Water Resources Planning Committee

Maine Department of Agriculture, Conservation, and Forestry

December 12, 2025

Agenda

1. Introductions and review of WRPC mandate
2. LUPC update on water withdrawal permitting
3. Legislative and policy update
4. The Drought

- BREAK -

4. Updates from MGS
5. Updates from other members and groups
6. Public comment period
7. Future meeting topics

Committee Membership

Seat	Name	Organization
1	Mary Szatkowski	MGS
2	Craig Lapine	DACF Food and Rural Resources
3	Jordan McColman	PUC
4	vacant	DEP
5	Audie Arbo	LUPC
6	Susan Breau	DHHS Drinking Water Program
7	Jeannie Tapley	Maine Potato Board
8	Mary Jane Dillingham	MaineWater and Maine Water Utilities Assoc
9	Mark Dubois	Poland Spring
10	Bertrand Kendall	retired Denmark Town Manager
11	David Courtemanch	The Nature Conservancy
12	Dirk Gouwens	Ski Maine
13	Susan Gallo	Maine Lakes
14	Stacy Thompson	City of Saco WRRD
15	Ryan Gordon	MGS
16	Jessica Meeks	MGS
17	David Bell	Cherryfield Foods Inc
18	Annie Watson	Sheepscot Valley Farm
19	Kate Warner	Maine Rural Water Assoc
20	Andrew Beahm	Maine Audubon
21	Dan Kuznierz	Penobscot Nation

WRPC Mandate

Title 5, §6401:

https://legislature.maine.gov/statutes/5/title5sec6401.html

APPROVED
APRIL 30, 2019
BY GOVERNOR

CHAPTER
67
PUBLIC LAW

STATE OF MAINE

IN THE YEAR OF OUR LORD

TWO THOUSAND NINETEEN

H.P. 162 - L.D. 199

An Act To Create the Water Resources Planning Committee

Be it enacted by the People of the State of Maine as follows:

Sec. 1. 5 MRSA Pt. 15-C is enacted to read:

PART 15-C

WATER RESOURCES PLANNING COMMITTEE

CHAPTER 357

WATER RESOURCES PLANNING COMMITTEE

§6401. Water Resources Planning Committee

1. Water Resources Planning Committee. The Water Resources Planning Committee, as established in section 12004-I, subsection 68-C and referred to in this subsection as "the committee," is established in the Department of Agriculture, Conservation and Forestry.

Summary of WRPC Goals

Plan for the sustainable use of water resources. The committee shall focus on:

1. Collecting and reviewing information regarding water withdrawal activities;
2. Coordinating state water resources information; and
3. Identifying watersheds at risk by refining the most recent analysis of watersheds at risk performed by the . . . Maine Geological Survey, including:
    a) Conducting appropriate water resources investigations in watersheds at risk;
    b) Considering projected increased water use by population, agricultural irrigation, commercial users, industrial users and other users;
    c) Considering seasonal use;
    d) Considering potential effects of climate change;
    e) Considering the effects of anticipated future water quality classification changes on the availability of water for withdrawal;
    f) In establishing priorities for further investigations, seeking input from the user community, from towns dealing with multimunicipal aquifers and from towns with significant local aquifers; and
    g) Developing guidelines for consistency in further investigations.

Summary of WRPC Goals

Review state policy with regard to:

1. Conservation of water resources;
2. Development of regional sources and solutions to water use issues;
3. Incentives for stewardship of water resources; and
4. Effects of surface water quality improvements on water withdrawal opportunities.

The committee shall provide guidance to municipalities and water districts and develop and disseminate educational materials on water resources and the regulatory regime.

Legislative and Policy Update

First session of the 132nd Legislature

- Several bills on PFAS information and testing.
- LD 500 “Act to Ensure Access to Safe Drinking Water from Household Wells in Rural Areas by Expanding Testing”
- LD 757 “Resolve, to Study and Oversee Water in the State of Maine”
- LD 1696 “Resolve, to Study Maine's Absolute Dominion and Beneficial Use Laws Relating to Water Rights”
- LD 758 “Act to Update Flood Mapping…in the Sandy River Watershed”

Sandy River Watershed Study

Purpose: Update flood hazard information in the Sandy system

- Maine Geological Survey will contract a geomorphic study on flood hazards (river movement, erosion).
- Provide information about flood risks to local people.
- DACF “shall seek funding”.

APPROVED
MAY 30, 2025
BY GOVERNOR

CHAPTER
42
RESOLVES

STATE OF MAINE

IN THE YEAR OF OUR LORD

TWO THOUSAND TWENTY-FIVE

S.P. 291 - L.D. 758

Resolve, to Conduct a Study to Update Flood Hazard Data in the Sandy River Watershed

Sec. 1. Department of Agriculture, Conservation and Forestry, Maine Geological Survey to conduct Sandy River watershed geomorphic study. Resolved: That, in coordination with the United States Department of Homeland Security, Federal Emergency Management Agency; the Department of Transportation; the Department of Environmental Protection; the Department of Inland Fisheries and Wildlife; the Maine Office of Community Affairs; the Department of Defense, Veterans and Emergency Management, Maine Emergency Management Agency; and other relevant state agencies, the Department of Agriculture, Conservation and Forestry, Bureau of Resource Information and Land Use Planning, Division of Geology, Natural Areas and Coastal Resources, Maine Geological Survey shall contract for a geomorphic study within the Sandy River watershed to update flood hazard data within the watershed. The study must include an assessment of river movement, erosion and sedimentation and the impacts of those factors on flood risk and river health. The study must also provide individuals who reside within the Sandy River watershed and individuals who reside within the watershed of similar river systems with information about flood risks and options to manage those risks. The Department of Agriculture, Conservation and Forestry, in collaboration with relevant state agencies, shall seek funding to support the costs of the study.

Sandy River Watershed and Inland Flooding Work

- Senator Russell Black, Franklin County Commissioners and EMA, John Field, Greg Stewart (USGS), Jeremy Bell (TNC), Judy East (DACF), Brian Ambrett (State Resilience Office)
- Ongoing monthly meetings on inland flood risks and mapping.
- Four town halls in June: New Sharon, Farmington, Strong, Phillips.
- Field trip in July to river sites in Franklin County.

- Funding for the Sandy River study: a work in progress…
  DACF, State Resilience Office, TNC are continuing to work on options.

Legislative and Policy Update

Second Session of the 132nd Legislature

- 82 bills accepted (out of 258)
- LR 2820 An Act to Protect Private Well Owners from Toxic Chemicals (Rep. D. Ankeles)

2025 Hydrologic Cycle Review

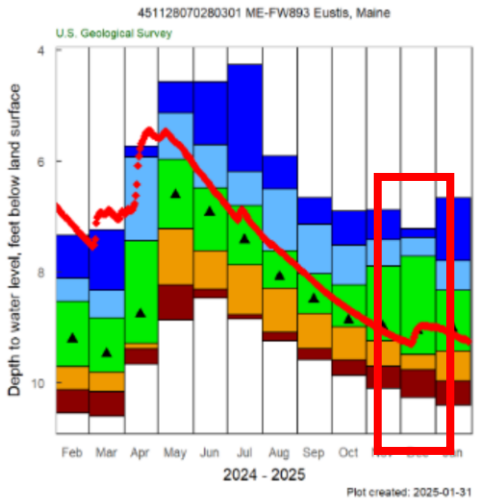
Water Resources Planning Committee

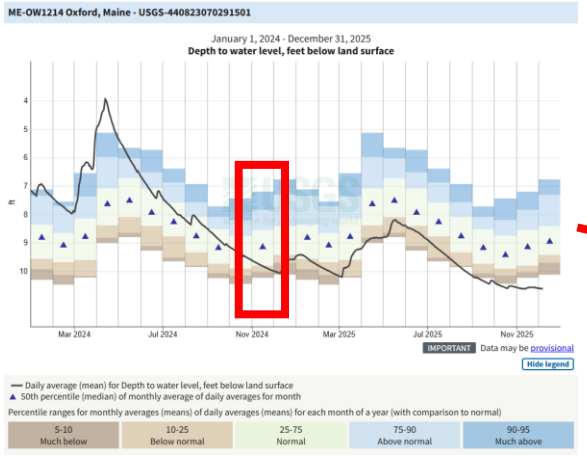
Jessica Meeks, Ph.D.
Maine Geological Survey

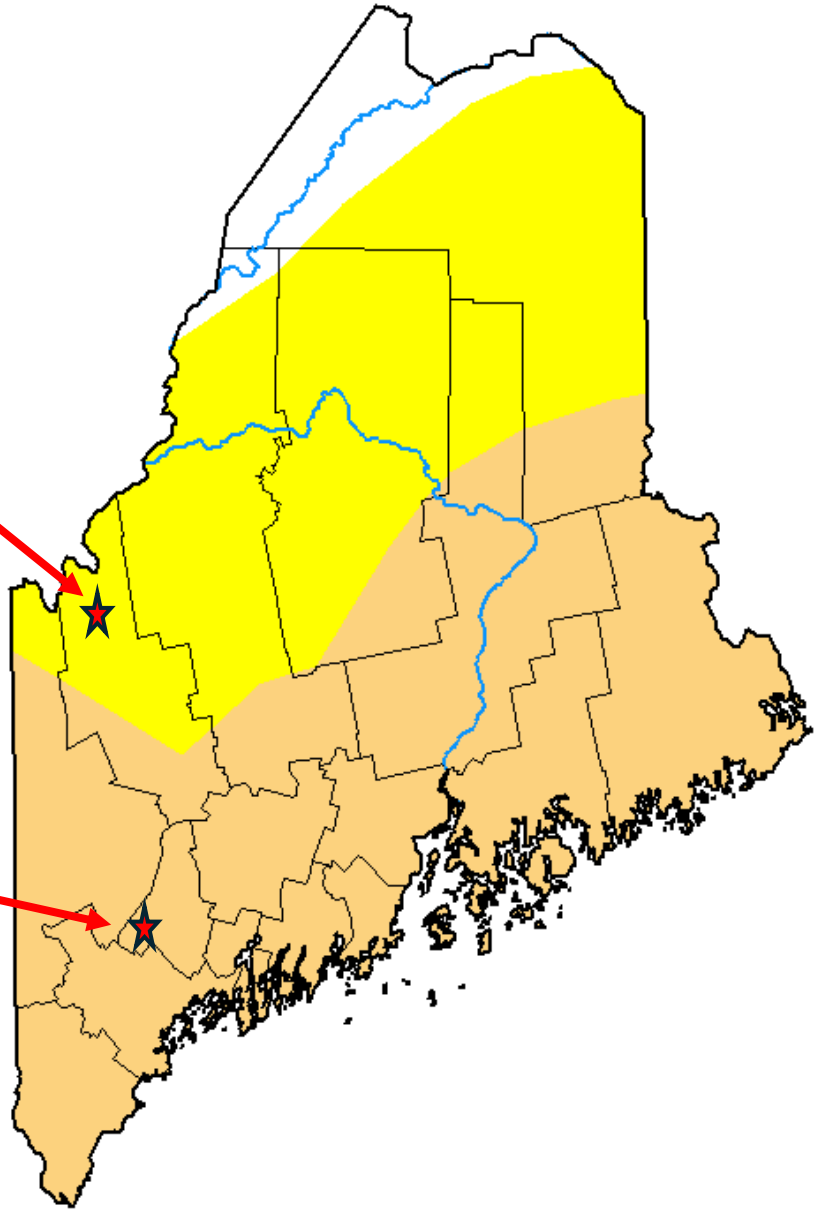
December 12, 2025

https://www.maine.gov/dep/water/monitoring/classification/reclassification.html

December 31, 2024







Intensity:

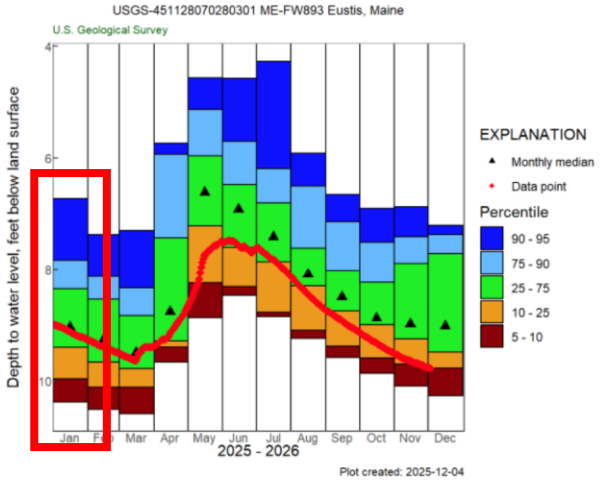
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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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U.S. Geological Survey
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Data point
Percentile
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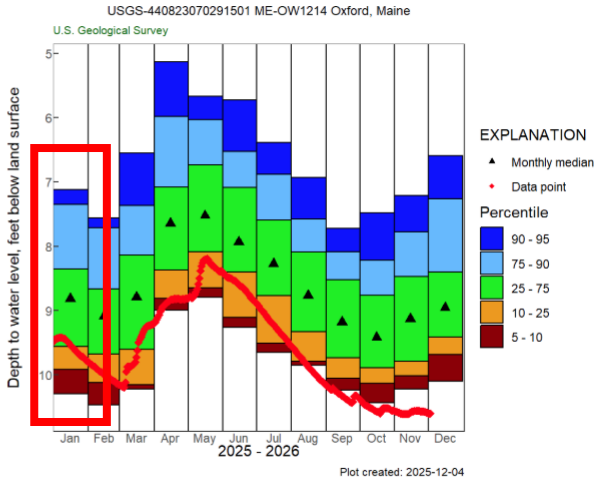
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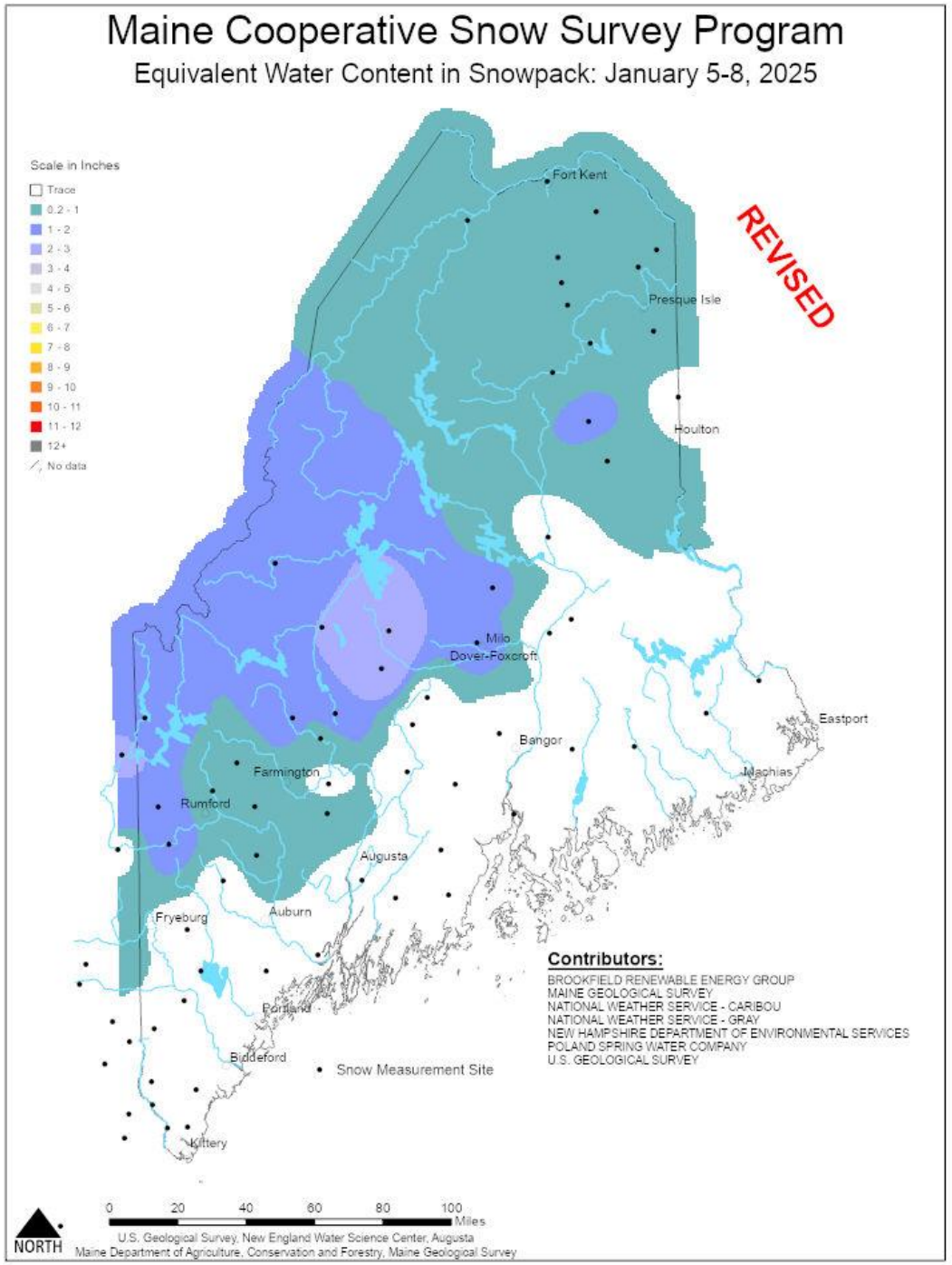
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Scale in Inches
Trace
0.2 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
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9 - 10
10 - 11
11 - 12
12+
No data
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NORTH
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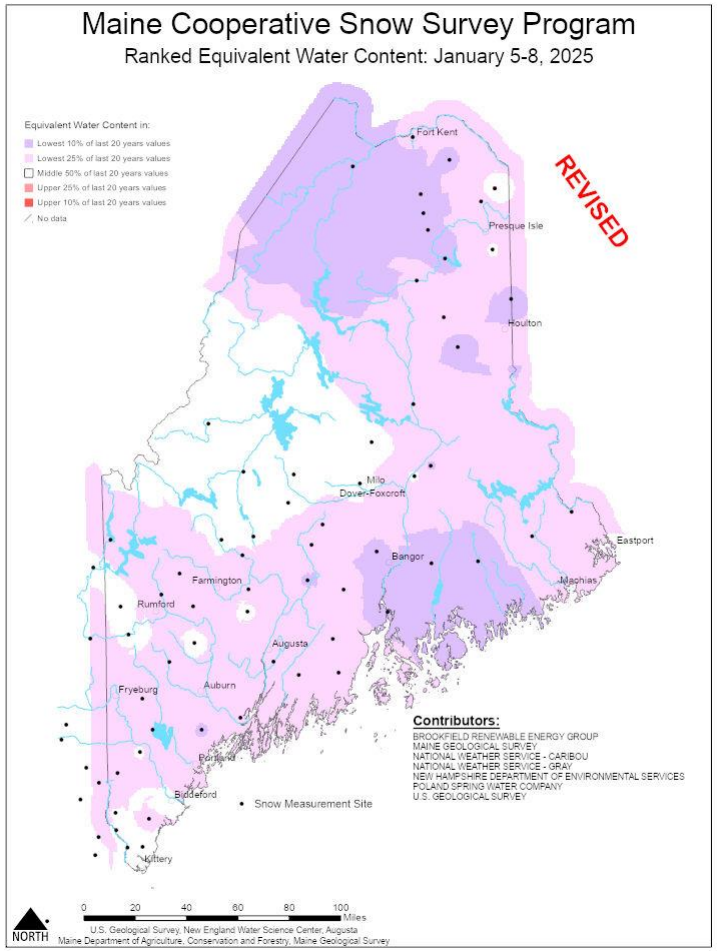
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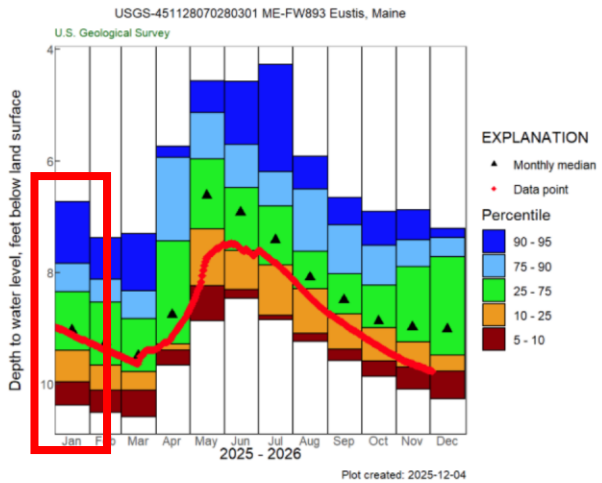
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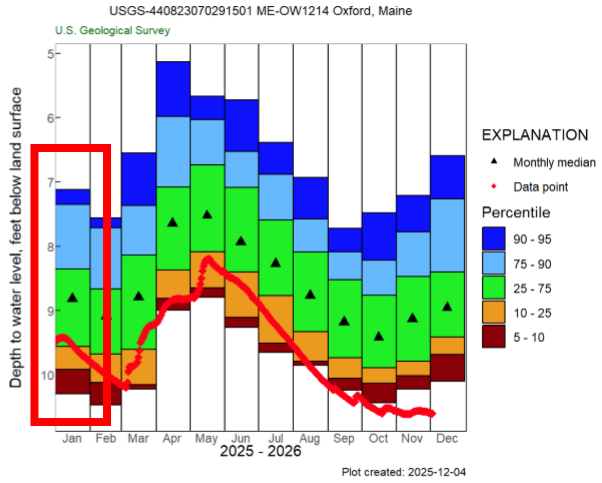
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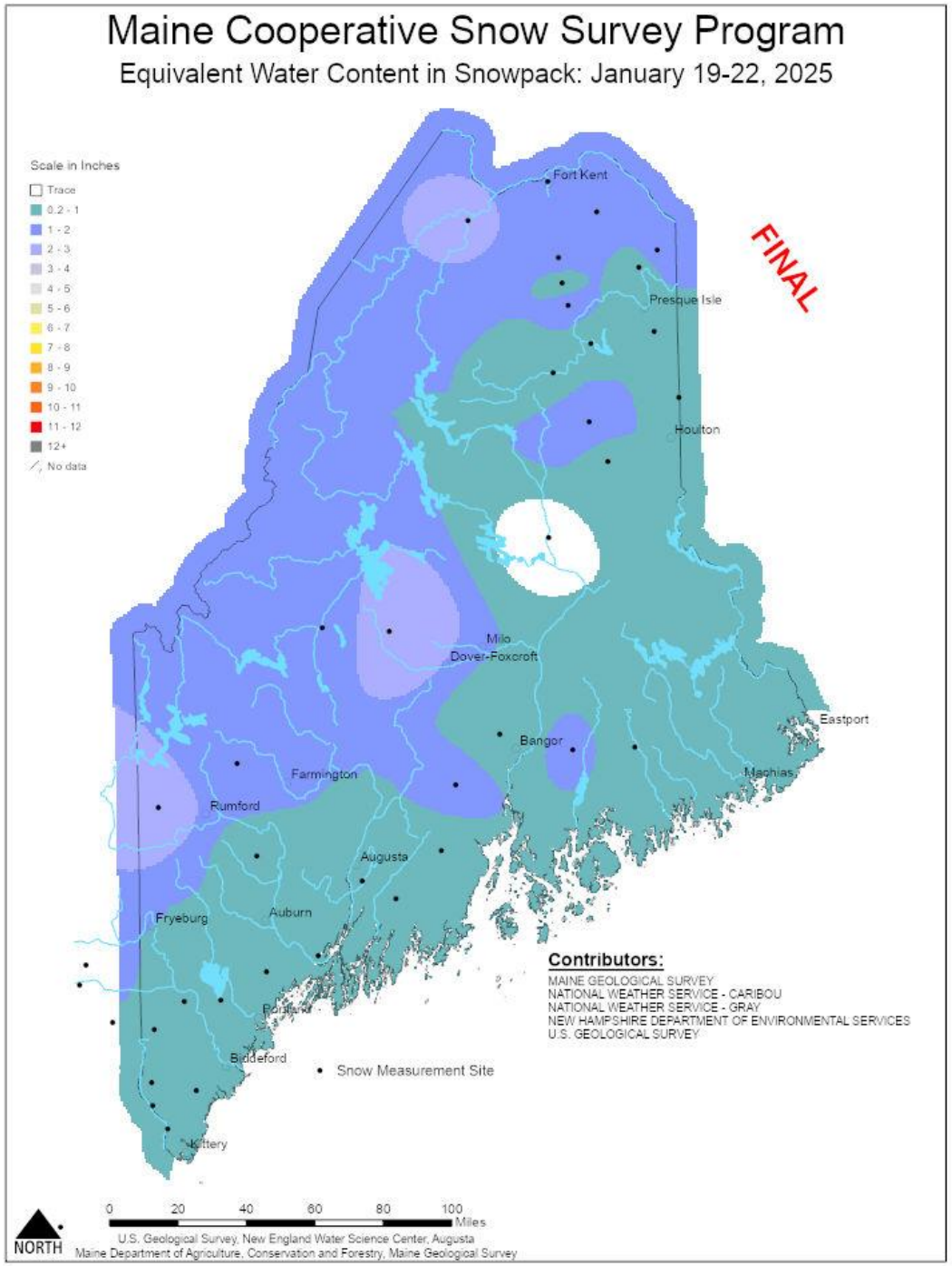
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Equivalent Water Content in Snowpack: January 19-22, 2025
Scale in Inches
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0.2 - 1
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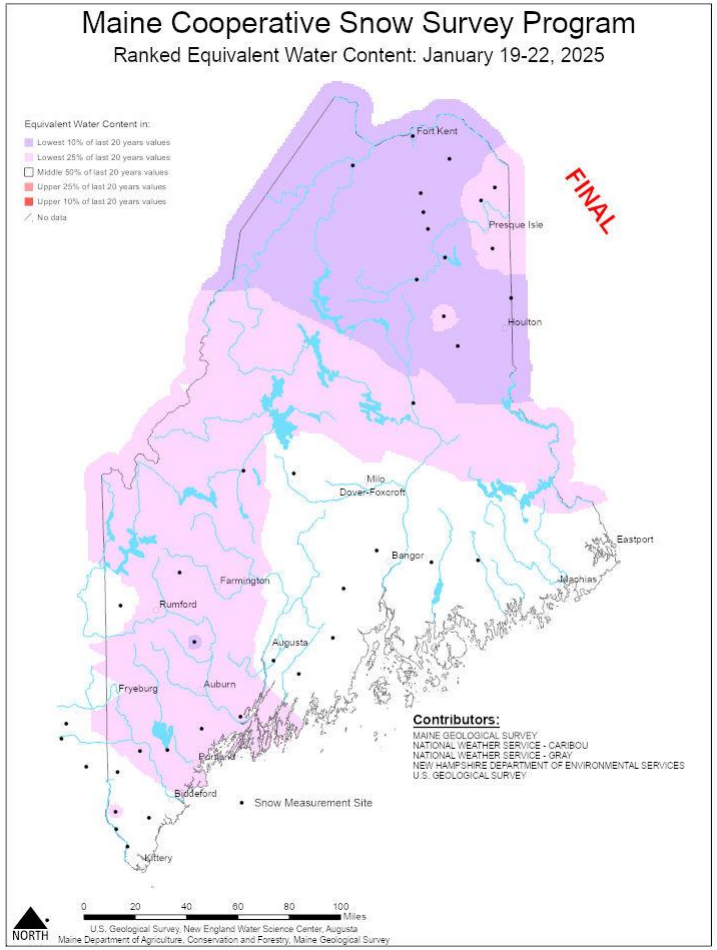
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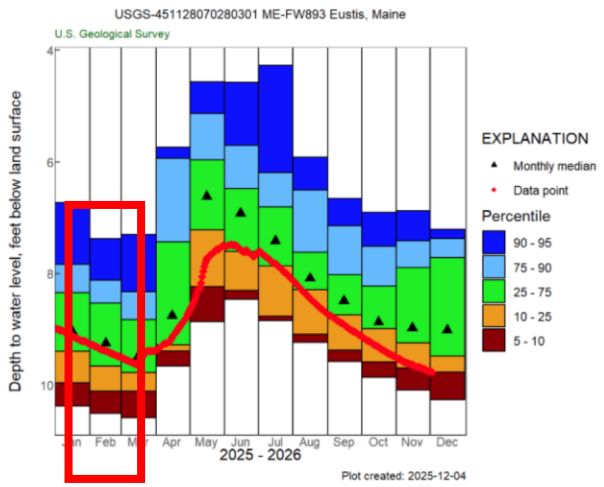
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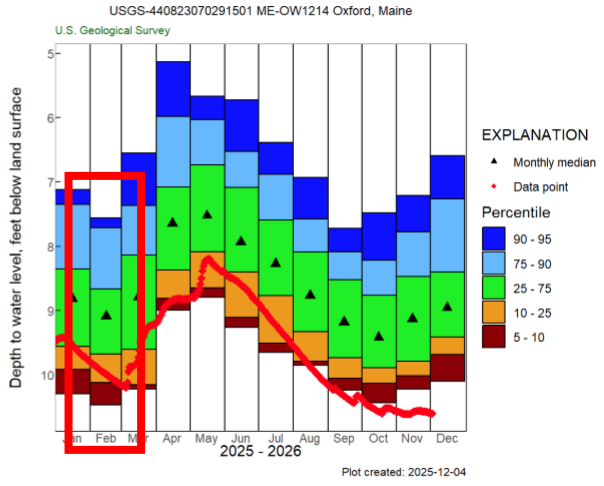
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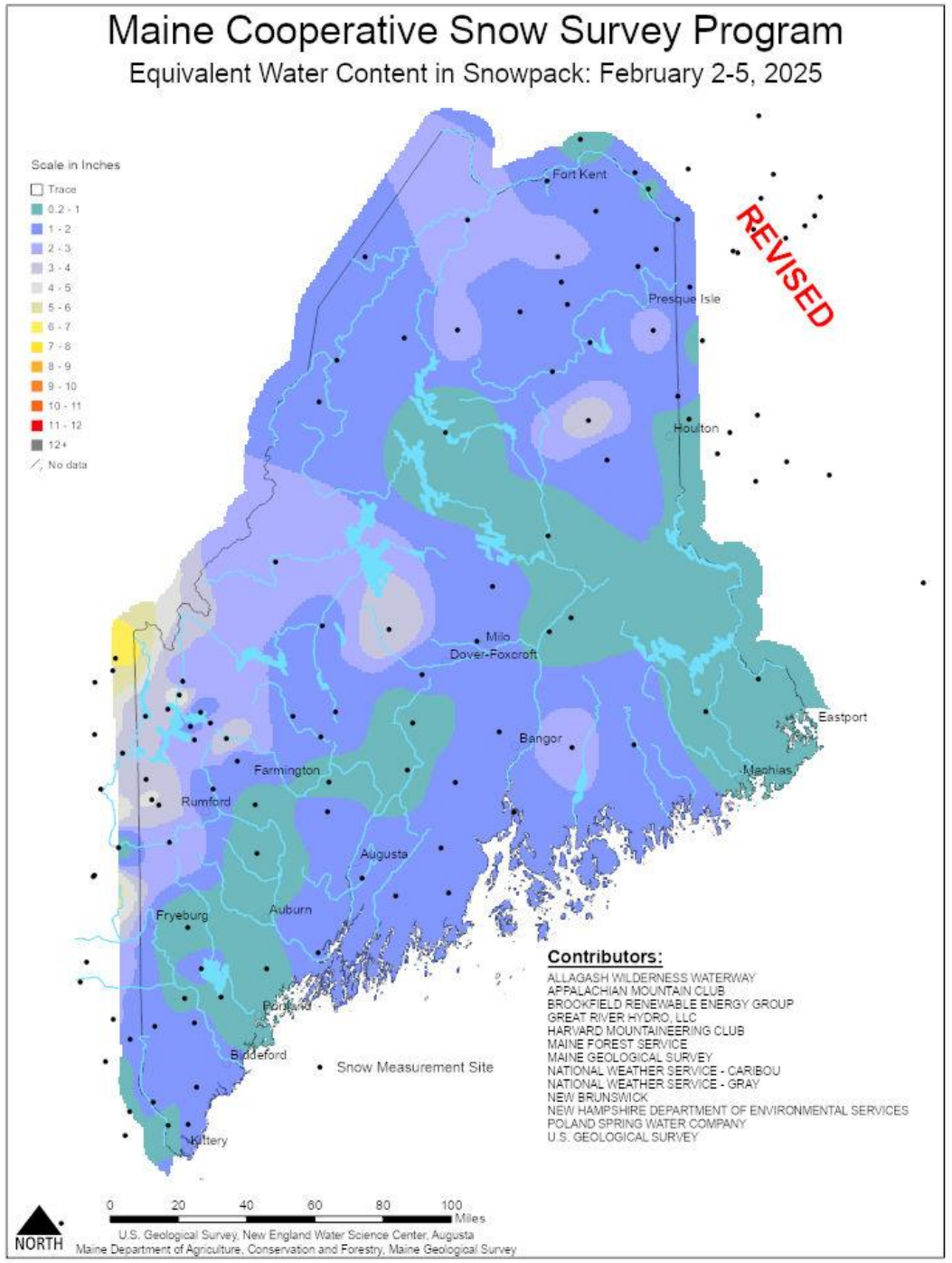
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Equivalent Water Content in Snowpack: February 2-5, 2025
Scale in Inches
Trace
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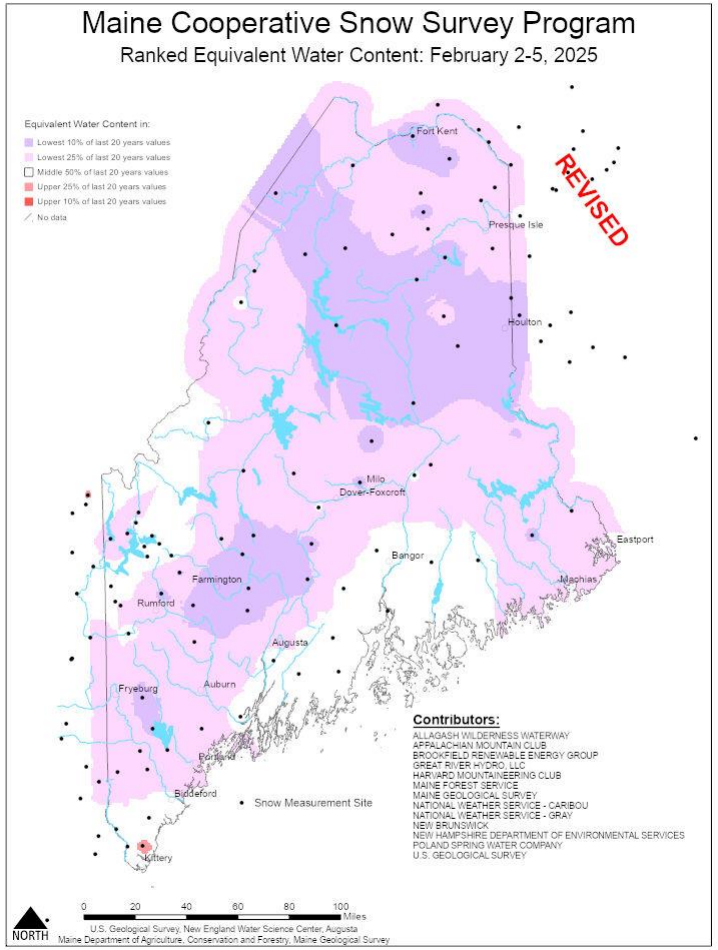
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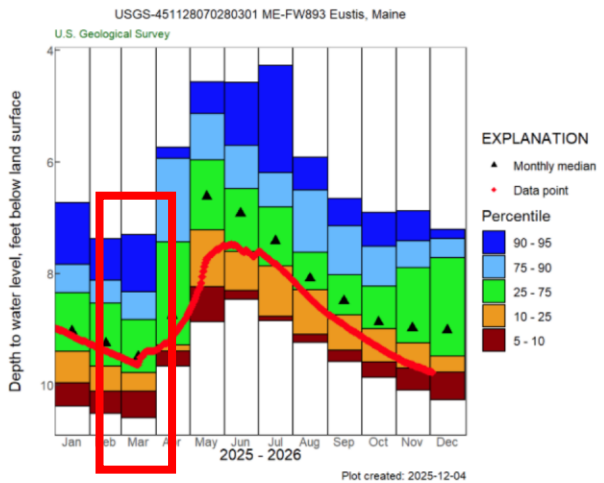
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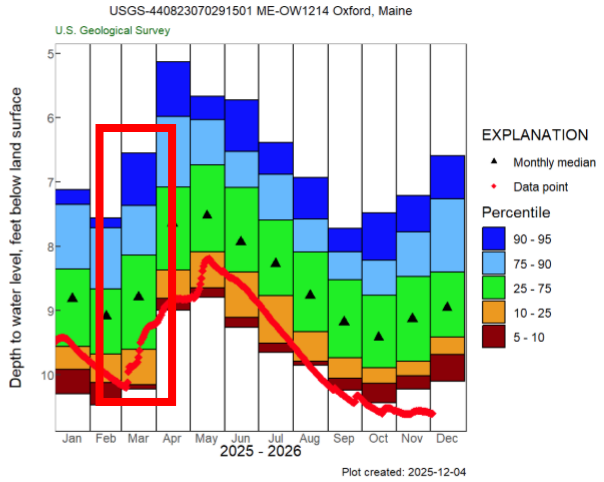
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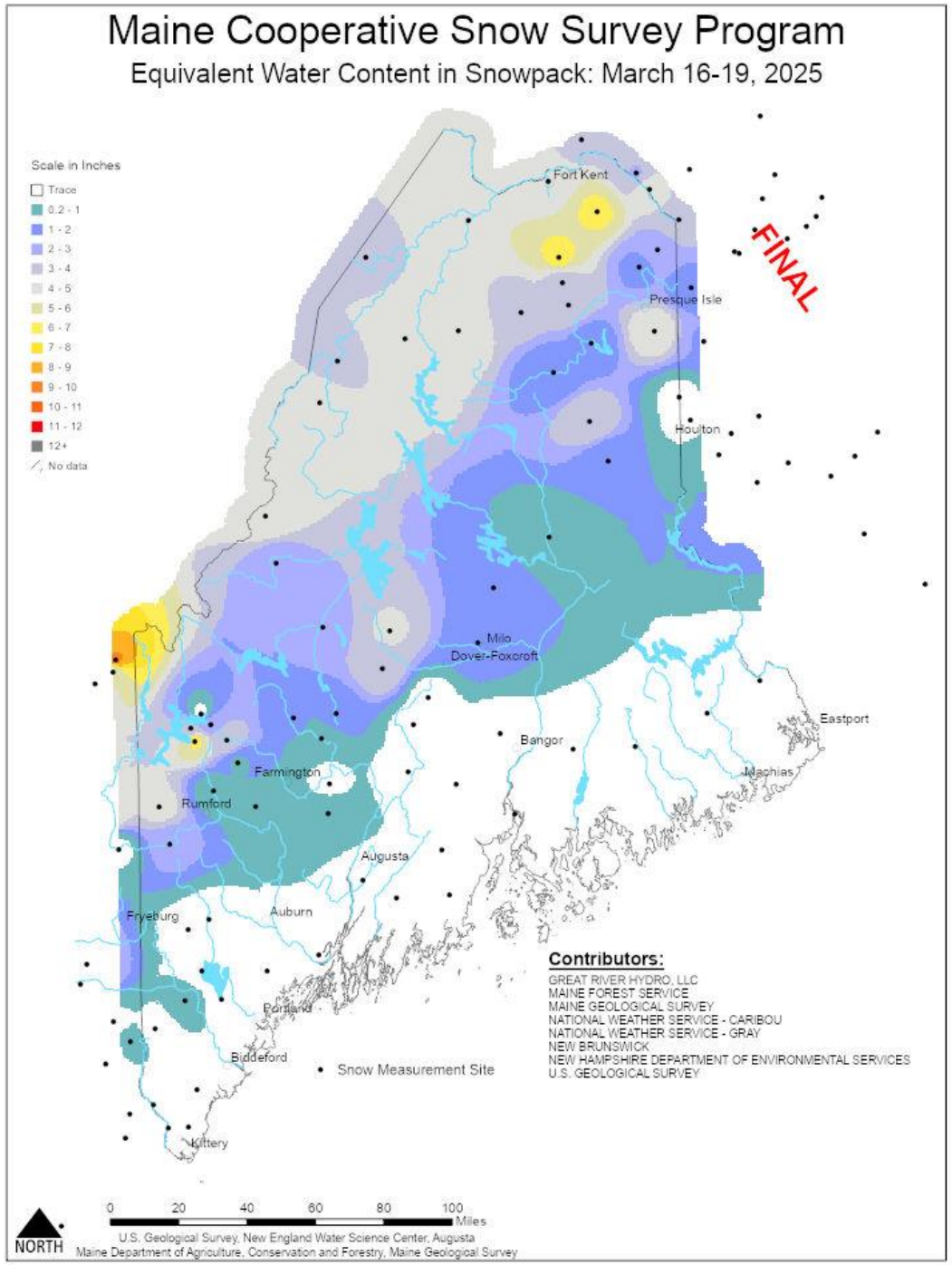
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Equivalent Water Content in Snowpack: March 16-19, 2025
Scale in Inches
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1 - 2
2 - 3
3 - 4
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6 - 7
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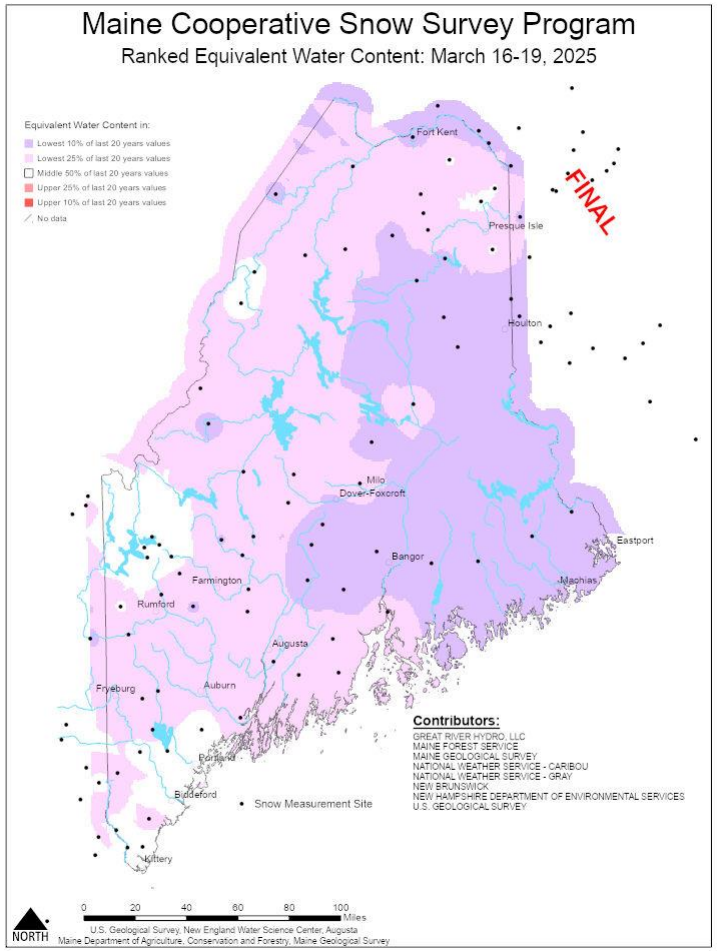
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Lowest 25% of last 20 years values
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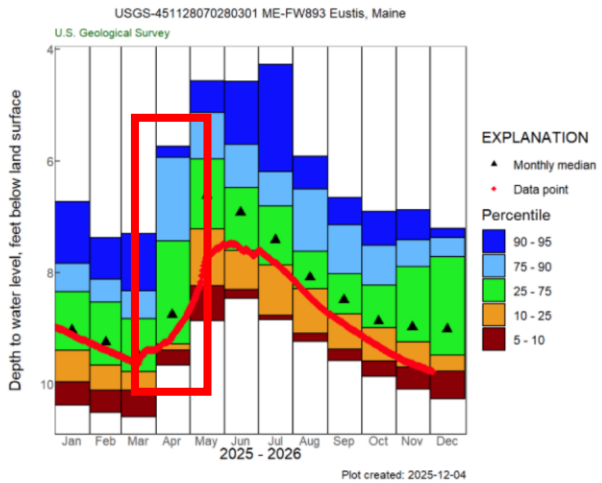
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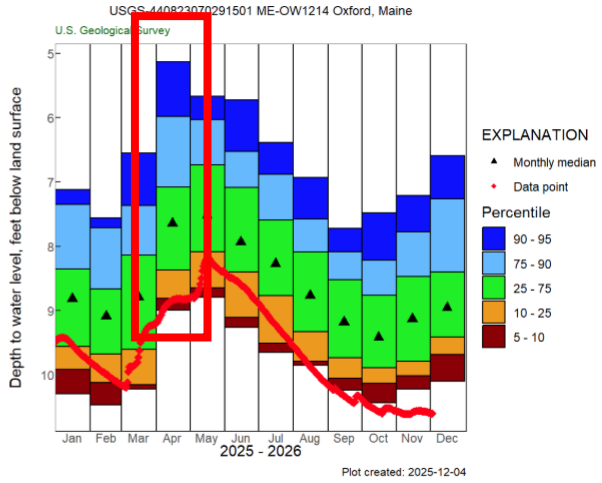
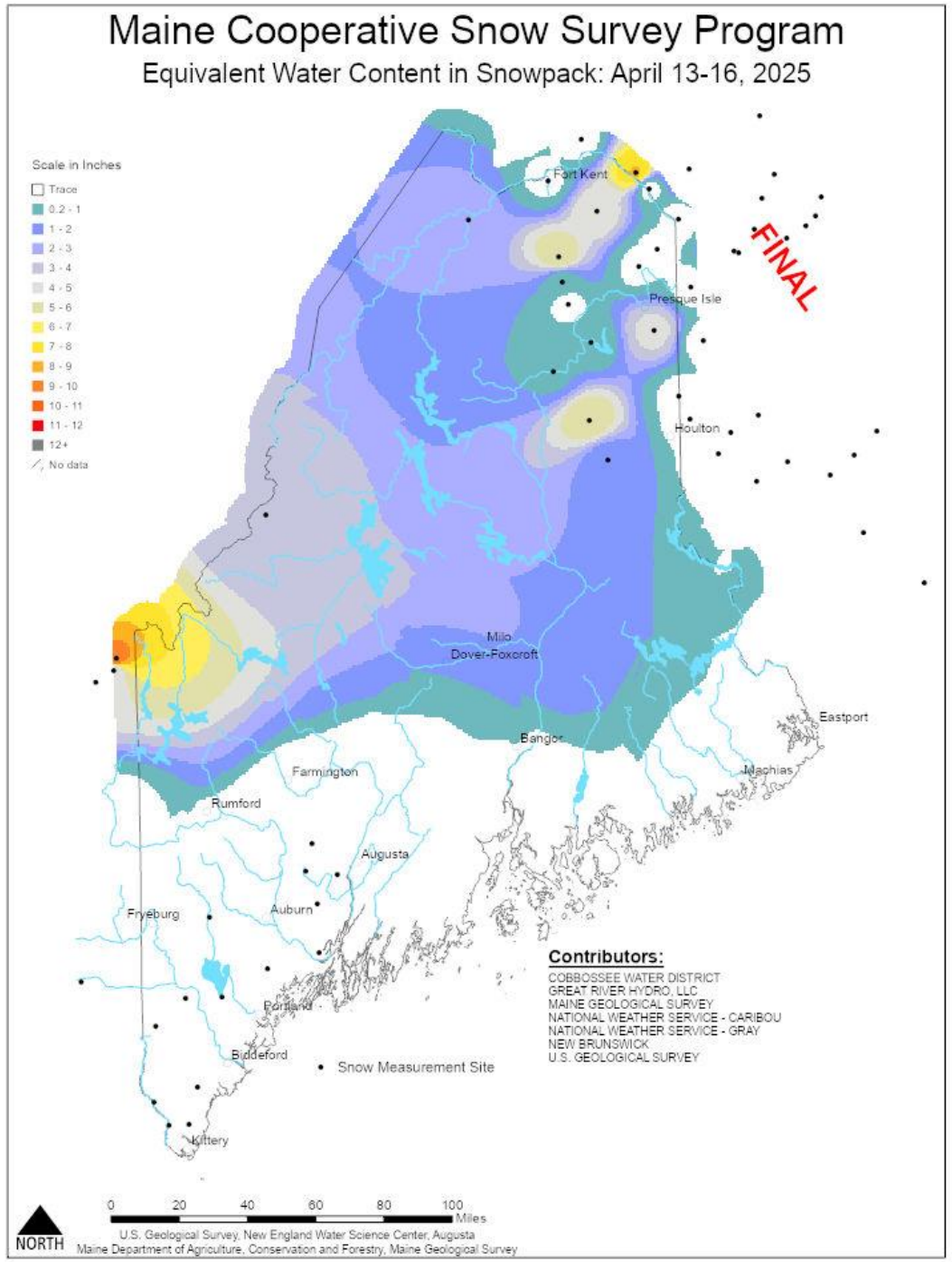
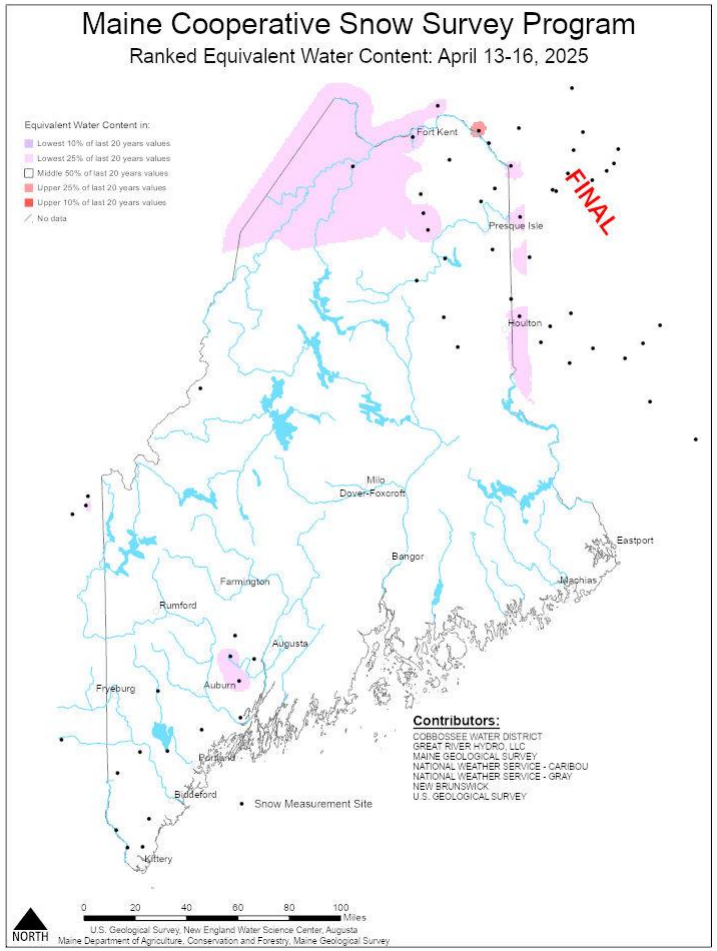
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2025 - 2026
Plot created: 2025-12-04
EXPLANATION
Monthly median
Data point
Percentile
90 - 95
75 - 90
25 - 75
10 - 25
5 - 10


