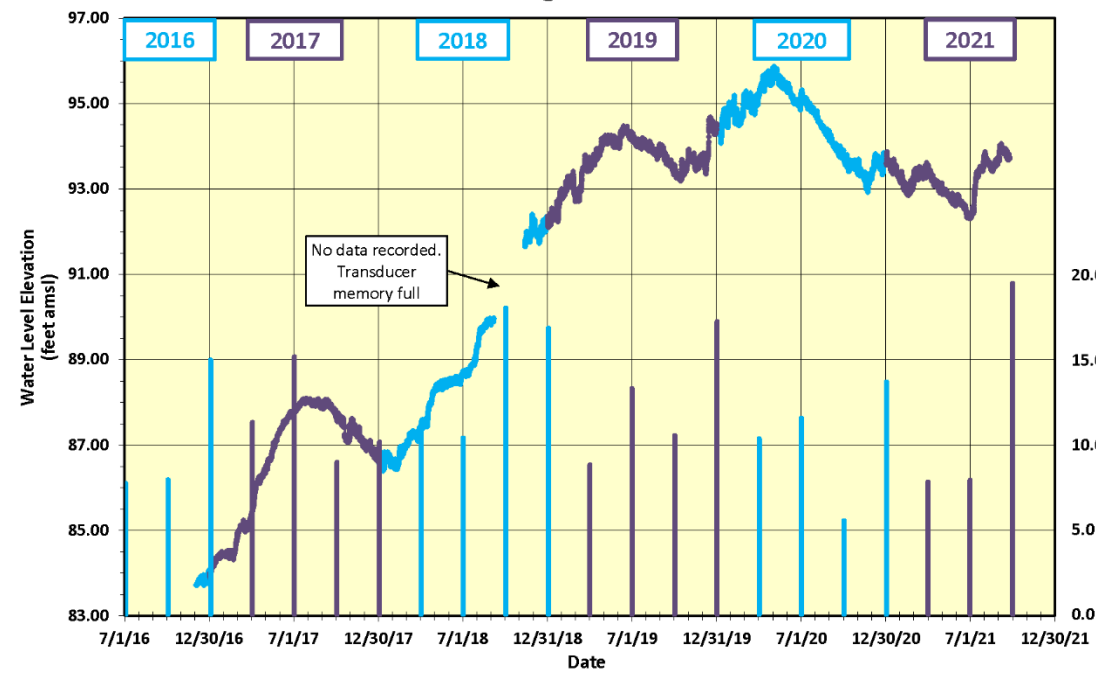
NEWS

Dover, N.H. shuts down drinking water
well due to contamination



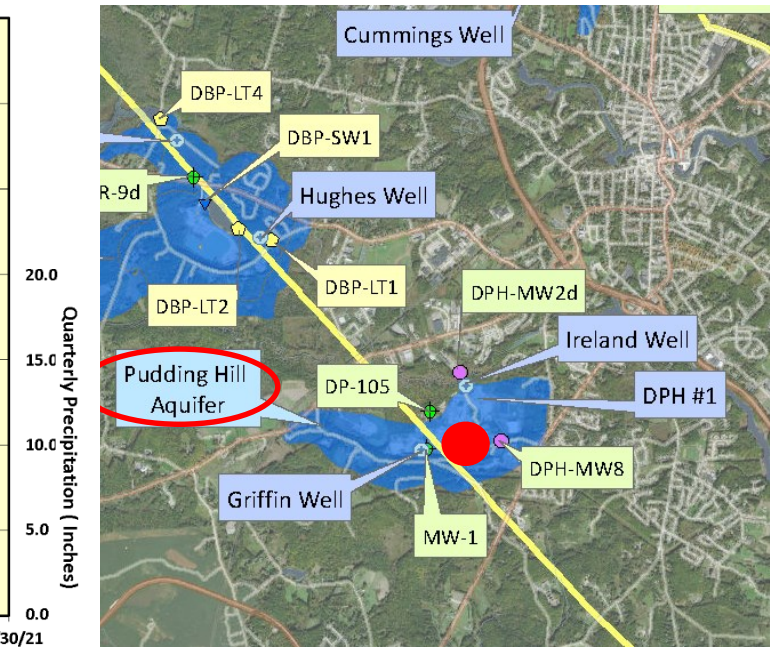
Contaminant	MCL	Griffin Well	Ireland Well	DPH-1 Well	
PFAS (ppt)					
PFHxS	18	24.7	50.7	4.66	8.14
PFOA	12	84	106	4.42	9.51
PFNA	11	ND	ND	ND	ND
PFOS	15	217	173	ND	2.02
MtBE (pbb)	13	1.6	1.9	ND	
1,4 Dioxane (pbb)	0.32	0.59	1.2	0.34	
Fe (mg/L)	0.3	0.40	0.19	0.315	
Mn (mg/L)	0.05	0.30	0.238	0.059	