USGS-440823070291501 ME-OW1214 Oxford, Maine
U.S. Geological Survey
Depth to water level, feet below land surface
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2025 - 2026
Plot created: 2025-12-04
EXPLANATION
Monthly median
Data point
Percentile
90 - 95
75 - 90
25 - 75
10 - 25
5 - 10


Maine Cooperative Snow Survey Program
Equivalent Water Content in Snowpack: April 13-16, 2025
Scale in Inches
Trace
0.2 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
11 - 12
12+
No data
FINAL
Fort Kent
Presque Isle
Houlton
Milo
Dover-Foxcroft
Eastport
Bangor
Jonesboro
Machias
Farmington
Rumford
Augusta
Fryeburg
Auburn
Portland
Biddeford
Kittery
Snow Measurement Site
Contributors:
COBBOSSEE WATER DISTRICT
GREAT RIVER HYDRO, LLC
MAINE GEOLOGICAL SURVEY
NATIONAL WEATHER SERVICE - CARIBOU
NATIONAL WEATHER SERVICE - GRAY
NEW BRUNSWICK
U.S. GEOLOGICAL SURVEY
NORTH
0 20 40 60 80 100
Miles
U.S. Geological Survey, New England Water Science Center, Augusta
Maine Department of Agriculture, Conservation and Forestry, Maine Geological Survey


Maine Cooperative Snow Survey Program
Ranked Equivalent Water Content: April 13-16, 2025
Equivalent Water Content in:
Lowest 10% of last 20 years values
Lowest 25% of last 20 years values
Middle 50% of last 20 years values
Upper 25% of last 20 years values
Upper 10% of last 20 years values
No data
FINAL
Fort Kent
Presque Isle
Houlton
Milo
Dover-Foxcroft
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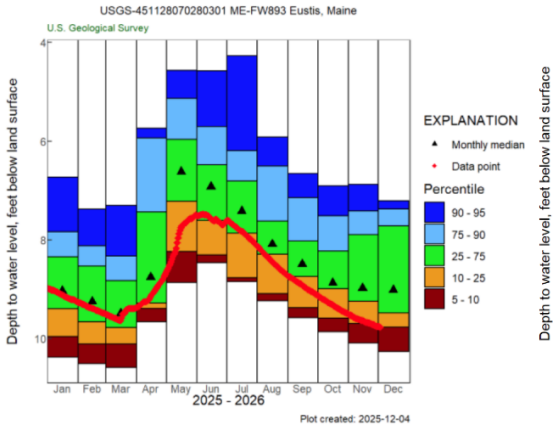
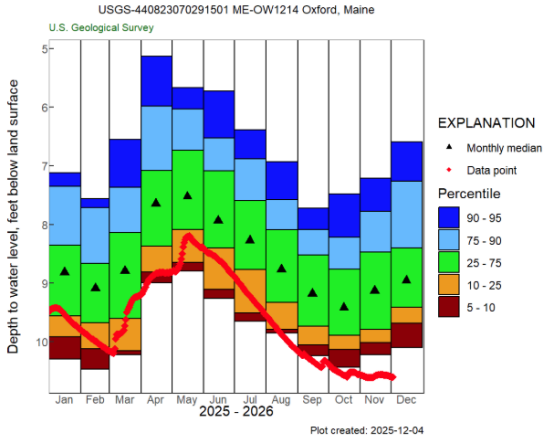
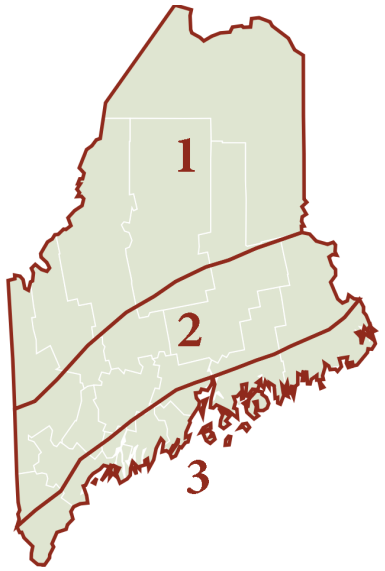
Northeast Regional Climate Center

Regional Precipitation





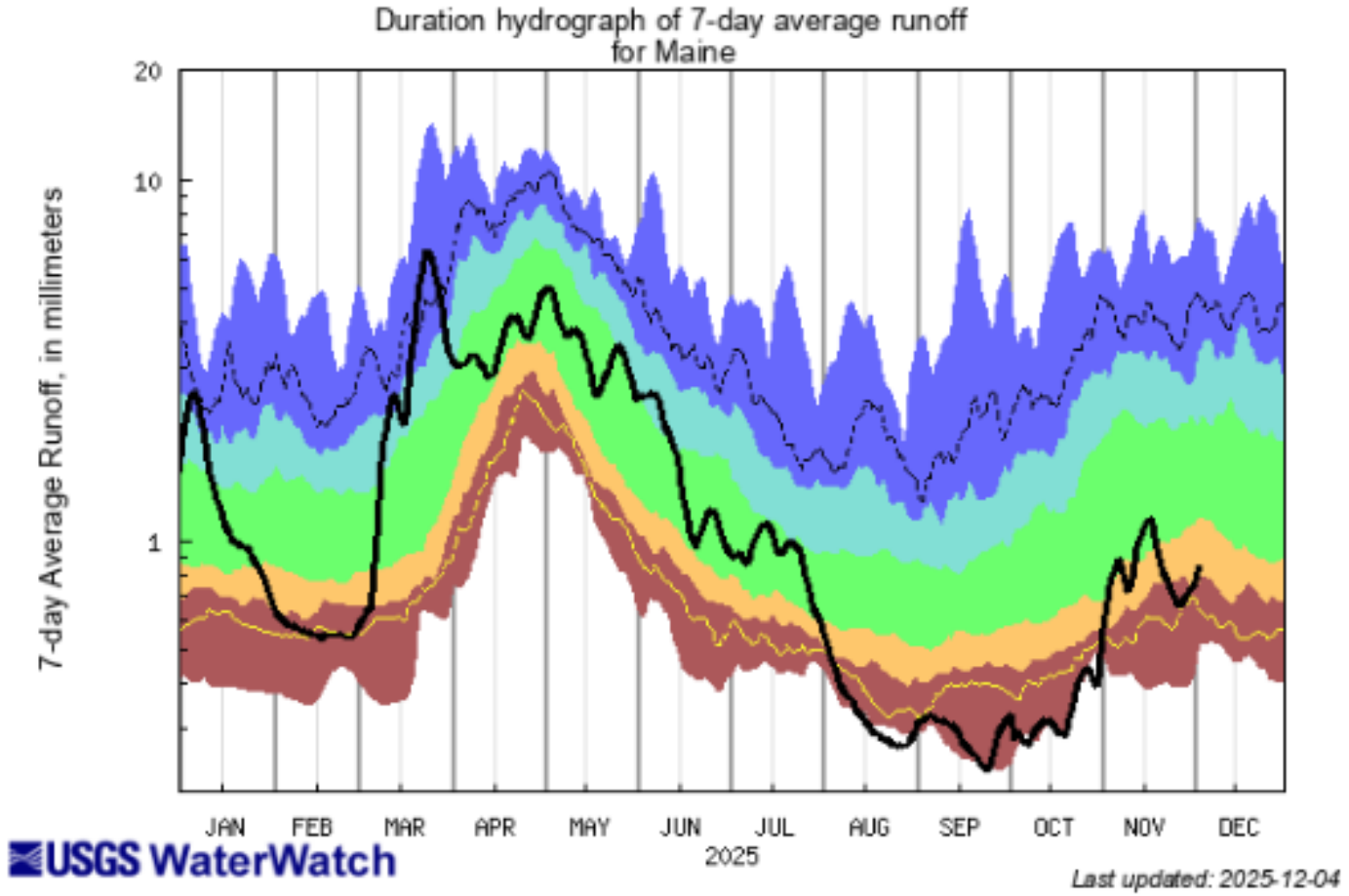
Rankings are for the 131 years between 1895 and 2025. 1=driest; 131=wettest.



	State				Northern				Southern Interior				Coastal			
	Average	Departure	Pct Normal	Rank	Average	Departure	Pct Normal	Rank	Average	Departure	Pct Normal	Rank	Average	Departure	Pct Normal	Rank
January	1.67	-1.6	51%	14	1.59	-1.4	53%	15	1.66	-1.82	48%	12	2.07	-1.84	53%	16
February	2.57	-0.21	92%	56	2.59	0.04	102%	79	2.43	-0.49	83%	39	2.8	-0.57	83%	36
March	4.34	0.99	130%	108	3.85	0.87	129%	109	4.84	1.2	133%	108	5.1	0.94	123%	100
April	4.46	0.75	120%	108	4.06	0.63	118%	109	4.7	0.76	119%	100	5.55	1.27	130%	108
May	5.18	1.5	141%	115	4.99	1.33	136%	115	5.29	1.62	144%	114	5.72	1.94	151%	113
June	3.71	-0.64	85%	68	3.95	-0.48	89%	70	3.5	-0.77	82%	67	3.2	-1.02	76%	64
July	2.39	-1.64	59%	9	2.95	-1.42	68%	20	1.73	-1.97	47%	7	1.69	-1.75	49%	10
August	1.95	-1.77	52%	10	2.22	-1.69	57%	17	1.66	-1.9	47%	11	1.59	-1.72	48%	16
September	2.51	-1.22	67%	31	2.15	-1.51	59%	20	3.05	-0.7	81%	52	2.72	-1.25	69%	42
October	3.53	-1.32	73%	57	3.79	-0.82	82%	75	3.24	-1.83	64%	48	3.15	-2.12	60%	44
November	2.77	-1.21	70%	33	2.77	-0.83	77%	39	2.71	-1.62	63%	24	2.97	-1.71	63%	28

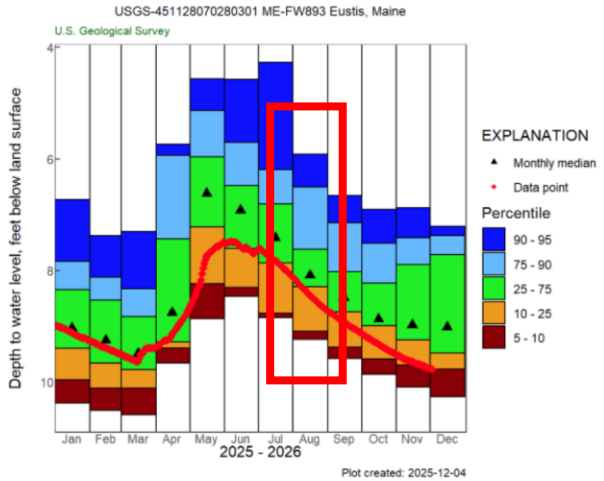
https://www.nrcc.cornell.edu/regional/tables/tables.html

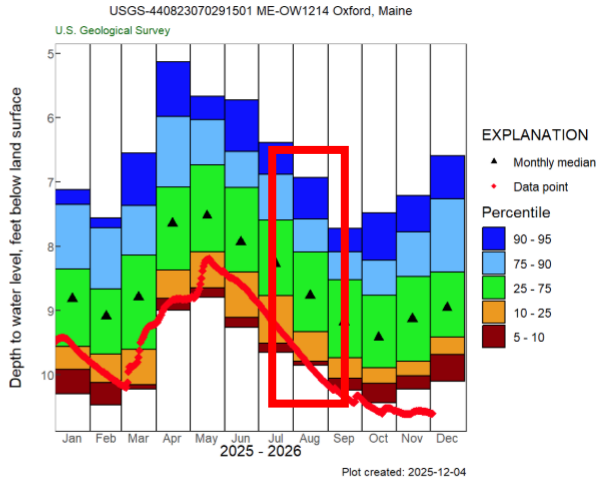
Surface Water

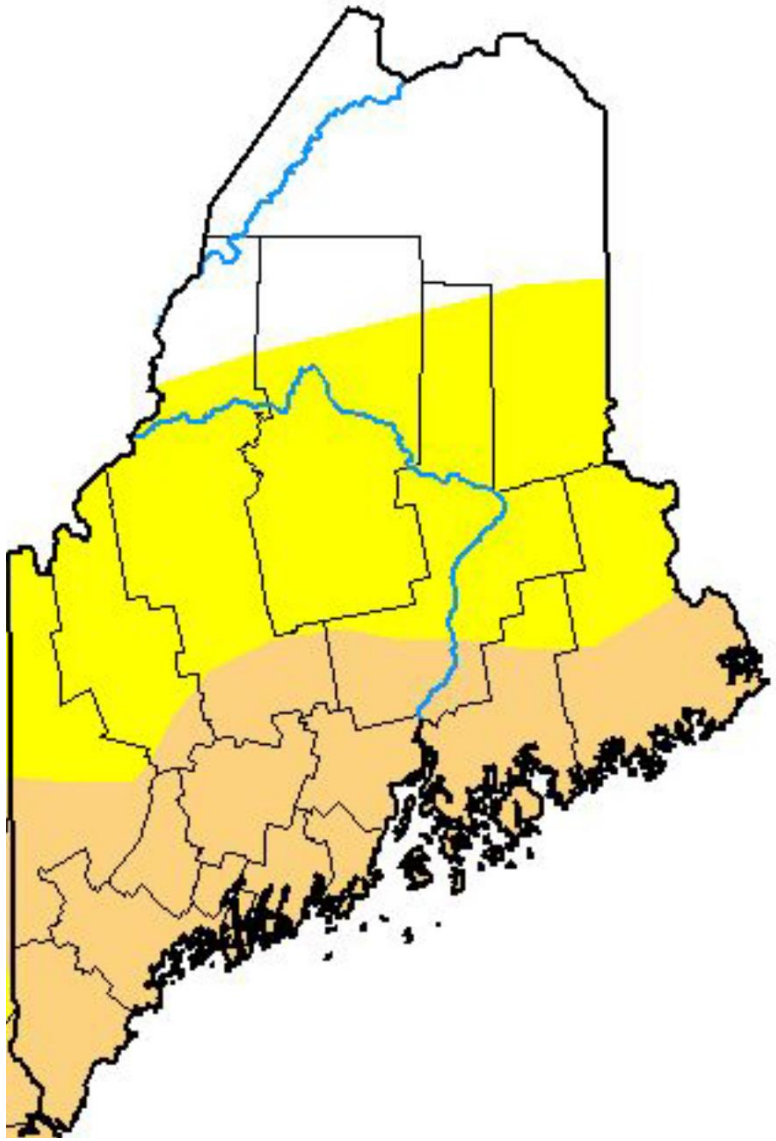


USGS 7-Day Streamflow Runoff Duration Hydrograph for Maine (left) and New Hampshire (right) based on the percentile of existing streamflow records on this day of the year.

August 12, 2025







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

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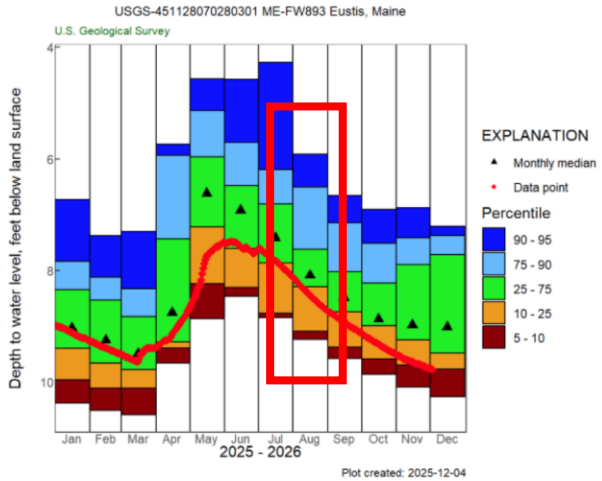
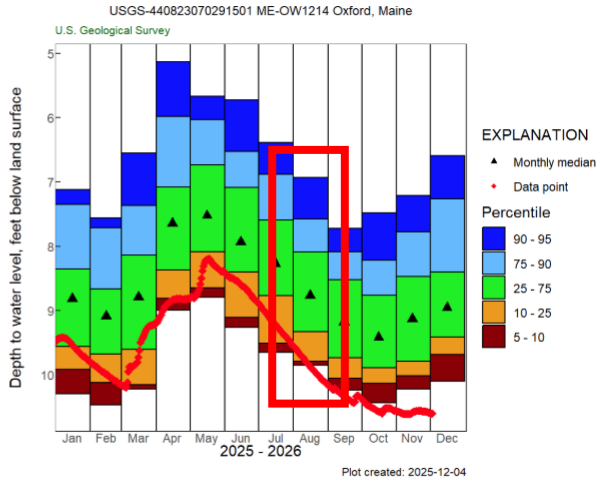
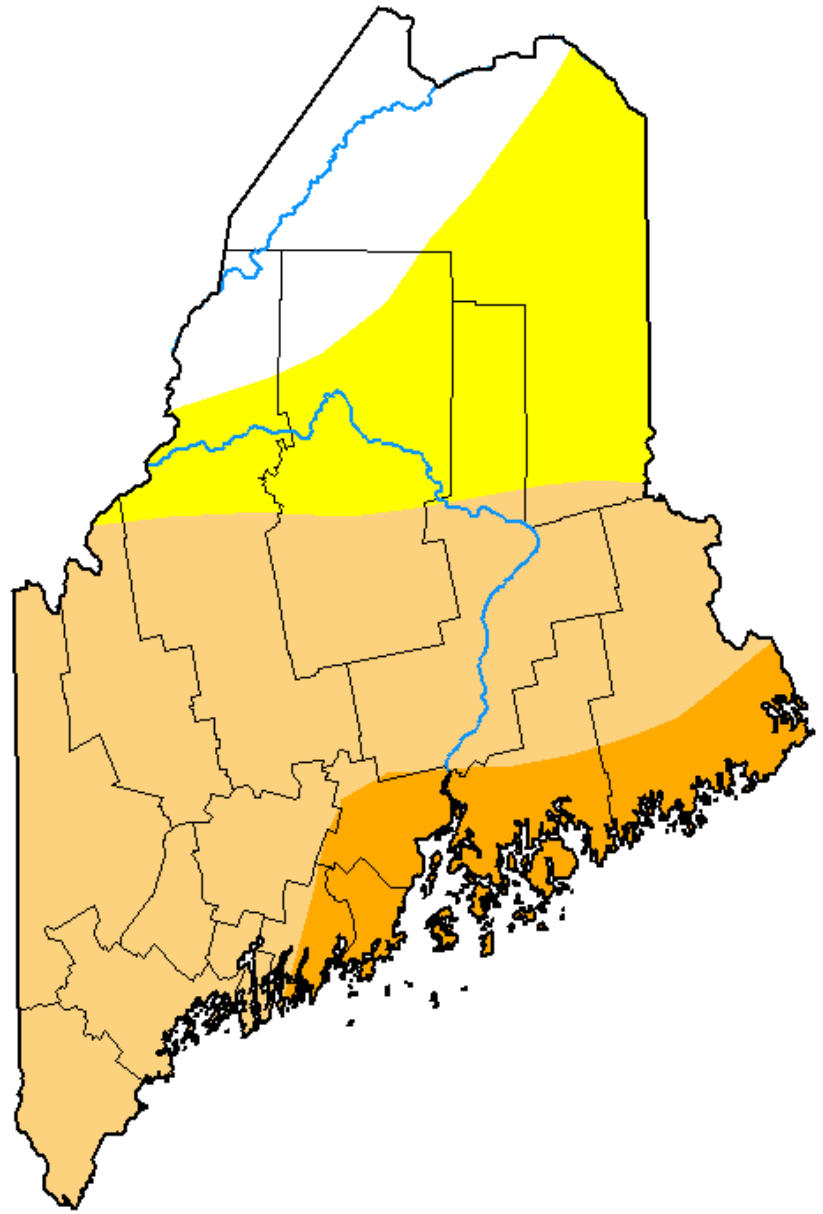
August 26, 2025







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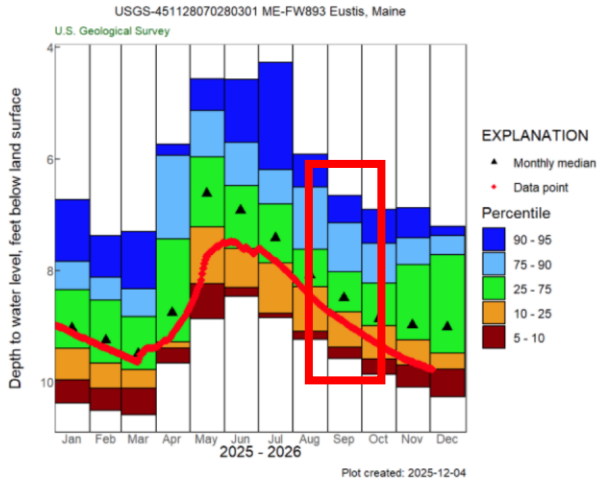
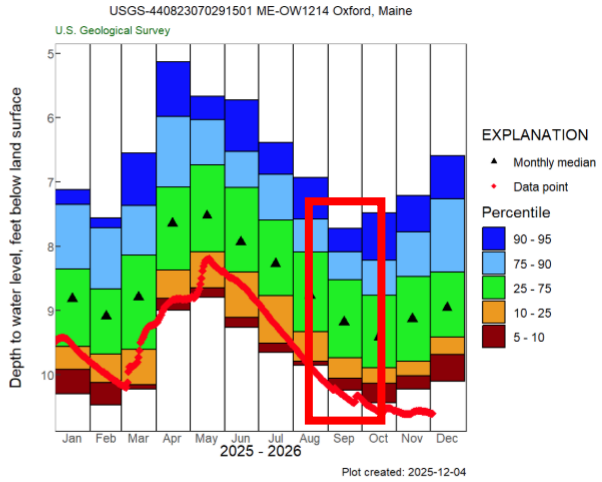
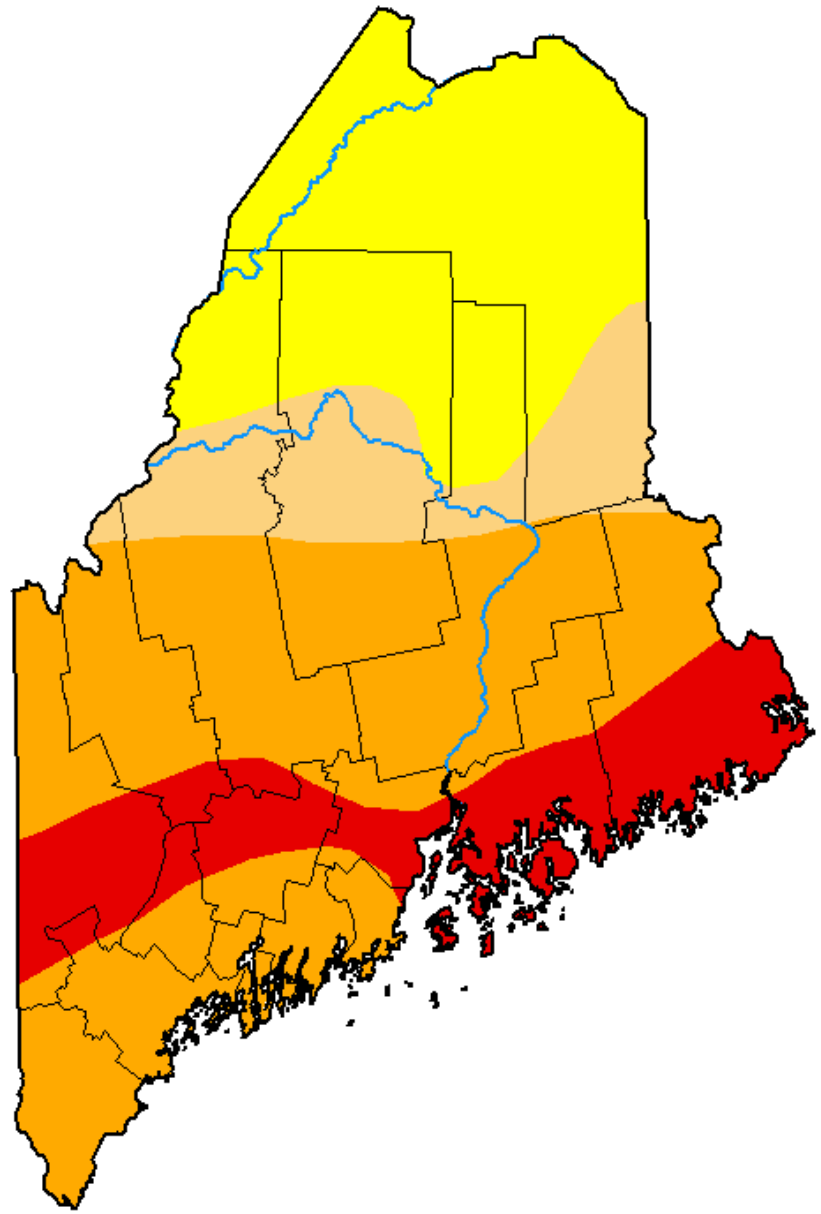
September 30, 2025







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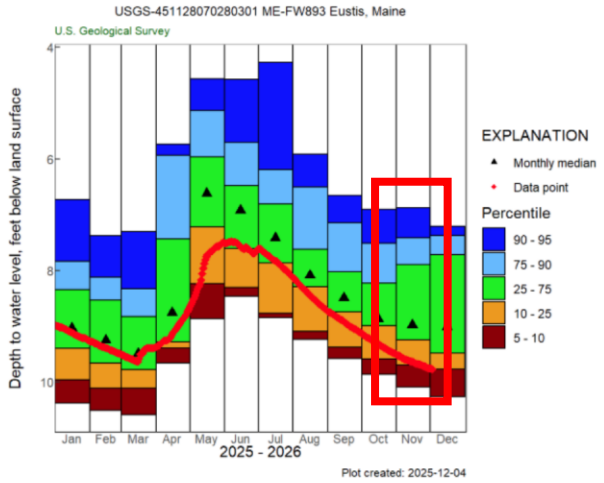
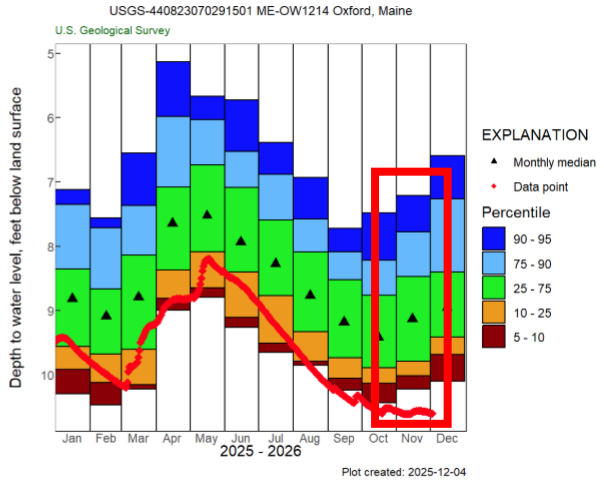
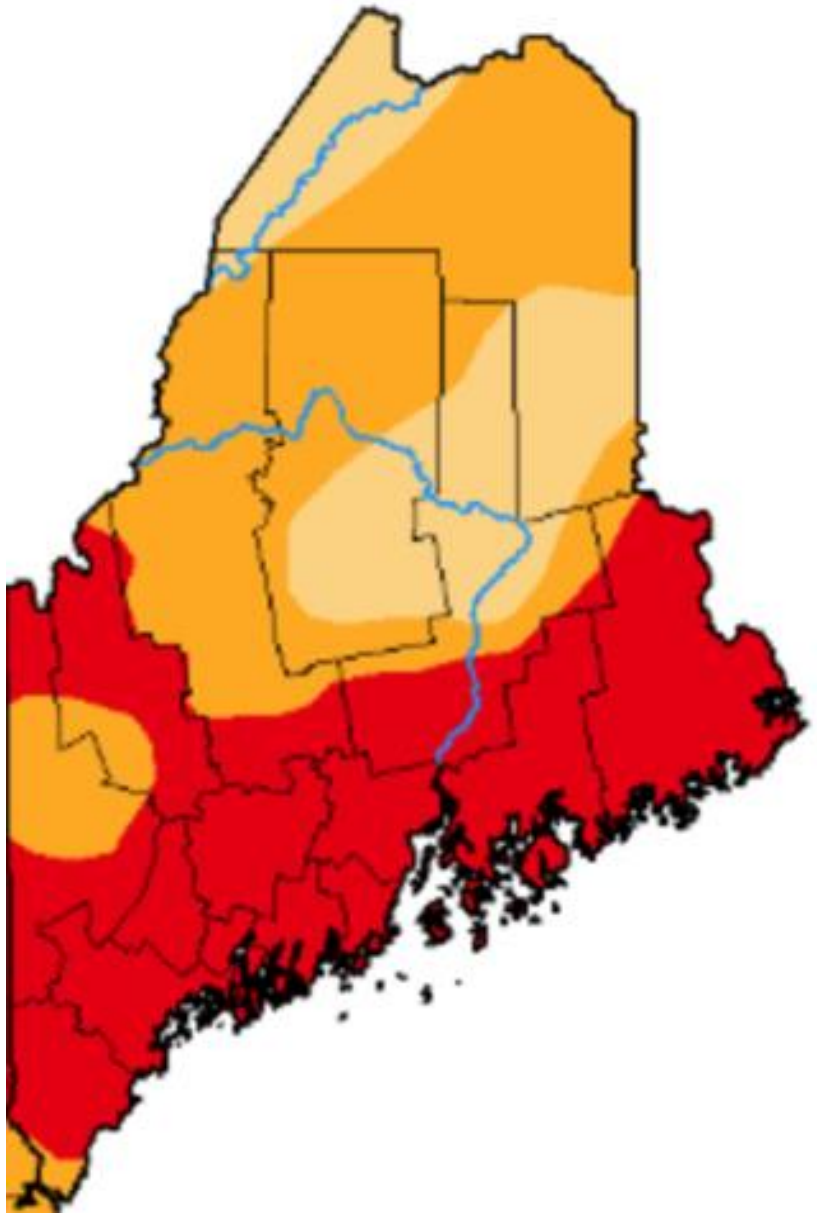
November 4, 2025







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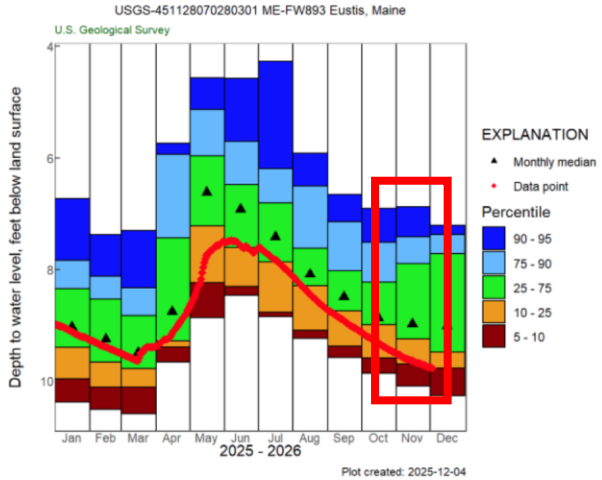
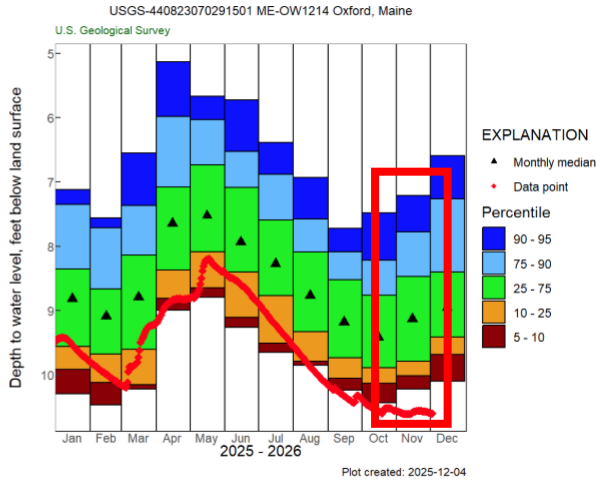
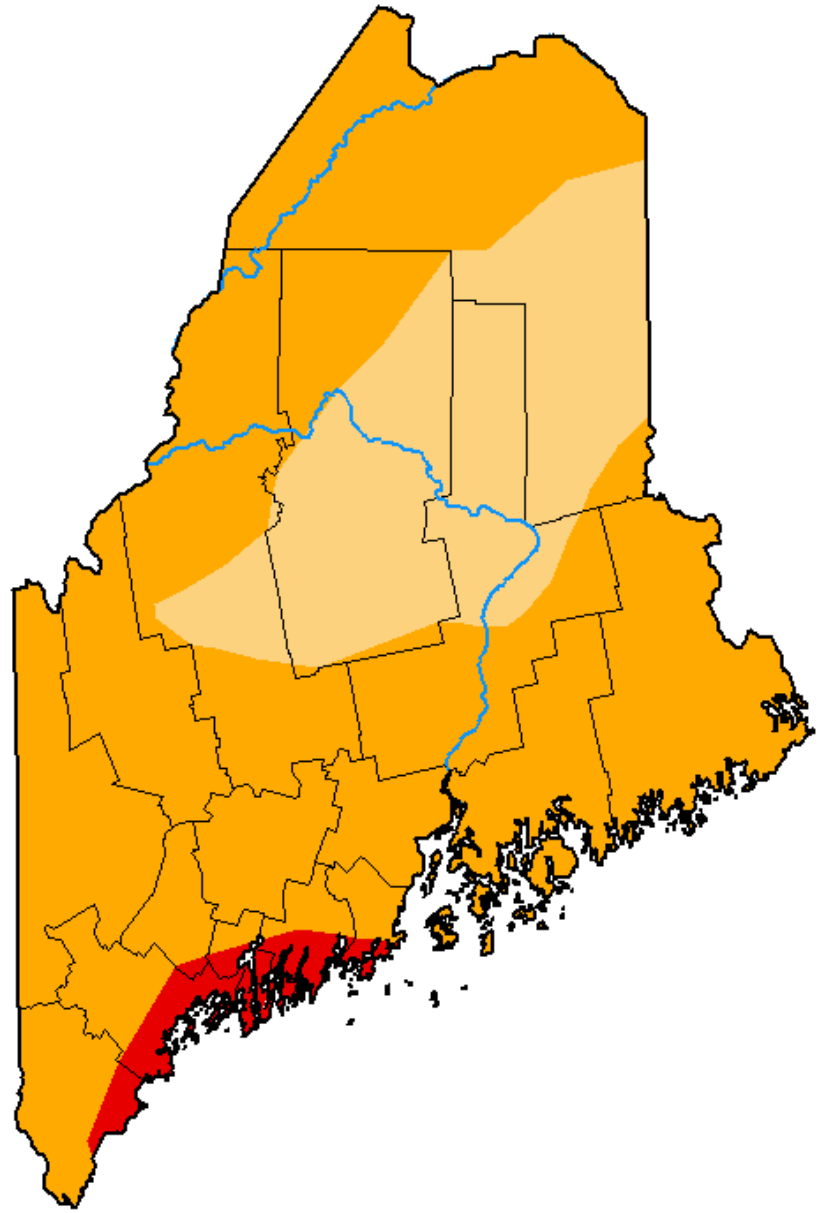
November 18, 2025







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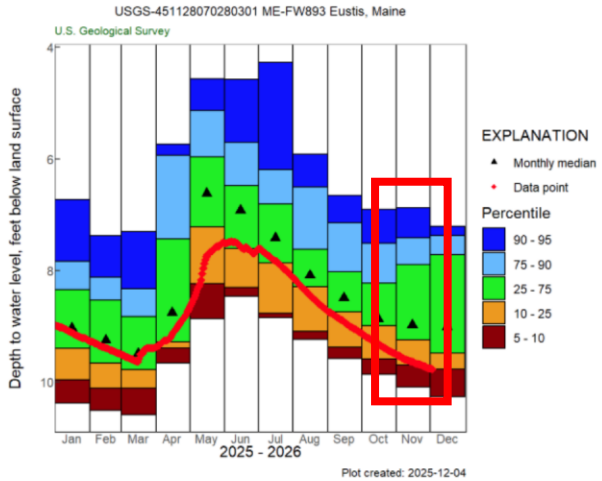
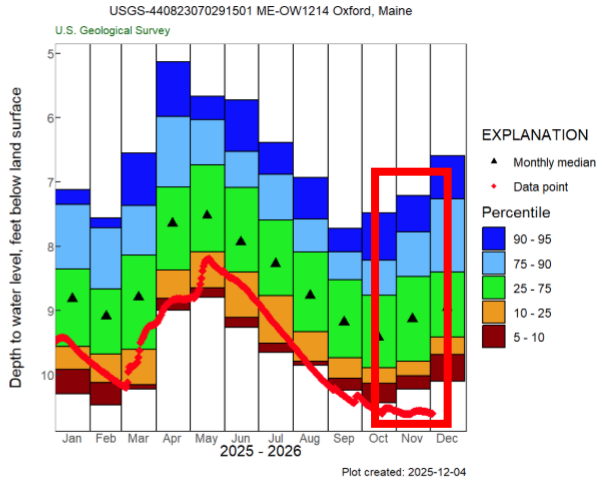
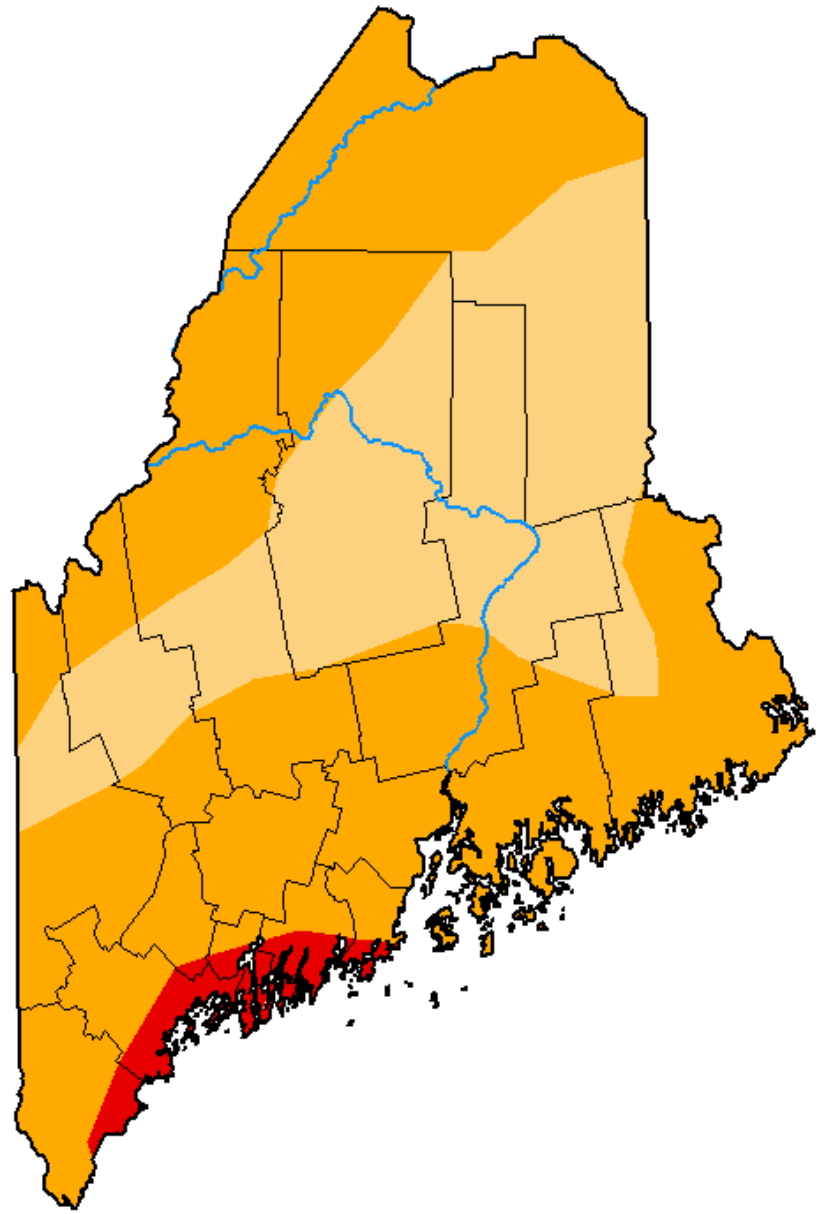
November 25, 2025







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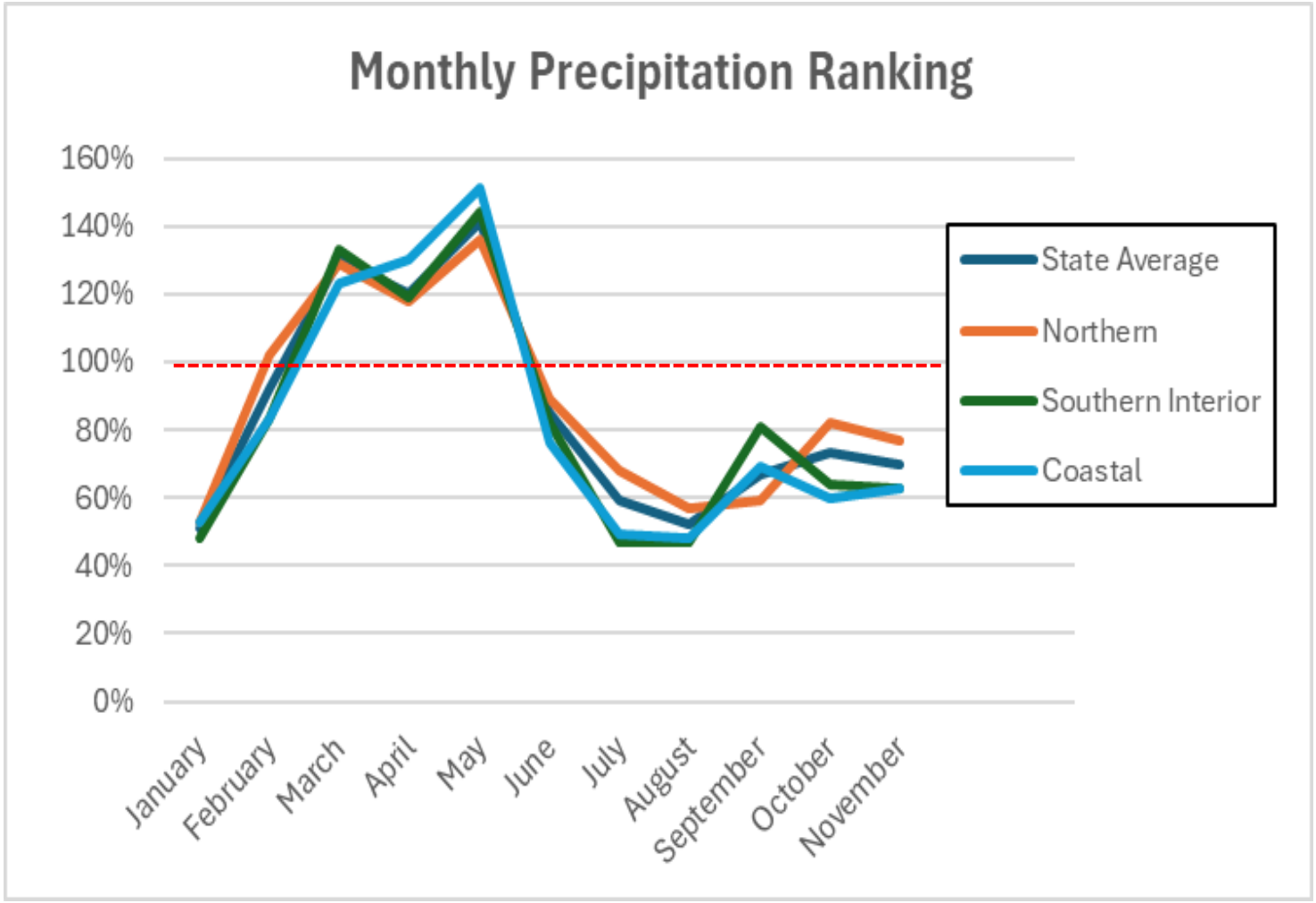
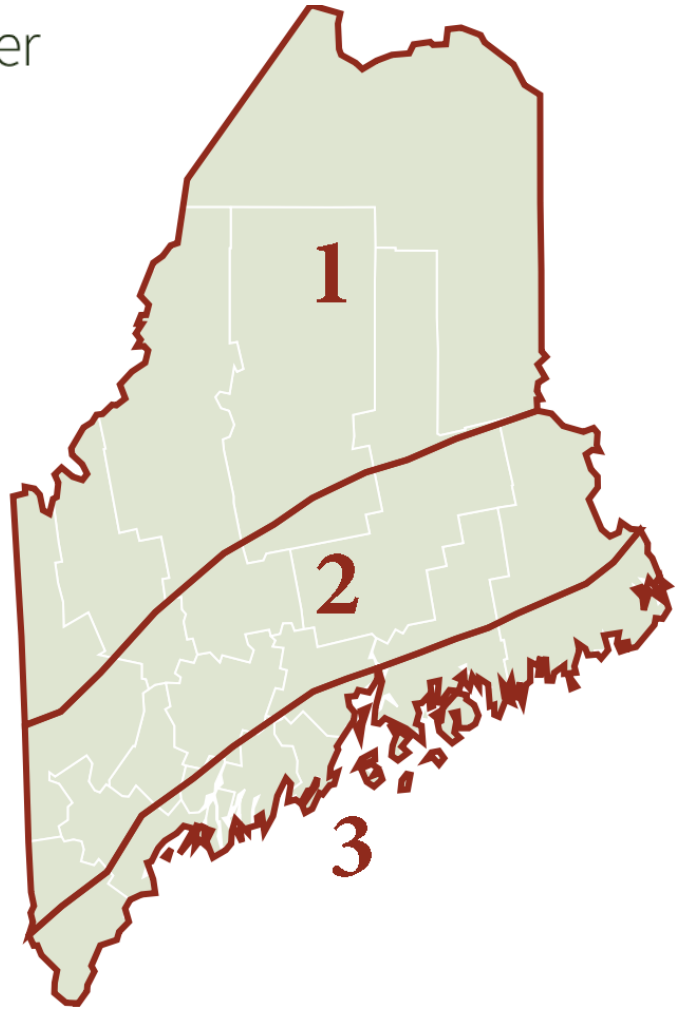
Northeast Regional Climate Center





Percent normal are calculated using the 1991-2020 normals.

https://www.nrcc.cornell.edu/regional/tables/tables.html

Overview

- Entered 2024/25 winter in a moderate drought (southern ME) and abnormally dry (central – northern ME).
- Received a below average snowpack for the early part of 2024/25 winter.
- Above average precipitation in spring caused surface waters to regain average flows through the spring and early summer but did little to restore our groundwater conditions to the long-term levels.
- Entering 2025/26 winter in worse drought conditions than the 2024/25 winter.
- 6-12 inches of precipitation needed to fully alleviate soil moisture and groundwater deficits.

Water Resources Web Portal and Water Use Data

Mary Szatkowski

Hydrogeologist, Maine Geological Survey

Landing Page for Water Resource Information

https://www.maine.gov/dacf/mgs/explore/water/index.shtml

Maine's Water Resources

Overview

- Precipitation: Water that falls to the Earth's surface from the atmosphere as rain, sleet, or snow. Average annual precipitation is 46 inches, or 28 trillion gallons.
  - Maine Cooperative Snow Survey | Maine Geological Survey
  - NOAA Meteorological Station Data: NOAA NCEI U.S. Climate Normals Quick Access
- Evapotranspiration: About 35% of precipitation, or 9.9 trillion gallons annually, is transferred from the land to the atmosphere by evaporation and plant transpiration.
- Run-off: About 50% of precipitation, 14.1 trillion gallons annually, runs-off the landscape to surface waters.
- Infiltration to groundwater: About 15% of precipitation, 4.2 trillion gallons annually, infiltrates the ground and recharges groundwater aquifers.
- Drought: Prolonged period of abnormally low rainfall, corresponding with dry soil, low groundwater levels, and low stream/lake levels.
  - Drought monitor Maine | U.S. Drought Monitor
  - Drought Task Force | Maine Emergency Management Agency
  - Dry Well Survey | Maine Drought Task Force
- Our virtual tour is a series of photos which portray issues related to water supplies, wells, and environmental issues.
- Frequently Asked Questions
- USGS: Learn About Water
- Maine Water Resources Planning Committee

▸ Surface Water

▸ Groundwater and Wells

▸ Water Use

Water Use Studies

- Maine generally receives a lot of water. Demands are concentrated to certain areas and seasons. Climate, industry, and social changes will continue to adjust demand.
- There has been a lot of collection and analyses of water withdrawal data within the State
- There is lack in public facing conclusions
- What has been done? What can be updated or expanded upon? How best to present this information to Maine public?

What water use data collection and analyses has been done?

Maine Water Withdrawal Reporting Program

Water Use in Million Gallons											
Type of Use	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Water Utilities	33,800	34,400	33,500	33,600	29,355	31,065	31,000	33,400	31,905	24481	23637
Paper Mills	70,000	66,000	63,000	57,900	64,919	67,532	60,504	66,700	62,856	60398	60372
Agriculture	861	719	622	514	1,691	1,380			1,488		
SnowMaking	590	559	606	863	537	660			765	756	757
Bottled Water	365	448	440	699	646	701	609	768	708	765	764

- Compilation of data reported to the state by statute Title 38, §470
- Annual legislative report for 2003 – 2007 data.
- Time-frame includes periods of drought as well as record setting precipitation
- Public Water Utilities reported to the Public Utilities Commission.
- Paper Mill wastewater discharge reported to DEP, a subset of 10 included
- Agricultural use reported to DACF. Greatest volumes for blueberries.
- Snow making use voluntarily reported to MGS. 5-8 reports per year.
- Bottled water use reported to DEP.

Maine Water Withdrawal Reporting Program

Water Use in Million Gallons			
Type of Use	2003-2013 Avg	Est % SW	Est % GW
Water Utilities	30,922	75	25
Paper Mills	63,653	100	0
Agriculture	1,039	35	65
SnowMaking	677	85	15
Bottled Water	628	0	100

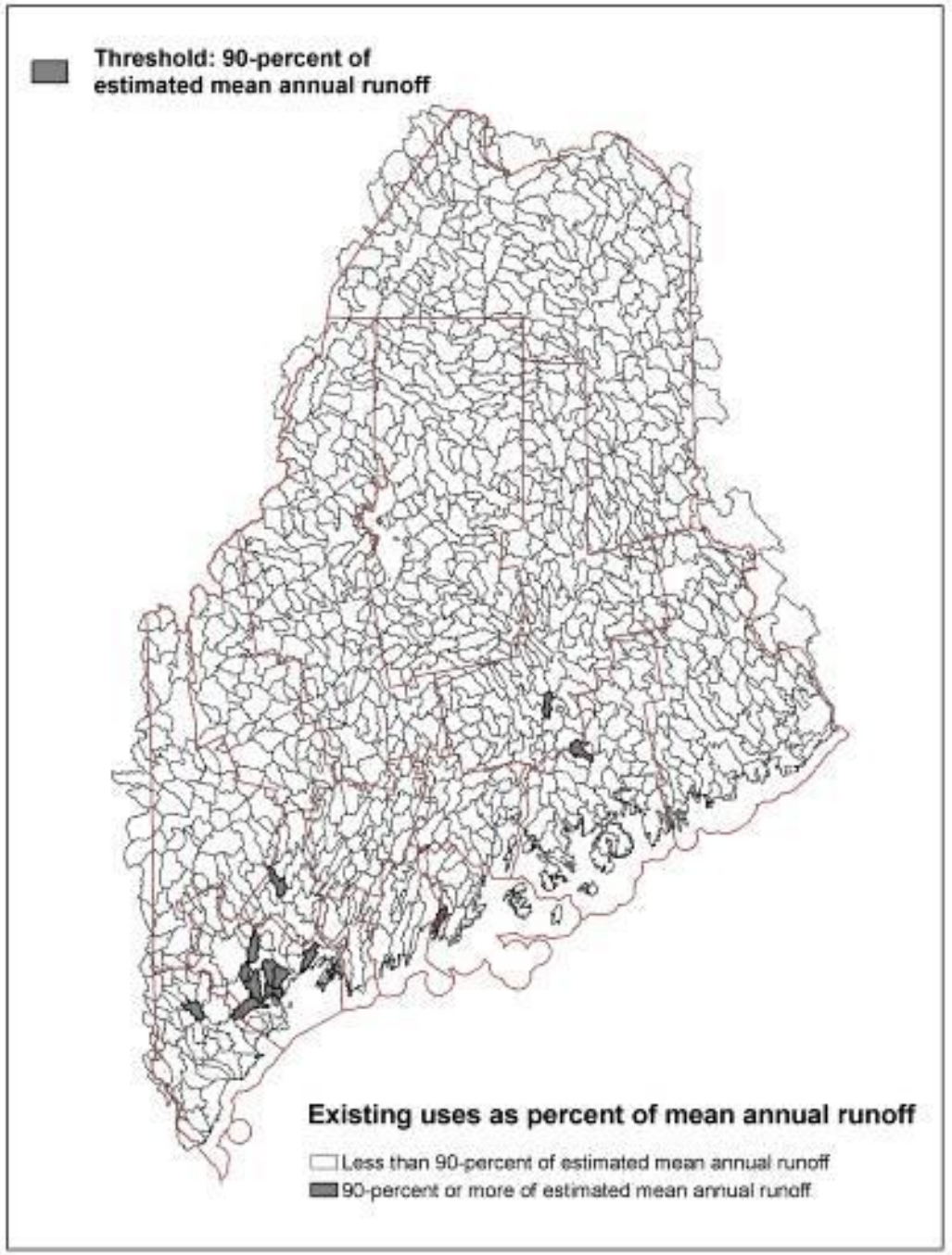
- Data complied statewide, by county, and by HUC 12. Shared with the USGS
- Paper mills had greatest annual withdrawal (assumed from wastewater reports). Discharge to same river that withdraw from.
- Agriculture varies largely with summer conditions, and reporting.
- Snow making data limited by reporting.
- Bottled water industry growth 2003-2013.

Additional work:

- 2002-2004 river low flow studies
- 2005 evaluation of Prestile Stream and Kenduskeag Steam watershed, identified as potentially stressed by multiple water uses
- 2005 golf course water use surveys

2006 Watersheds at Risk

- Determination of watersheds where surface water withdrawals > 90% annual runoff
- HUC 12 areas
- USGS annual runoff equations
- In-stream flow requirements
- Water use: industry, agriculture, public water systems, and private wells



USGS Water Use Data Research (WUDR)

- Cooperative agreement to improve water use estimates
  - Fill gaps in present program
  - Improve estimation methodology
  - Streamline and standardize process
  - Share data with USGS (by county and watershed)
- 2015-2022

WUDR: Agricultural Water Use Surveys

- 10 counties, 319 respondents, 62% reported water use. Qualitative and quantitative information for crops and livestock
- 3300 irrigated acres reported, 12% USDA total estimate
- Low reporting from York and Washington. Among other crops, underreported blueberries and cranberries
- Crop irrigation total 549 MG (avg 8.89 in or 6.2 in exposed area)

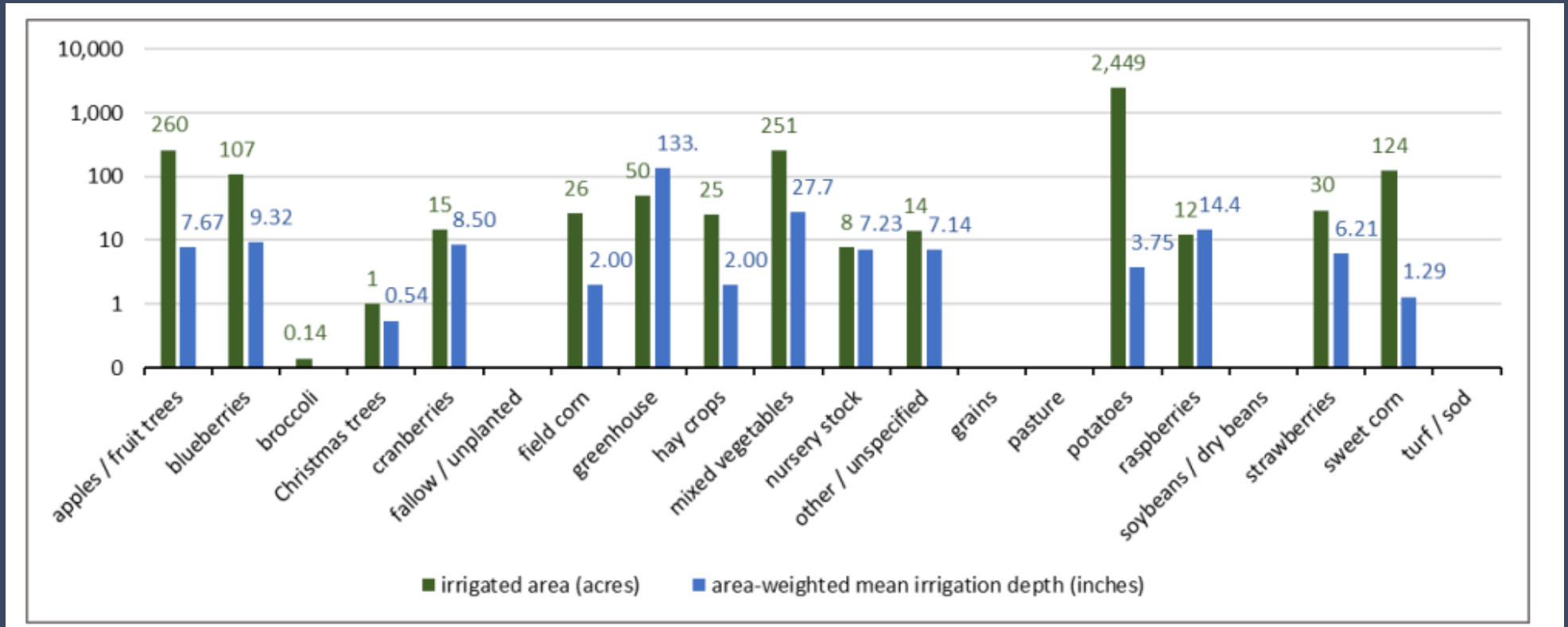


Figure 2. Total irrigated acres of each crop type reported by survey respondents, and area-weighted mean inches of water applied to each type of irrigated crop in all of 2016. Vertical axis scale is logarithmic.

https://digitalmaine.com/mgs_publications/539/

WUDR: Agricultural Water Use Surveys

- 26539 animals represented. Mostly poultry and dairy cows
- Total reported 103 MG statewide, plus 6.6 MG for livestock adjacent use

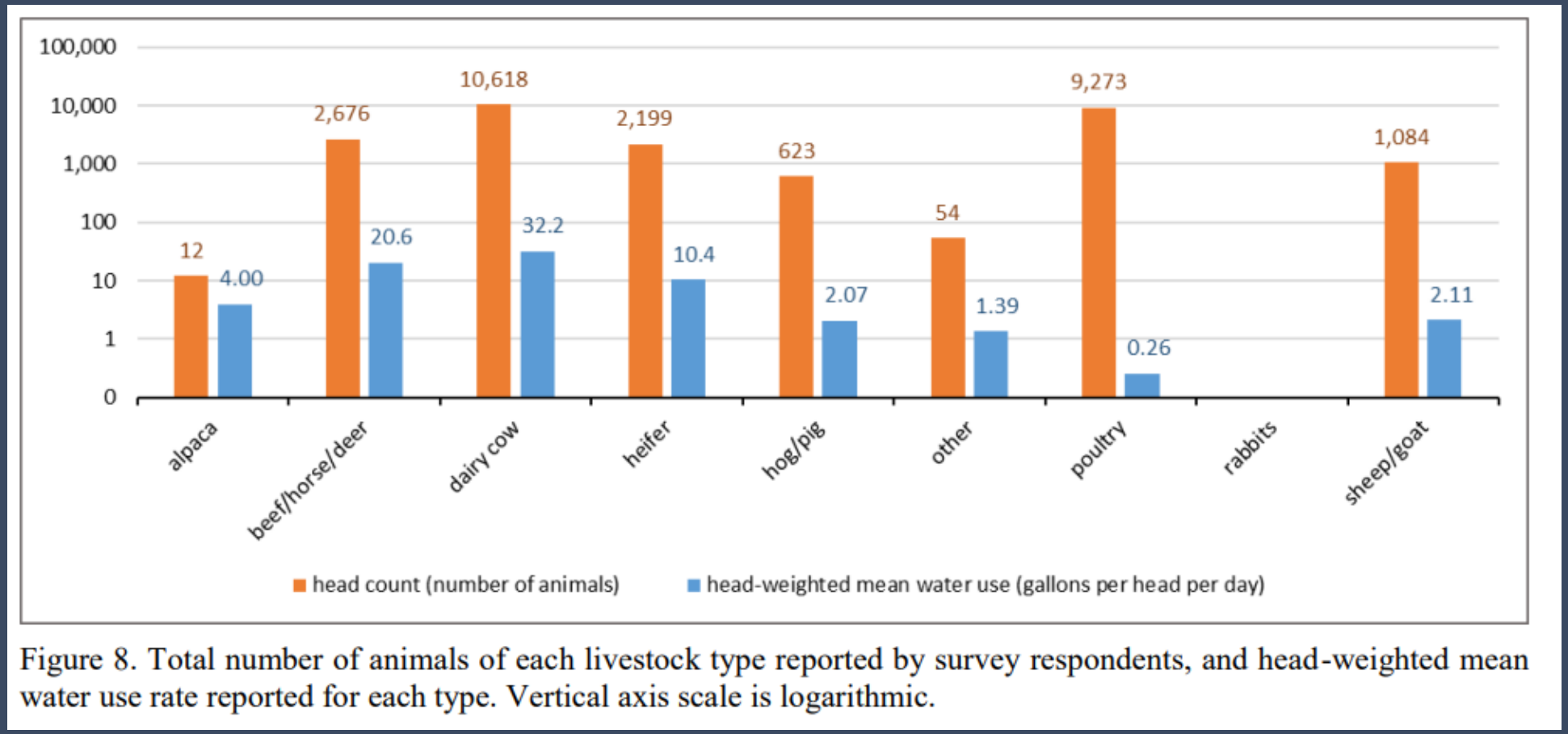
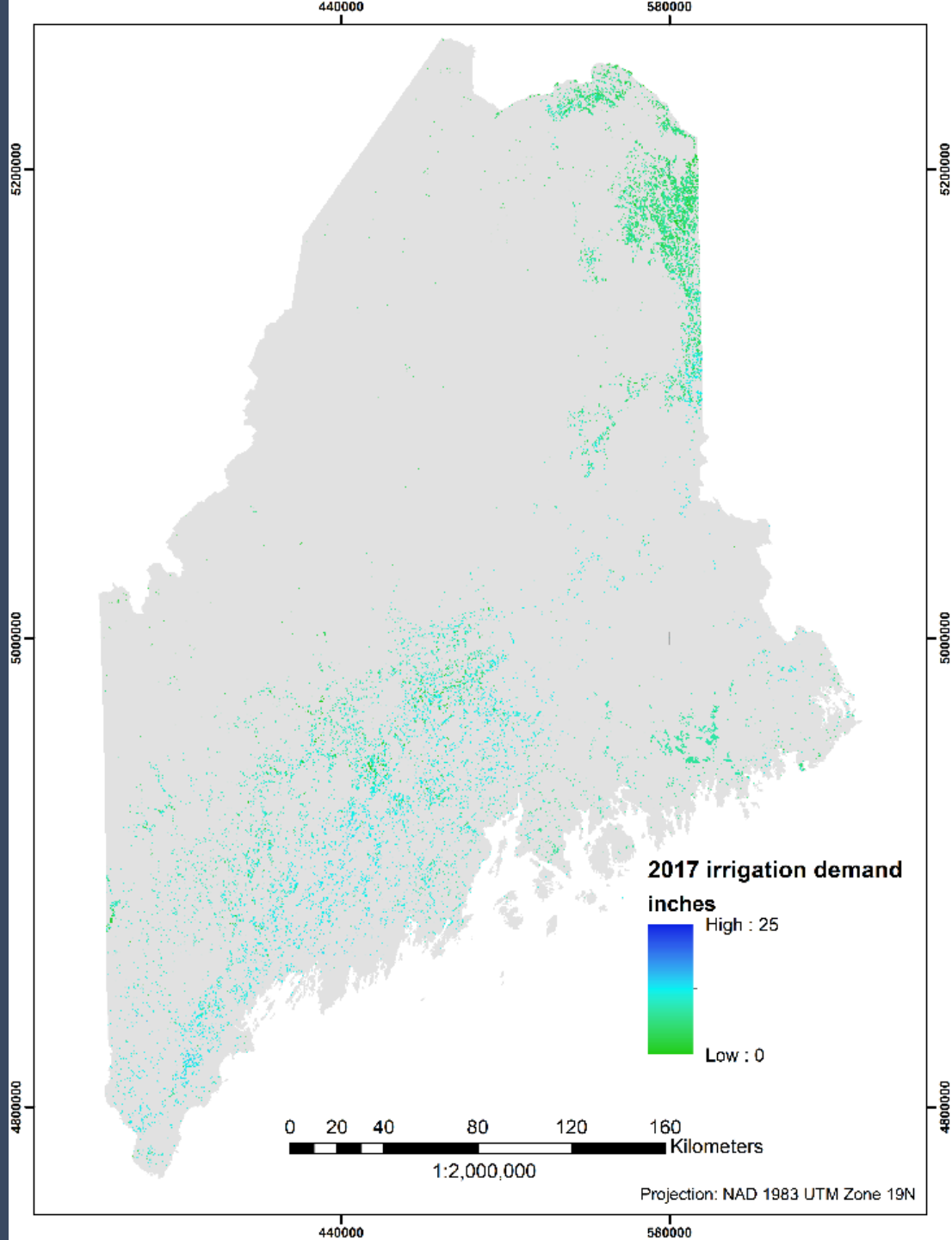


Figure 8. Total number of animals of each livestock type reported by survey respondents, and head-weighted mean water use rate reported for each type. Vertical axis scale is logarithmic.

https://digitalmaine.com/mgs_publications/539/

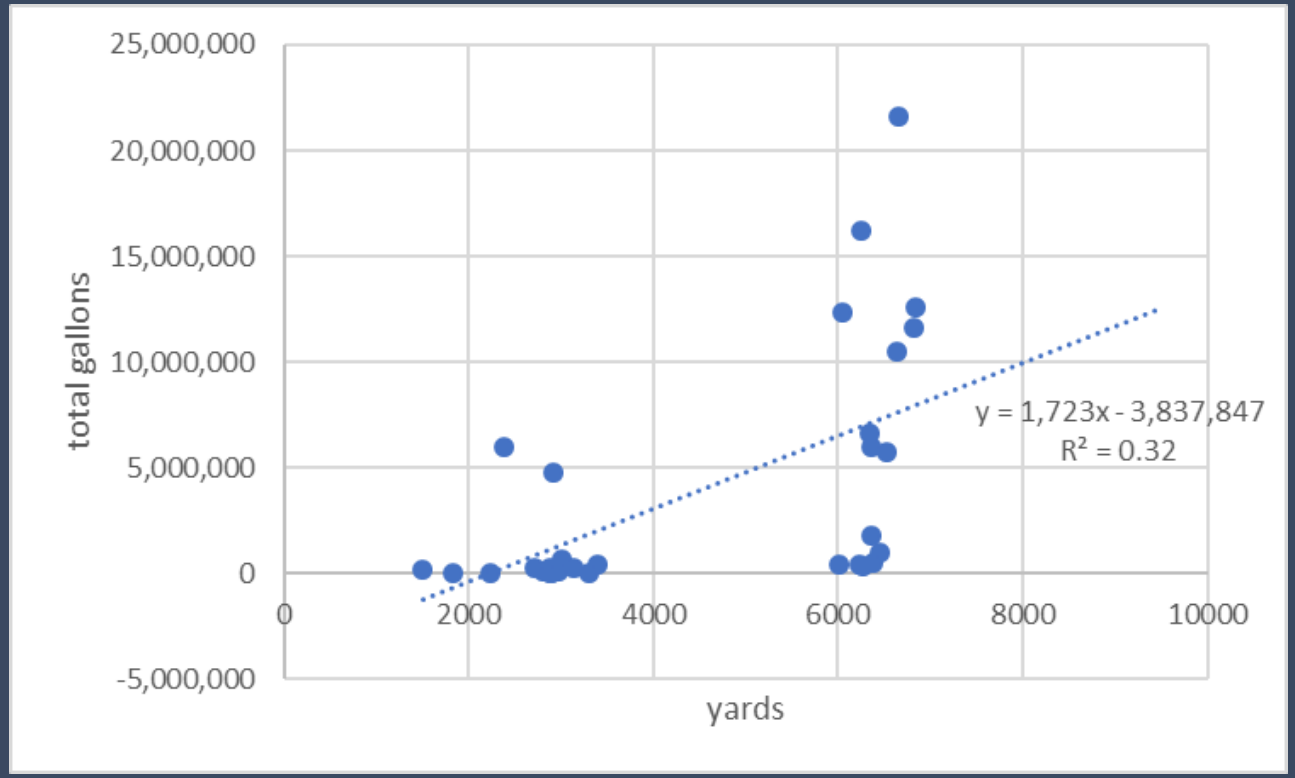
Agricultural Water Use Model

- USGS Soil Water Balance Mode
  - DayMet precipitation
  - Maine groundwater recharge model
  - Calibrate with crop usage 2013 USDA survey and 2016 MGS survey
- 2013: 7,226 MG
- 2016: 8,810 MG
- 2017: 9,436 MG
- Compare to 718 MG reported via surveys and average of 1,039 MG reported 2003-2011



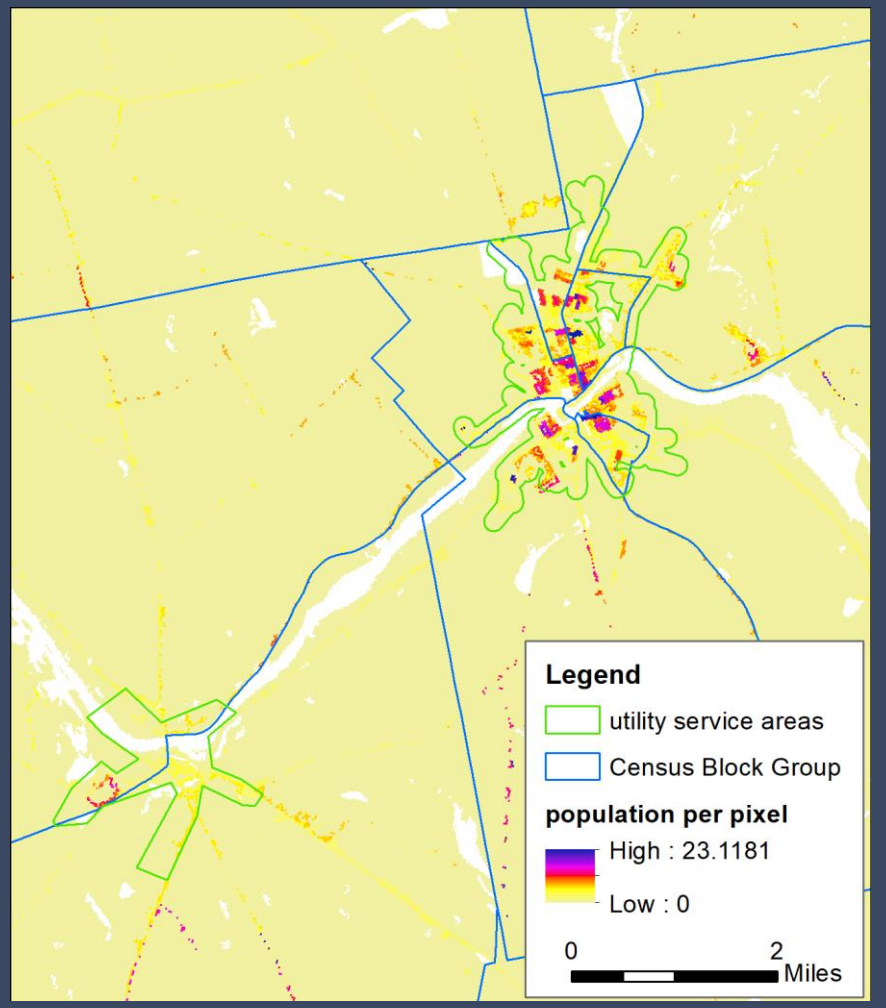
WUDR: 2017 Gold Course Surveys

- Survey responses from 46 (34%) golf courses
- Relationship between total annual gallons and total course yards used to estimate total usage.
- Calculated 545 MG for 2017
  - 3490 irrigated acres
  - 5.76 in



WUDR: Domestic Supply

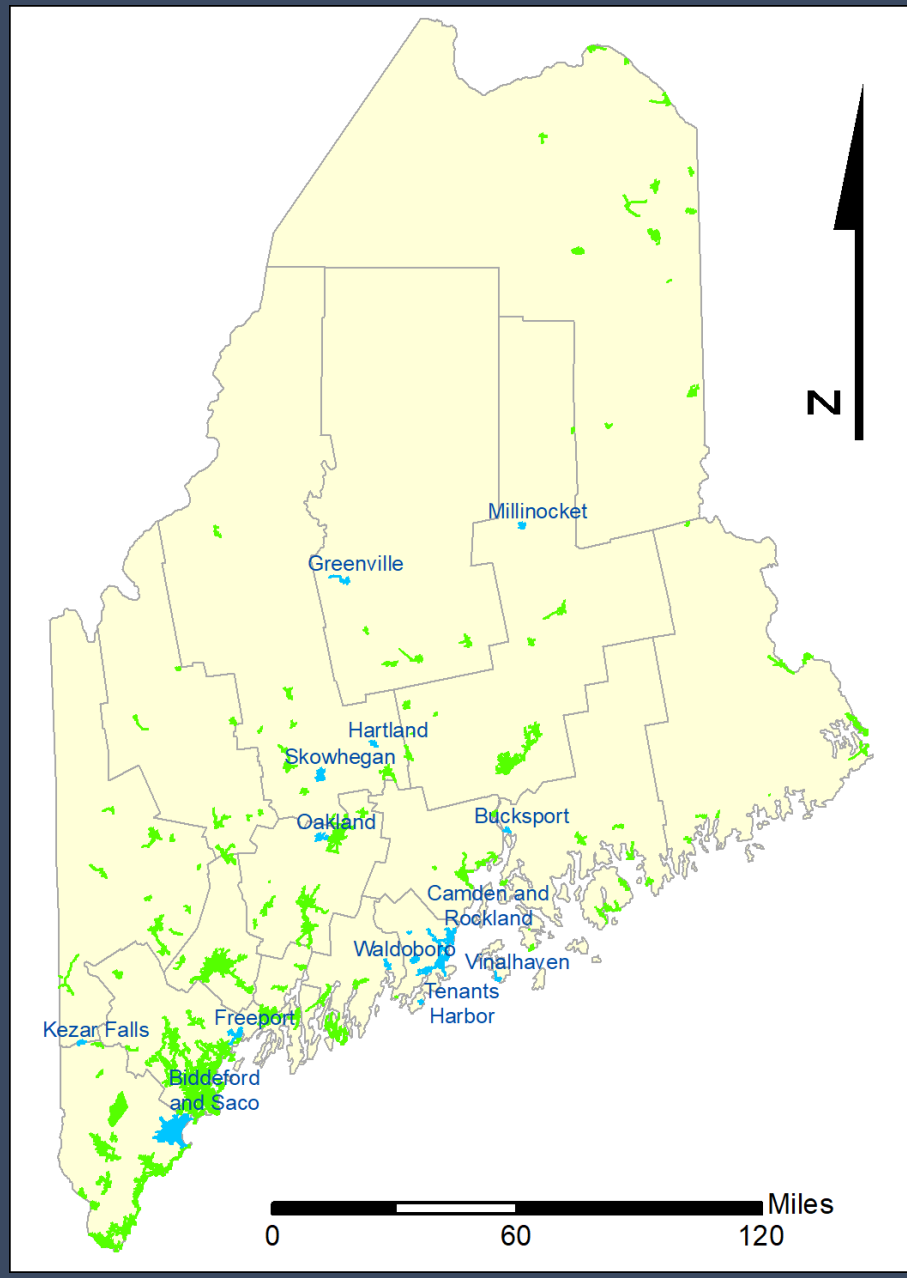
- Public water systems reports – residential
- Determine the number of people serviced
  - Safe Drinking Water Information System est 2.5 people per residential account
  - MGS determined population by mapping census data (rasterized from EPA) and utility service areas
  - → Average use / person in mapped service area
- Apply “average” to people in unmapped service areas as well as self serviced population
  - Across 14 water districts, average 68.5 gal per person per day. Variability pushed by seasonal visitors. Model of individual use by number of residents.



https://digitalmaine.com/mgs_publications/616/

WUDR: 2018 Domestic Supply

- State population: 1,339,057
  - Self supplied 666,772 (49,7%)
  - Utility supplied 672, 285 (50.3%)
- State residential use:24.6 BG
  - Self supplied 11.9 BG (48%)
  - Utility supplied 12.7 BG (52%)
- Total PWS withdrawal: 31B
  - Compare to 2003-2013 average 30.9 BG

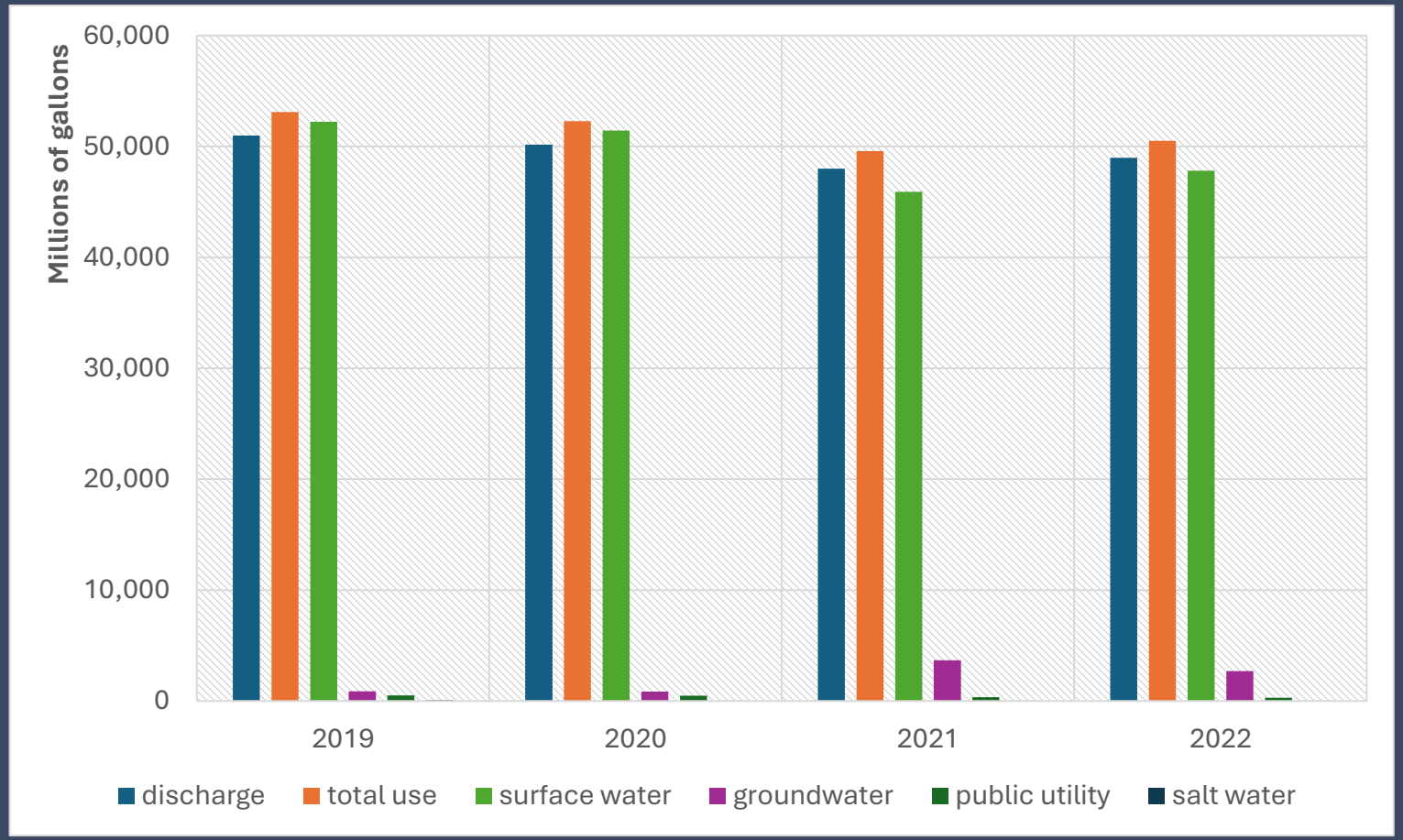


131 mapped PWS service areas

https://digitalmaine.com/mgs_publications/616/

WUDR: Industrial Supply

- 25 industrial users evaluated
- DEP wastewater discharge data
- Surveyed users to determine consumptive ratio
  - 16 responses
  - Ranged from 0.97 (pulp mill) to 3 (sawmill)
- Thermoelectric use not separated
- Total annual use about 50 BG