Pudding Hill Aquifer Monitoring Well DPH-MW6



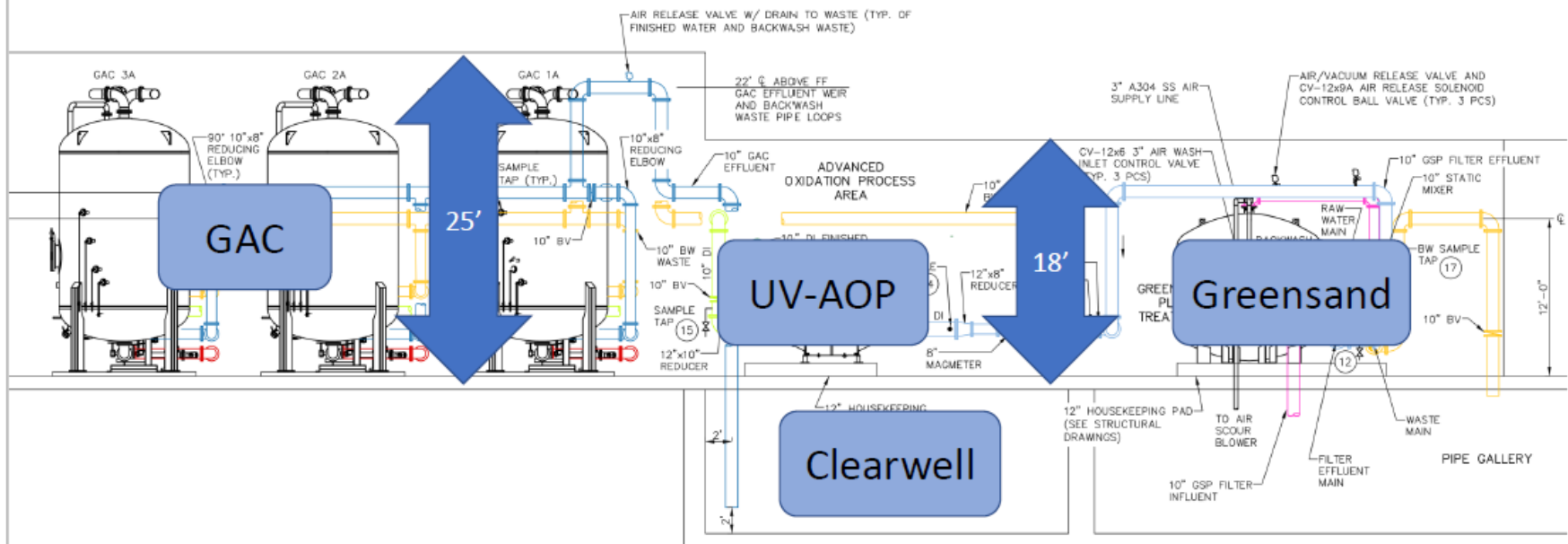
Plot of Water Level Elevation versus Time for December 2, 2016 to September 24, 2021