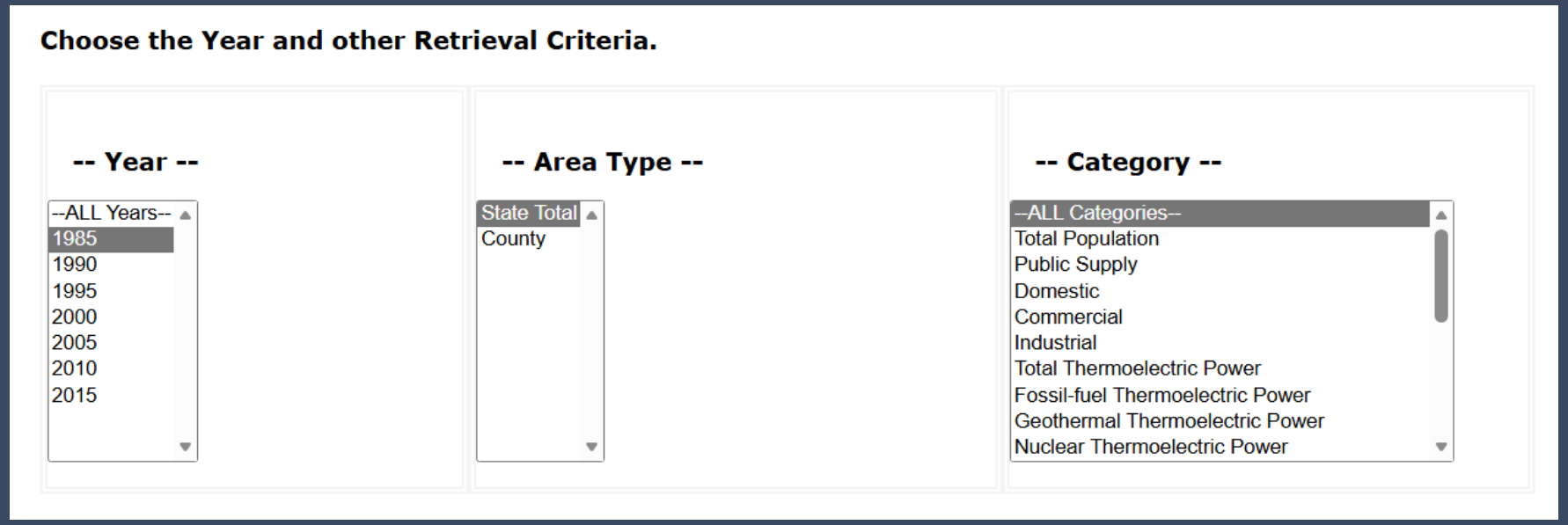


WUDR: 2019-2021 Snow Making Surveys

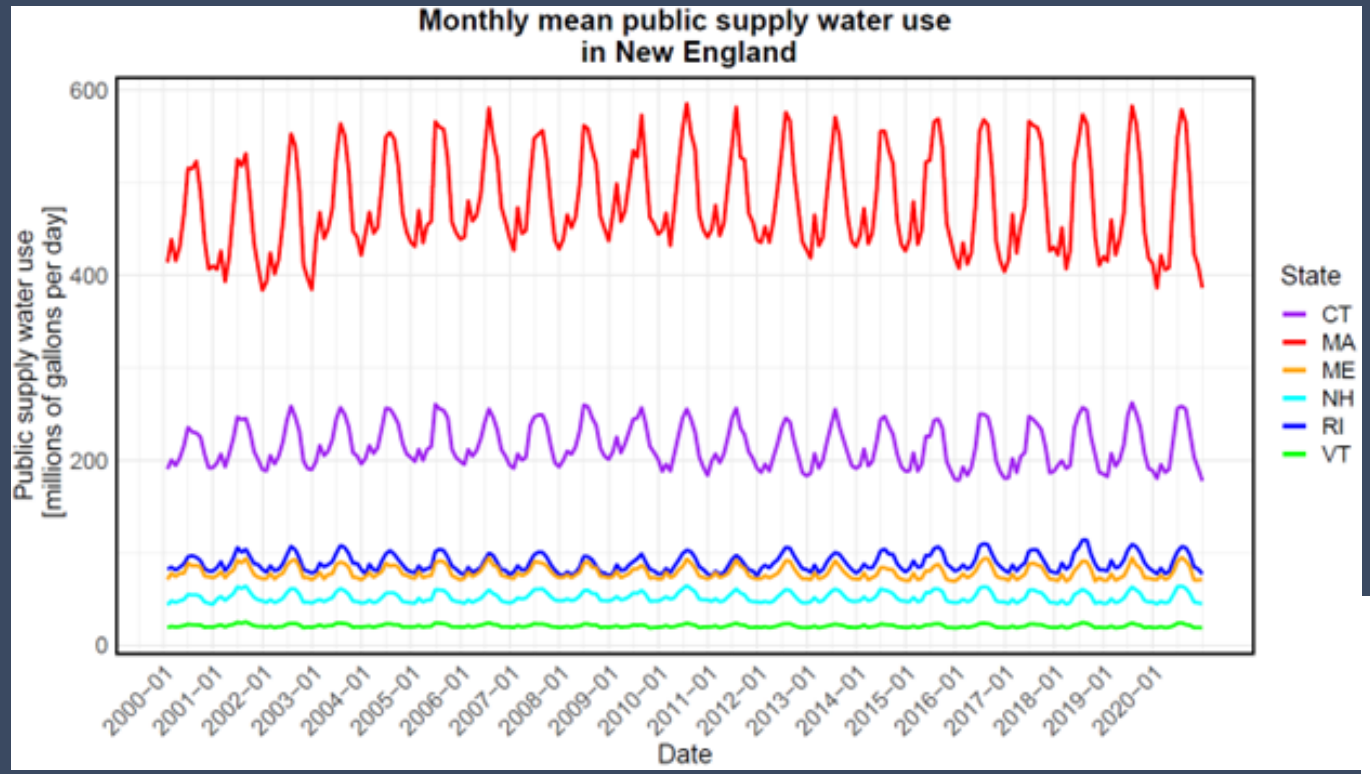
- Outreach to 21 ski areas
  - Responses from 15, 10 reported making snow, only half had water use estimates
  - 684 MG 2019-2020 season
  - 752 MG 2020-2021 season
  - Exclusively surface water
  - Compare to 2003-2013 average 677 MG and 85% surface water

USGS Water Use Data for Maine

- Derived from Federal and State reporting
- Public supply, Domestic, Commercial, Industrial, Thermoelectric, Mining, Livestock, Irrigation, Aquaculture, Hydroelectric, Wastewater Treatment
- https://waterdata.usgs.gov/me/nwis/water_use/



USGS: Public supply water use reanalysis for the 2000-2020 period by HUC12, month, and year for the conterminous United States (2024)



- Public supply is largest category of freshwater use.
- Relatively consistent year-year.
- More water use in summer
- Largely function of population

https://www.sciencebase.gov/catalog/item/65f86970d34e97daac9ff4c8

https://www.usgs.gov/centers/new-england-water-science-center/science/new-england-water-use

Child Items (9)

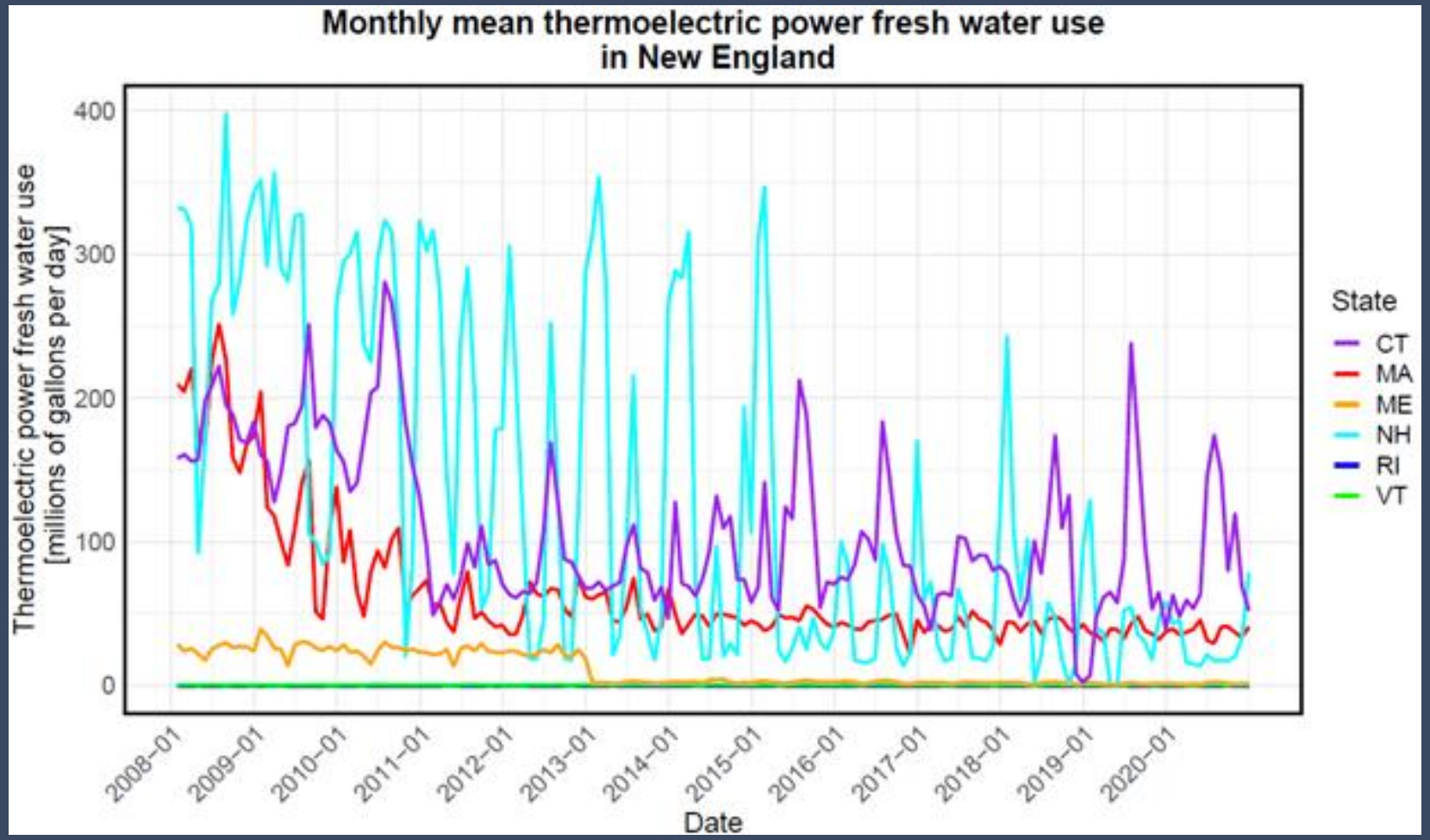
- Machine learning model that estimates public-supply deliveries for domestic and other use types
- Machine learning model that estimates total monthly and annual per capita public-supply water use (version 2.0)
- National watershed boundary (HUC12) dataset for the conterminous United States, retrieved 10/26/2020
- Python code used to determine average yearly and monthly tourism per 1000 residents for public-supply water service areas
- Python code used to download gridMET climate data for public-supply water service areas
- Python code used to download U.S. Census Bureau data for public-supply water service areas
- R code that determines buying and selling of water by public-supply water service areas
- R code that determines groundwater and surface water source fractions for public-supply water service areas, counties, and 12-digit hydrologic units
- R code used to estimate public supply consumptive water use

Thermoelectric-power condenser duty estimates by month and cooling type for use to calculate water use by power plant for the 2008-2020 reanalysis period for the conterminous Unites States (2023)

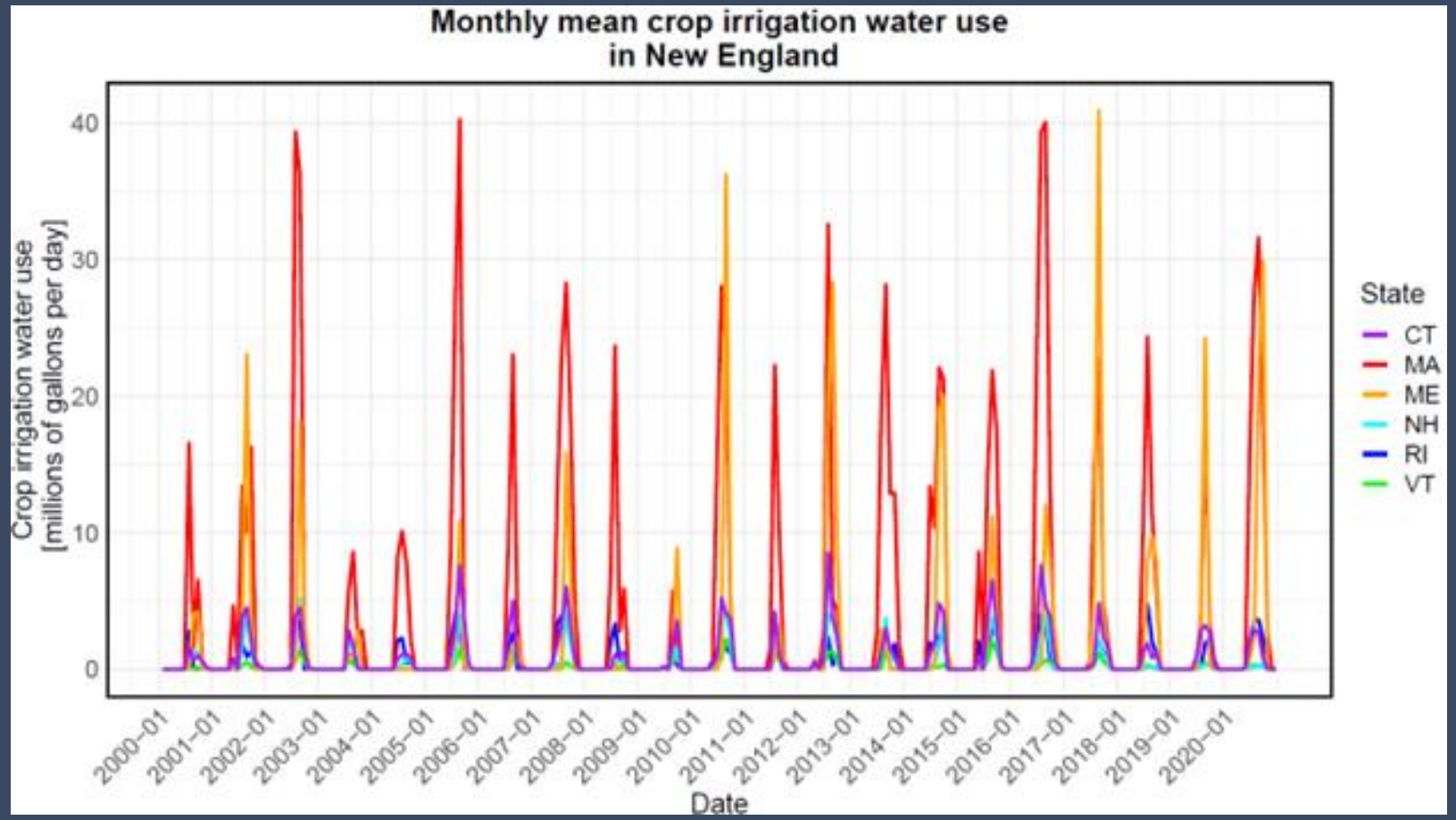
- Overall decline in number of facilities as coal-fire plants are being retired. 2008-15; 2020-11
- Winter and summer peaks reflect electric demand for heating and cooling

https://www.sciencebase.gov/catalog/item/63dbfac3d34e9fa19a98a10f

https://www.usgs.gov/centers/new-england-water-science-center/science/new-england-water-use



Irrigation water use reanalysis for the 2000-20 period by HUC12, month, and year for the conterminous Uniter States (2024)



- Categories that use the most irrigation are greenhouse, potatoes, blueberries, and mixed vegetables
- Peak July / August

https://www.sciencebase.gov/catalog/item/639a11b9d34e0de3a1f0ddde

https://www.usgs.gov/centers/new-england-water-science-center/science/new-england-water-use

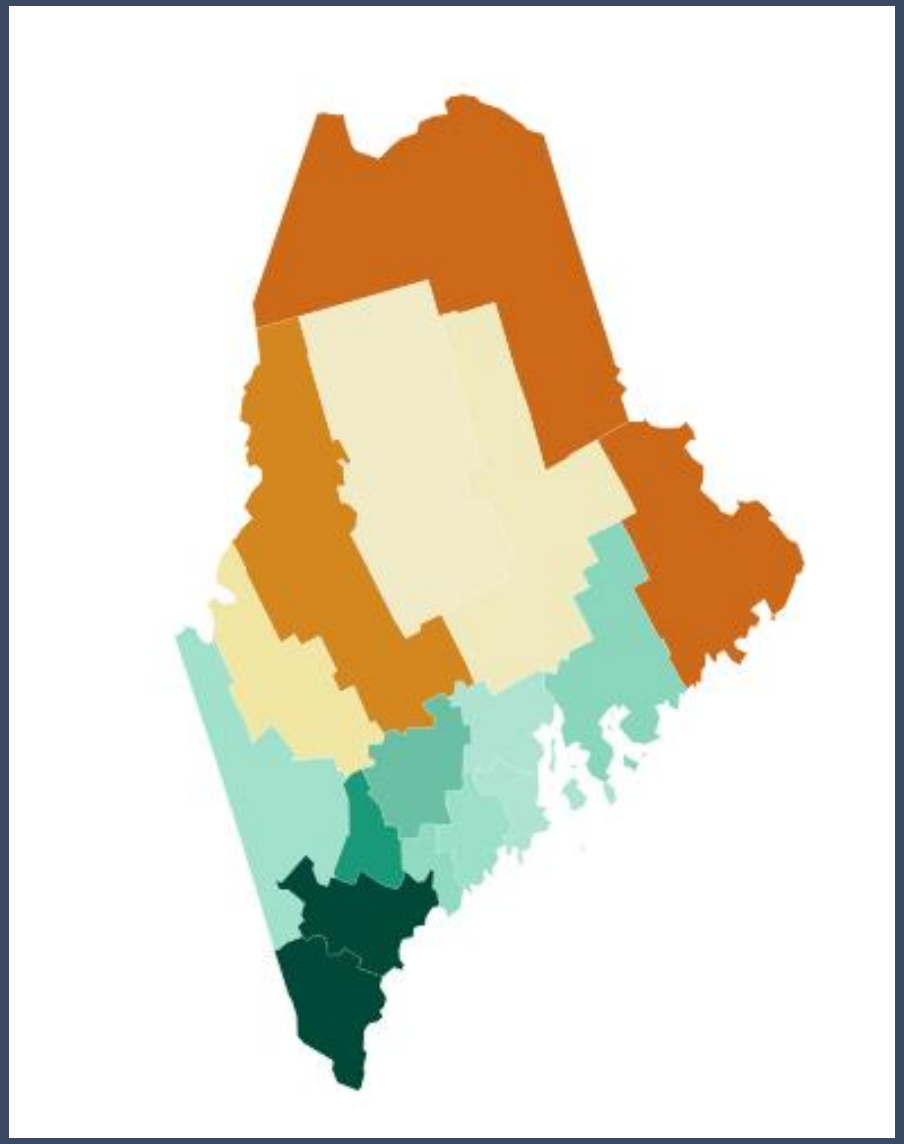
What can be updated or expanded upon?

Updating Annual Water Use Snapshots

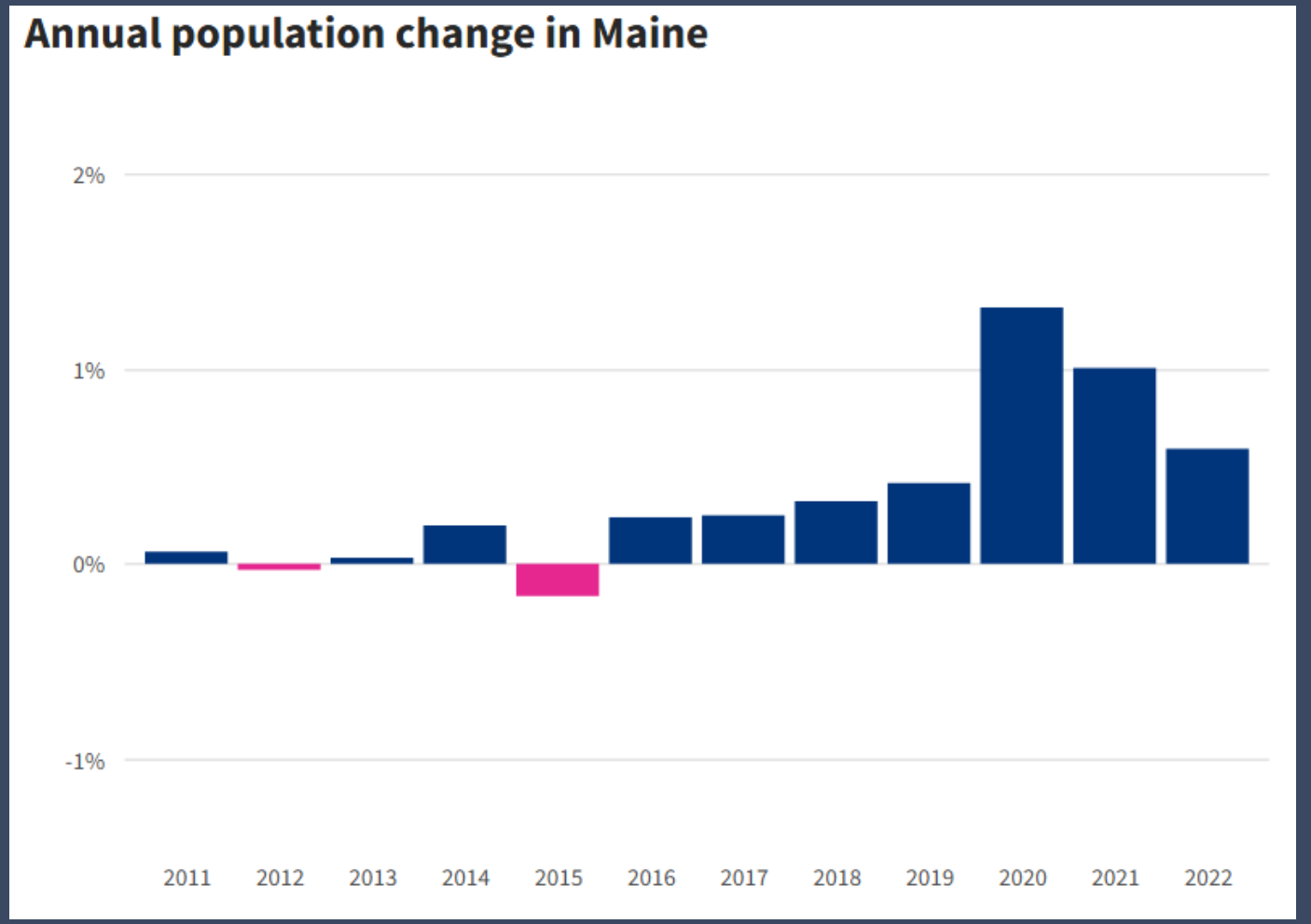
- Use developed methods to compile water use data annually
- Continue to improve method efficiency and accuracy
- How often do surveys need to be repeated? Surveys can be arduous and offer inconsistent results. How much are these metrics changing versus the time it takes to re-determine them
- Alternate approach to non-consumptive use (ski areas, golf courses) study?
- How do the data compiled by MGS compare to the USGS products? How can these agencies continue to work together to improve water use and availability assessments for Maine?

Watersheds at Risk

- Last assessment 2006!
- Climatic shifts
- Population has increased overall; specifically increasing in the southern half of the state while decreasing in the northern half.
- Potential expansion of PWS areas
- Industry changes: Numerous paper mills have closed, State’s first AI data center planned in Aroostook



Population change by country 2010-2022.
Range -4444 (orange) to +25970 (green)



https://usafacts.org/data/topics/people-society/population-and-demographics/our-changing-population/state/maine/

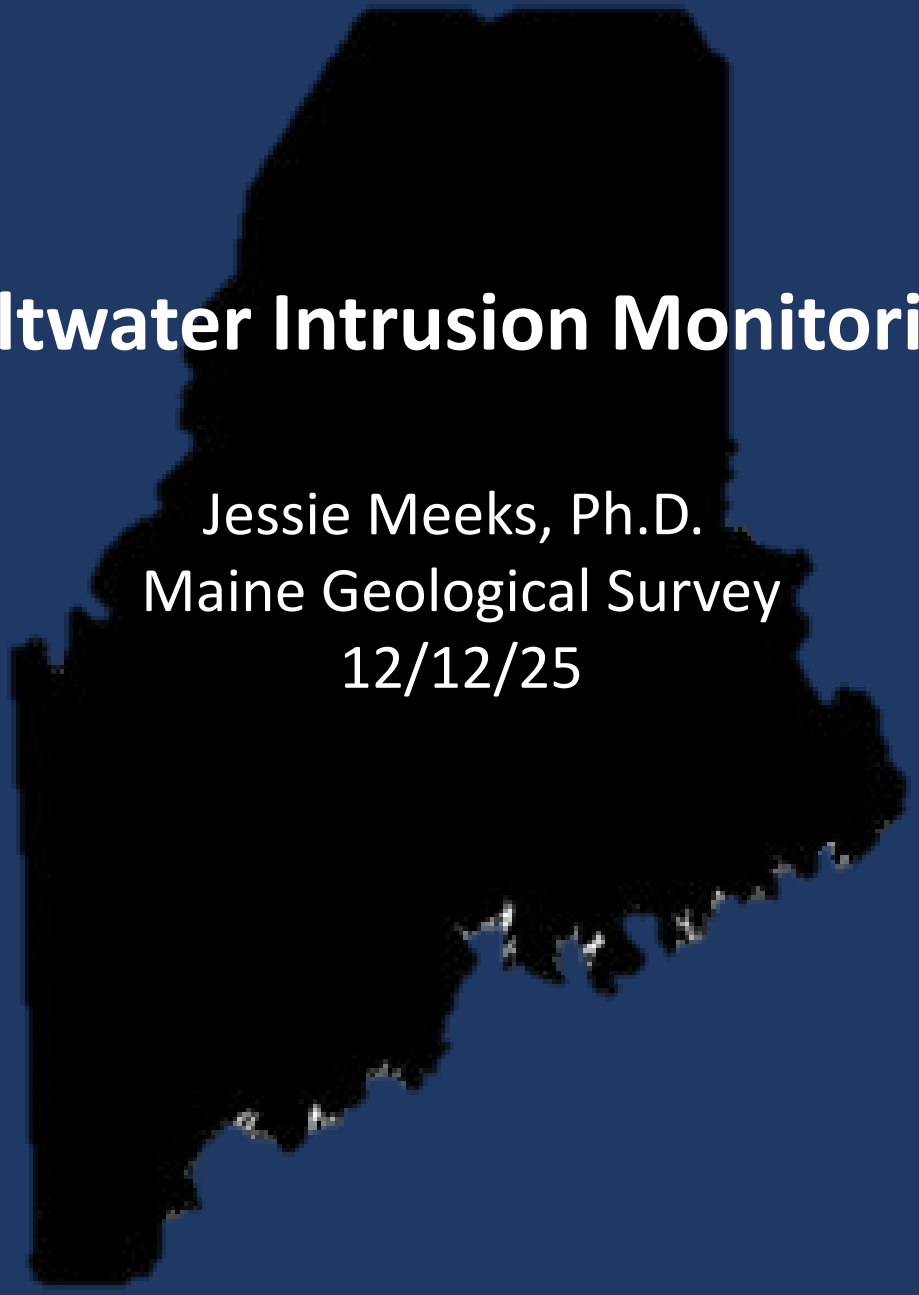
How best to present information to public?

Communicating Water Use Information

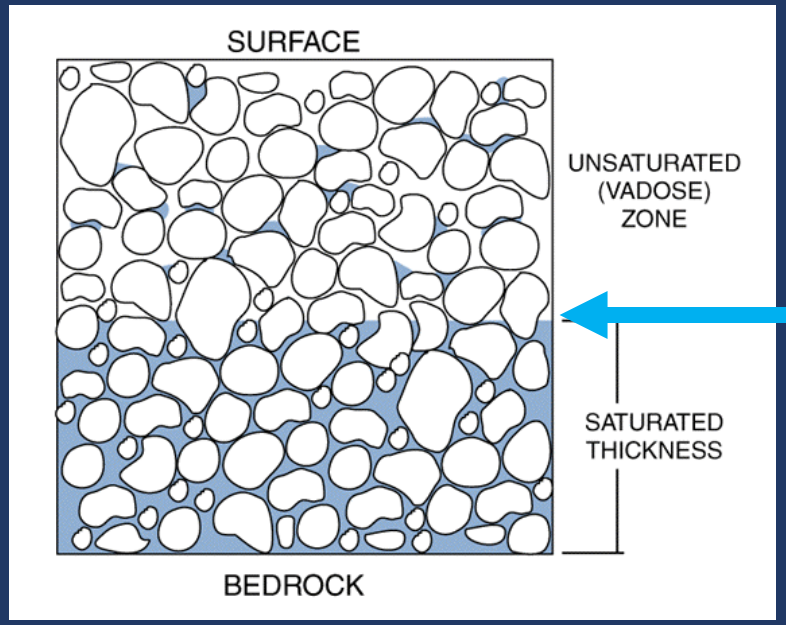
- Existing MGS publications: *Sources of water-use information in Maine*, 1984; *Survey of Agricultural Water Users in Maine Results for Calendar Year 2016*; *Improvements to Domestic Water Use Data Collection Methods and Population Estimates for Maine*, 2021
- What do we think is most important for people to know?
  - Watersheds under stress, origin of domestic supply, …
- What are people interested in?
  - Bottled water, land-based aquaculture, …
- How best to have information displayed?
  - Maps and figures
  - Something that can be updated year after year

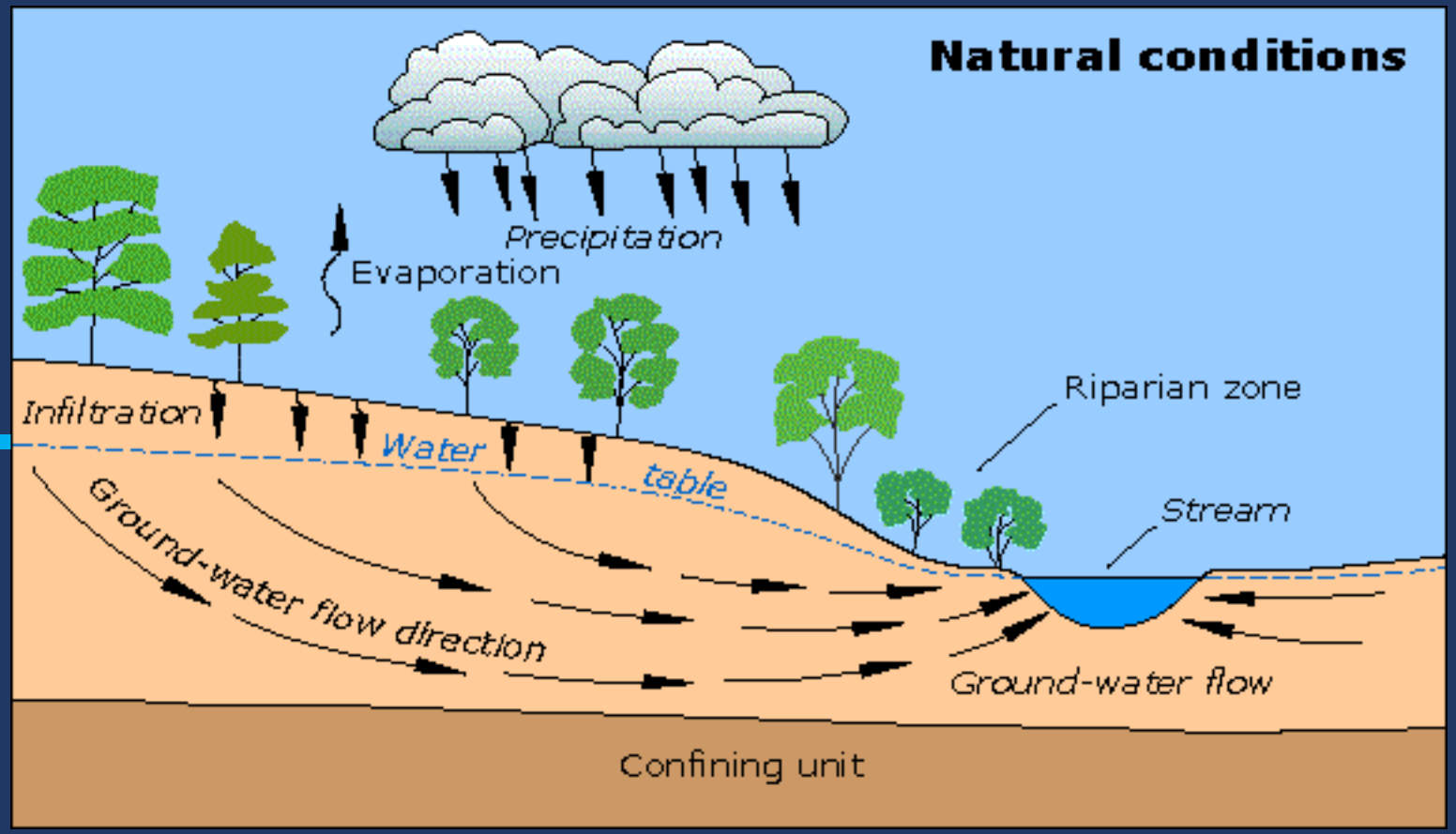
Saltwater Intrusion Monitoring

Jessie Meeks, Ph.D.
Maine Geological Survey
12/12/25



Groundwater flow



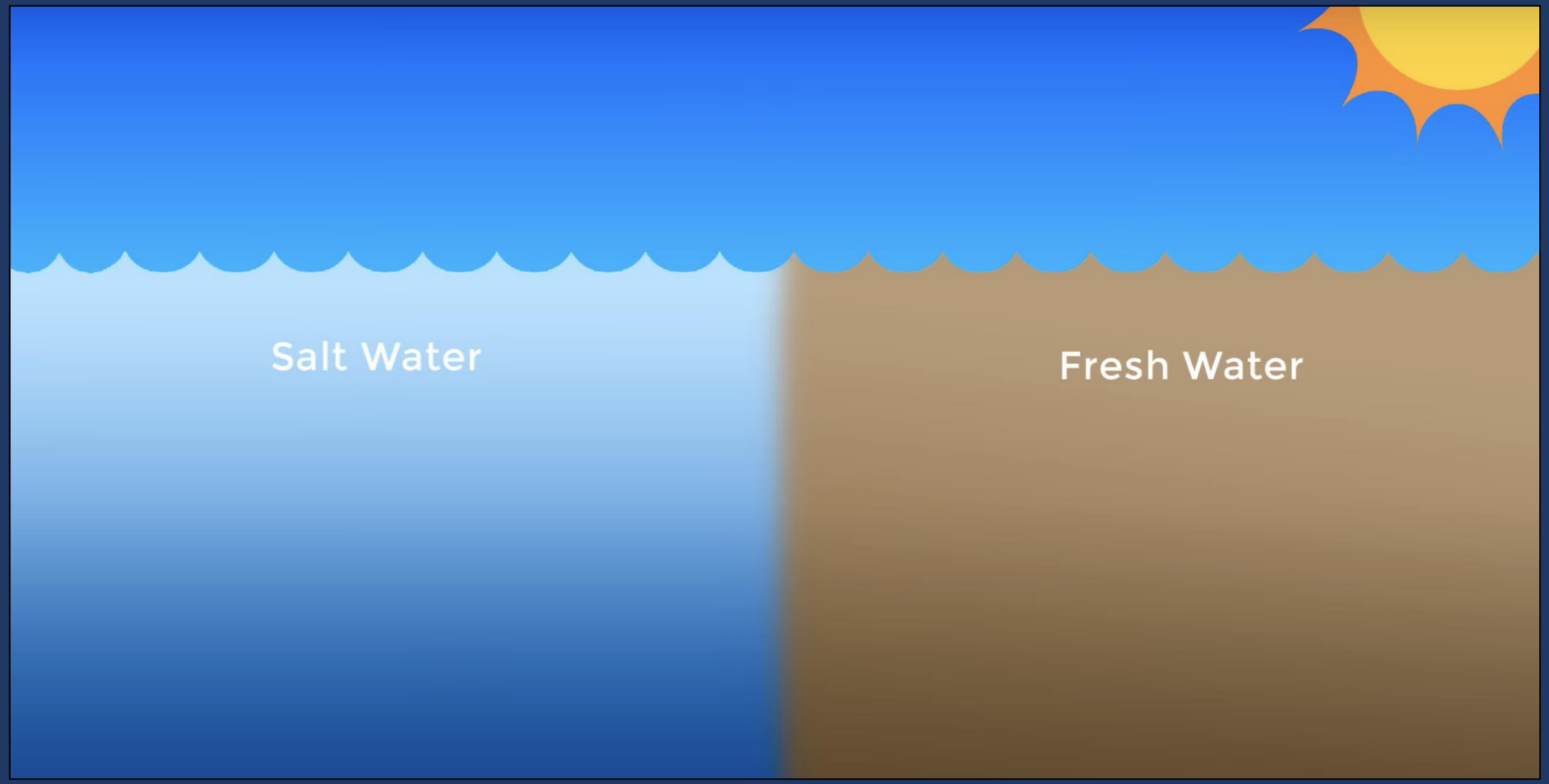


https://www.usgs.gov/media/images/groundwater-flow-showing-natural-conditions

When fresh water meets saline…

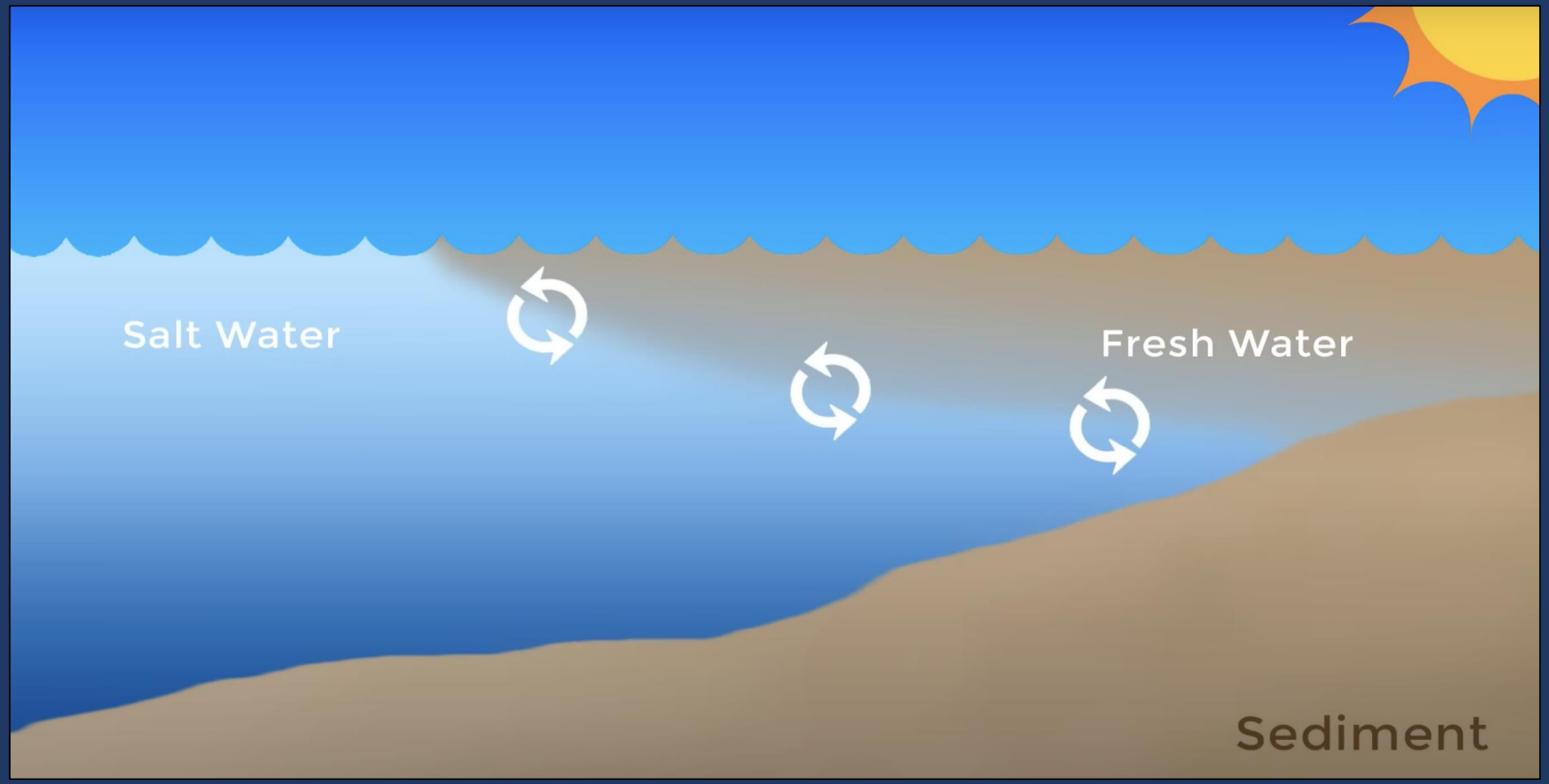
Frasier River meets Straight of Georgia in Vancouver, BC

When fresh water meets saline…



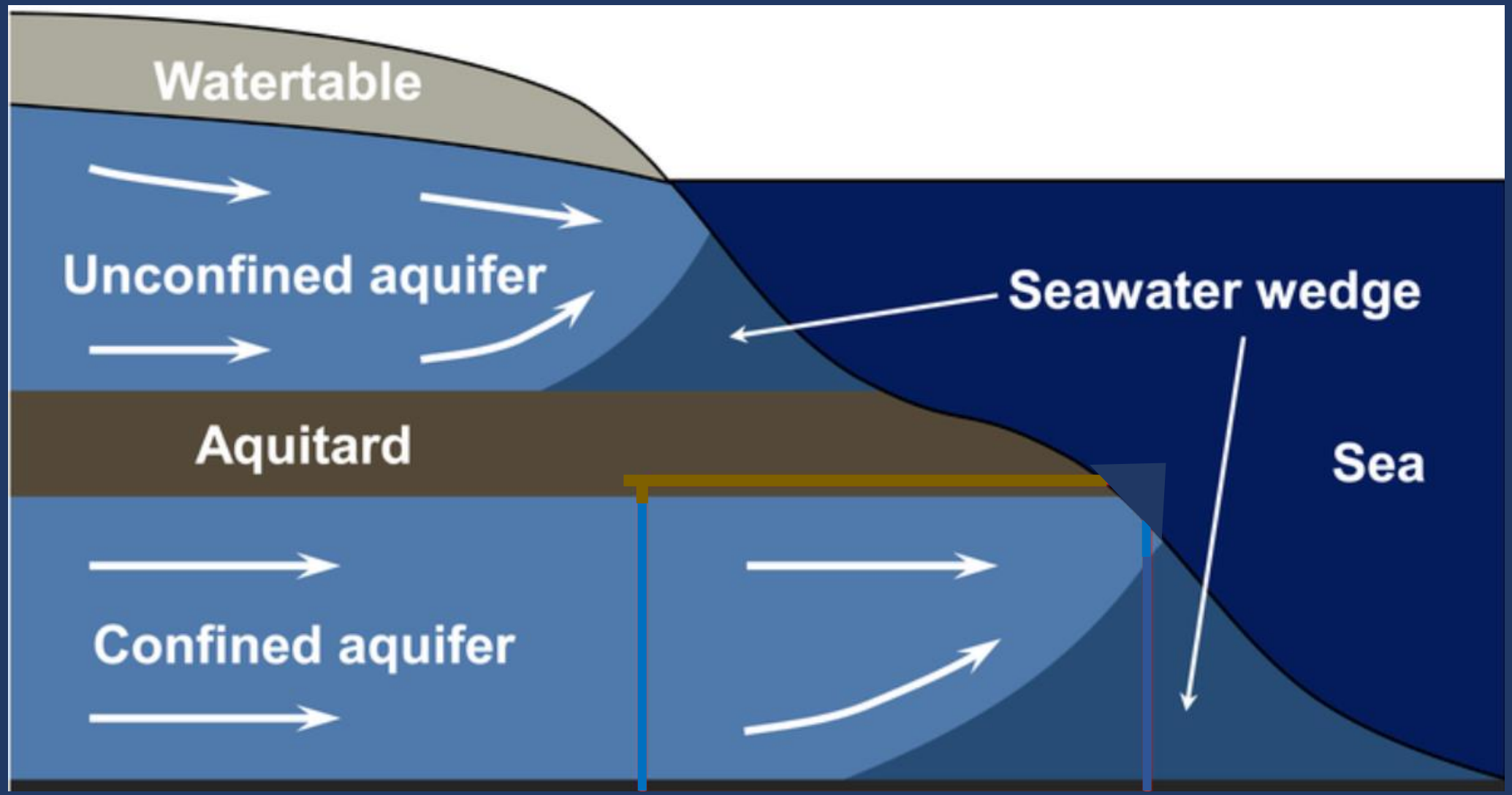
Frasier River meets Straight of Georgia in Vancouver, BC

When fresh water meets saline…



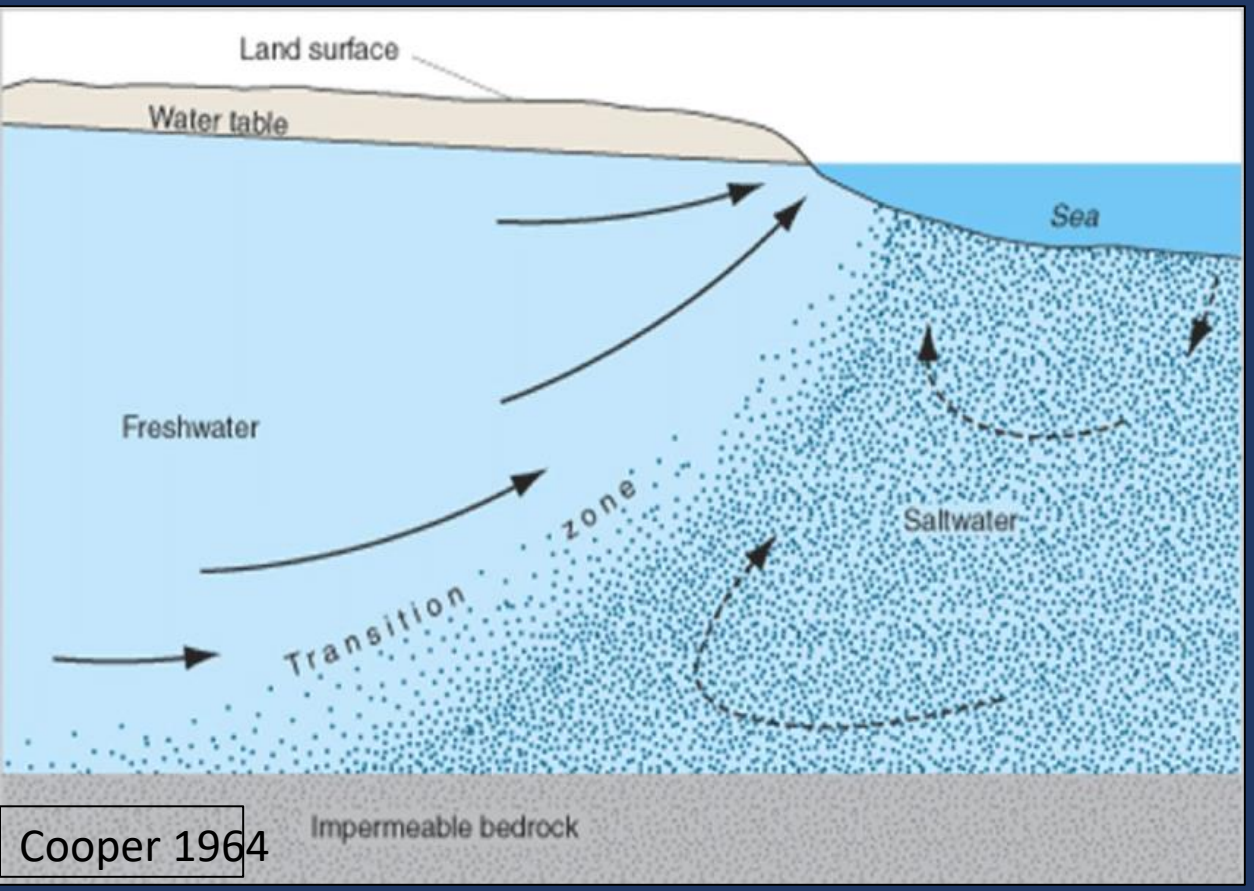
Frasier River meets Straight of Georgia in Vancouver, BC