Long-Term Groundwater Monitoring Program
Dover, New Hampshire





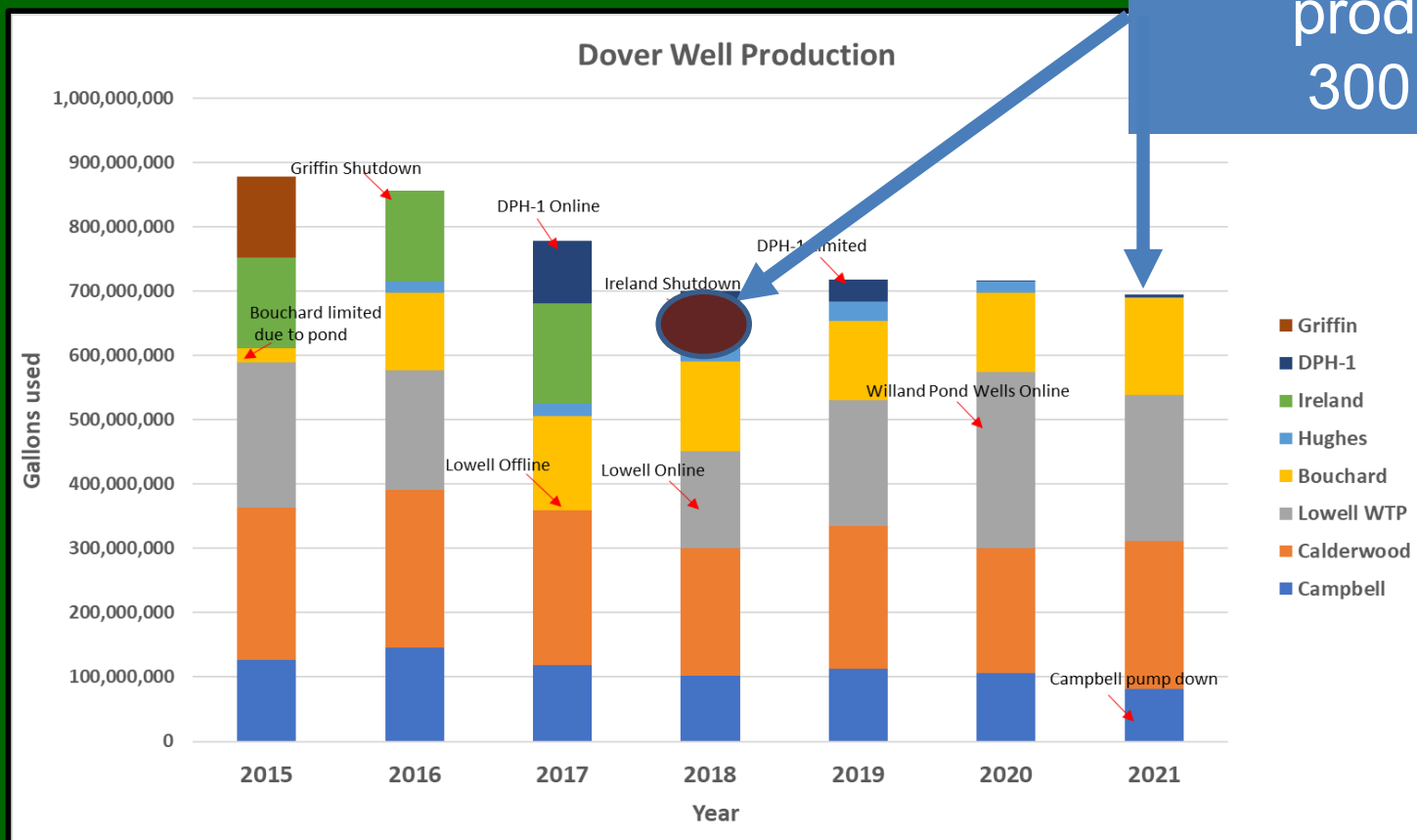
Pudding Hill Treatment





Well Usage Reduced – Hughes Well

Capable of
producing
300 gpm





Treatment Iron and Manganese in groundwater

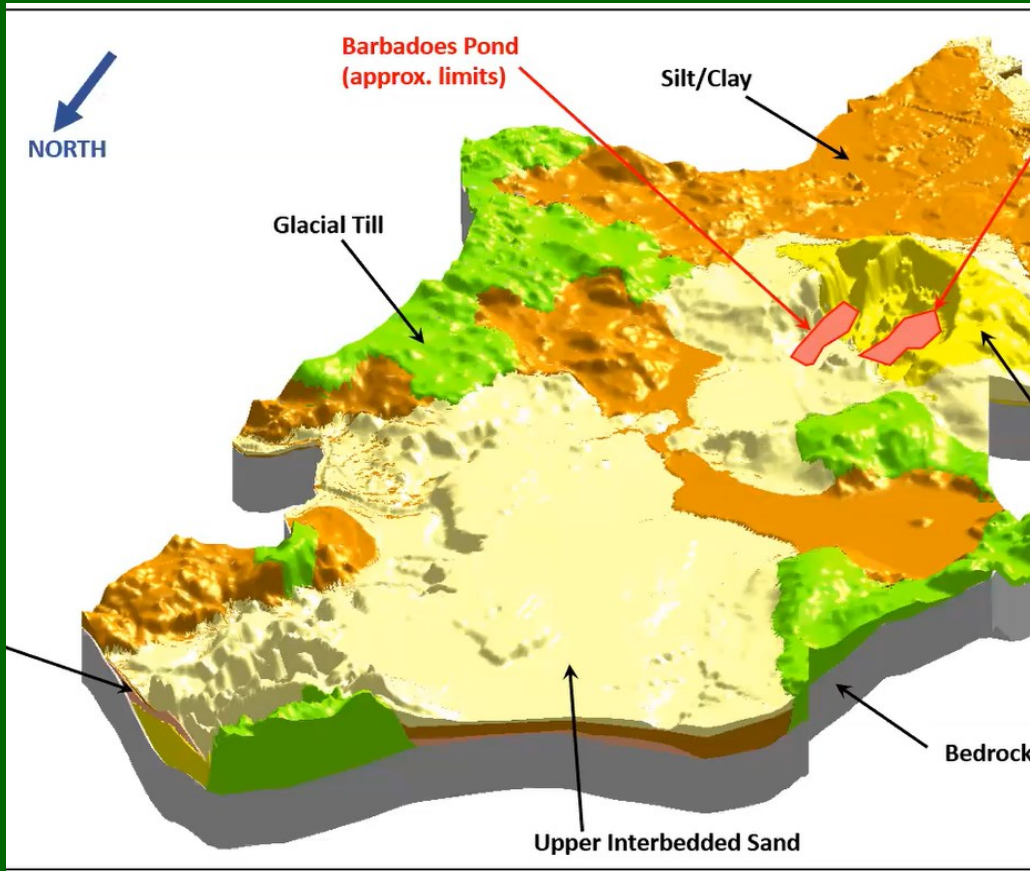


US EPA issued a manganese Health Advisory Level of 0.3 mg/L indicating that infant exposure should be avoided because of their inability to purge excess manganese.





Bring Hughes to Treatment Plant

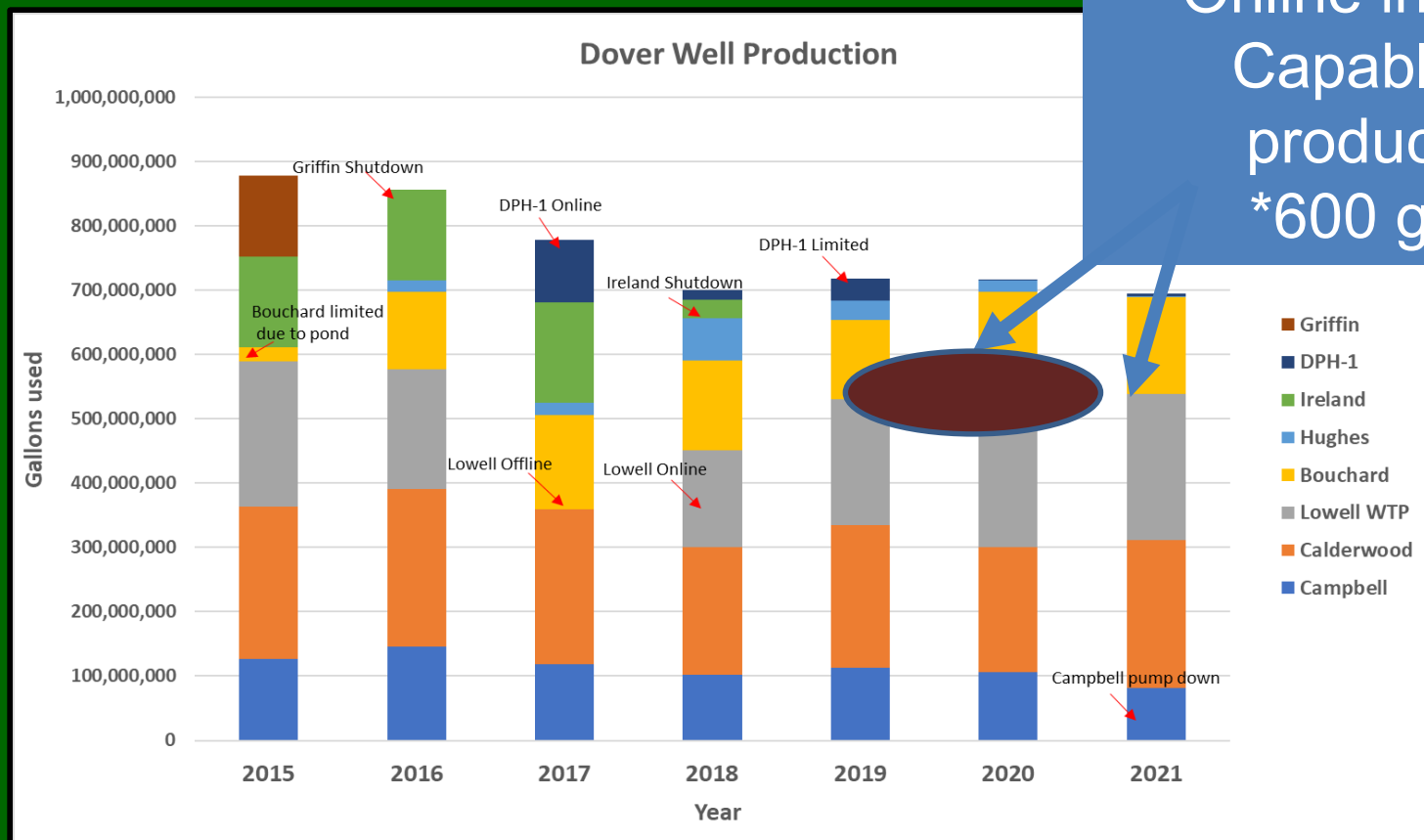


Water Main Replacement—Littleworth Road		Community Services Department	John B. Storer, Community Services Director	
2. Category: Water Fund		3. Priority: High		
4. Location: Columbus Avenue to Old Stage Road		5. Purpose of Project: Request Modify a project already in the CIP		
6. Master Plan Chapter, Section and page #: Community Facilities and Utilities				
7. Project History (Previous CIP Year or connection to other project): PW-reconstruction				
8. Description (including incorporating Climate Change): Project will replace a 1935 vintage 8-inch cast iron water main that is in poor shape and has reduced capacity. A new 12-inch water main will be installed from the intersection of Columbus Avenue out to connect to the Hughes Well. This will improve flow and impression, and also improve reliability of the water distribution system.				
9. Justification Useful life 30 years				
Criteria	Meets			
Protects health and safety of employees/community	X			
Significantly improves the efficiency of existing services	X			
Preserves a previous capital investment made by the City	X			
Reduces future operating costs	X			
Increases future operating revenues	X			
Supports efforts to promote economic vitality	X			
Supports efforts to promote a high quality of life	X			
Responds to a Federal or State requirement	X			
P.G. # or Consequence of Failure #	X			
Consistent with Dept. Strategic Plan	X			
10. Cost (Years 2 – 6 use an inflationary factor of 4%)		10A. Recommended Sources of Funding		
BUDGET FY	TOTAL (interest cost not included)	COST ELEMENT	PRINCIPAL	SECONDARY
Program year FY 2022	\$0	Choose an item.	Choose an item.	Choose an item.
Program year FY 2023	\$1,000,000	Other	Debt Financing	Choose an item.
Program year FY 2024	\$1,000,000	Other	Debt Financing	Choose an item.
Program year FY 2025	\$0	Choose an item.	Choose an item.	Choose an item.
Program year FY 2026	\$0	Choose an item.	Choose an item.	Choose an item.
Program year FY 2027	\$0	Choose an item.	Choose an item.	Choose an item.
TOTAL SIX YEARS	\$2,000,000	None		
After Sixth Year		10B. Source of Cost Estimate: Staff		

Legend
— Phase 2 raw water line
— Phase 2 water line



Well Usage Reduced – Willand Pond



Willand Pond Wells
Online in 2020
Capable of
producing
*600 gpm



Well Usage Reduced – Willand Pond

**Capable of yielding 600 gpm but limited by the water levels in Willand Pond and therefore production can be significantly impacted during drought conditions*