Saline wedge intrudes into the aquifer

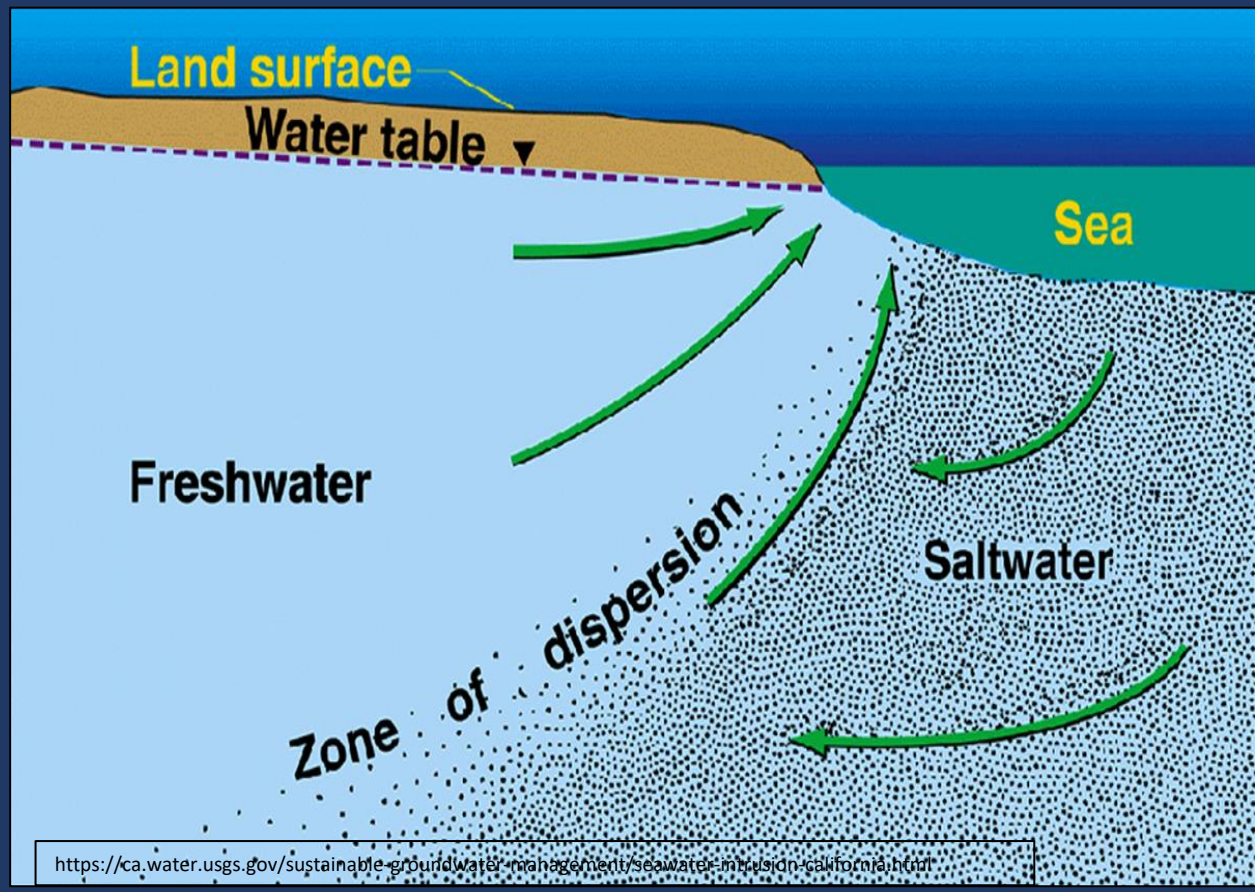


https://www.researchgate.net/figure/Conceptual-diagram-of-a-coastal-cross-shore-confined-unconfined-aquifers-and-major-flow_fig1_347123395

Transition zone / Zone of dispersion

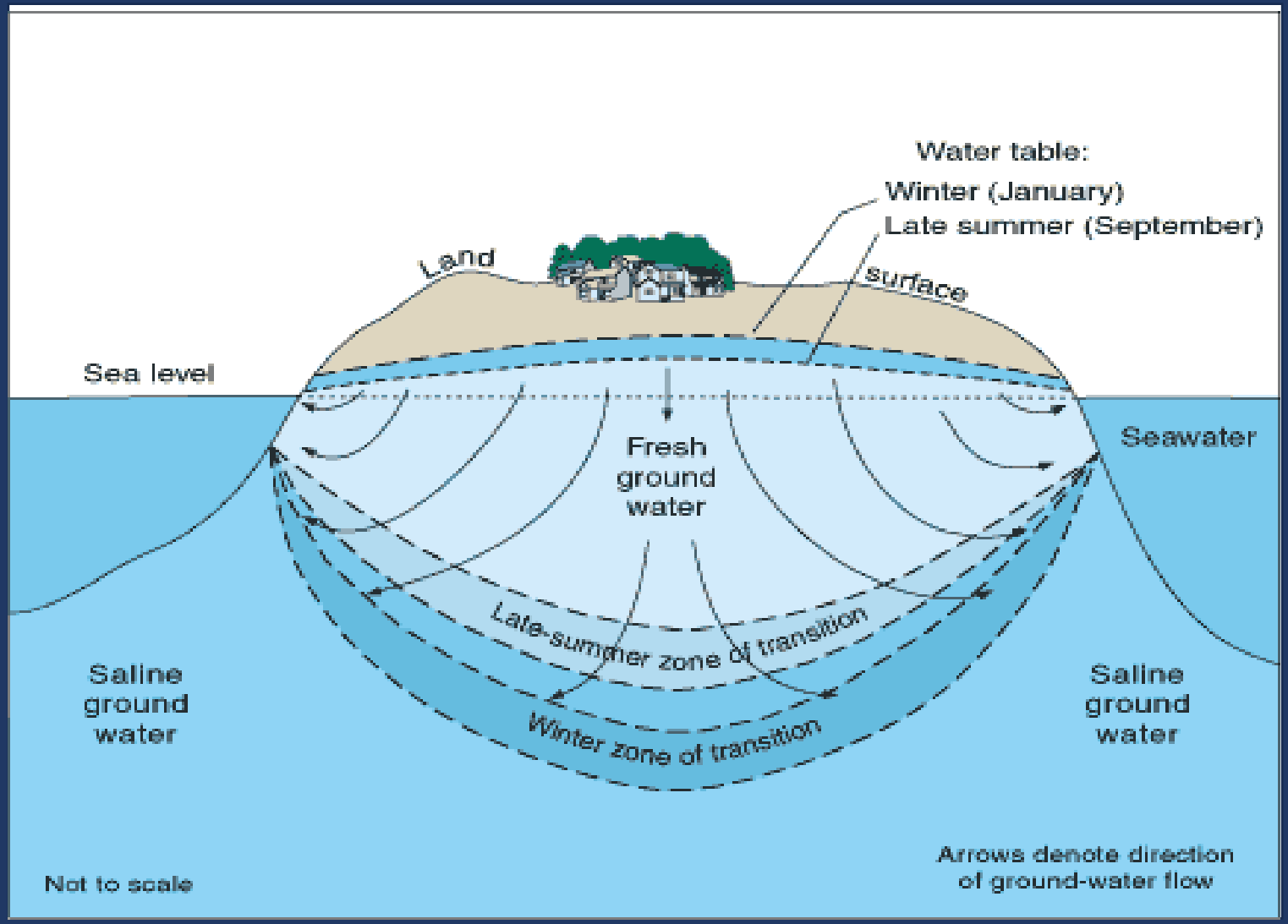


Cooper 1964



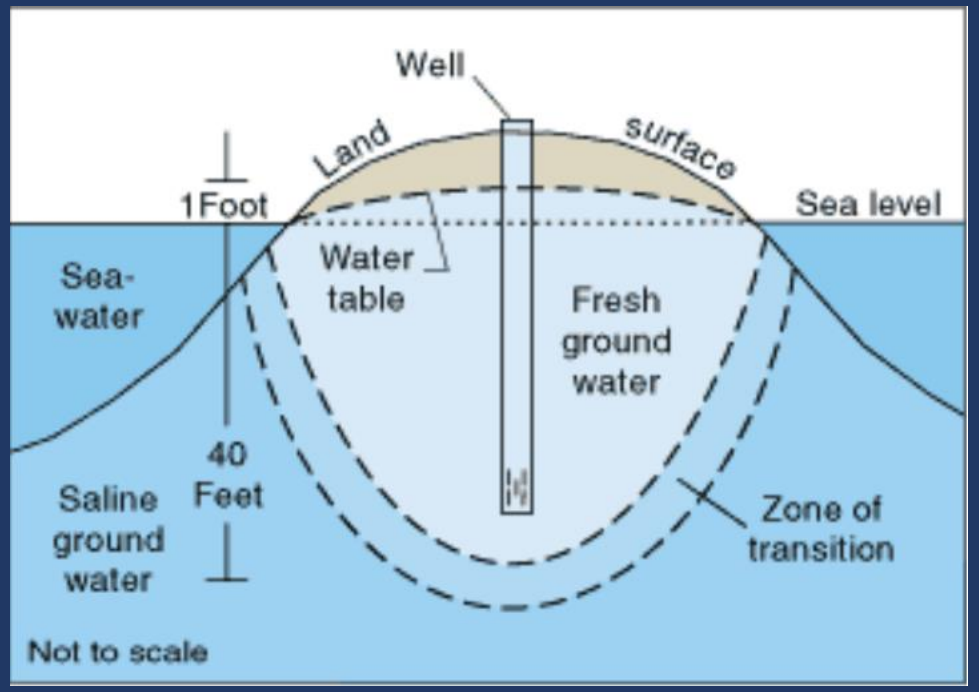
https://ca.water.usgs.gov/sustainable-groundwater-management/seawater-intrusion-california.html

Transition zone fluctuates with time



https://pubs.usgs.gov/fs/2000/fs-057-00/

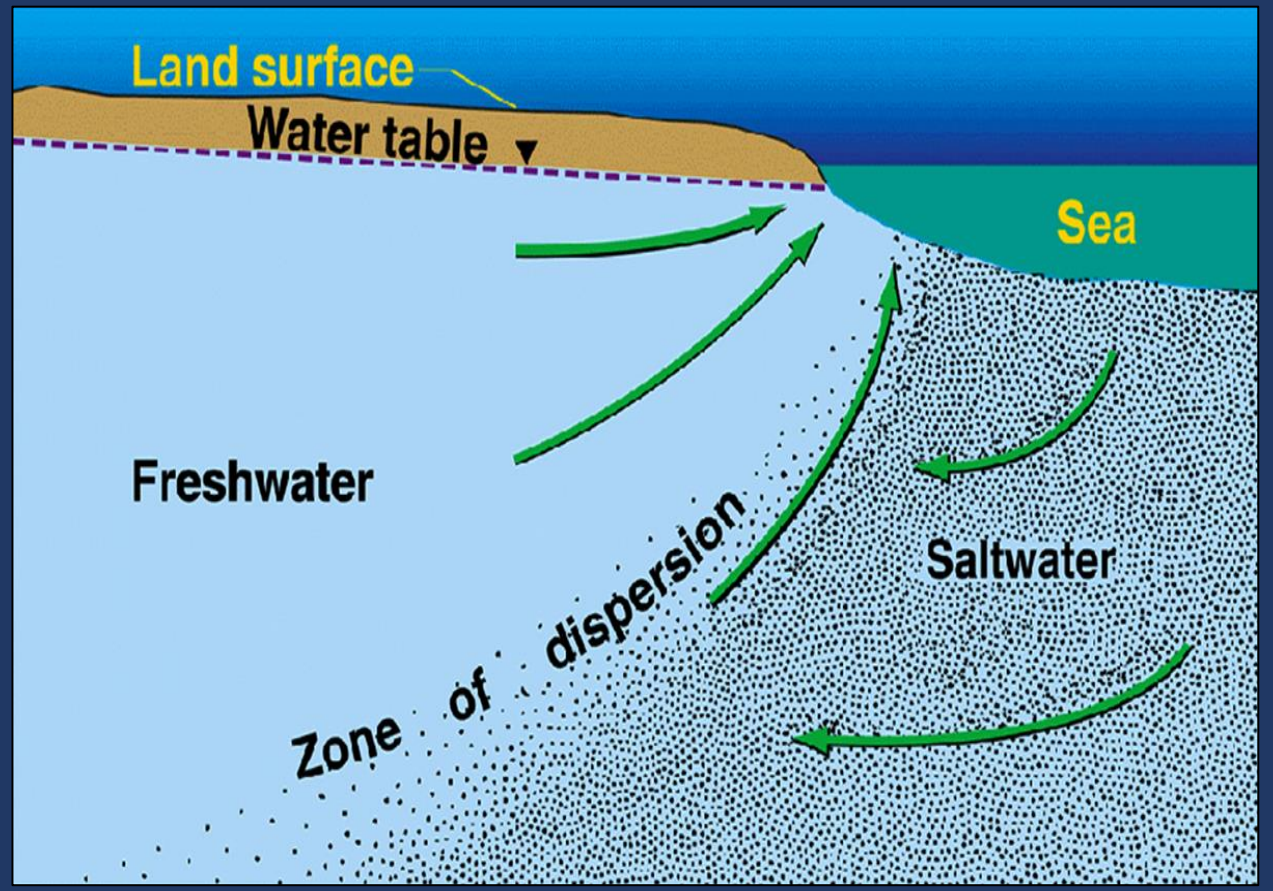
1-to-40 and the GHYBEN-HERZBERG PRINCIPLE



- A century ago, hydrologists working along Europe's coast observed that fresh ground water, appearing to float as a lens-shaped body on seawater, extended below sea level approximately 40 times the height of the freshwater table above sea level.
- This 1-to-40 relation occurs because freshwater is slightly less dense than seawater (1.000 grams per cubic centimeter (g/cm^3) versus 1.025 g/cm^3).
- Thus, for example, if the water table at a given site is 3 feet above sea level, the freshwater-seawater transition zone is 120 feet below sea level, and the vertical thickness of the freshwater body there is 123 feet.

https://pubs.usgs.gov/fs/2000/fs-057-00/

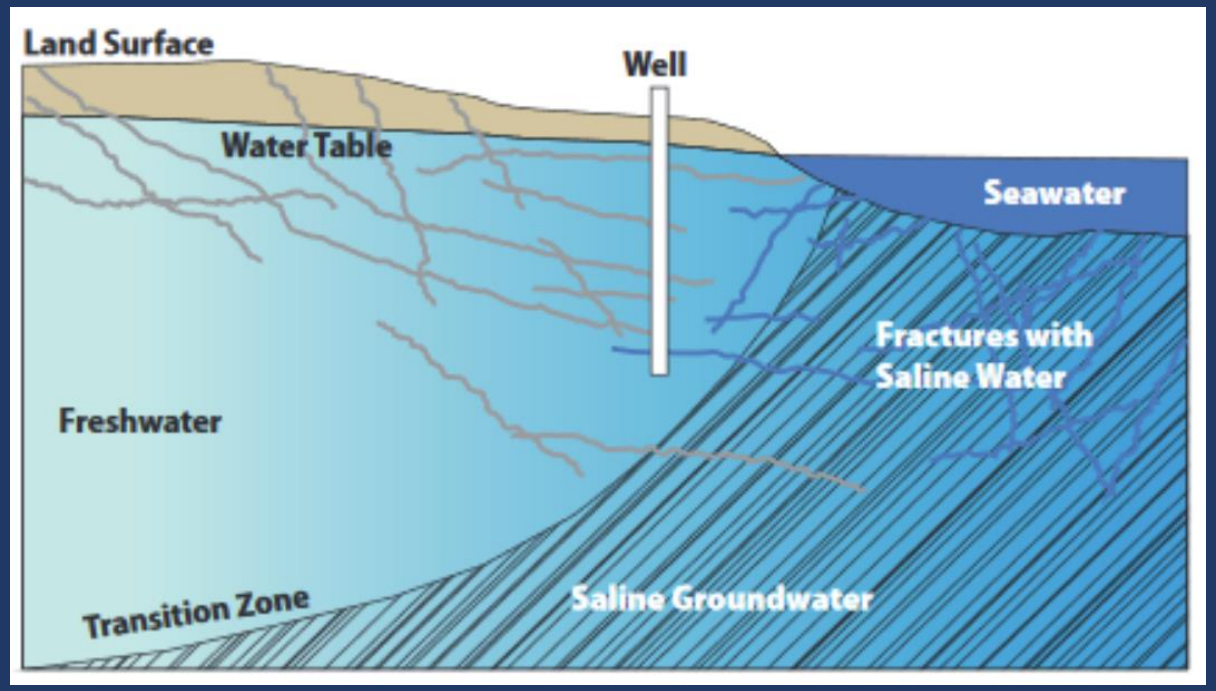
Not Maine…



https://climateactiontool.org/content/restore-natural-coastal-buffers-native-vegetation-buffers-and-plantings

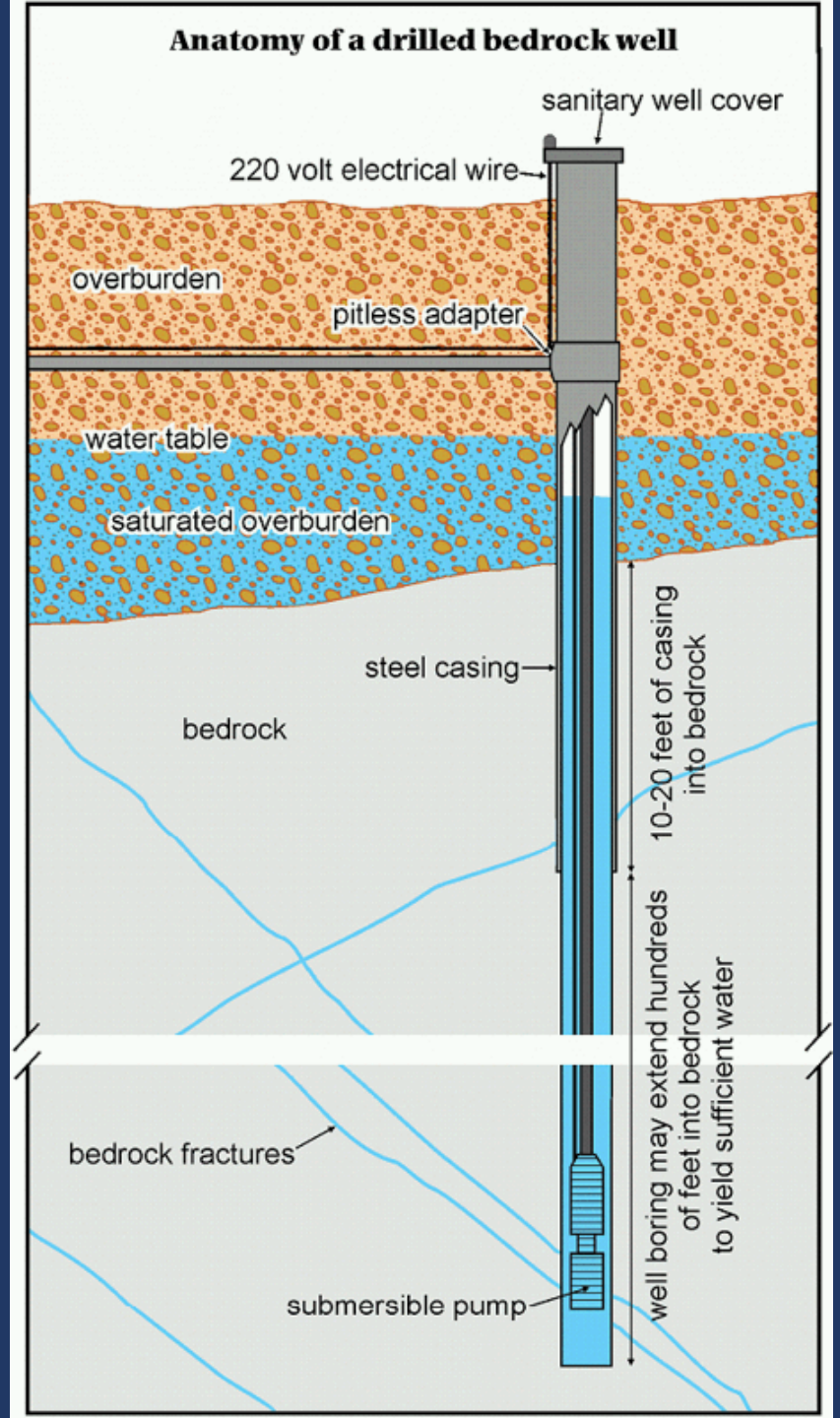
https://ca.water.usgs.gov/sustainable-groundwater-management/seawater-intrusion-california.html

Maine: Fractured bedrock



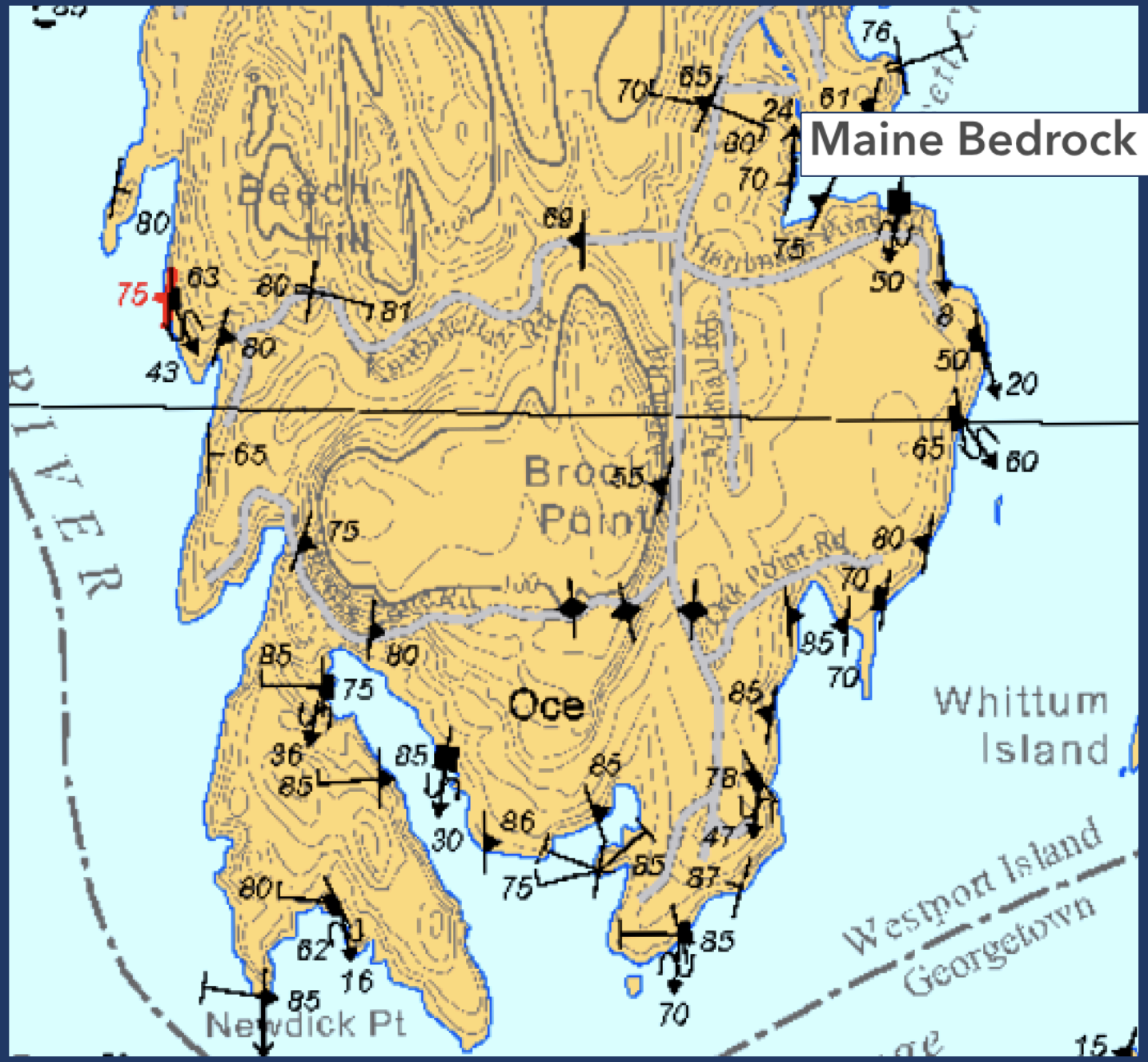
Cadillac Mountain Granite, Silurian-Devonian boundary times, ~419 Ma; Thunder Hole, Mt. Desert Island

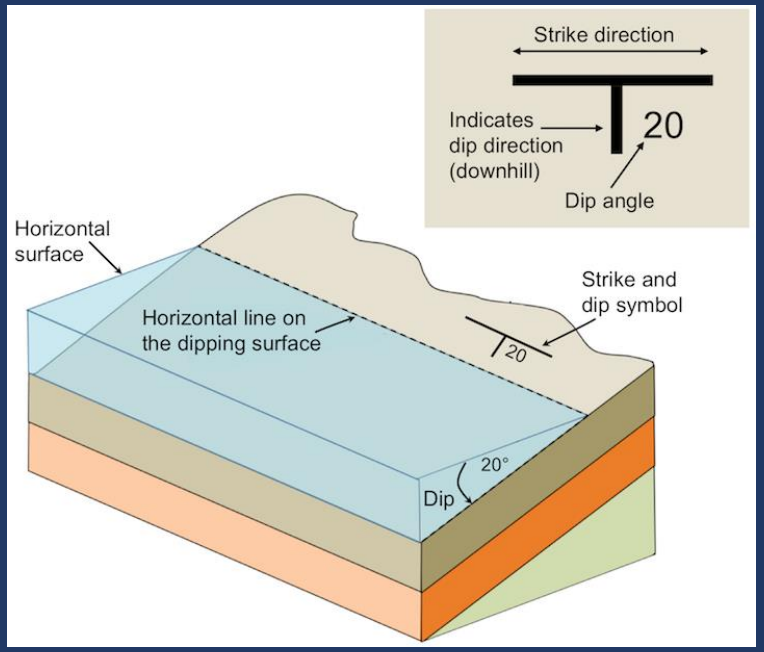
https://cleancistern.com/saltwater-intrusion/



https://www.maine.gov/dacf/mgs/explore/water/facts/well.htm

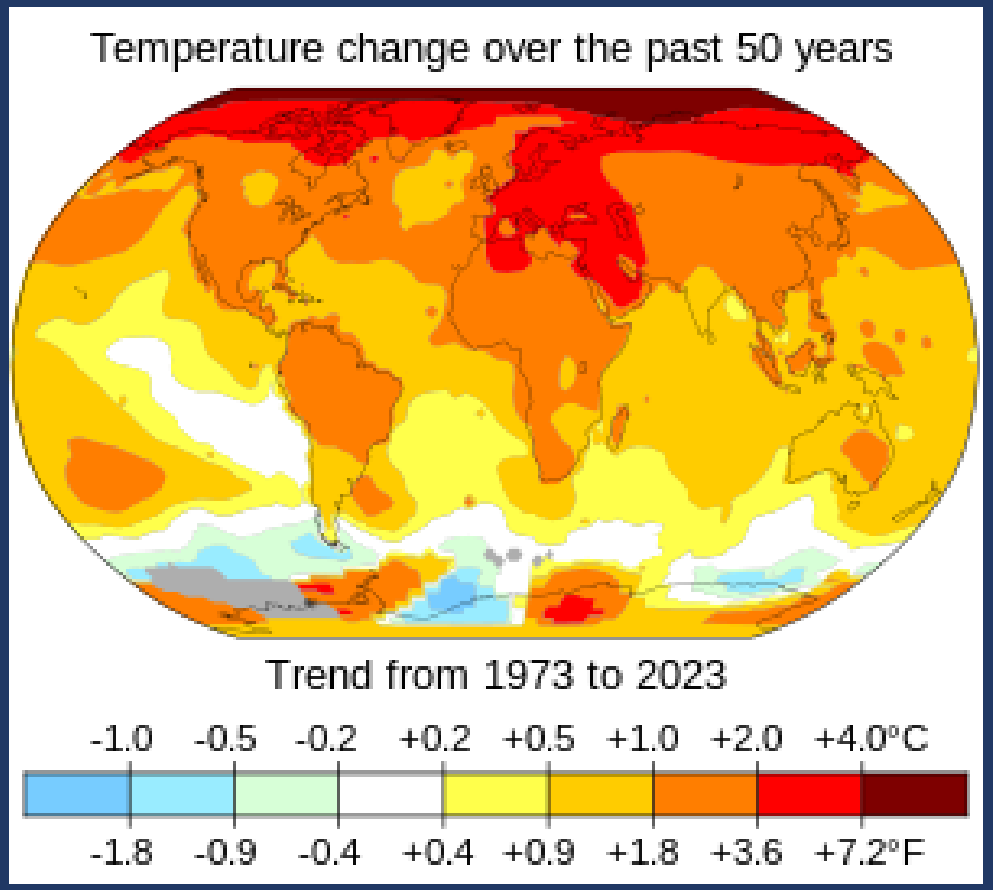
Maine Bedrock Geology 24K Maps





https://openpress.usask.ca/physicalgeology/chapter/13-5-measuring-geological-structures/

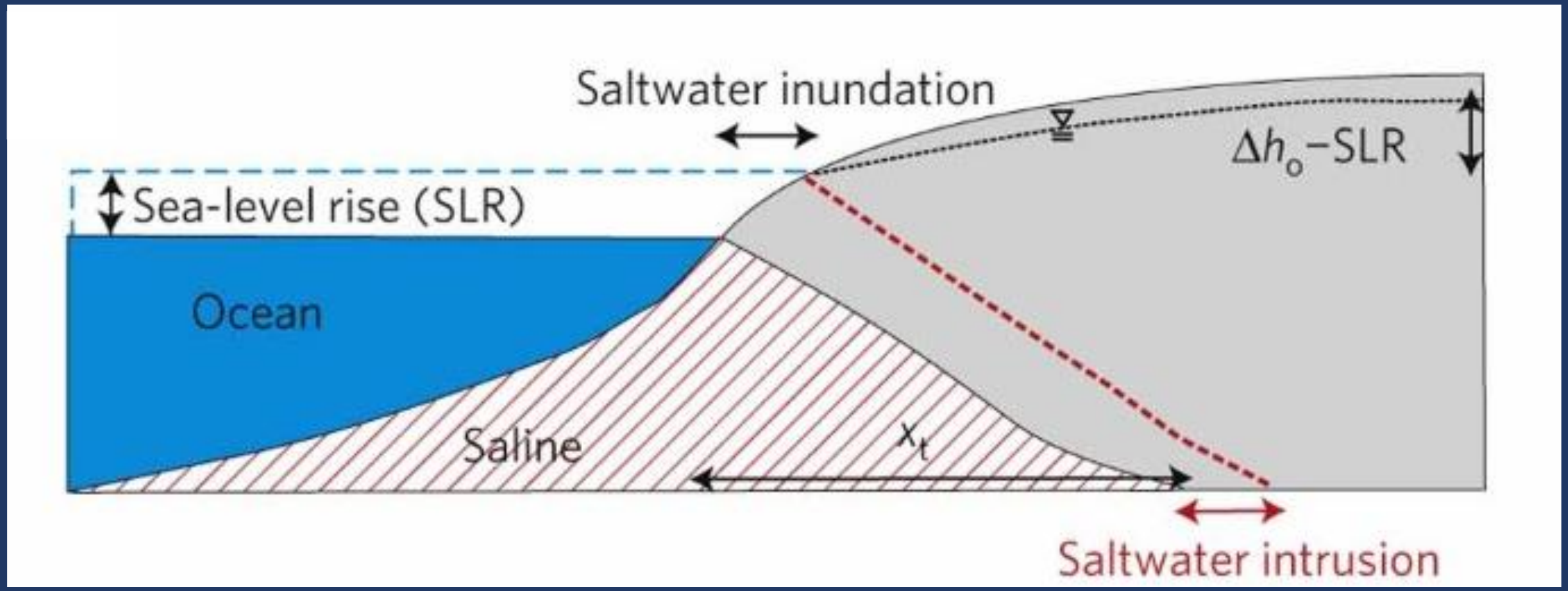
Causes of saltwater intrusion



https://overpopulation-project.com/is-overpopulation-a-dirty-word/

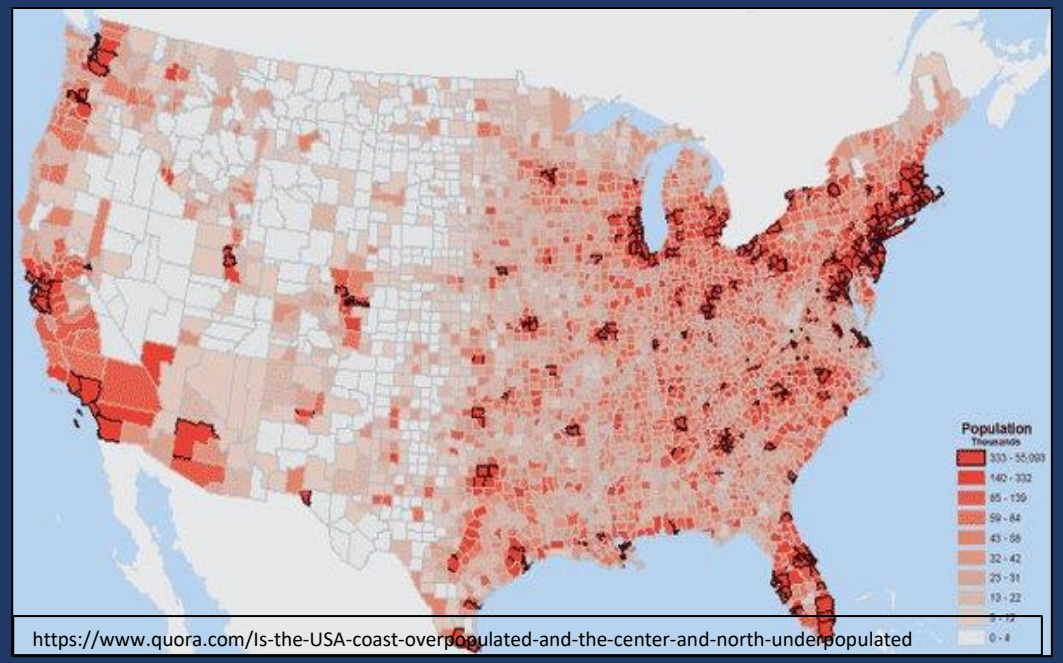
https://data.giss.nasa.gov/gistemp/maps/index_v4.html

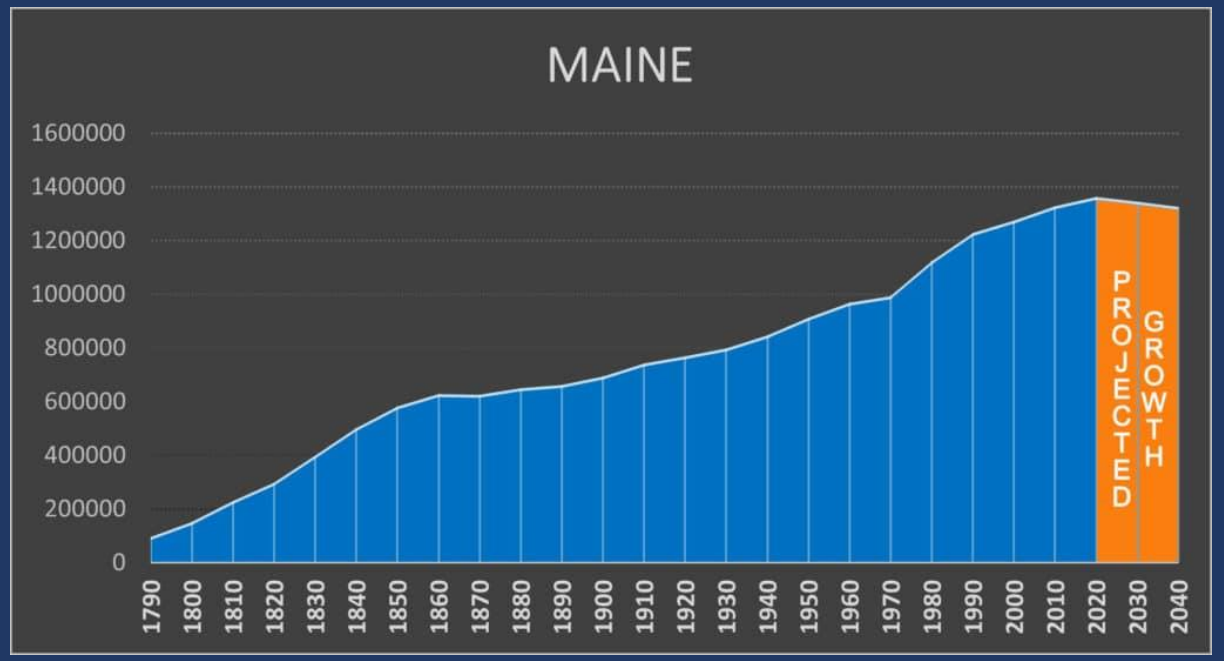
Projected impacts from sea level rise



http://www.groundwaterscienceandsustainability.org/uploads/5/6/1/7/56172195/12._ferguson_and_gleeson_2012_naturecc_coastal_aquifer_vulnerabilty.pdf

Projected impacts from overuse of coastal aquifers

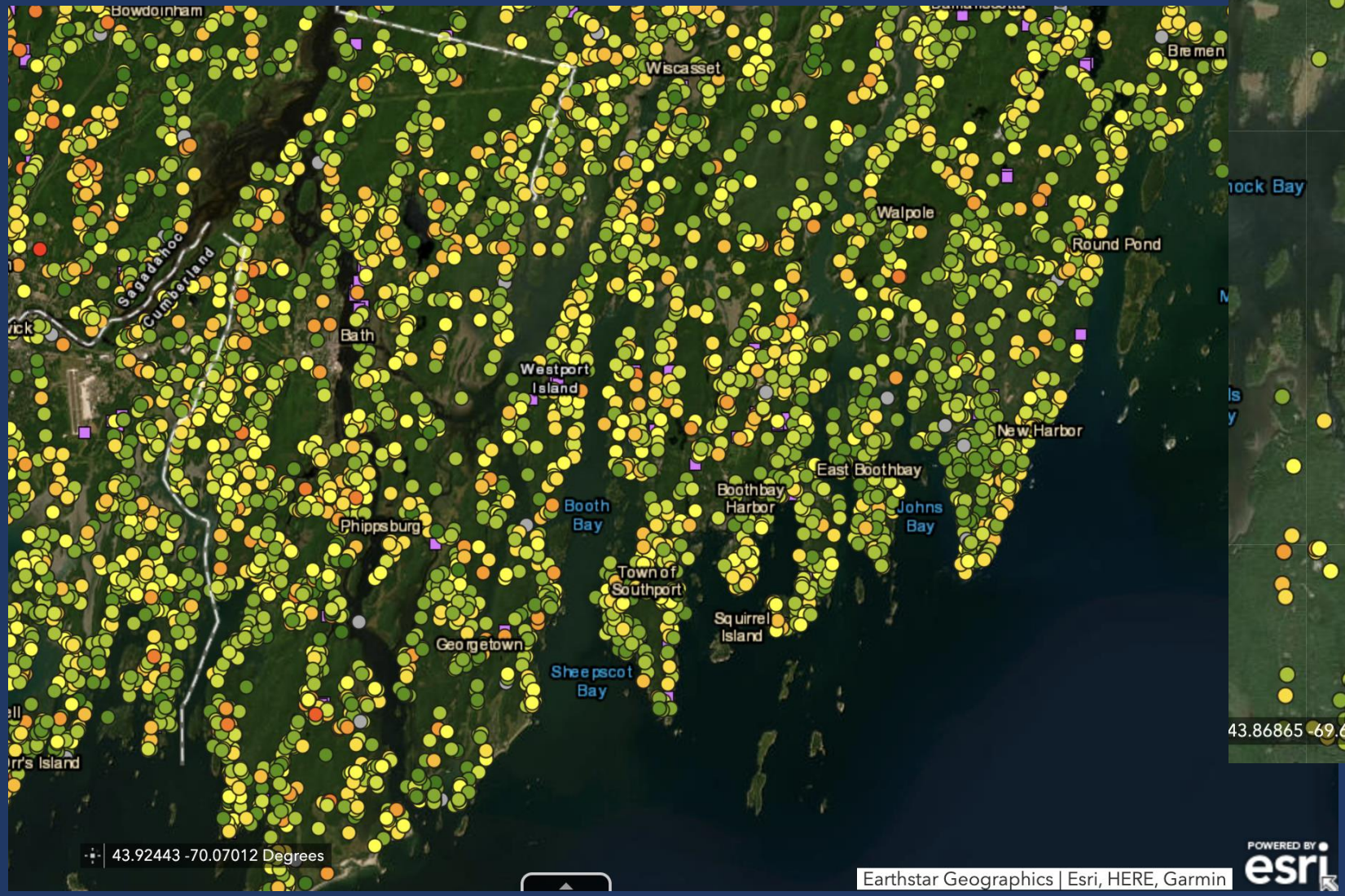


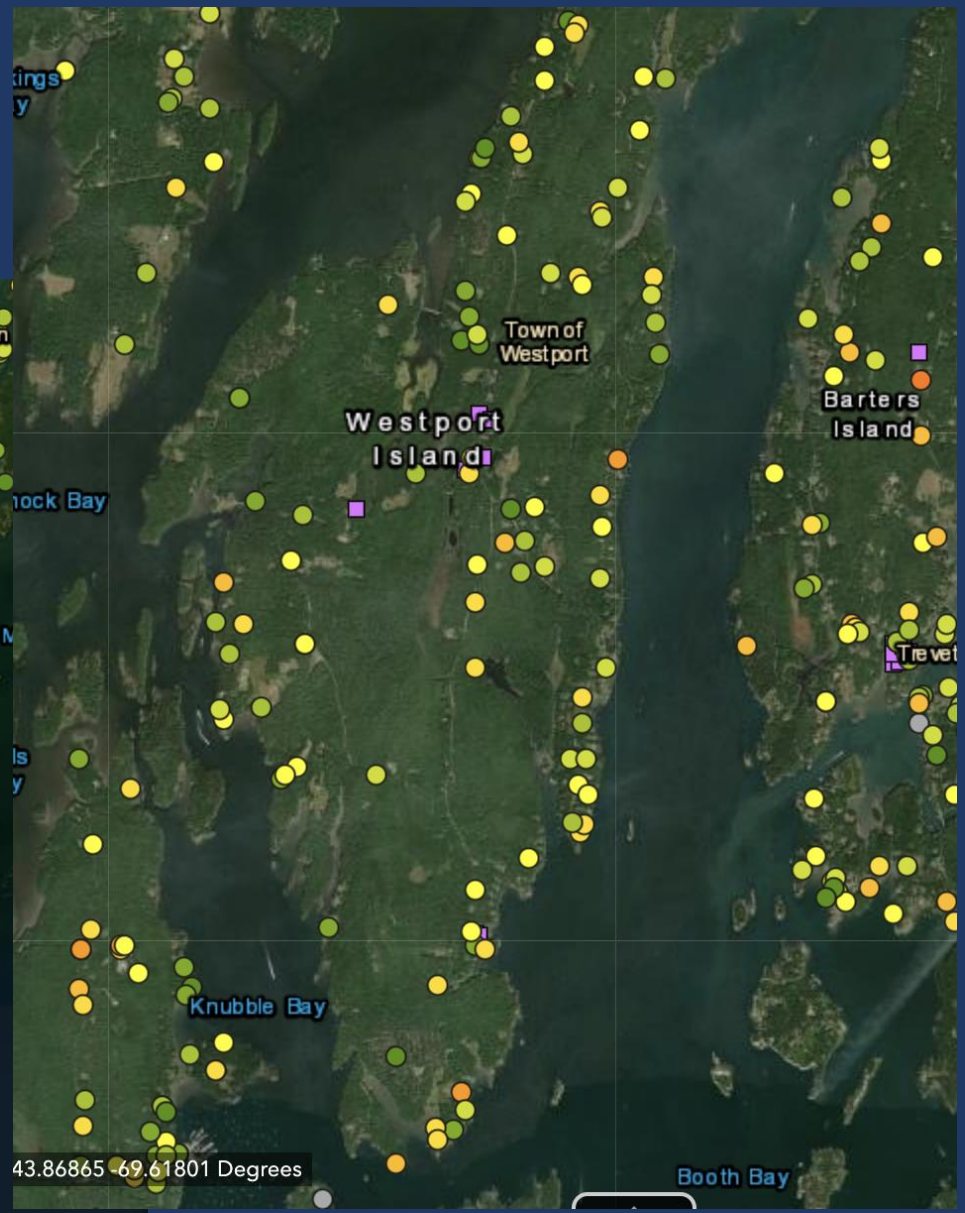


Hauer, Mathew E., Sunshine A. Jacobs, and Scott A. Kulp. "Climate migration amplifies demographic change and population aging." *Proceedings of the National Academy of Sciences* 121.3 (2024): e2206192119.