NEWS

Willand Pond water levels dip to record lows

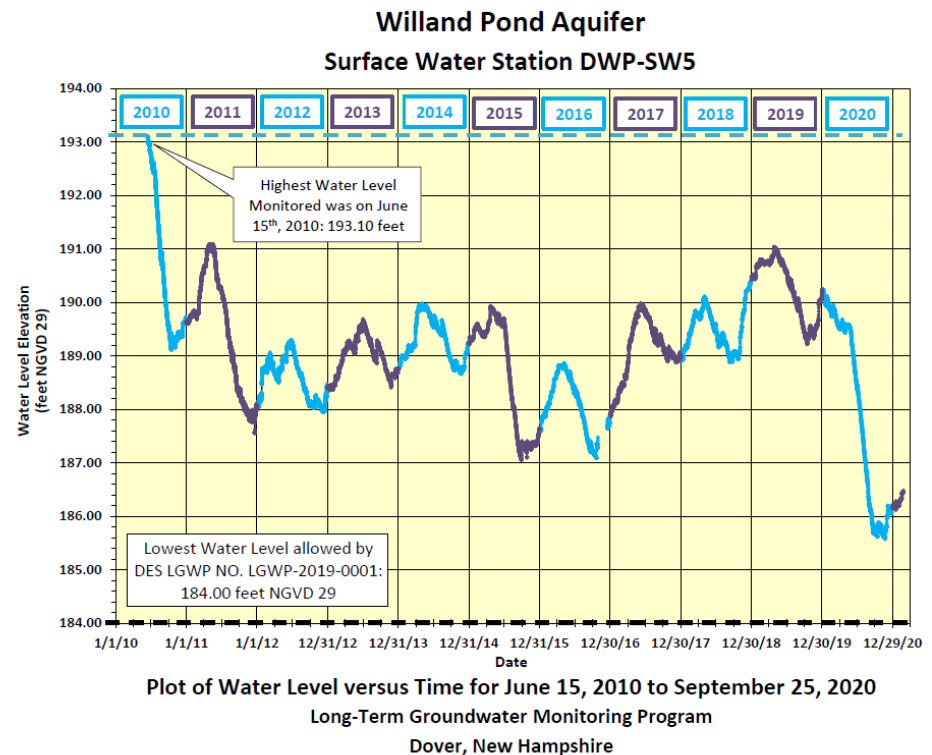
Jeff McMenemy

Published 5:39 p.m. ET Aug. 27, 2020

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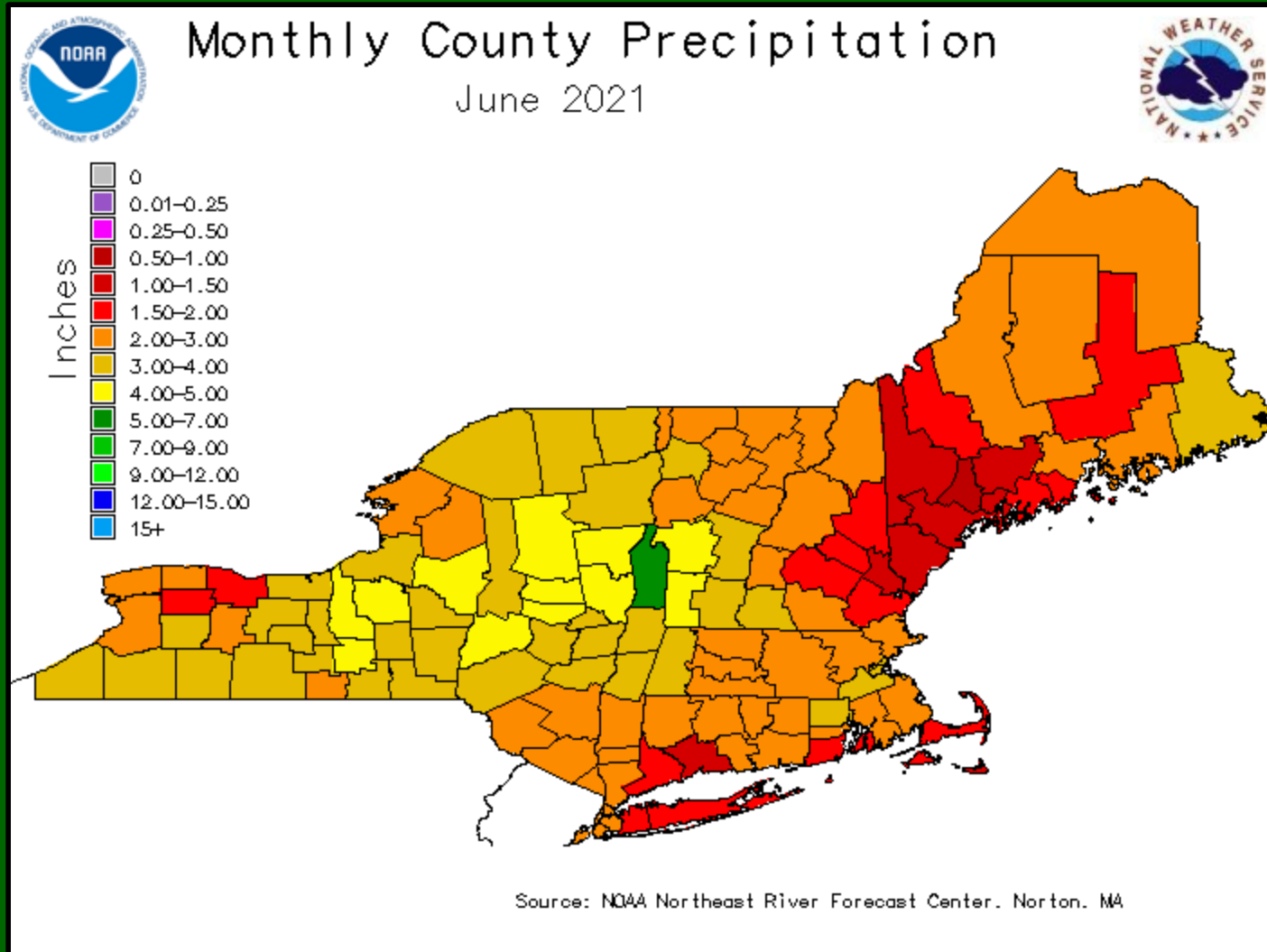


Water levels are low, as seen recently on the Dover side of Willand Pond, due to the lack of rain this summer. *Deb Cram/Fosters.com, File*





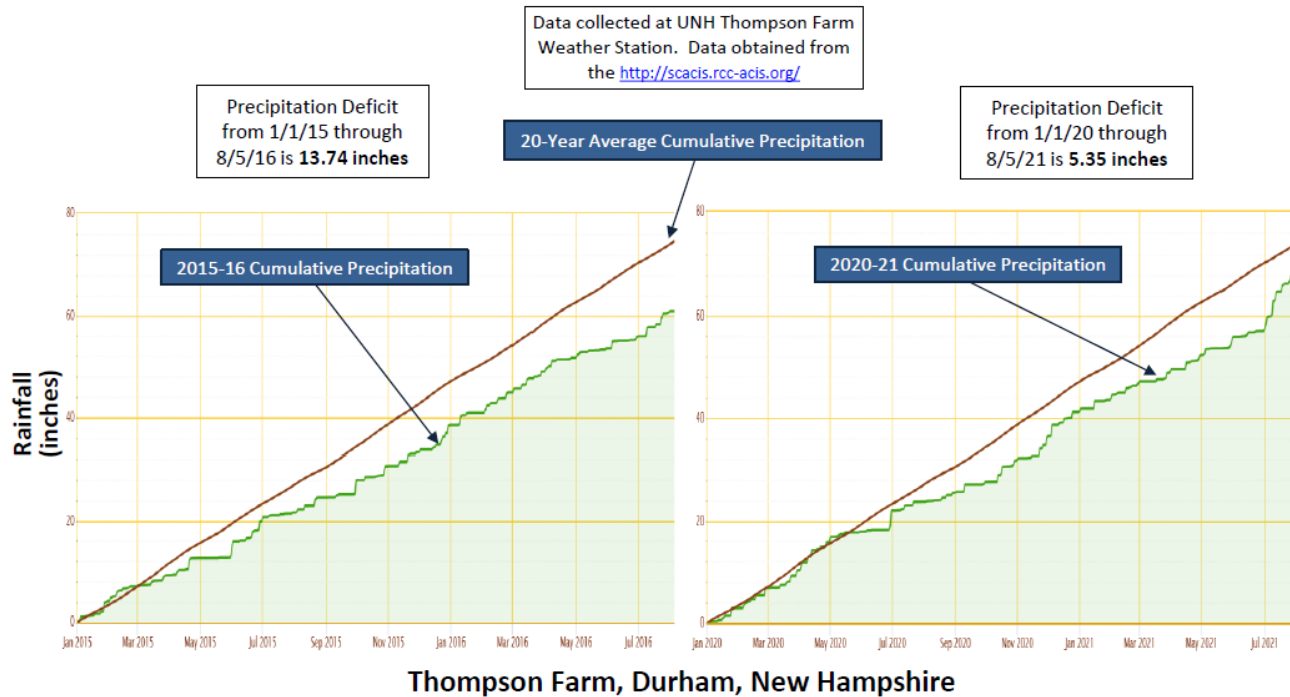
Drought – New England Wide





Multiple Droughts recent years

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

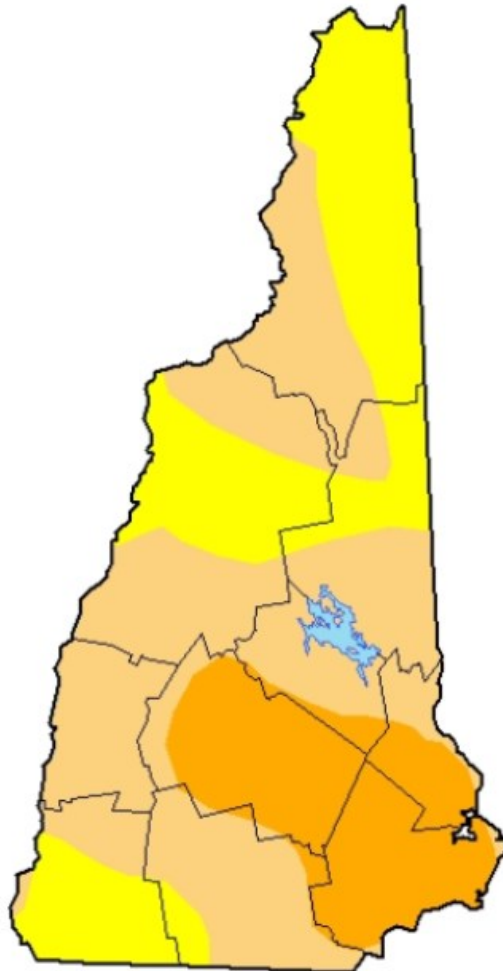




U.S. Drought Monitor New Hampshire

August 18, 2020
(Released Thursday, Aug. 20, 2020)
Valid 8 a.m. EDT

166 Community Water Systems had
some form of Use-Restrictions



Intensity:

-  None
-  D0 Abnormally Dry
-  D1 Moderate Drought
-  D2 Severe Drought
-  D3 Extreme Drought
-  D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