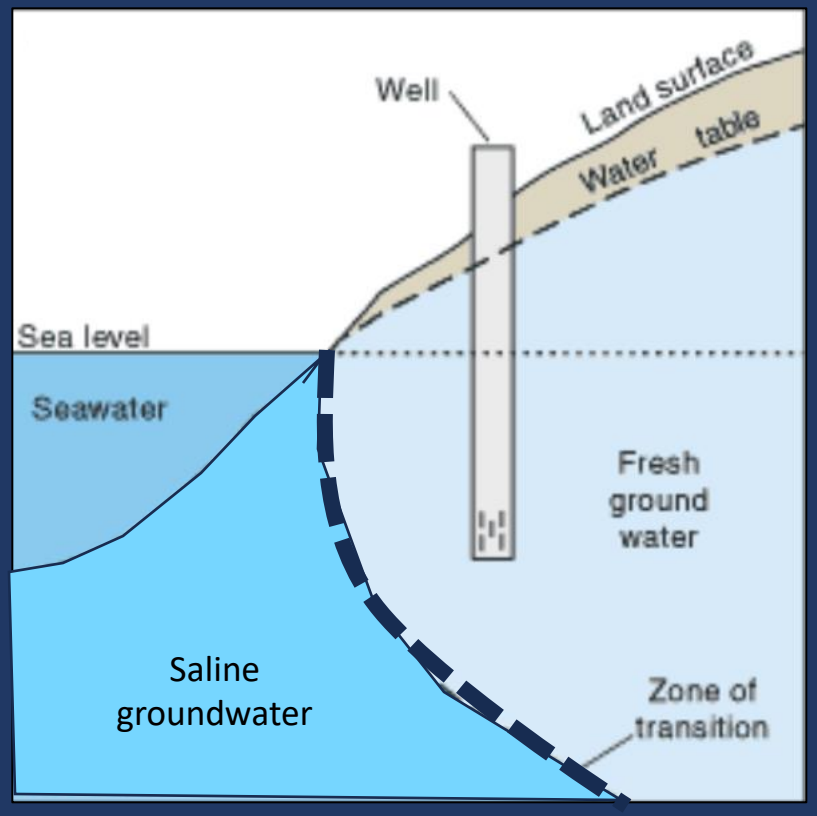
Schewel, Kerilyn, et al. "How well can we predict climate migration? A review of forecasting models." *Frontiers in Climate* 5 (2024): 1189125.

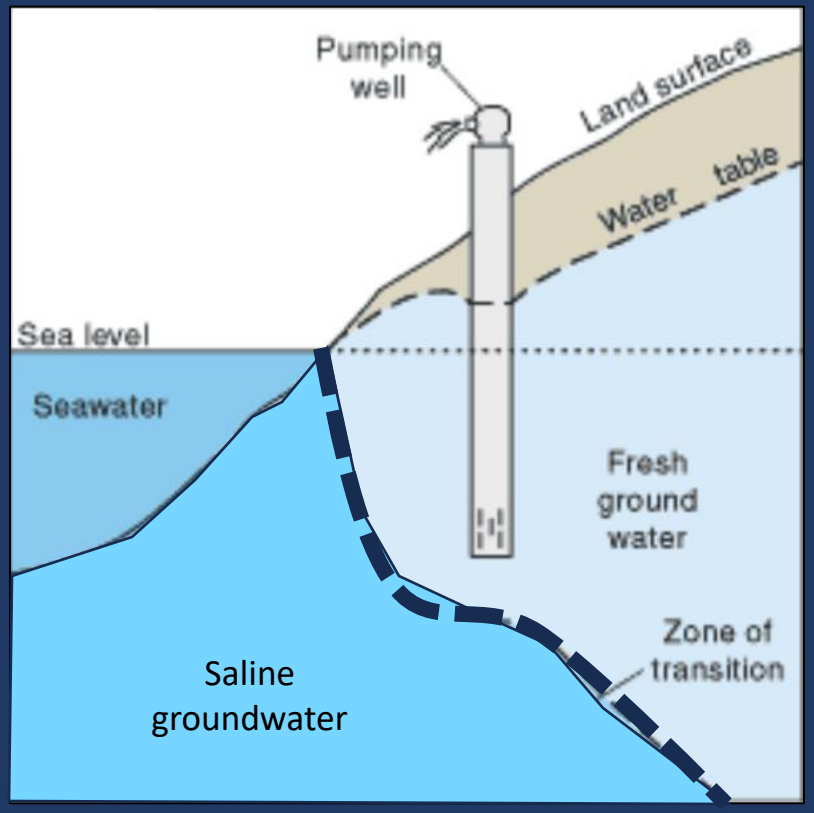
ME Water Well Database

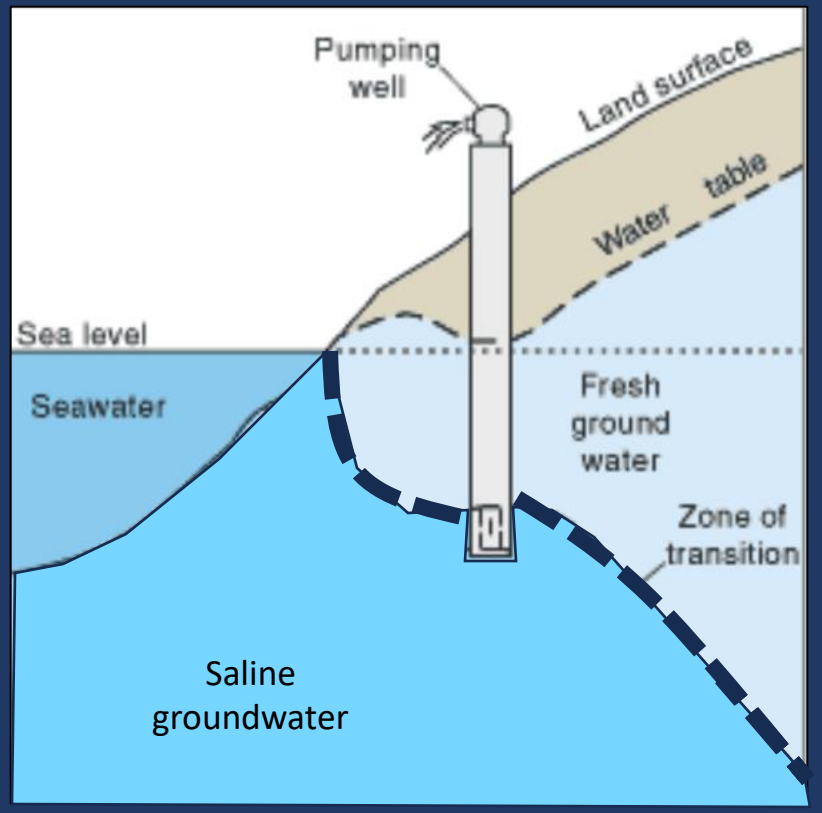




Projected impacts from overuse of coastal aquifers

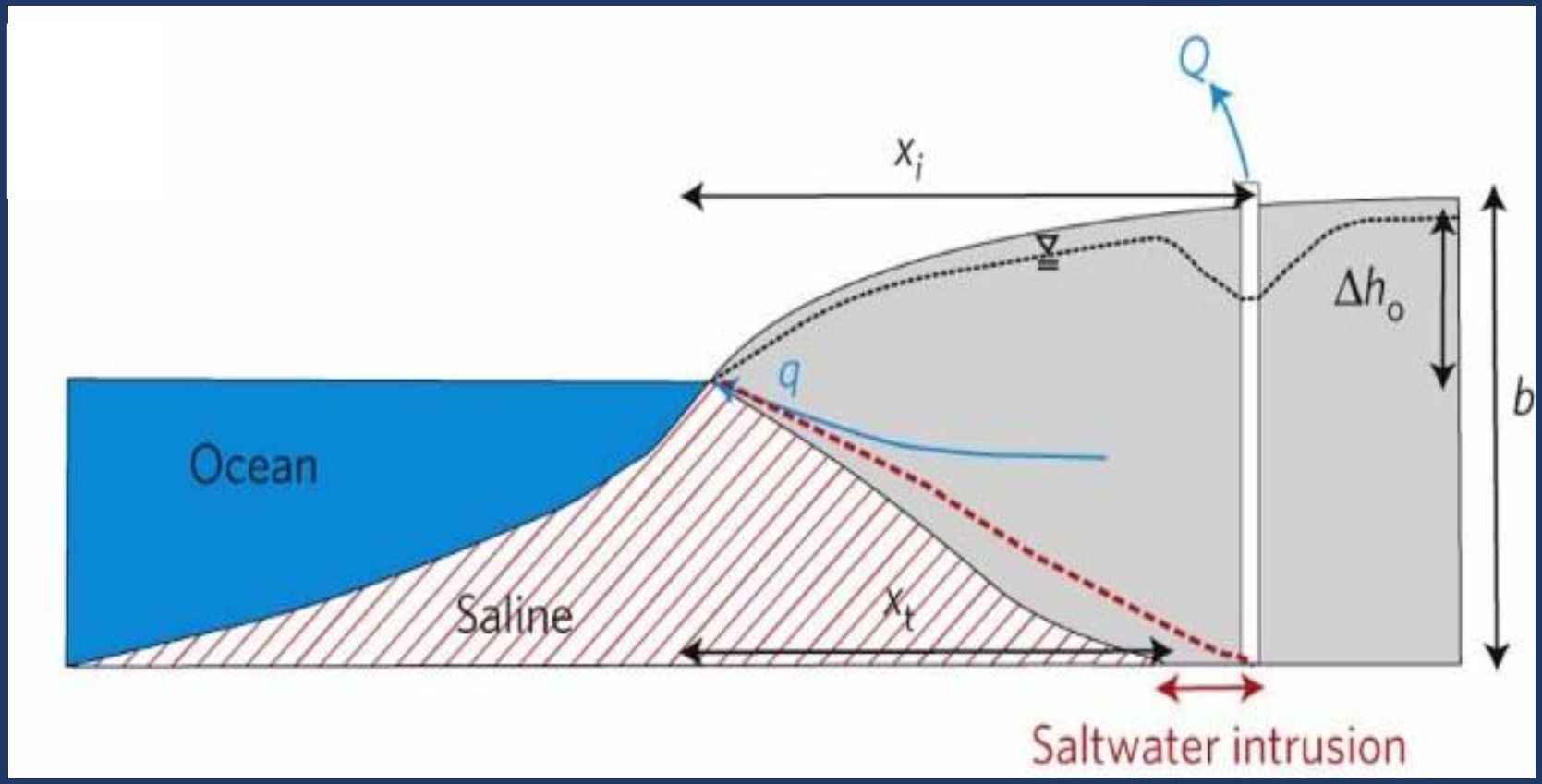






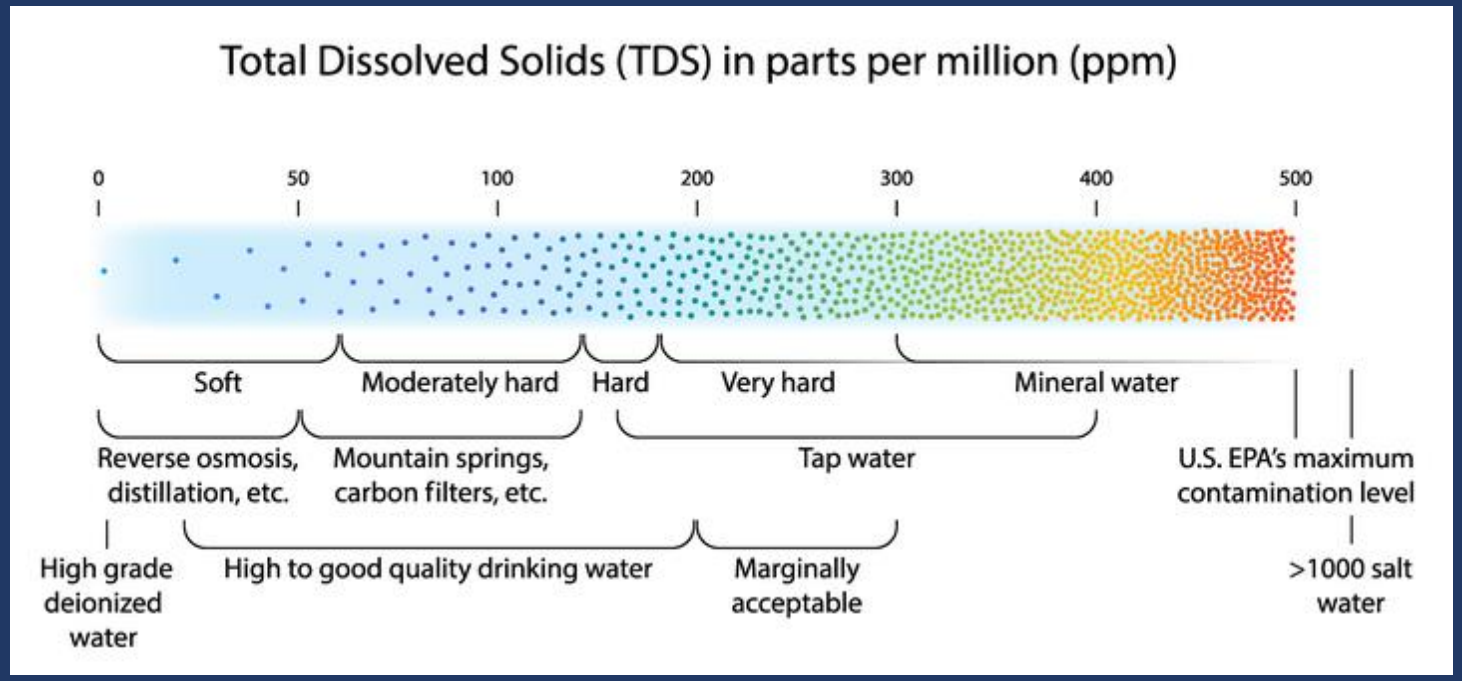
https://pubs.usgs.gov/fs/2000/fs-057-00/

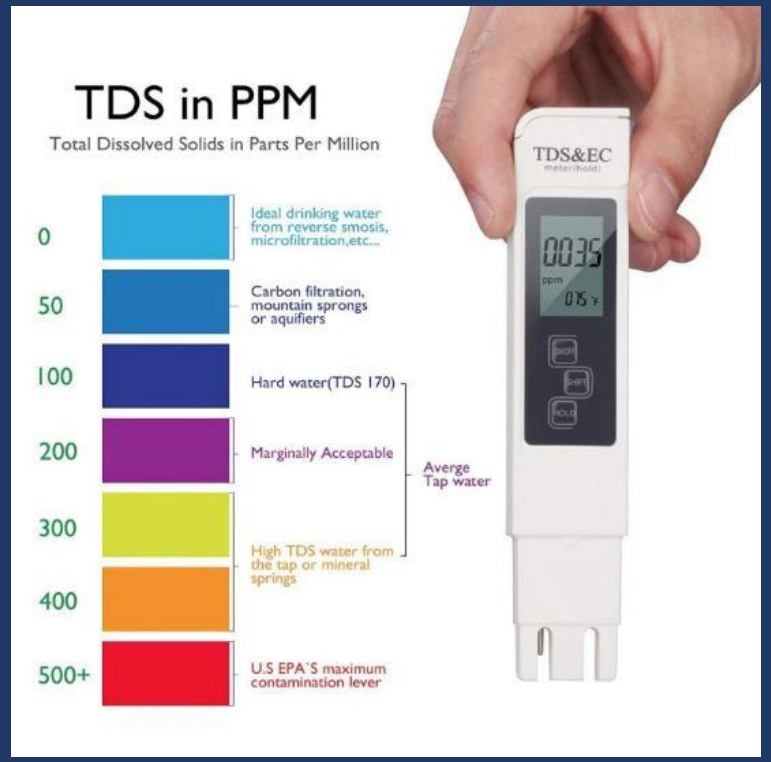
Projected impacts from overuse of coastal aquifers



Schmorak, S., & Mercado, A. (1969). Upconing of fresh water – sea water interface below pumping well
s, field study. Water Resource Research, *5*: 1290–1311
http://www.groundwaterscienceandsustainability.org/uploads/5/6/1/7/56172195/12._ferguson_and_gleeson_2012_naturecc_coastal_aquifer_vulnerabilty.pdf

Sampling for Total Dissolved Solids (TDS)

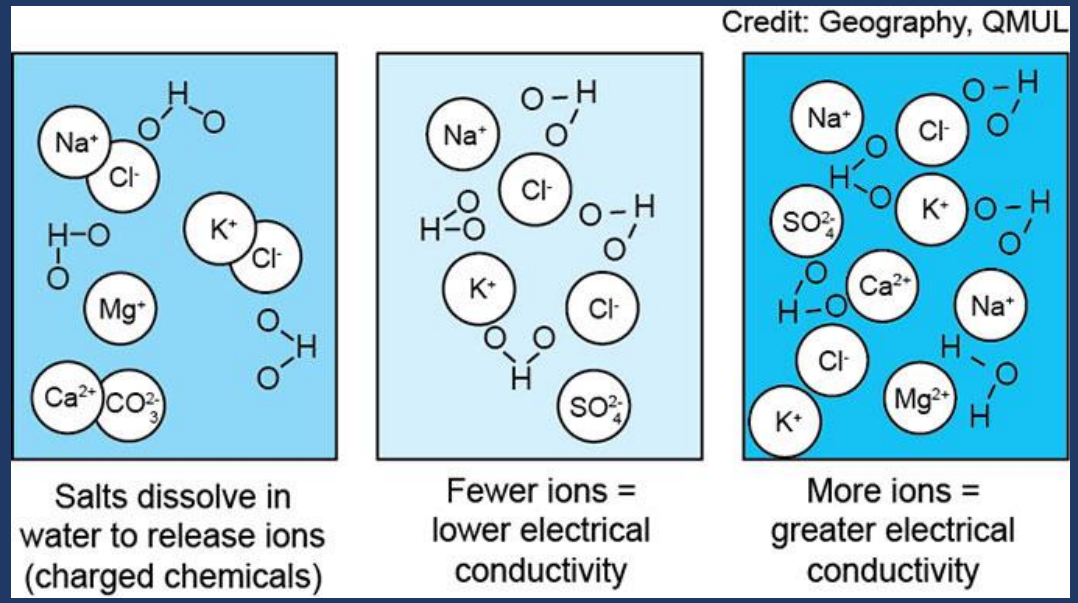




- Refers to the collection of substances contained within water.
- Comprised of both organic and inorganic matters.
  - Organic matters may include algae, bacteria, pesticides, and disinfectants.
  - Inorganic matters may include lead, arsenic, calcium, sodium, and chlorine.

https://quenchwater.ca/resources/tds-information-sheet/

Sampling for Electrical Conductivity (EC)



- Another way to explain salinity.
- Shows the ability of water to carry electrical current.
- Higher EC reflects a higher concentration of dissolved ions.
- EC increases by 2% when the temperature increases by 1°C.

Water type	µS/cm
Distilled Water	0.5 – 3
Melted Snow	2 – 42
Tap Water	50 – 800
Potable Water in the US	30 – 1,500
Freshwater Streams	100 – 2,000
Industrial Wastewater	10,000
Seawater	55,000

https://www.qmul.ac.uk/chesswatch/water-quality-sensors/electrical-conductivity/

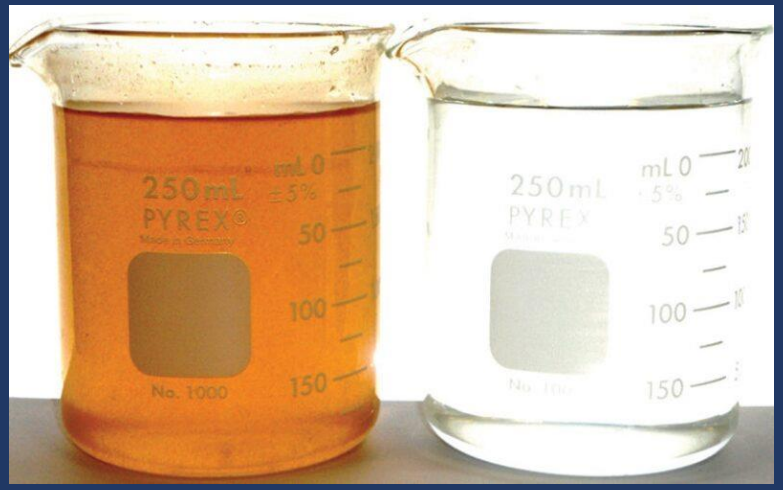
https://atlas-scientific.com/blog/conductivity-of-distilled-water/

Sampling for salinity

Parameter	EPA Standard
Chloride	250 mg/L
Total Dissolved Solids (TDS)	500 mg/L

	Salinity (salt content)	Average pH	Mineral Content (from highest to lowest concentration)
Freshwater	<0.5%	6.0 - 8.0	Chlorine, 1-250 mg/L Sodium, 1-200 mg/L Calcium, 15 mg/L Sulfate, 11 mg/L Silica, 7 mg/L Magnesium, 4 mg/L Potassium, 3 mg/L Iron, 1 mg/L
Brackish water	0.5 - 3%	6.0 - 9.0	Chlorine, 500-5000 mg/L Sodium, 5-800 mg/L Sulfate, 10 - 800 mg/L Calcium, 30 - 350 mg/L Magnesium, 5 - 80 mg/L Potassium, 5 - 50 mg/L
Saltwater	>3%	8.0 - 9.0	Chlorine, 19000 mg/L Sodium, 10000 mg/L Sulfate, 2680 mg/L Magnesium, 1290 mg/L Calcium, 400 mg/L Potassium, 395 mg/L Bromide, 66 mg/L

- Salt is not the only mineral that is found dissolved in bodies of water.
- Most water contains varying levels of sulfate, magnesium, calcium, and potassium, among others.



https://study.com/learn/lesson/freshwater-saltwater-mixed-differences-chemical-formula.html

Saltwater Intrusion Monitoring Network: Objectives

Instrument coastal groundwater wells for long-term monitoring of electrical conductivity, depth-to-water, and temperature to assess for changes in groundwater quality and quantity over time.

Saltwater Intrusion Monitoring Network: Funding

Climate Resilience Regional Challenge

PROJECT SUMMARIES

RESILIENT MAINE: LOCAL ADAPTATION AND RESILIENCE ACTIONS AT A COASTWIDE SCALE

Project Lead: Maine Governor's Office of Policy Innovation and the Future

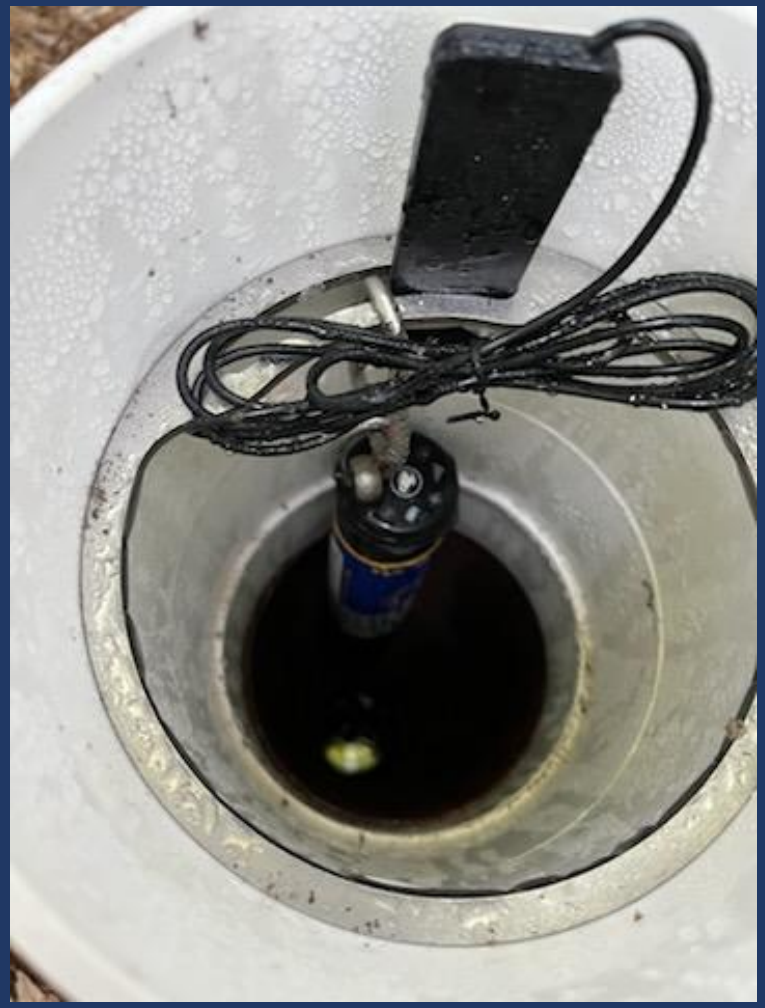
Funding Amount: $69,008,683

SUMMARY

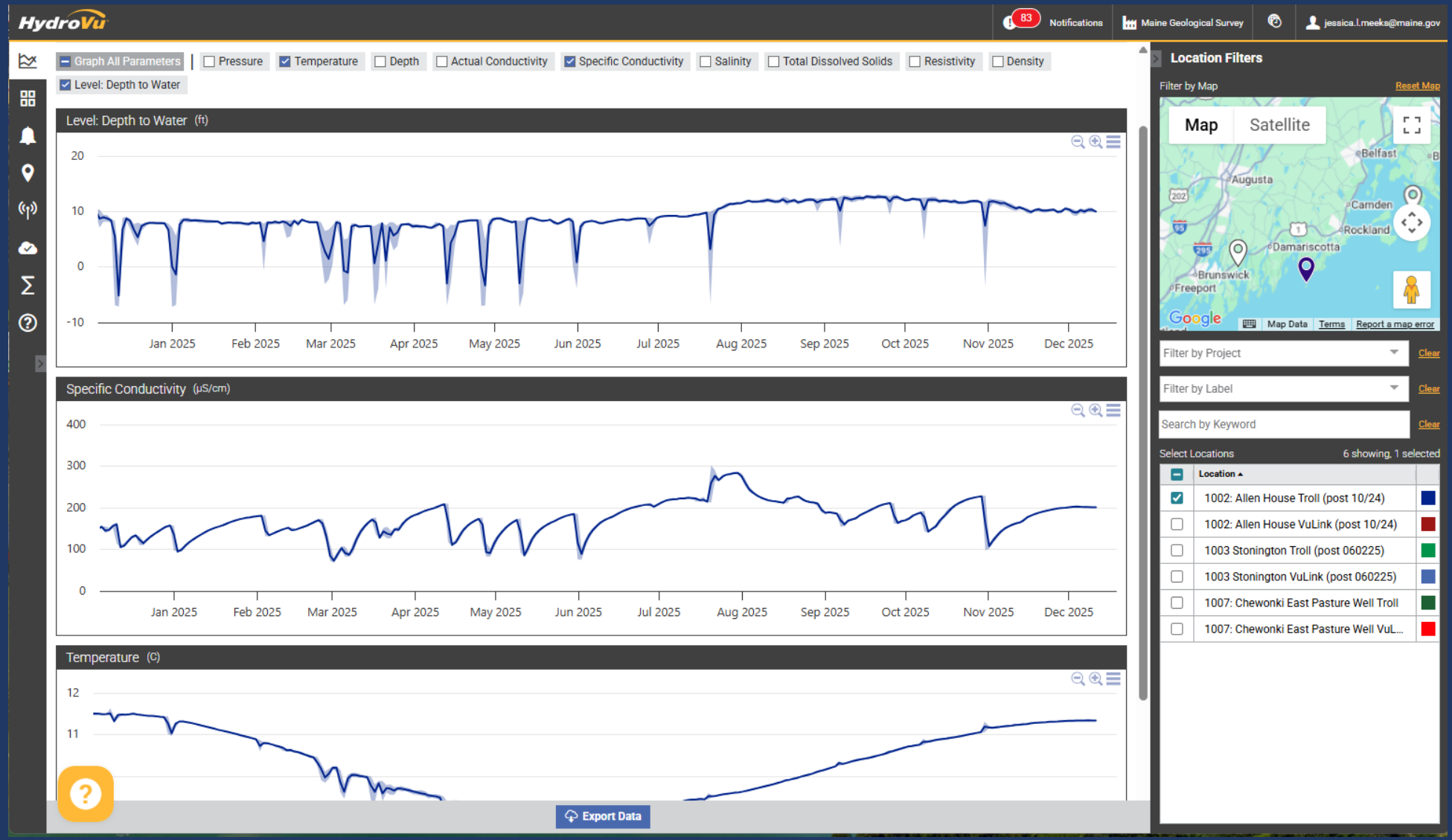
Maine's vision is to become a national leader in climate resilience among rural states by the end of this decade. This will be accomplished by supporting the goals outlined in *Maine Won't Wait*, the state's award-winning climate action plan. This funding is focused on nature-based solutions, strengthening the resilience of Maine's working waterfronts, and building enduring capacity to prepare for, and respond to, climate change impacts.

Specific activities include supporting underserved, rural, and tribal communities in the development and implementation of climate adaptation strategies; expanding the availability and use of technical assistance tools and training focused on flood risk, saltwater intrusion, bluff stability, and living shorelines; updating the state's regulatory framework to support climate resilience; conducting demonstration projects that incentivize regional collaboration and nature-based solutions; and strengthening the climate resilience of vulnerable public infrastructure and working waterfronts.

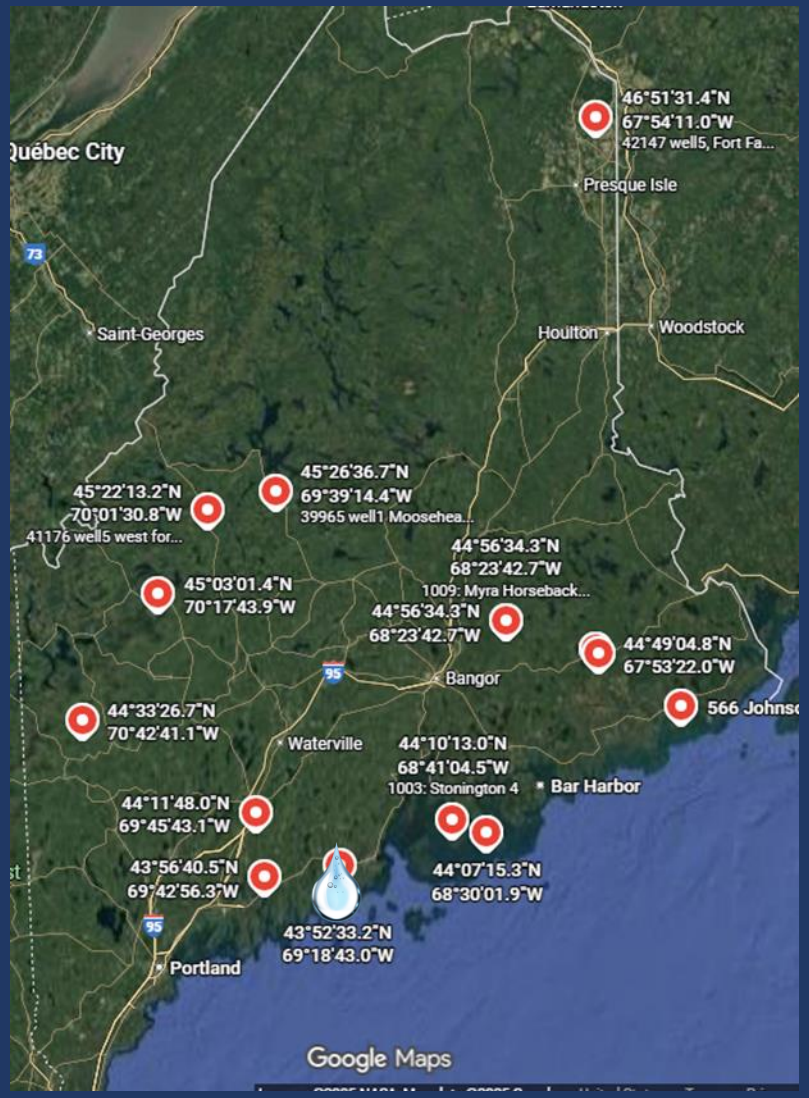
Saltwater Intrusion Monitoring Network: Equipment



Saltwater Intrusion Monitoring Network: Equipment

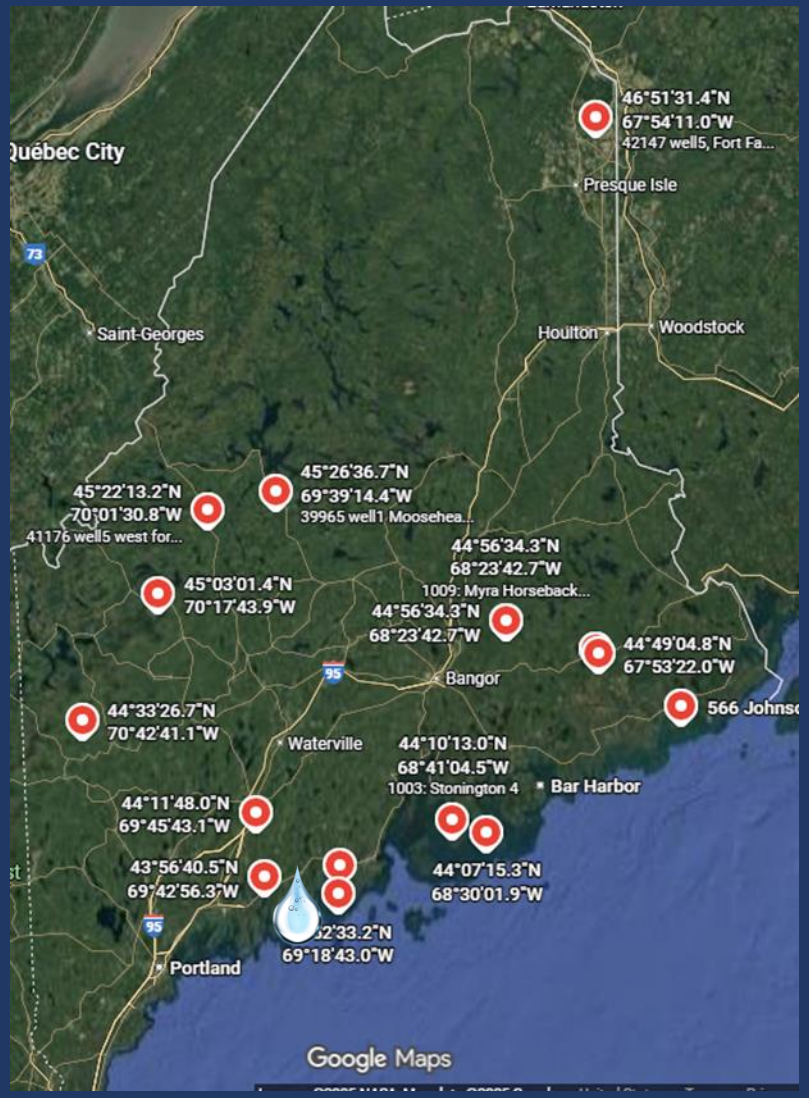


Saltwater Intrusion Monitoring Network:



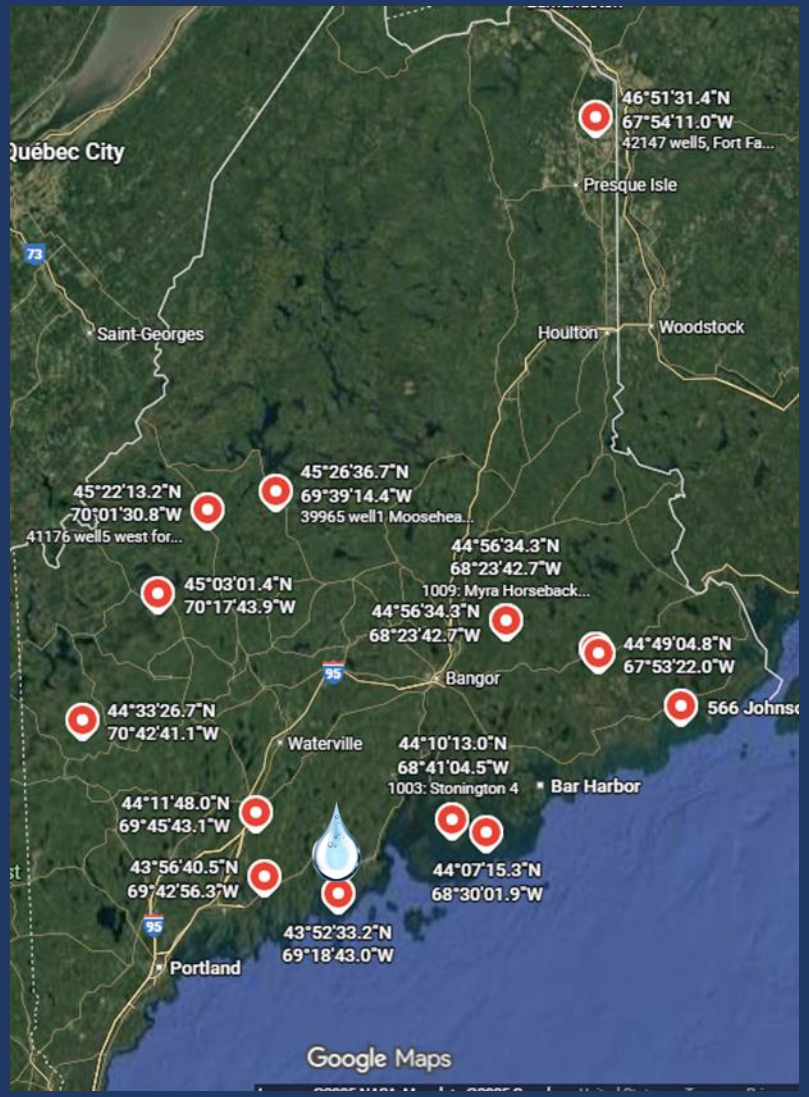
Allen Island : Colby College

Saltwater Intrusion Monitoring Network:



Westport :Carol White

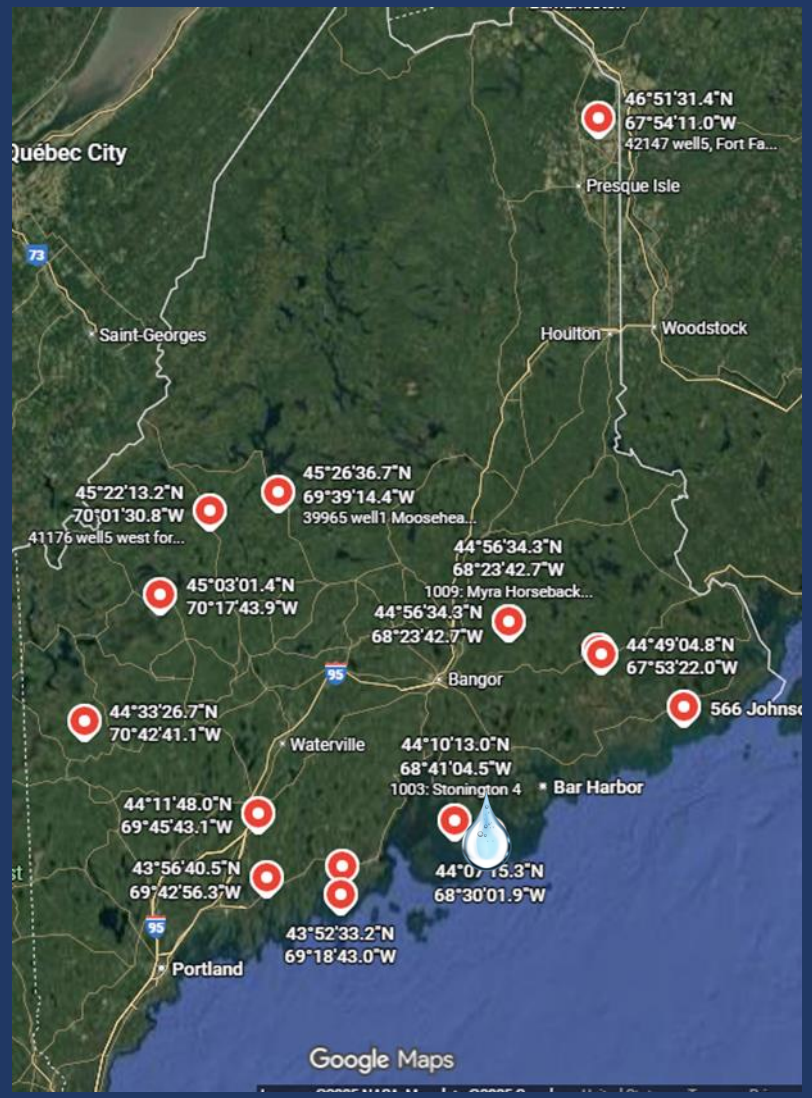
Saltwater Intrusion Monitoring Network:



Friendship : David Goold

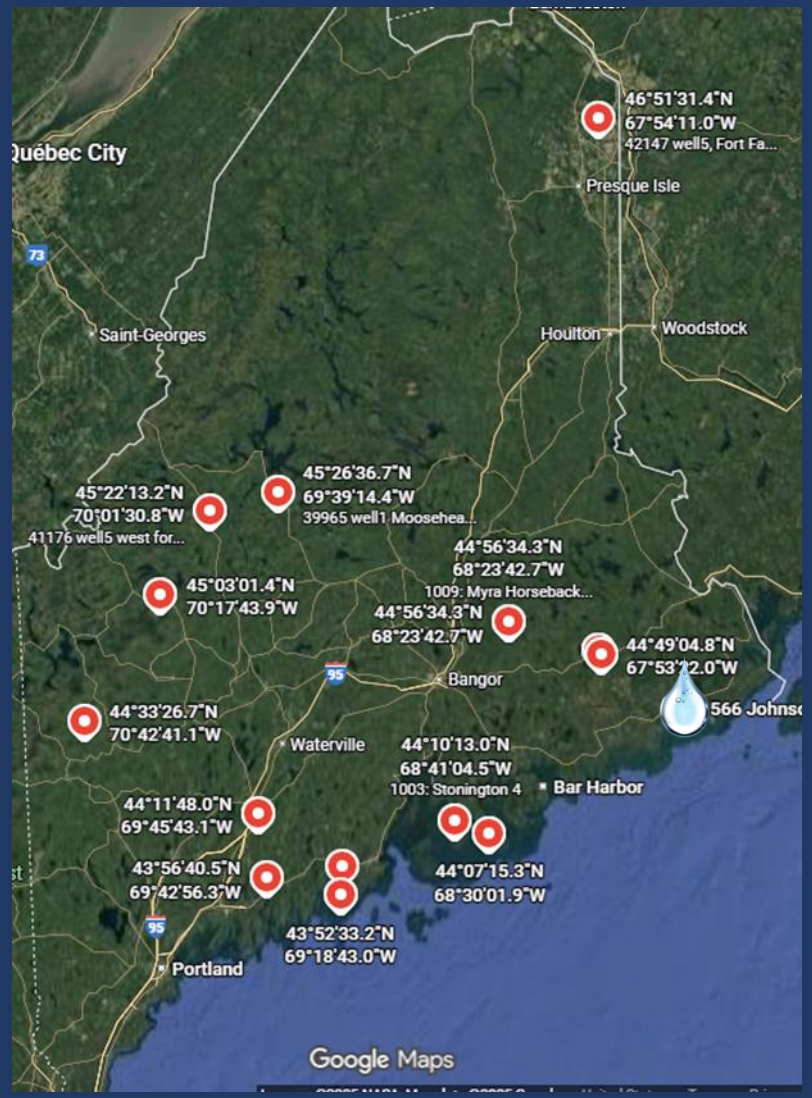
Saltwater Intrusion Monitoring Network:

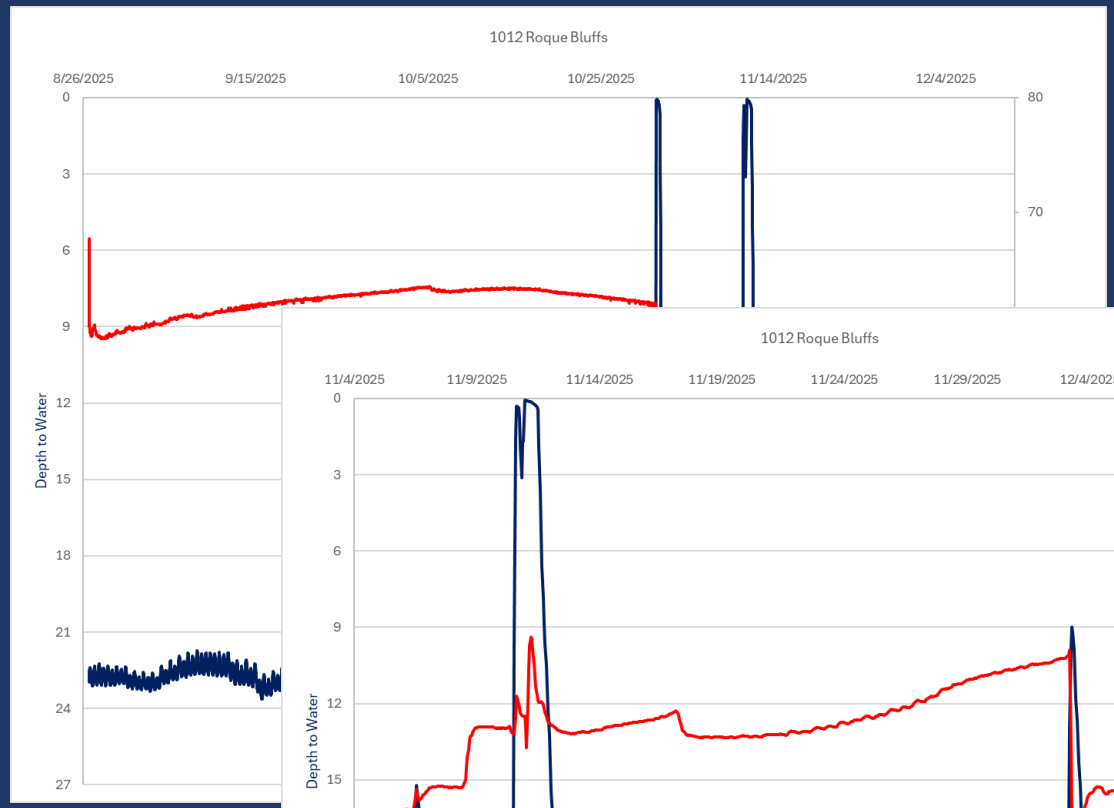
Maine Coast Heritage Trust

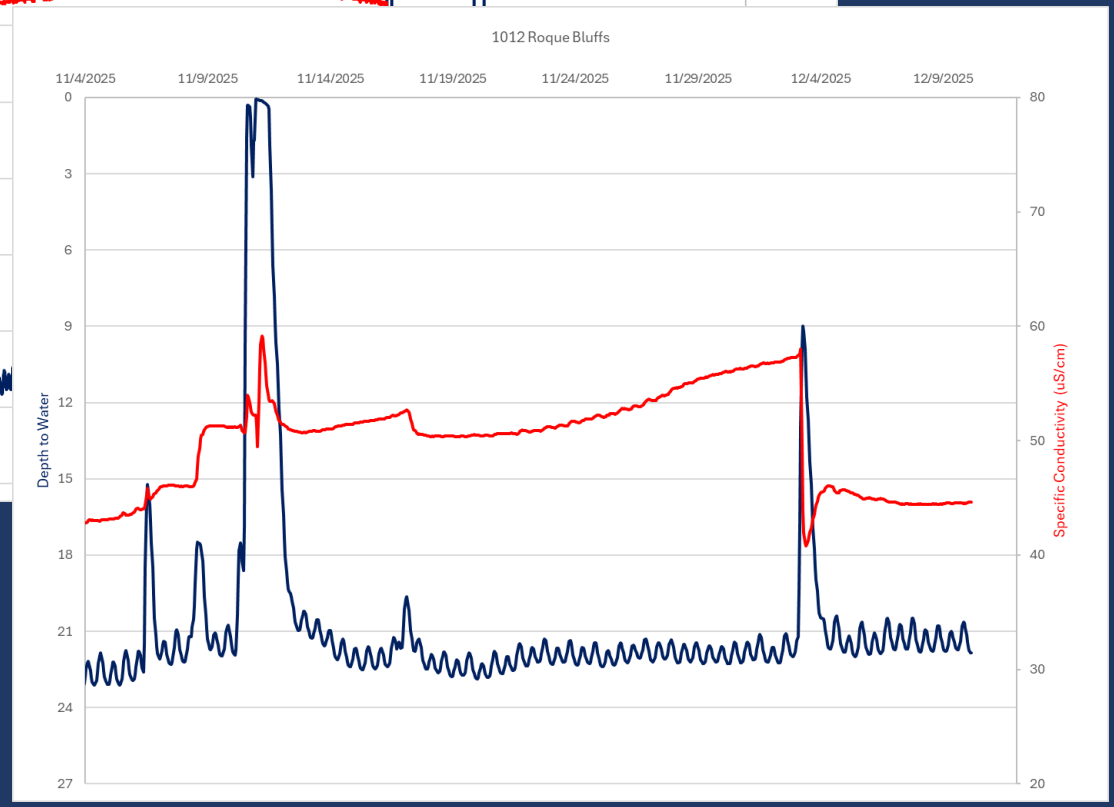


Saltwater Intrusion Monitoring Network:

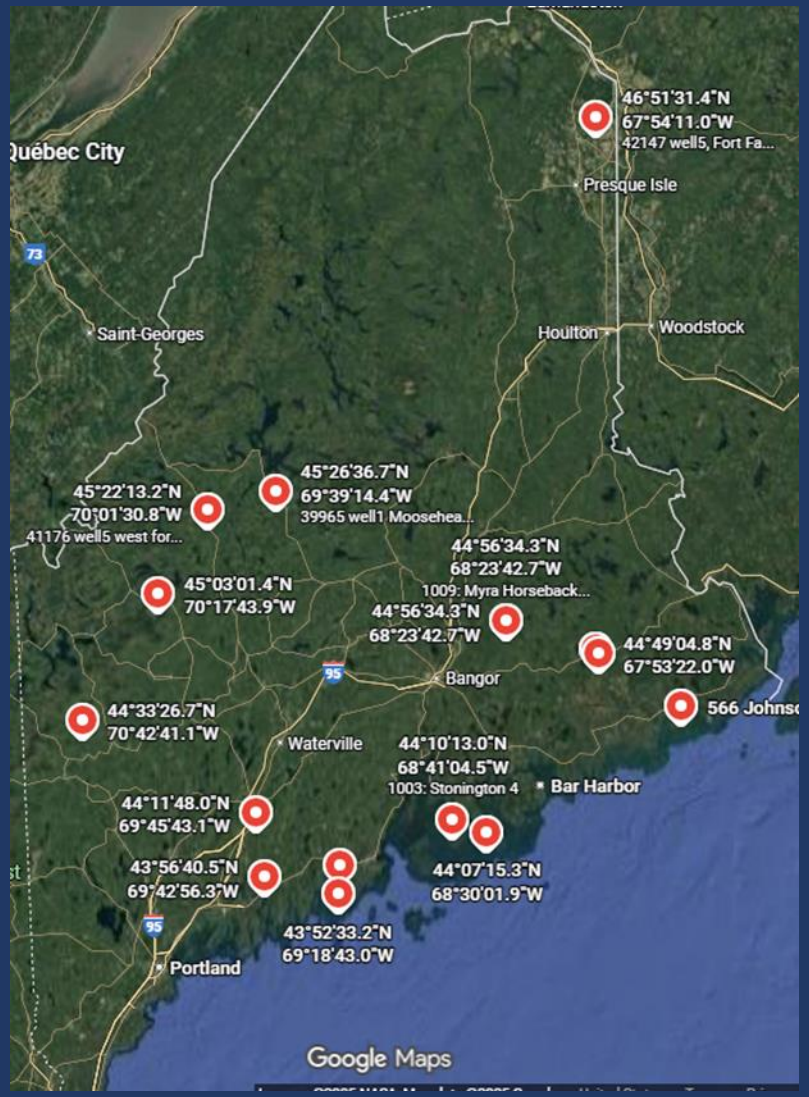
Roque Bluffs : Robin Pinto







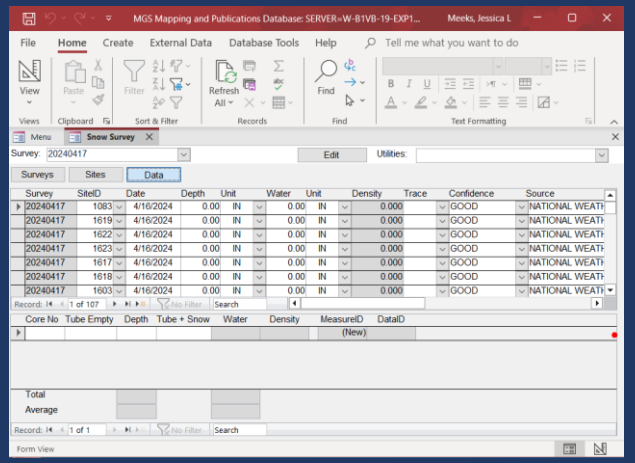
Saltwater Intrusion Monitoring Network: Potential Future Sites



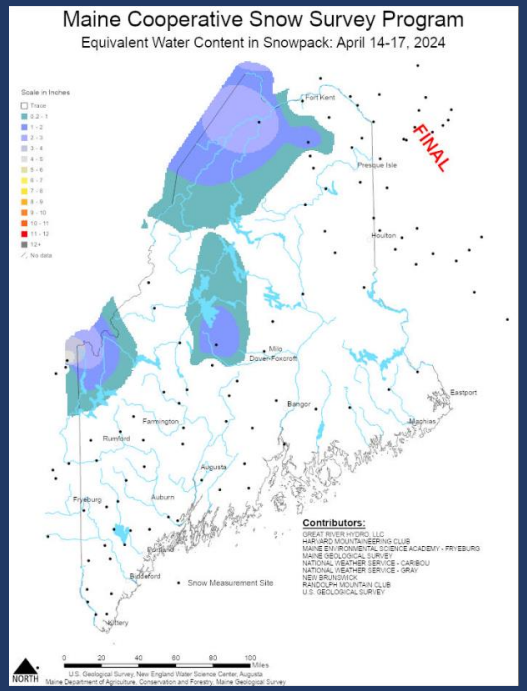
- Georgetown/Arrowsic : Carol White
- Harpswell
- Islesboro
- South Thomaston
- Little Deer Isle
- Southport
- Tremont

What will the MGS do with your data?

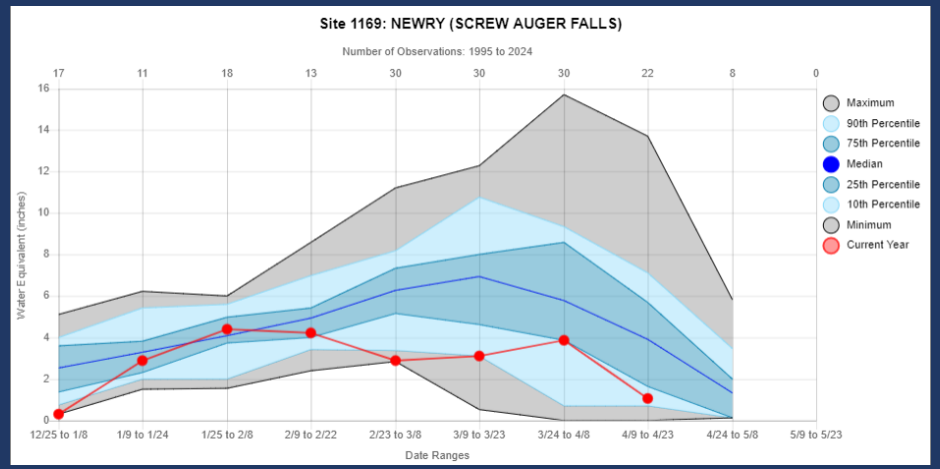
Water quality data into our MGS database



Will be able to make SWI impact maps



Will be able to evaluate SWI trends over time



How will the MGS protect your data?

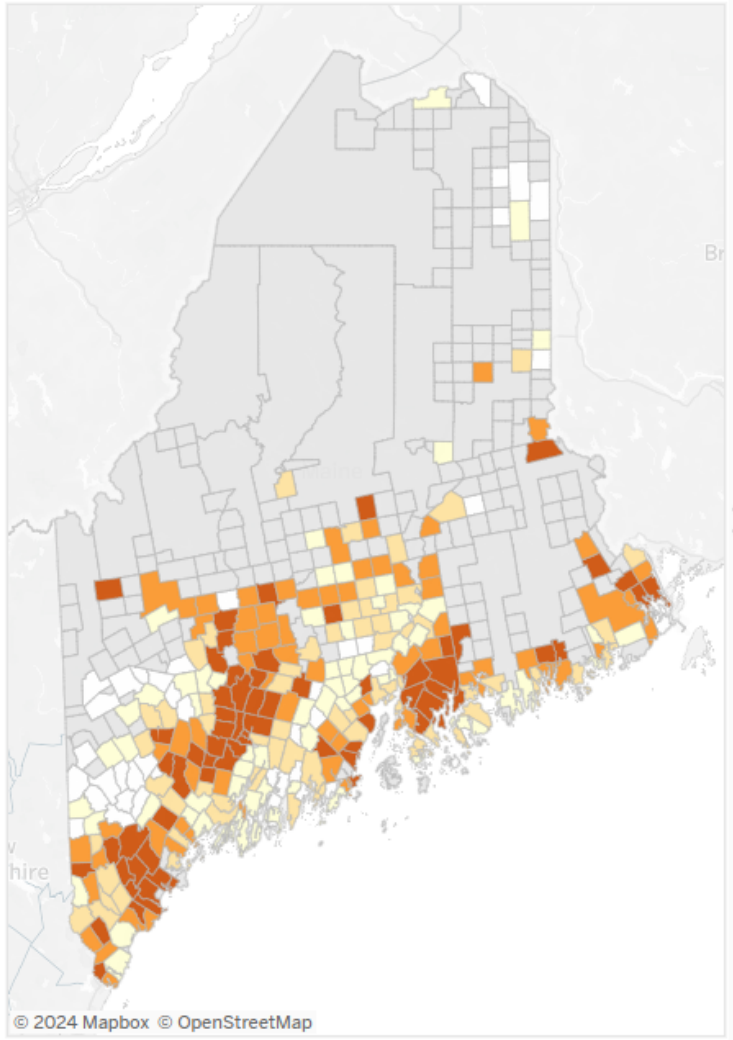
Maine Tracking Network

Town-level Data: Testing Results

County Comparison Maps: Compare % Above Guideline | Compare Analytes/Measures

Analyte: Arsenic | Measure: Percent Above Guideline | County: (All) | Locate Town: Highlight Location

Arsenic | by Town | Percent Above Guideline

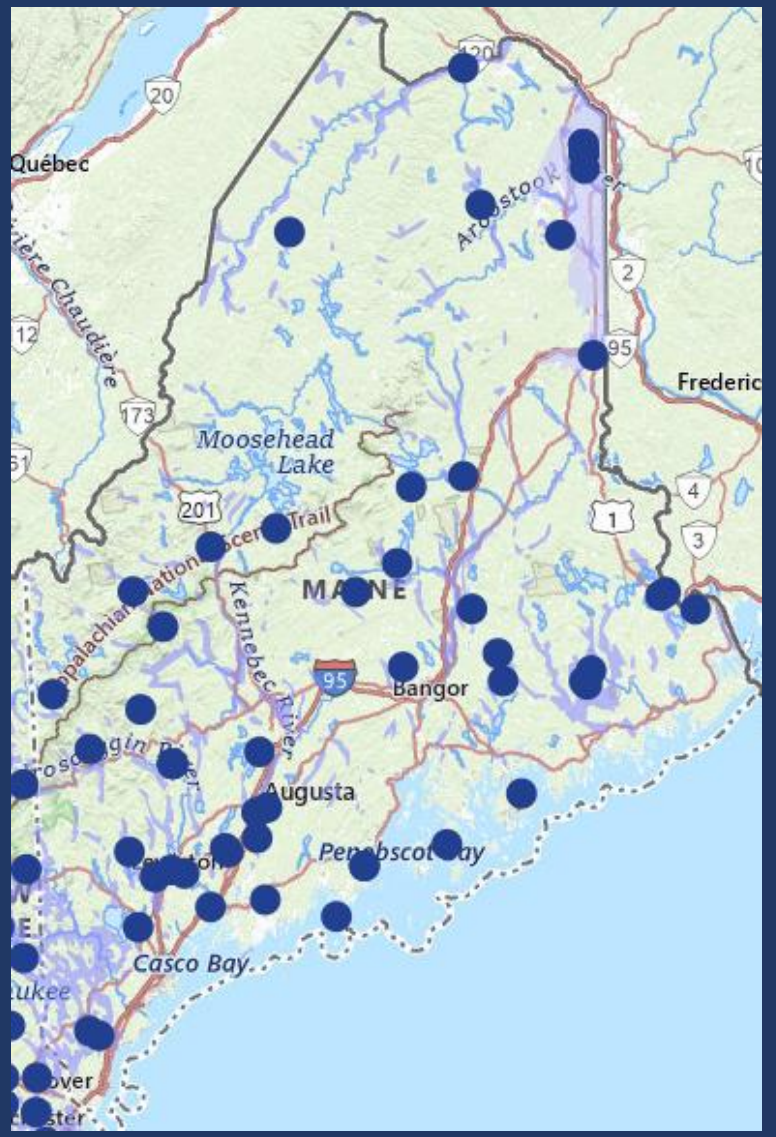


Percent Above Guideline: Zero | 0.7 - <5.3 | 5.3 - <11.8 | 11.8 - <21.3 | 21.3 - 61.9 | NR

National Groundwater Monitoring Network

National Ground-Water Monitoring Network

- The NGWMN activities are conducted under the authority of the Omnibus Public Land Management Act of 2009 (Secure Water Act), reauthorized in 2024.
- The NGWMN is a compilation of selected groundwater monitoring wells from Federal, State, and local groundwater monitoring networks across the nation.



National Ground-Water Monitoring Network

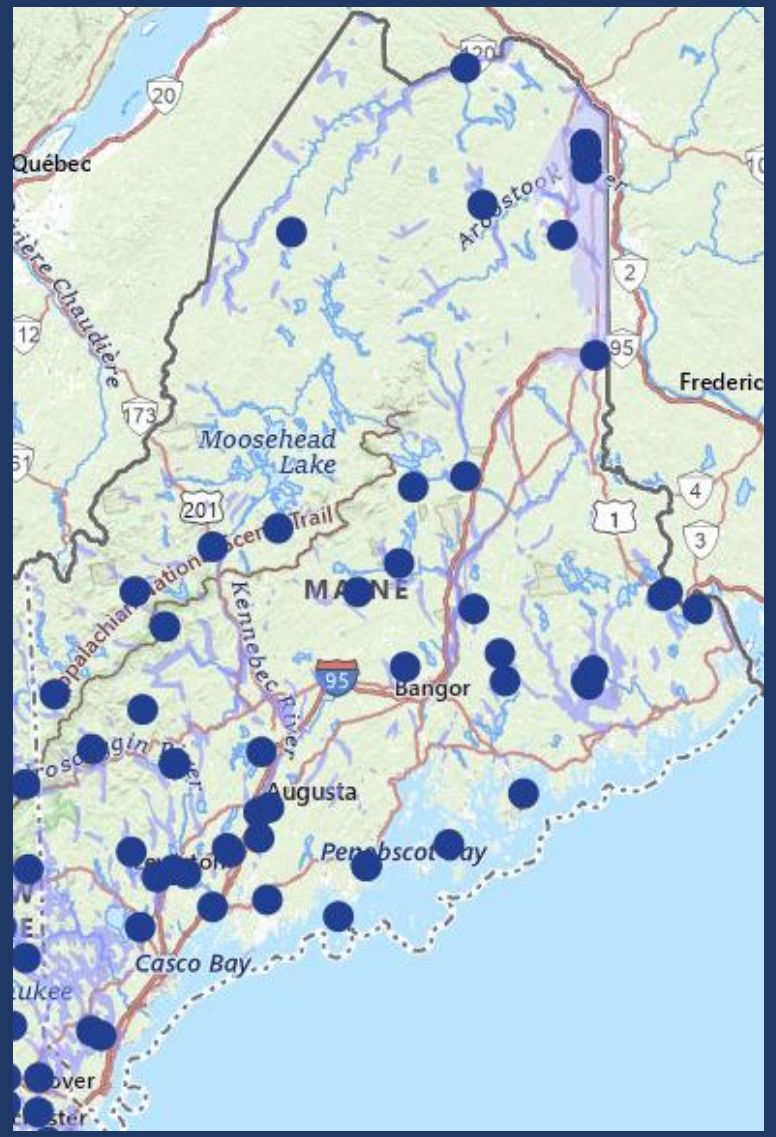
The [NGWMN Data Portal] provides access to groundwater data from multiple, dispersed databases in a web-based mapping application. The portal contains current and historical data including water levels, water quality, lithology, and well construction. The NGWMN is currently in the process of adding new data providers to the Network.

CURRENT NETWORK:

17853 water-level wells
4167 water-quality wells

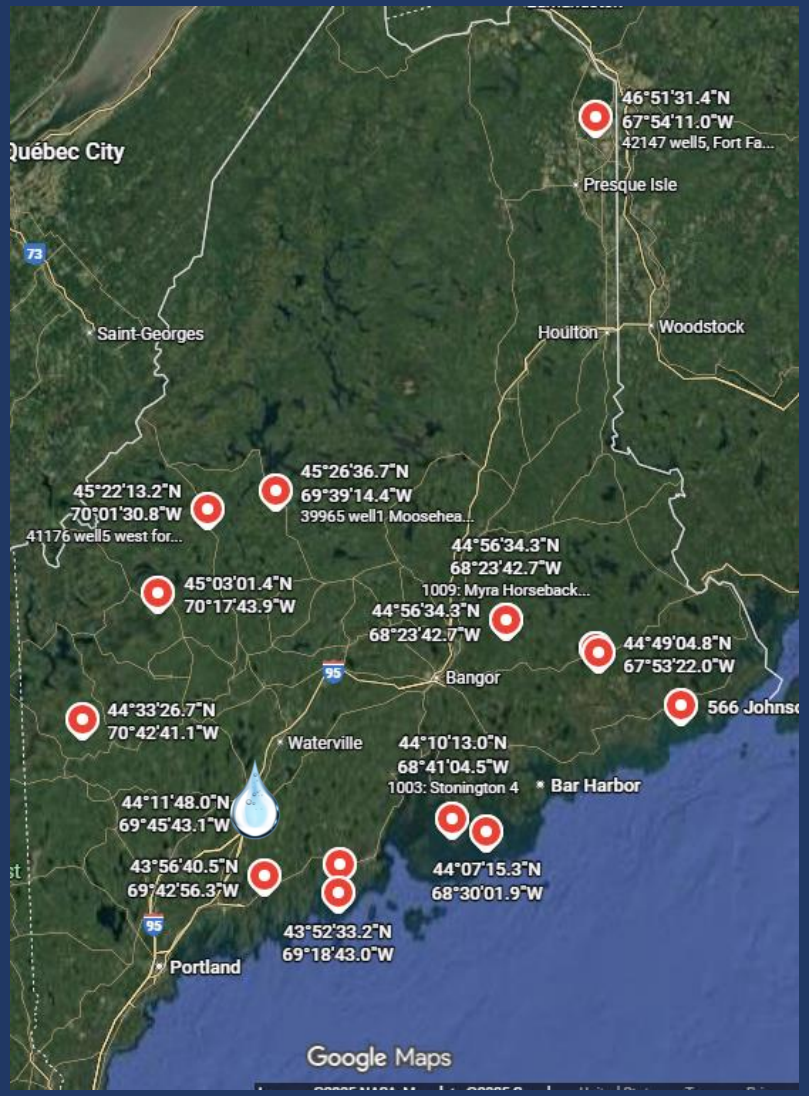
10 subnetworks

38 contributing agencies
53 administrative units
65 principal aquifers

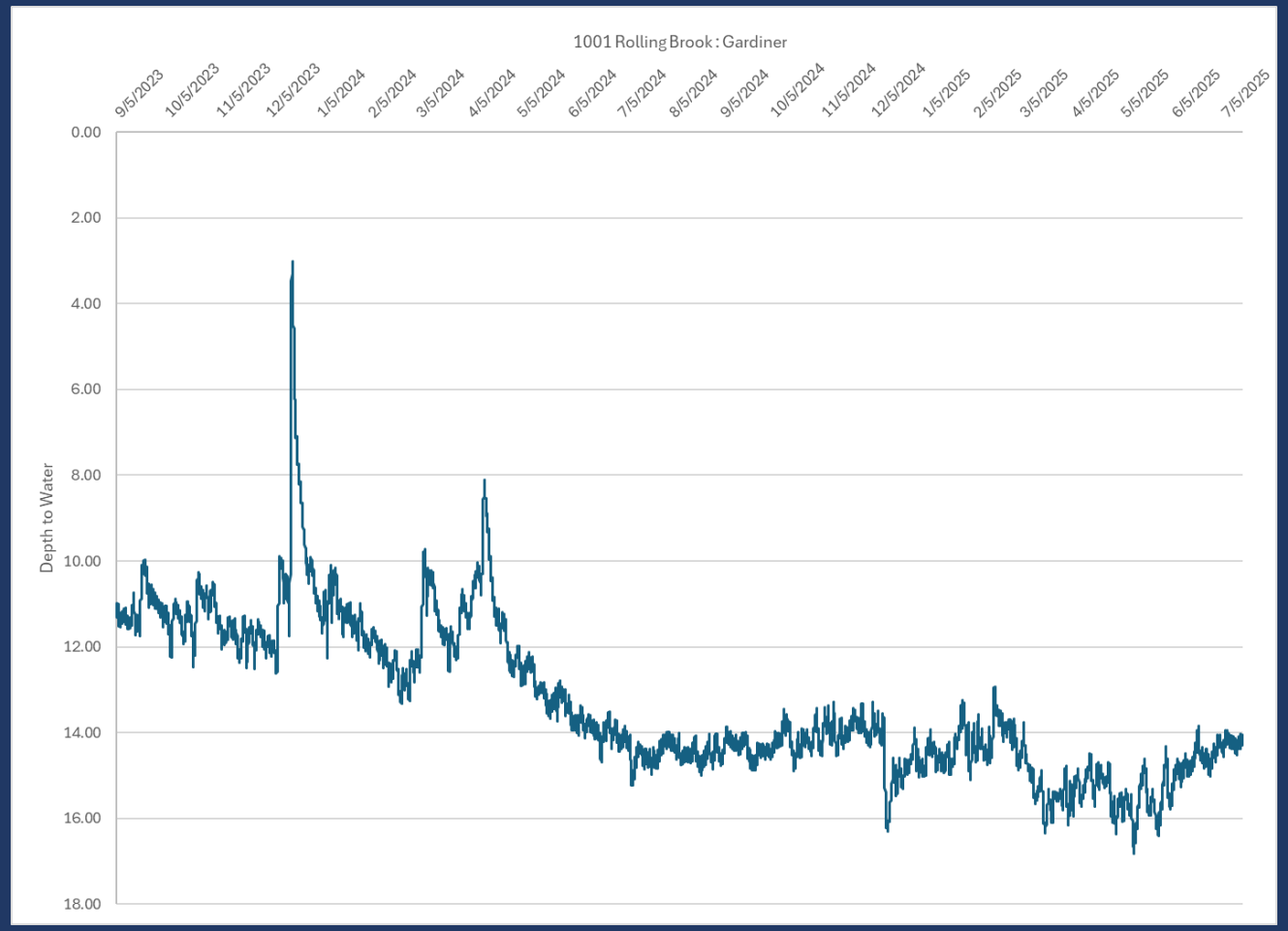


https://www.usgs.gov/apps/ngwmn/index.jsp

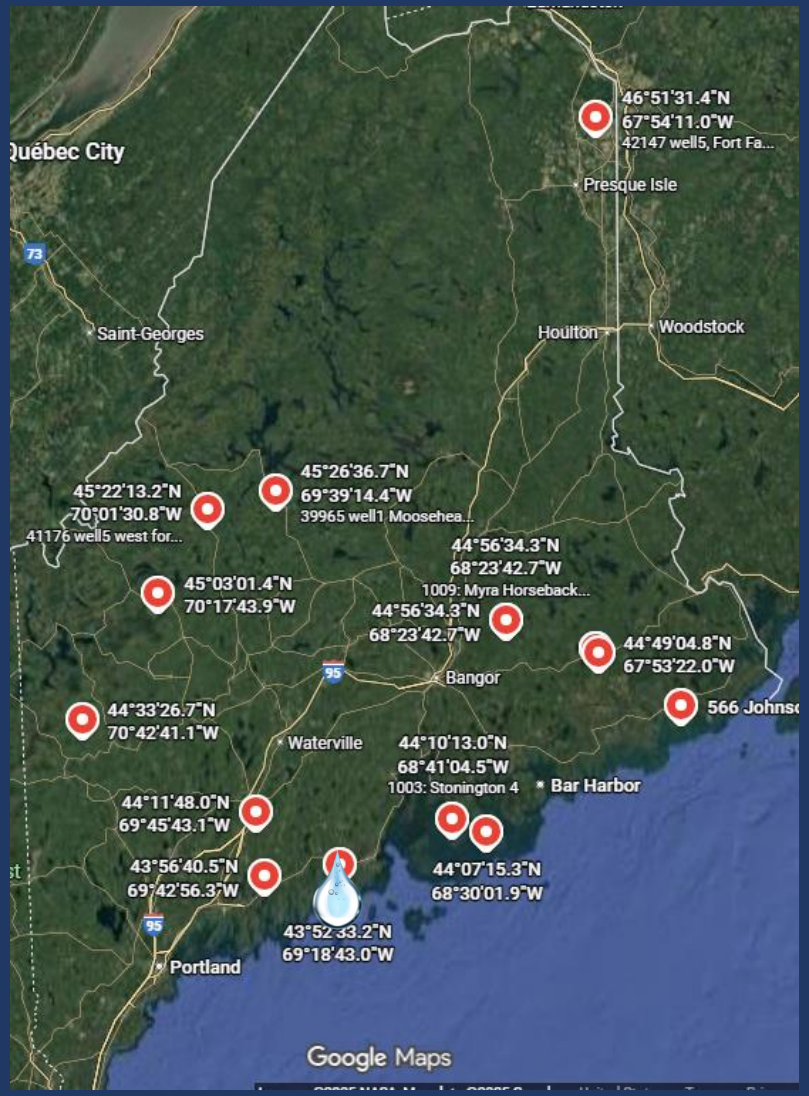
National Ground-Water Monitoring Network



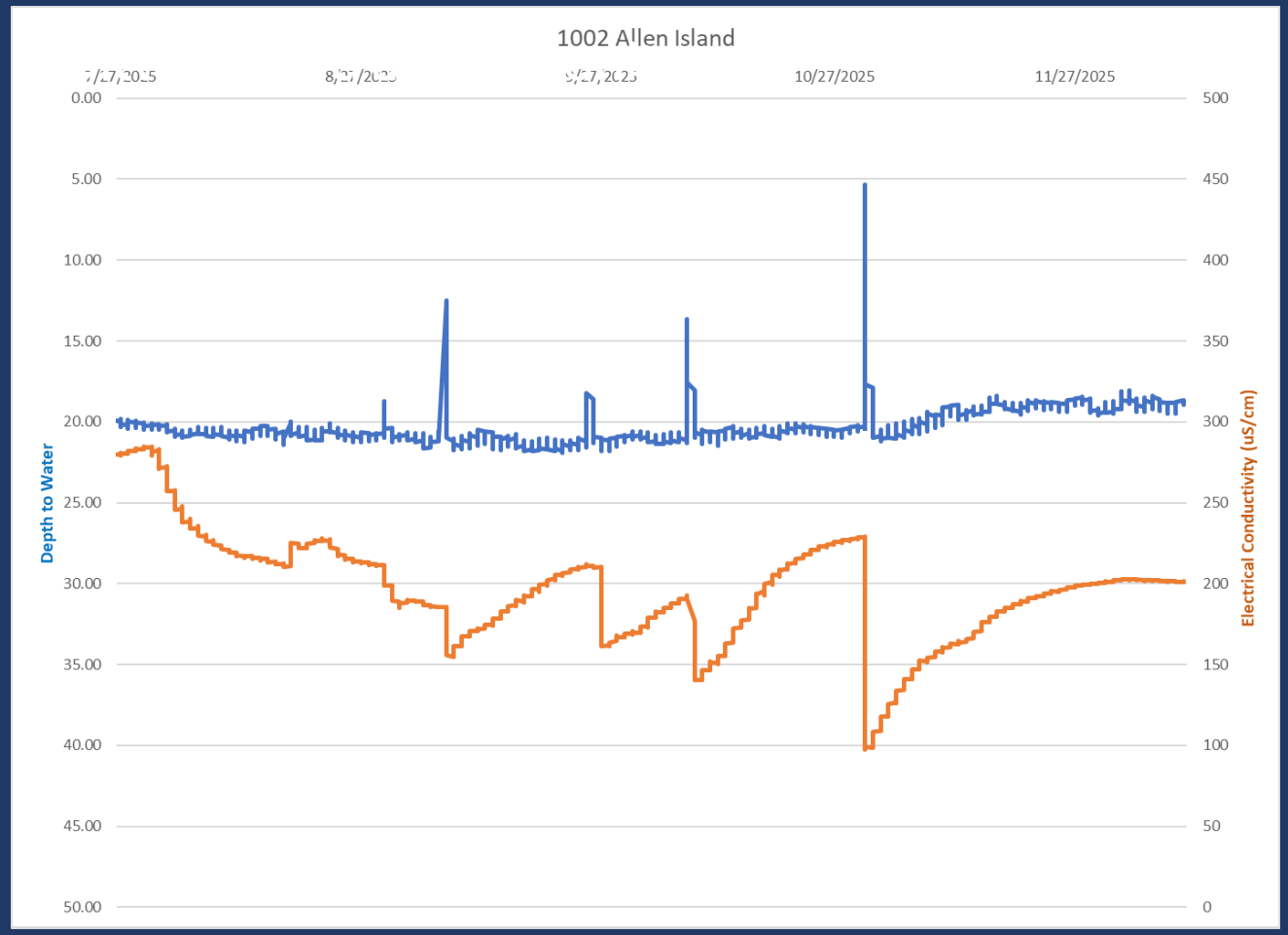
1001 Rolling Brook : Gardiner



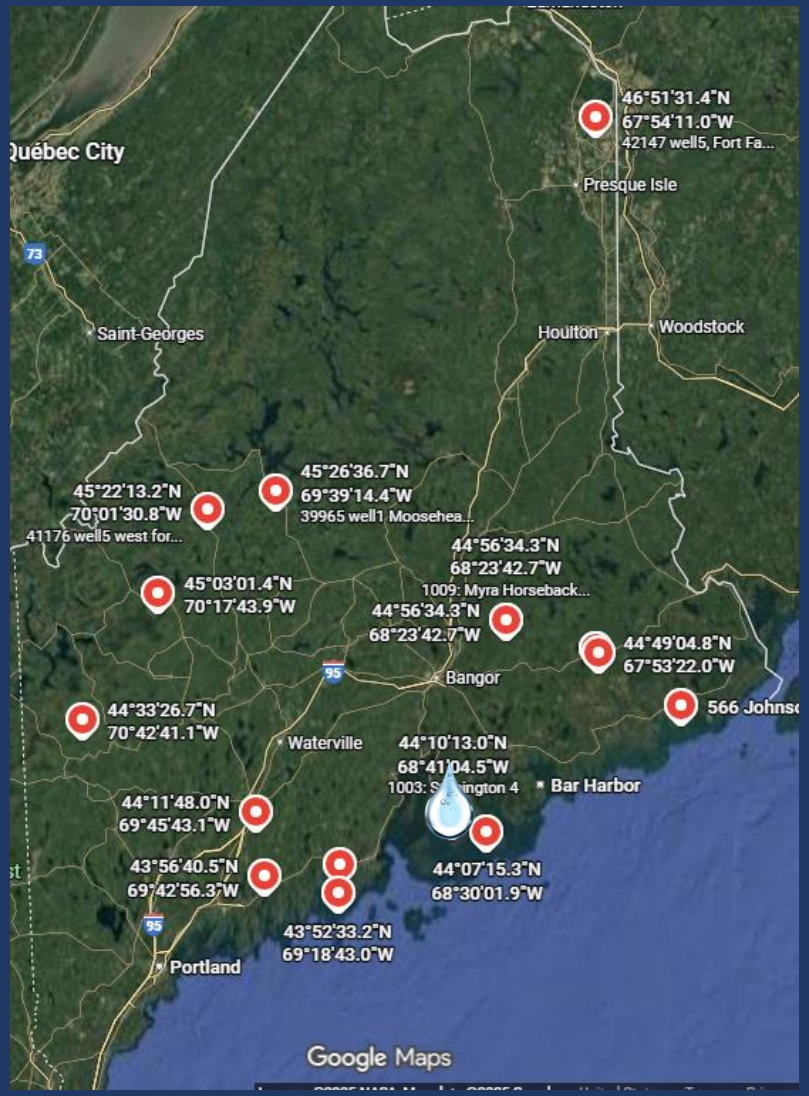
National Ground-Water Monitoring Network



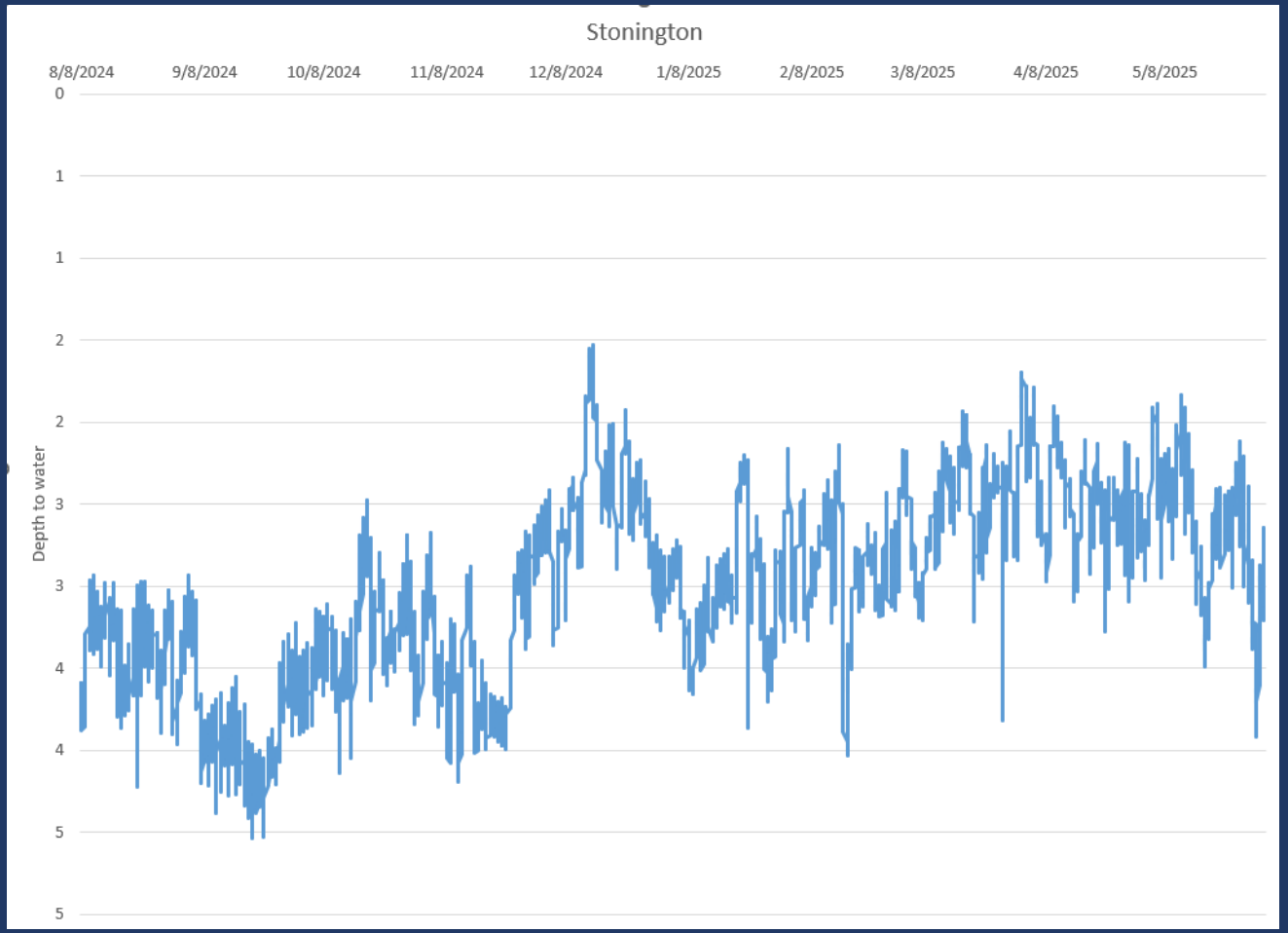
1002 : Allen Island



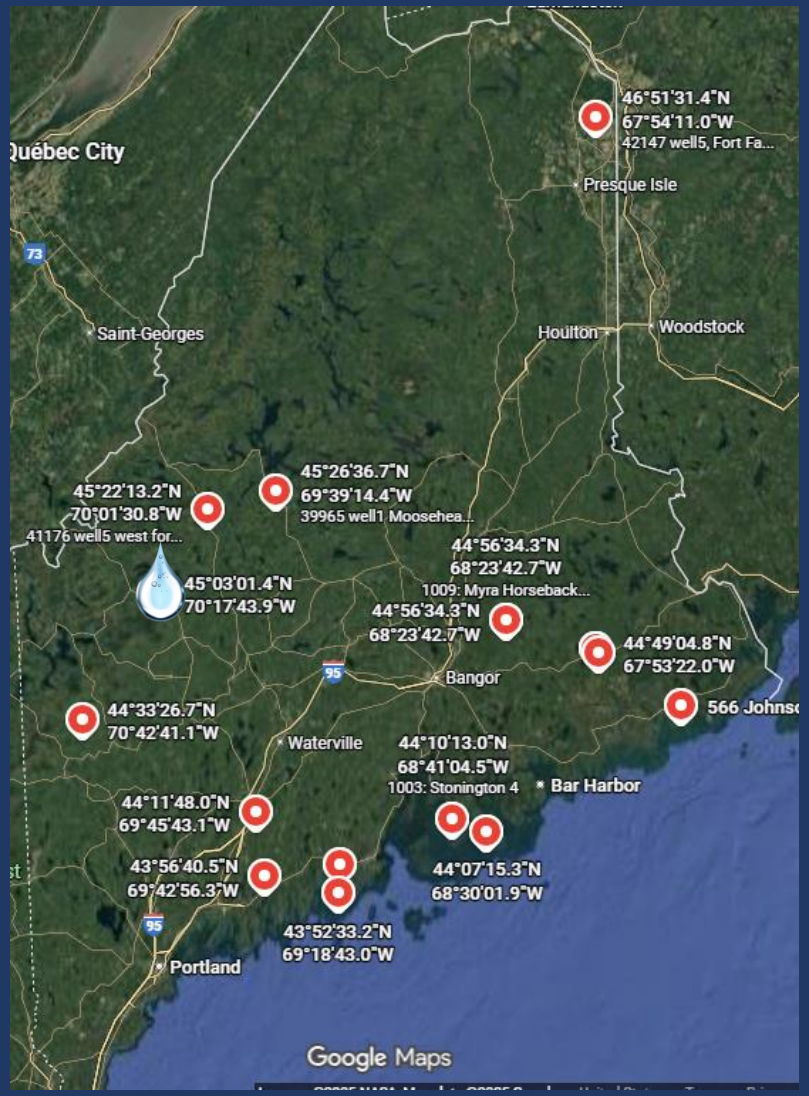
National Ground-Water Monitoring Network