David Simeral
Western Regional Climate Center

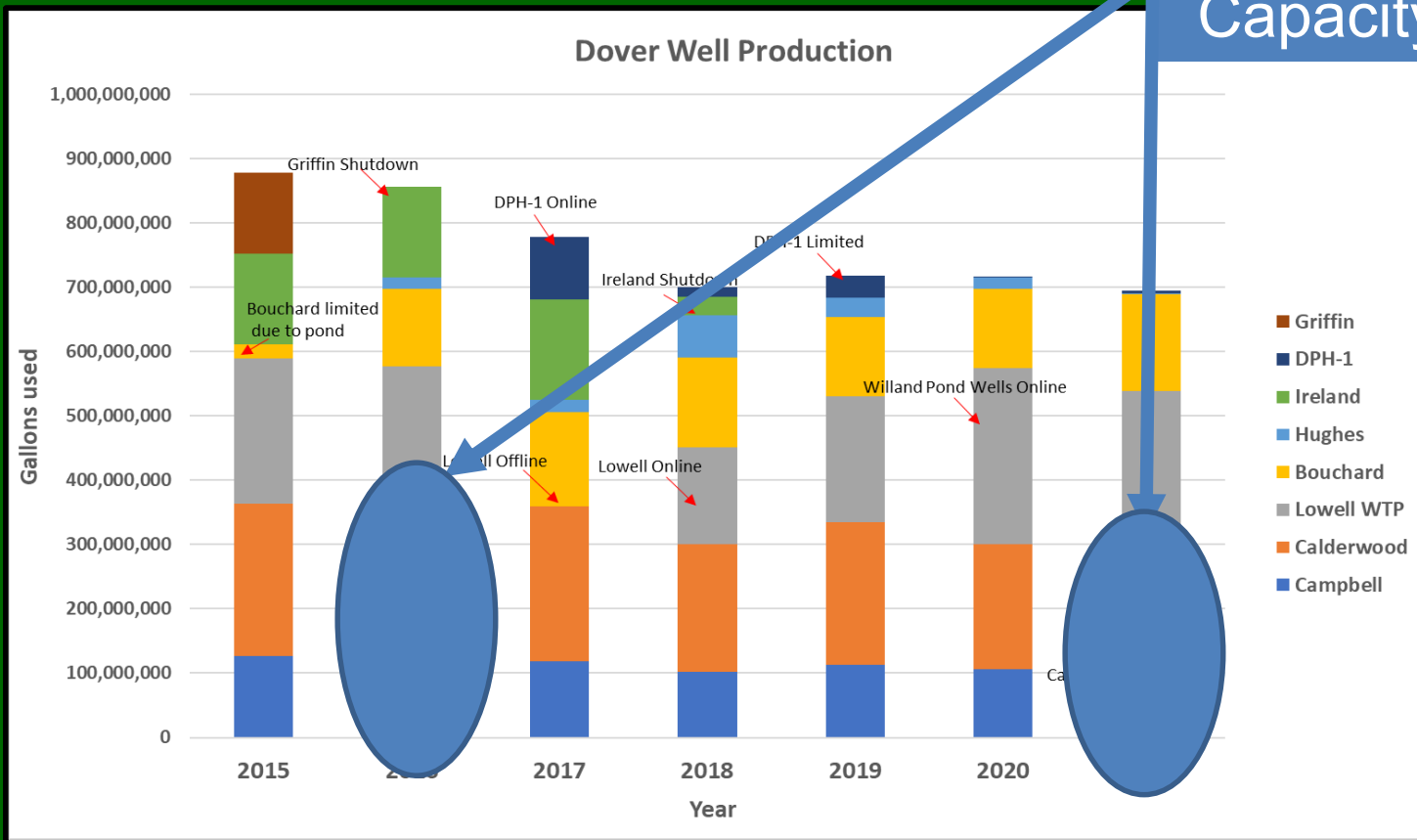


droughtmonitor.unl.edu

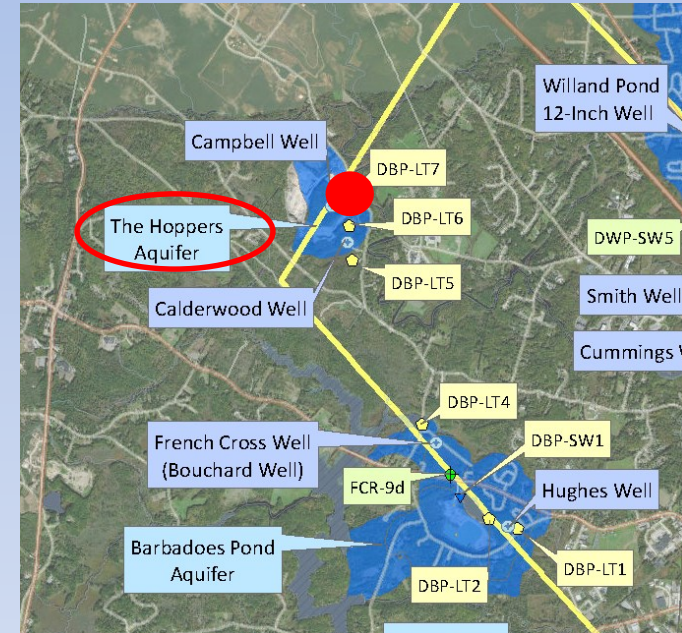
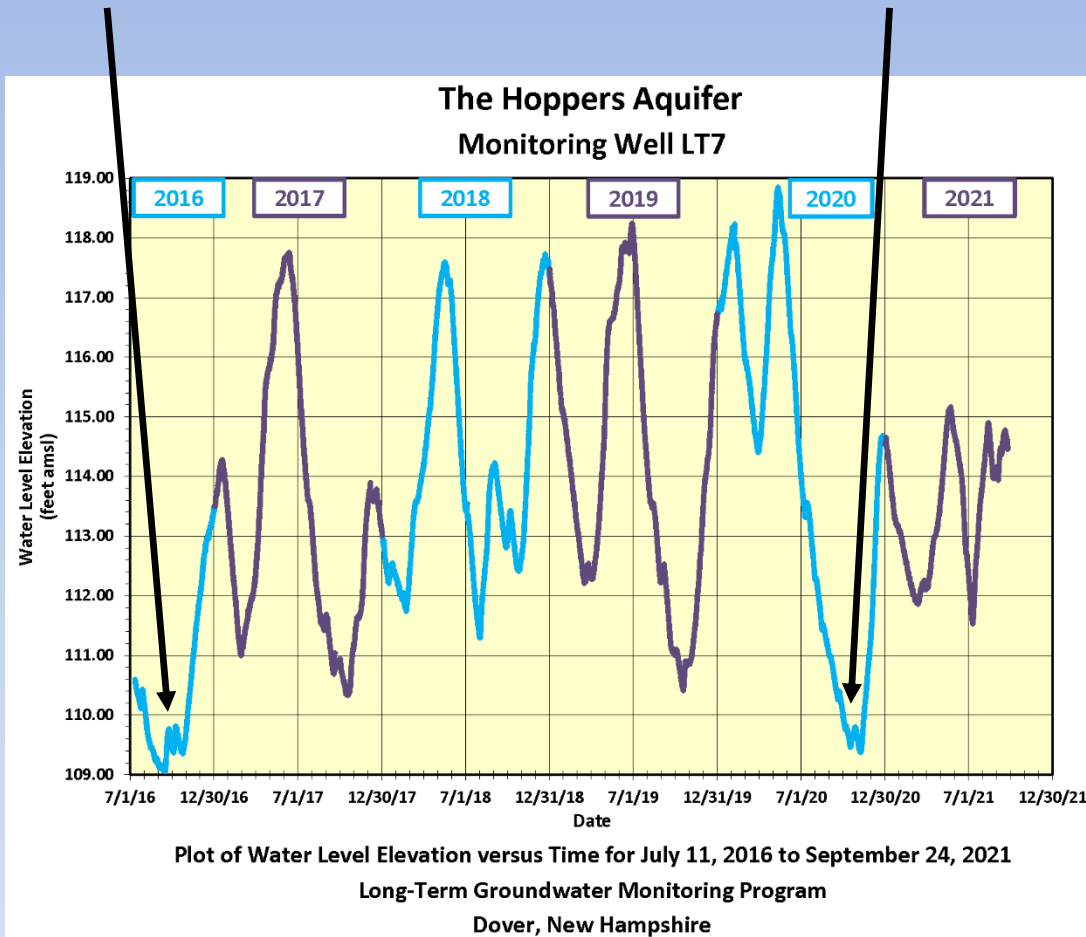


Water Usage - Hoppers Aquifer

Capable of Peak Capacity 1.4 MGD



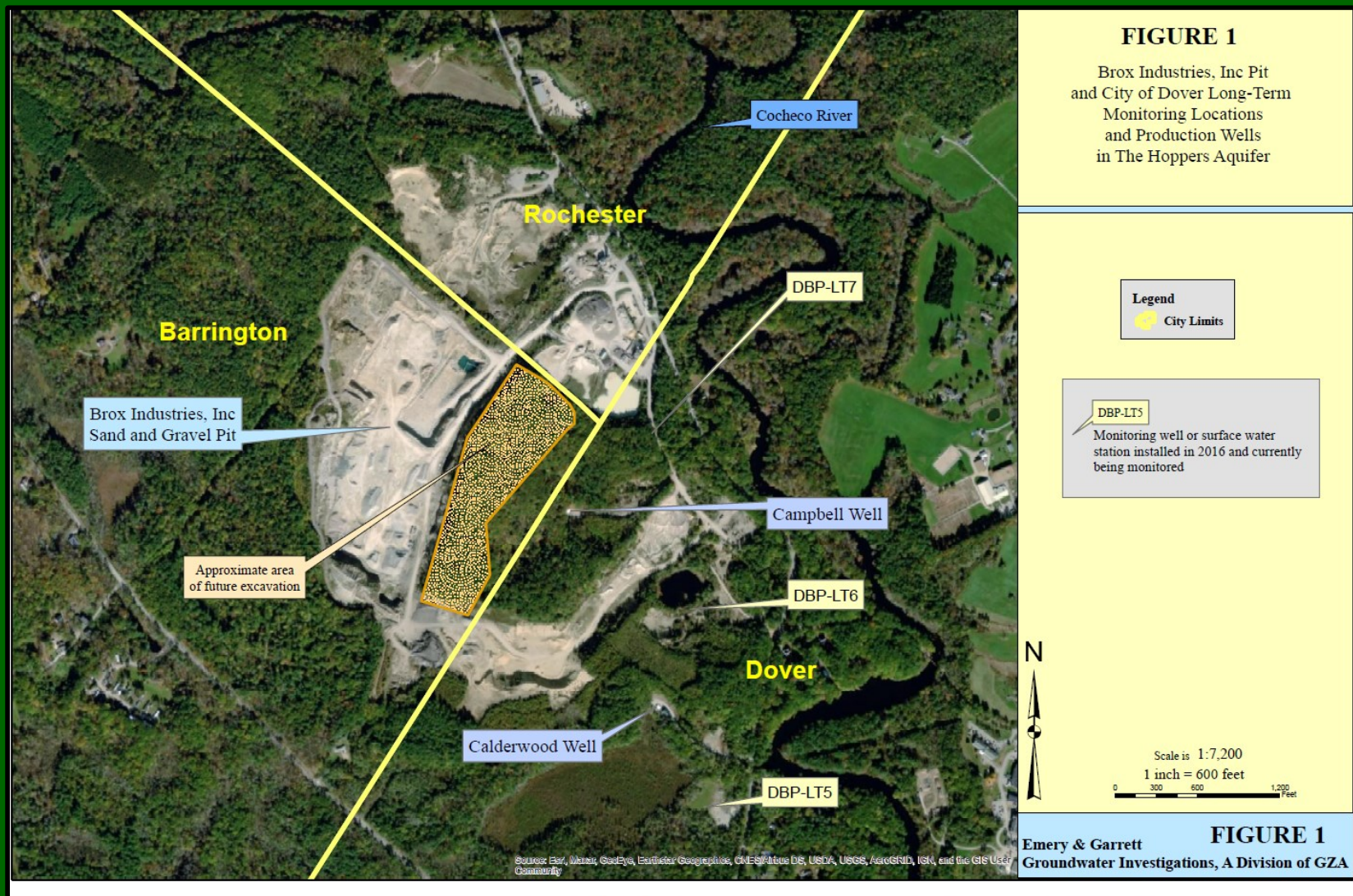
****Lack of full Pudding Hill capacity has put burden or strain on Hoppers Aquifer. Note significant drops in water levels in 2016 and 2020.***



Emery & Garrett Groundwater Investigations, A Division of GZA



Hoppers Aquifer

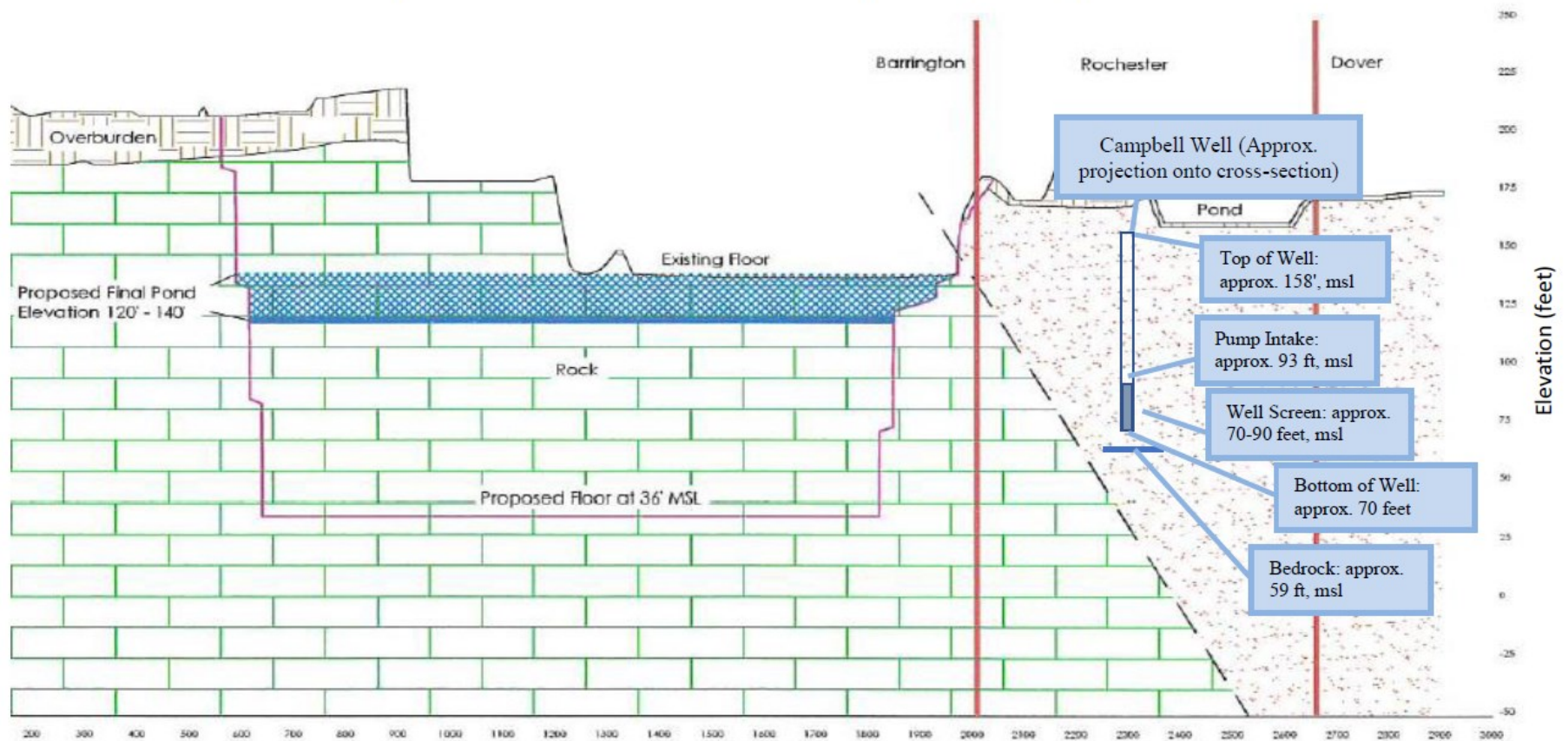




Hoppers Aquifer

FIGURE 2

Schematic cross-section excerpted from Figure 2 in Brox Industries, Inc 2009
Operational Plan with added information pertaining to Campbell Well





DOVER
WATER WORKS

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Questions??

By: John Storer
Director of Community Services