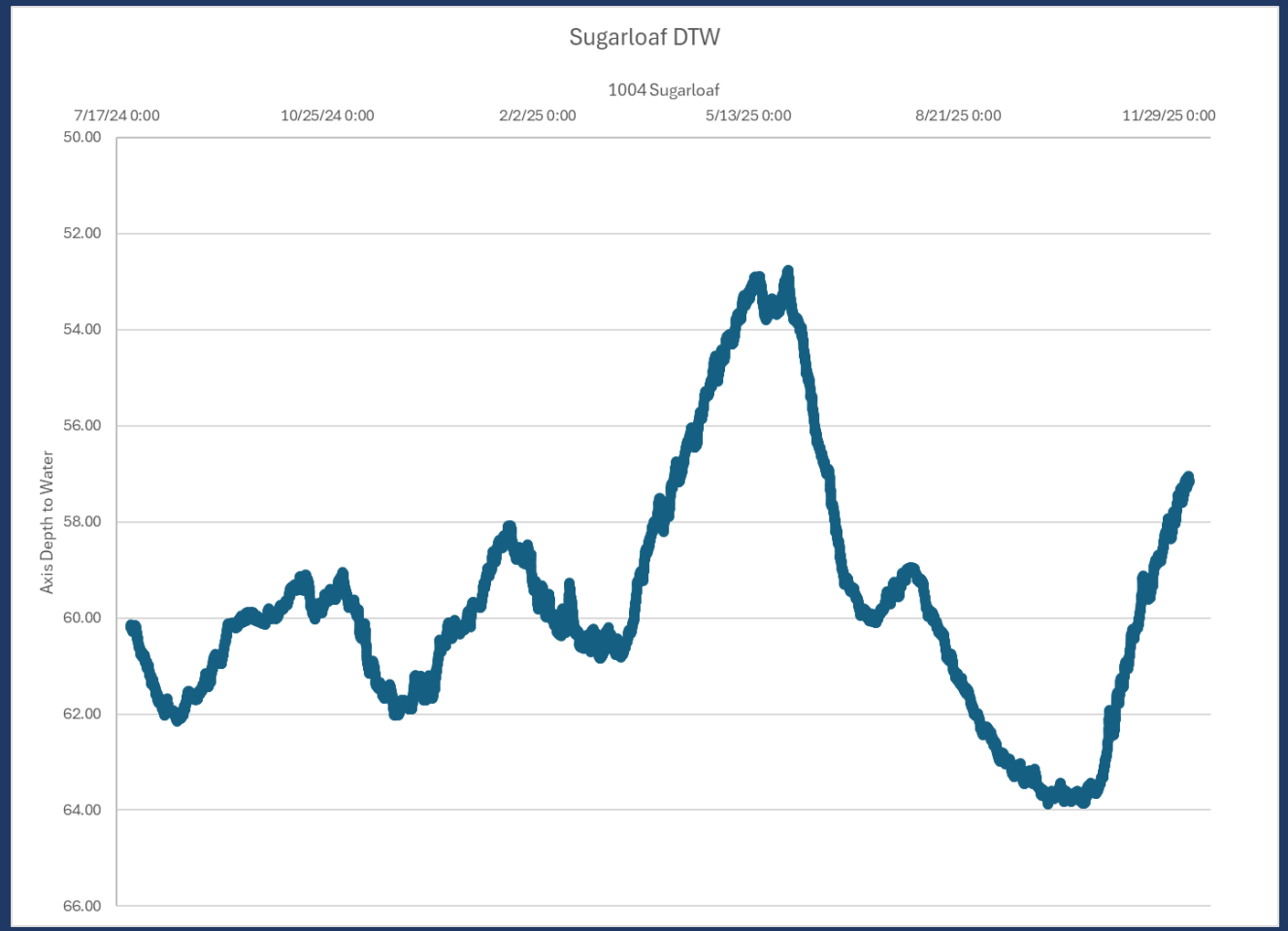
1003 : Stonington



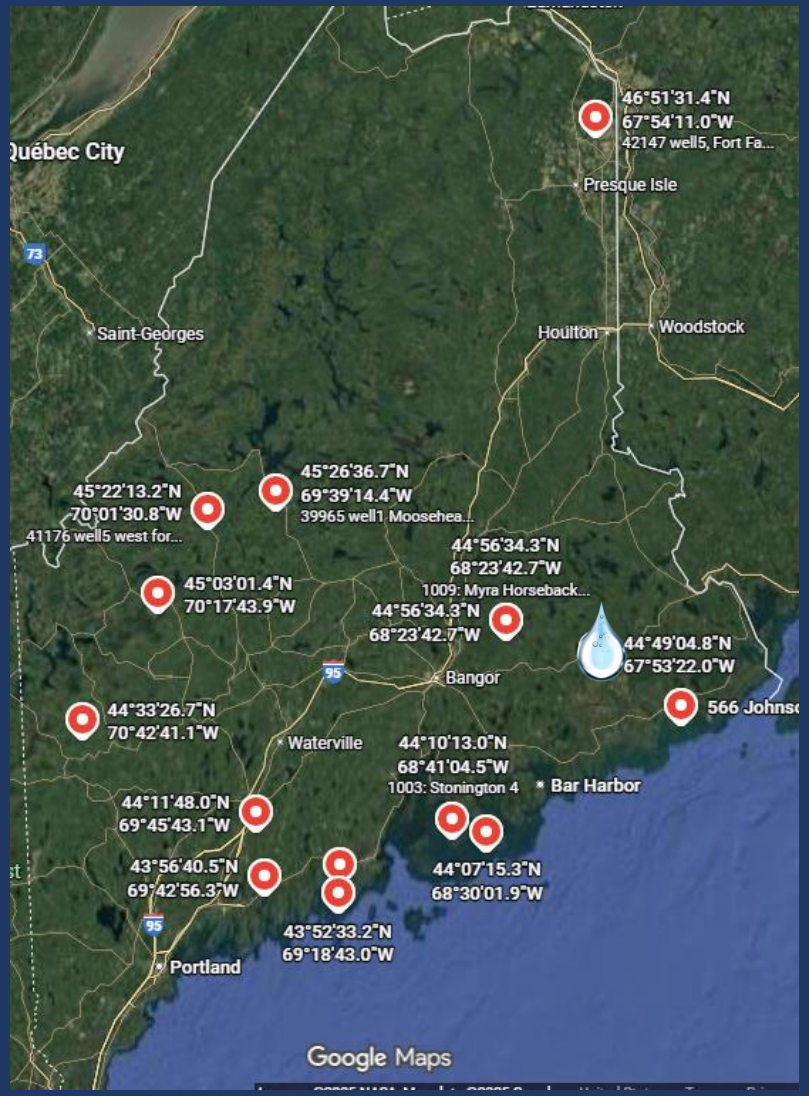
National Ground-Water Monitoring Network



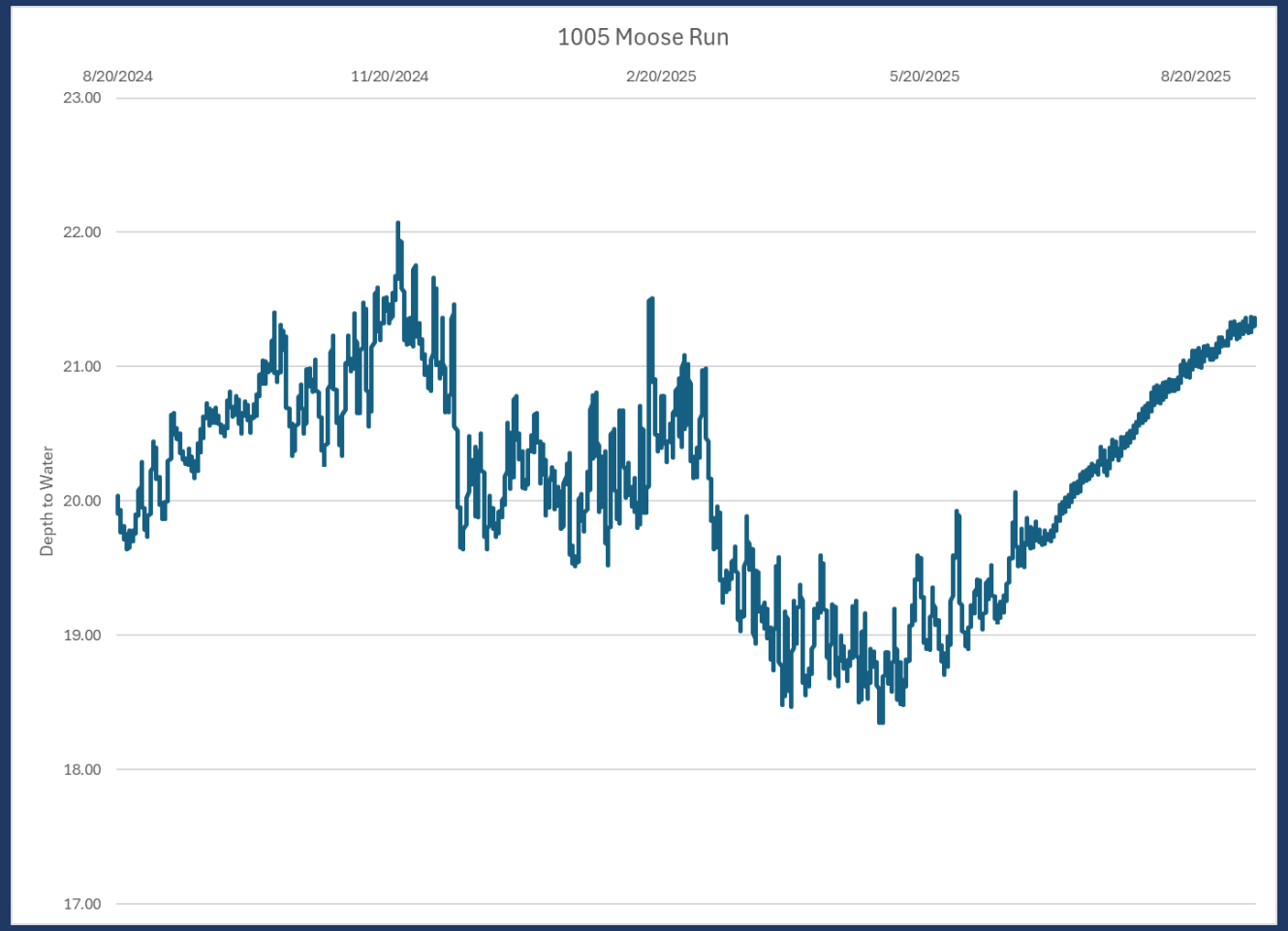
1004: Sugarloaf



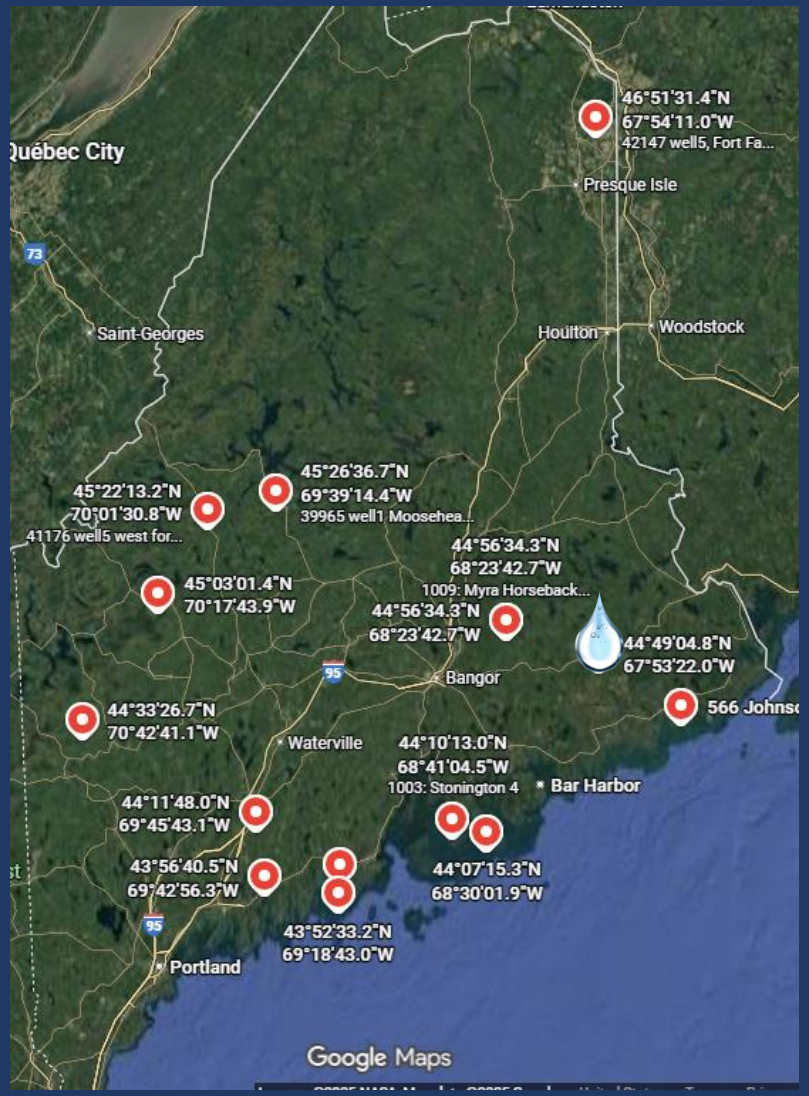
National Ground-Water Monitoring Network



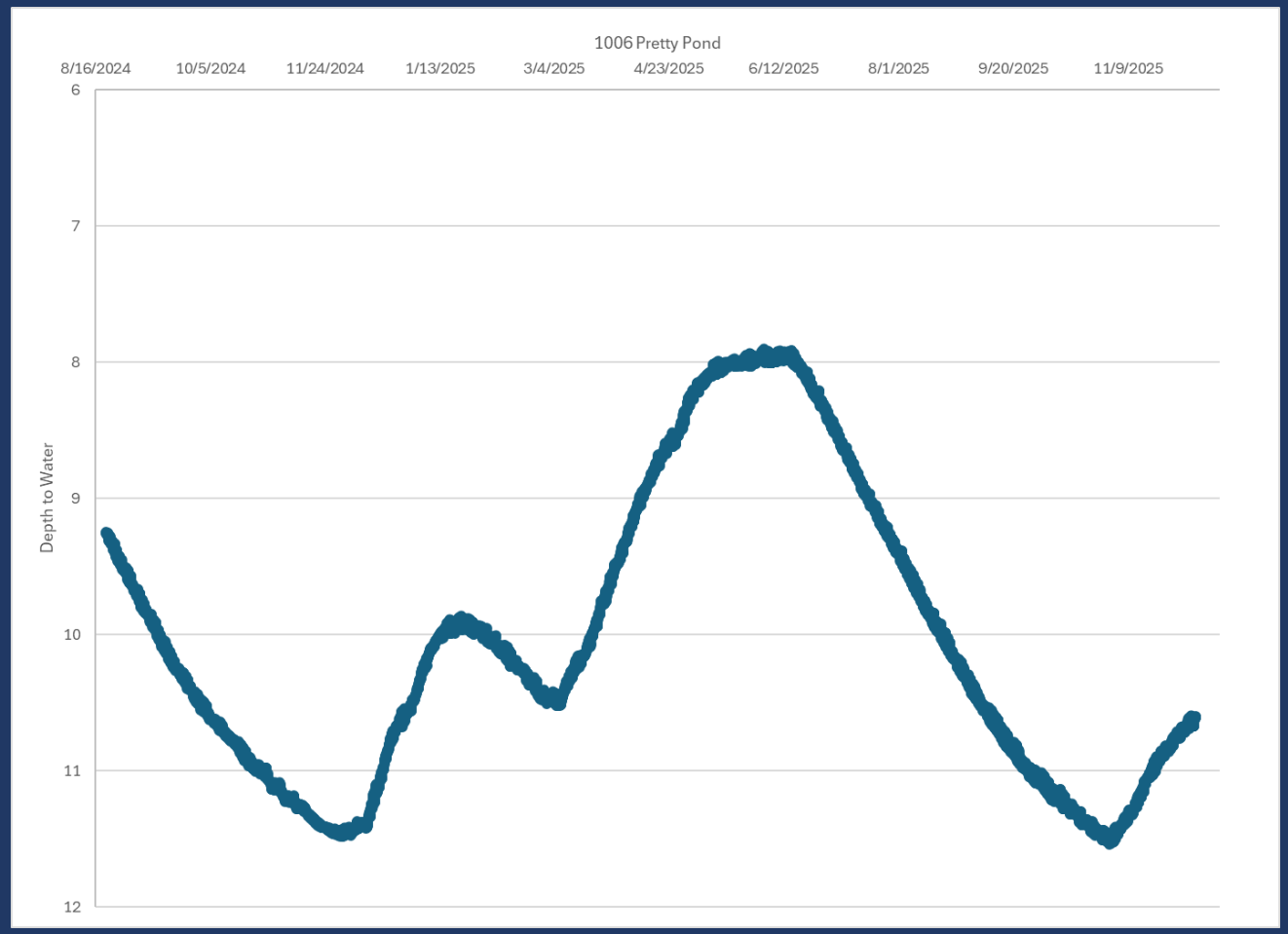
1005: Moose Run 2



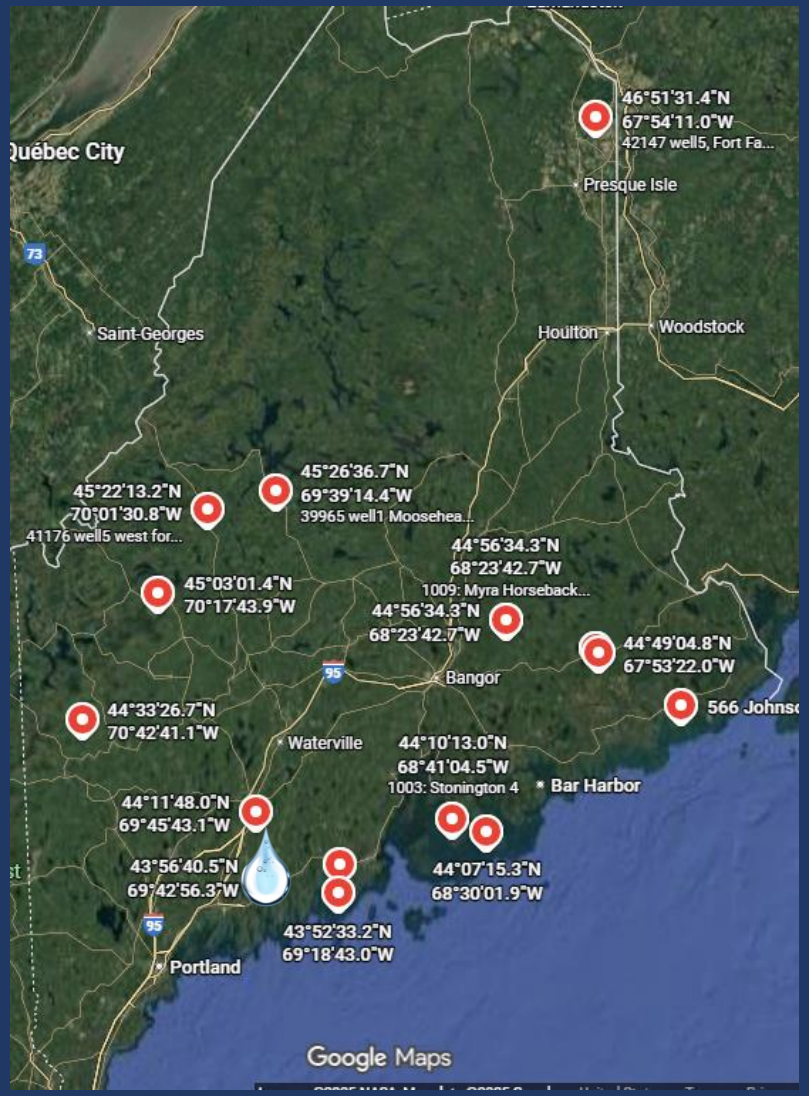
National Ground-Water Monitoring Network



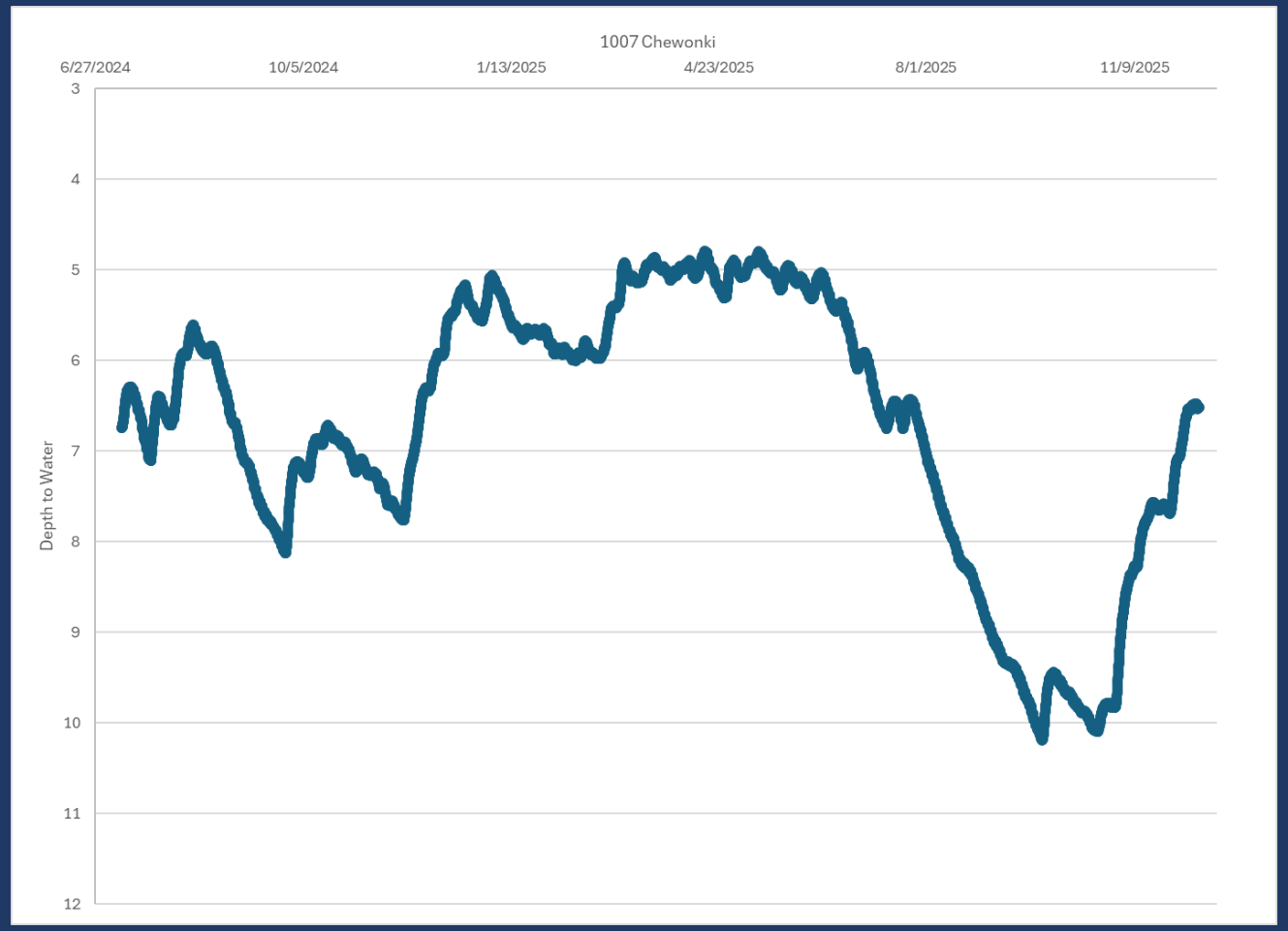
1006: Pretty Pond



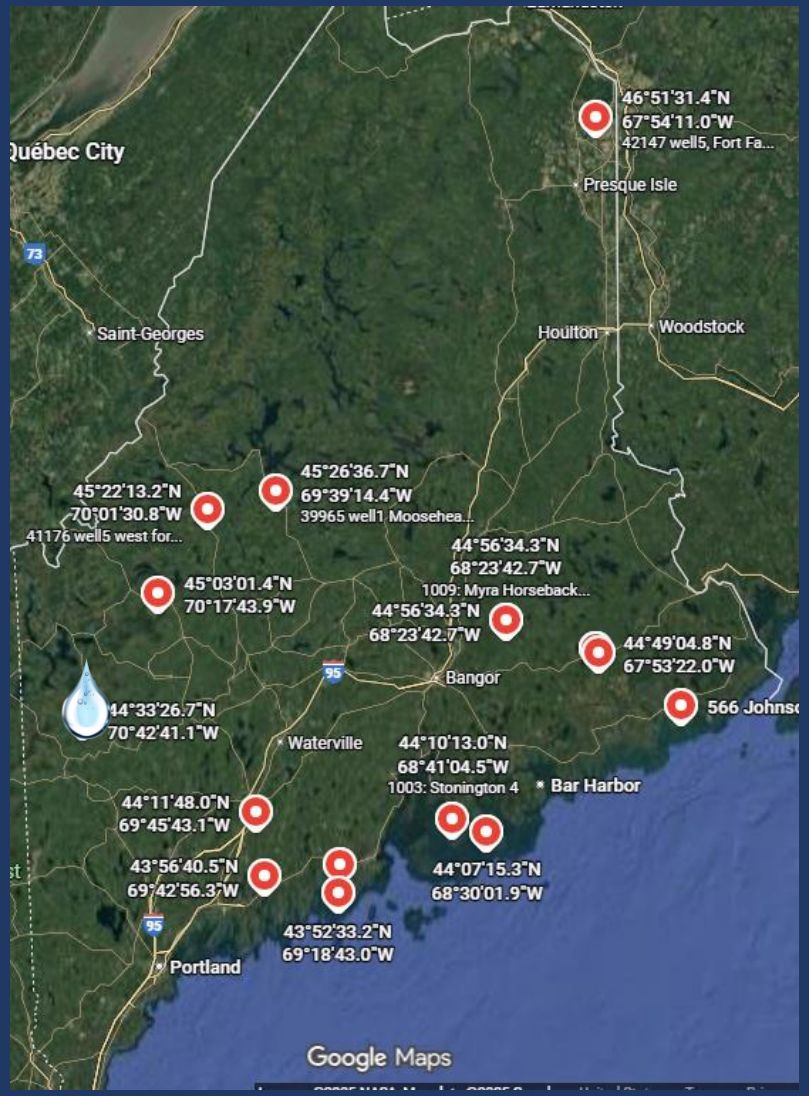
National Ground-Water Monitoring Network



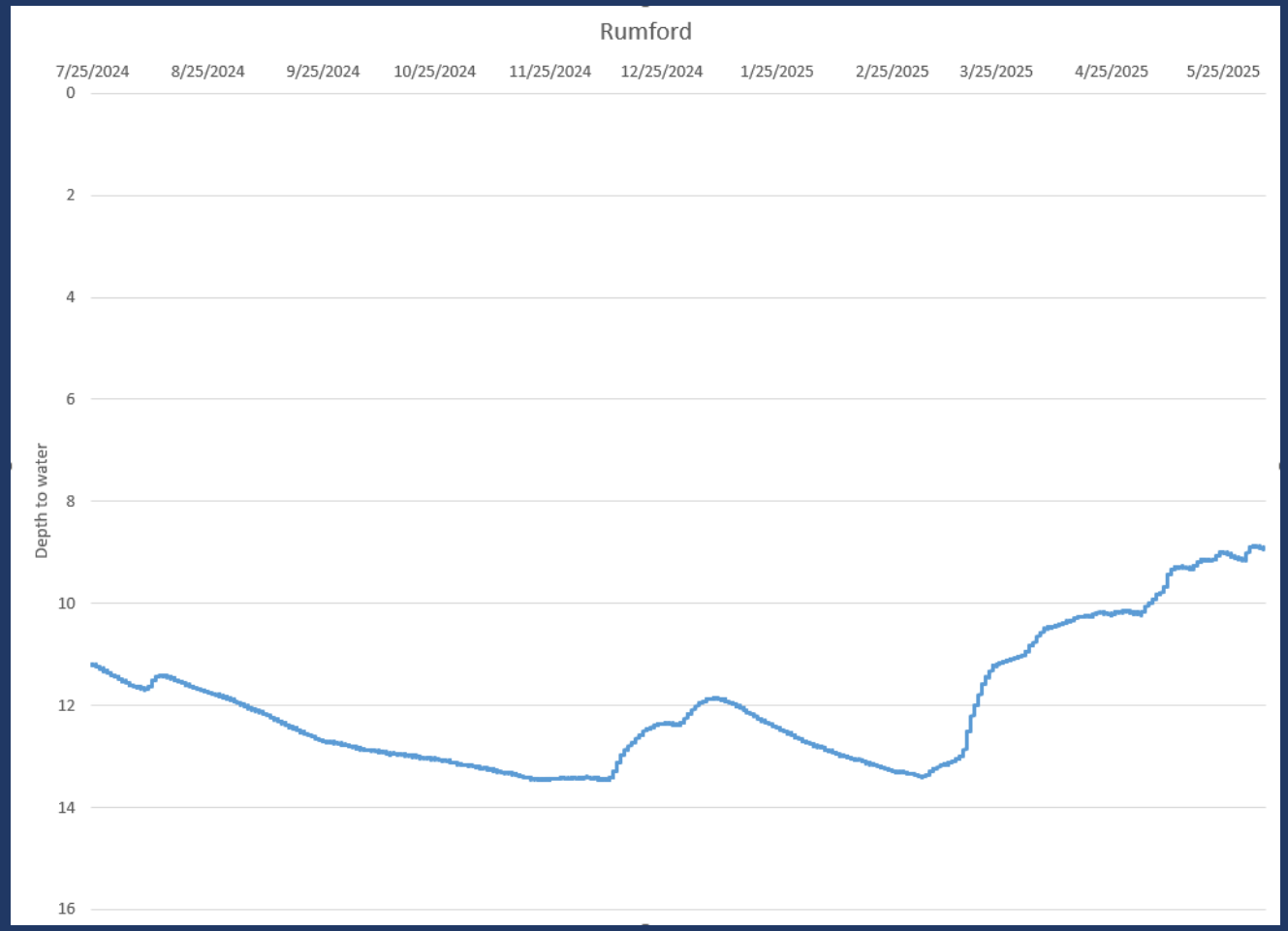
1007: Chewonki East Pasture well



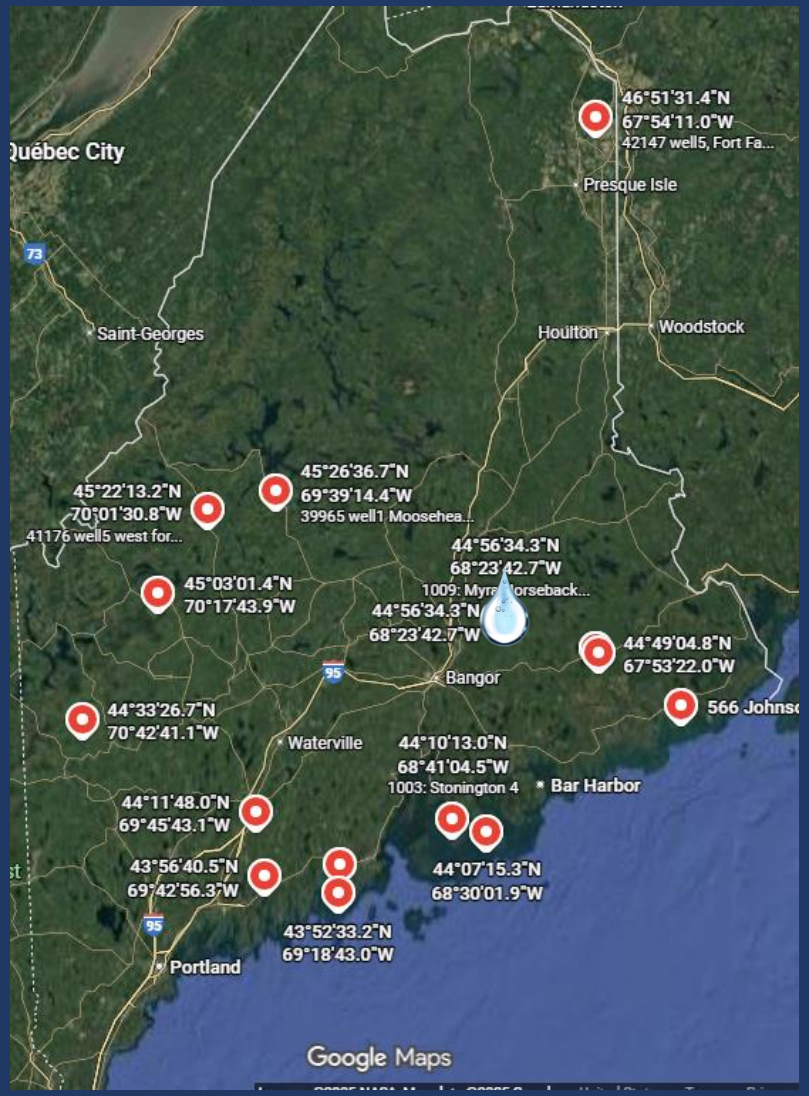
National Ground-Water Monitoring Network



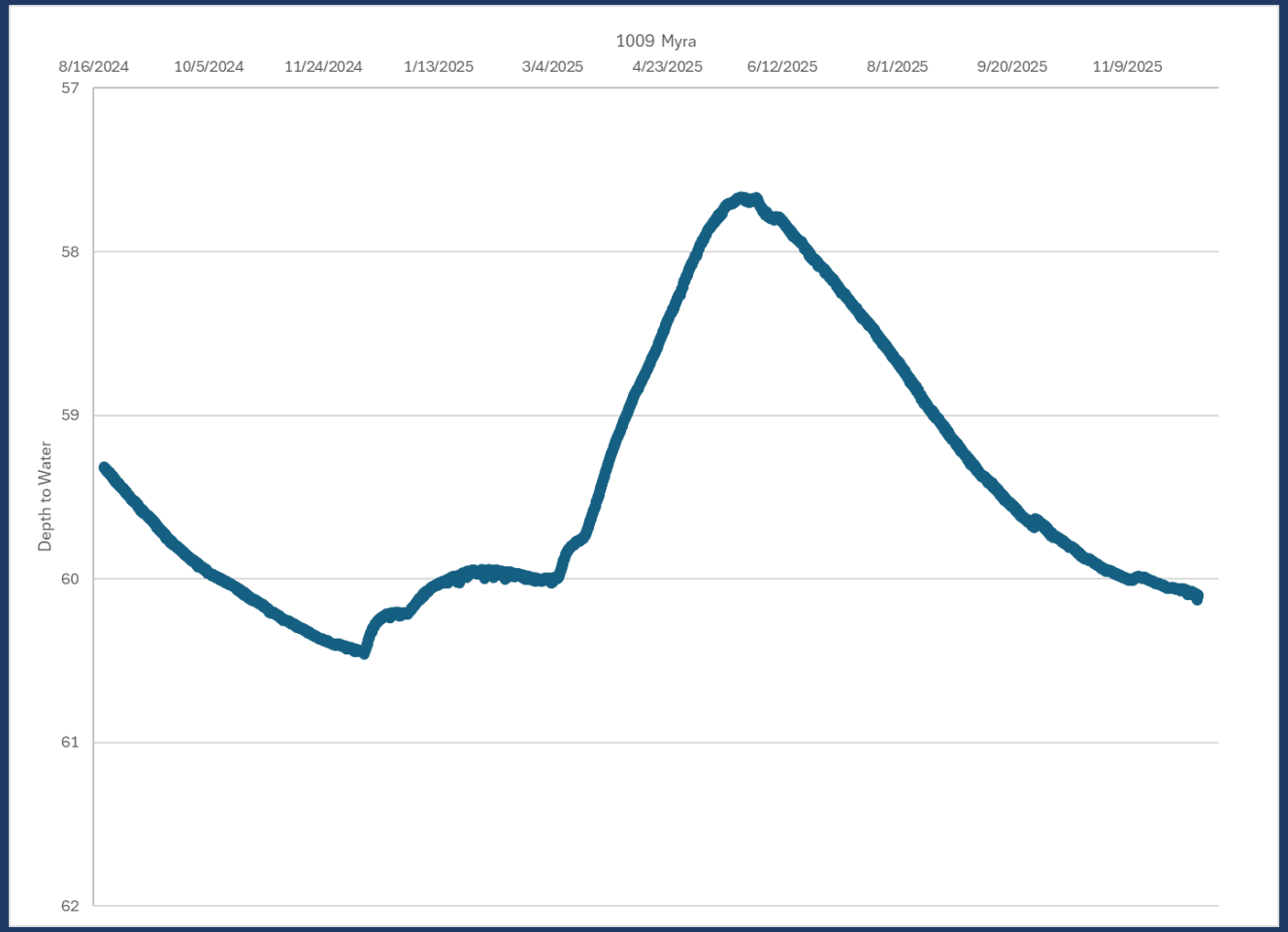
1008: Rumford



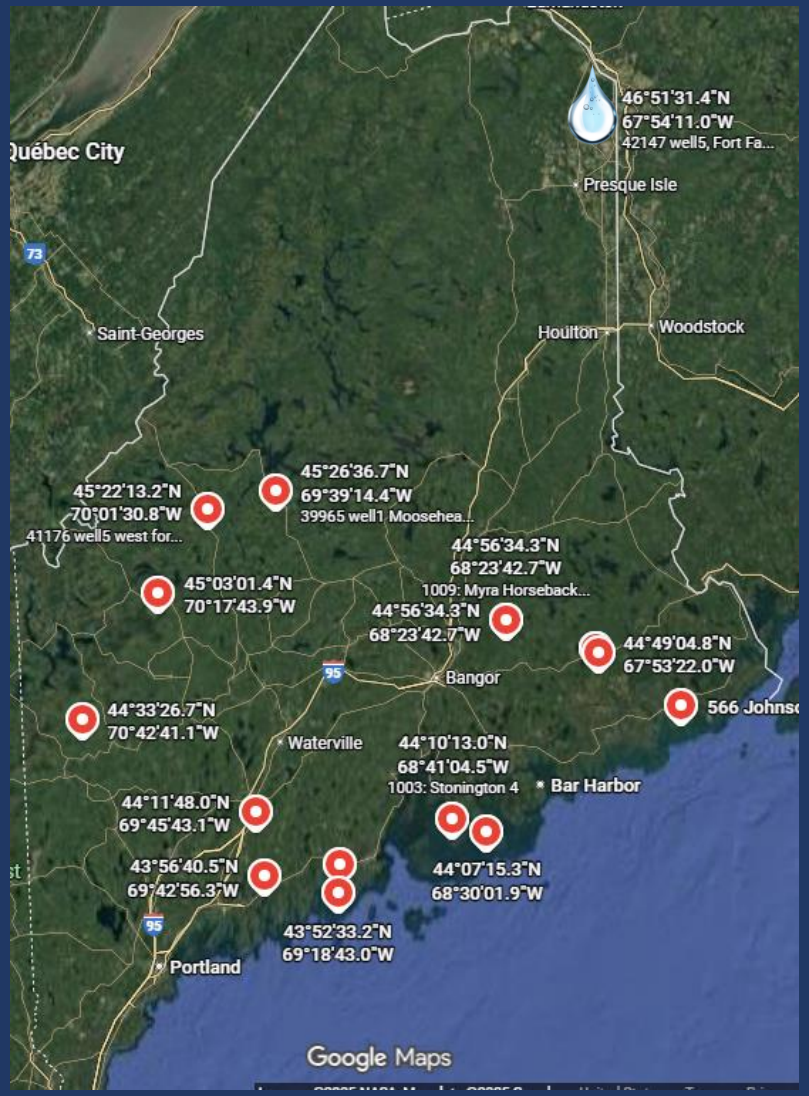
National Ground-Water Monitoring Network



1009: Myra Horseback



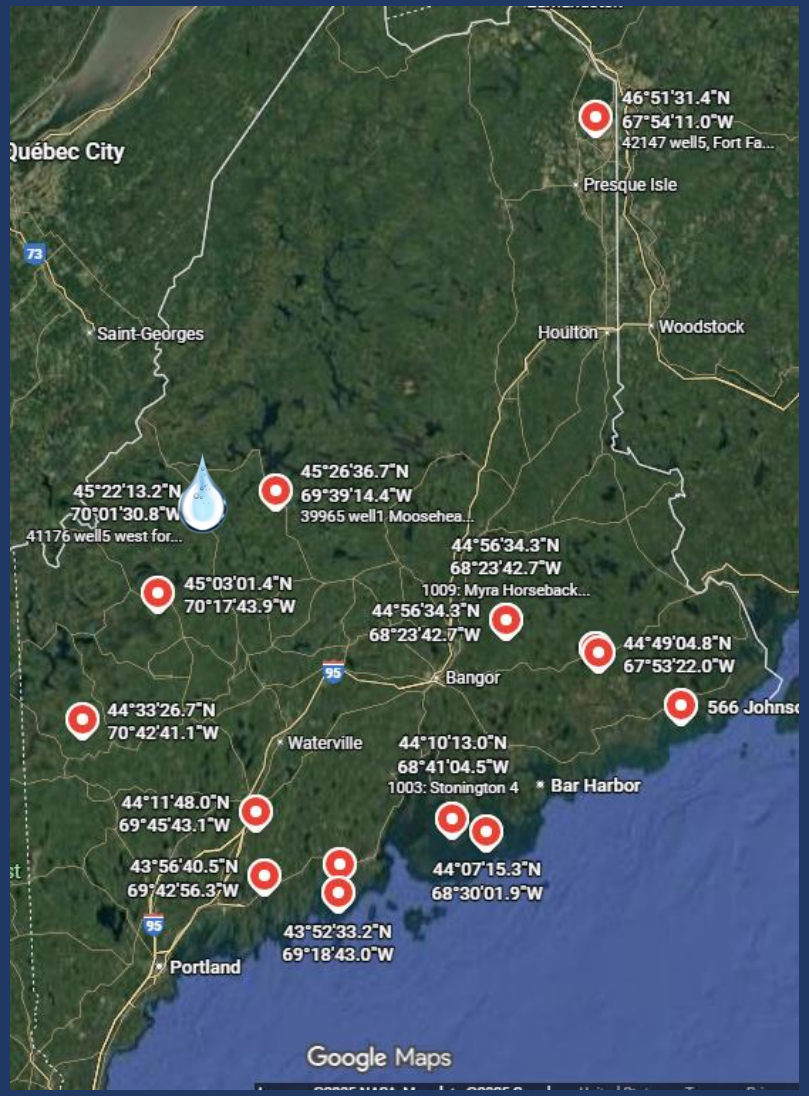
National Ground-Water Monitoring Network



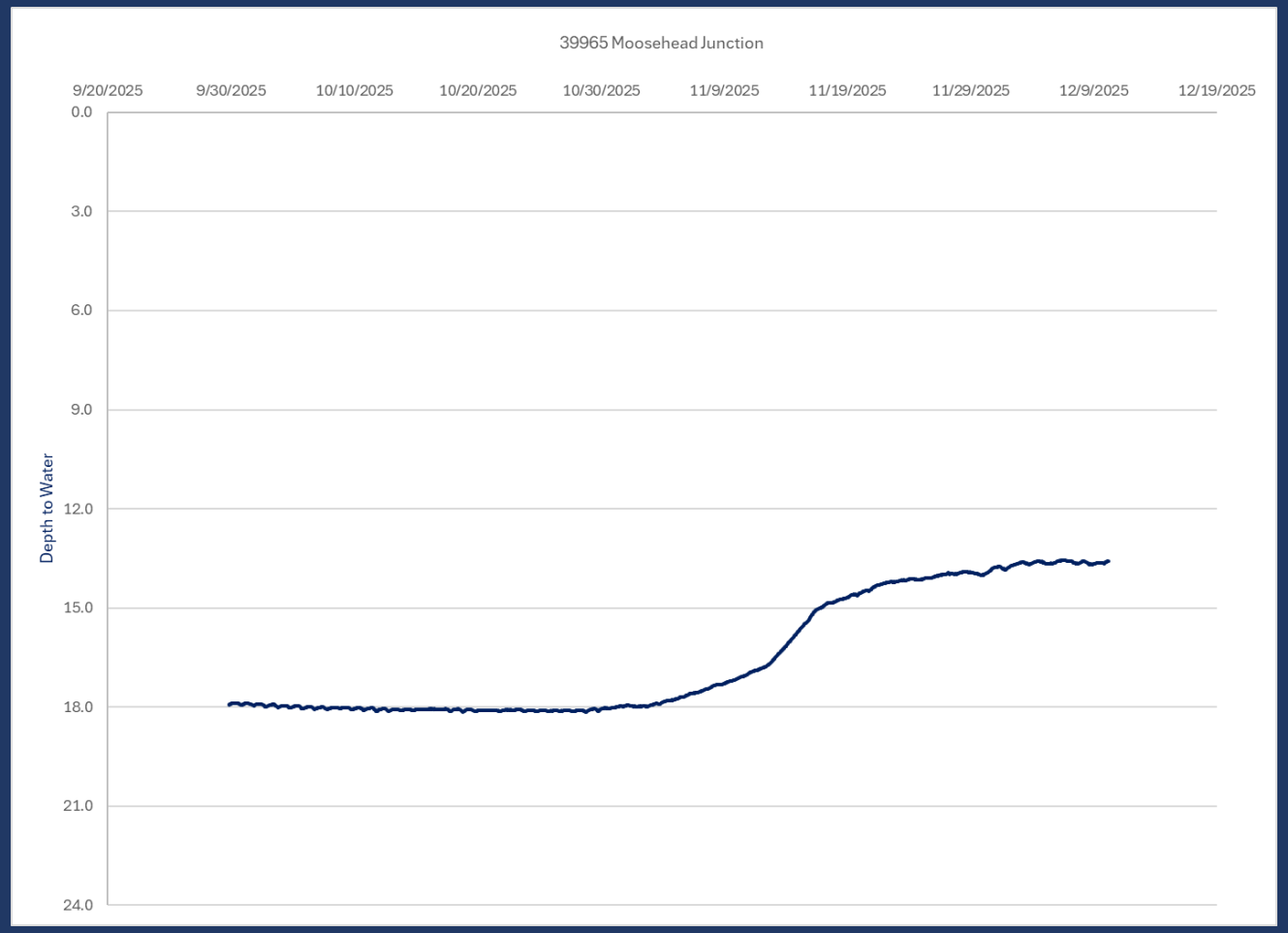
42147 Well 5 : Fort Fairfield

Data Not Transmitting

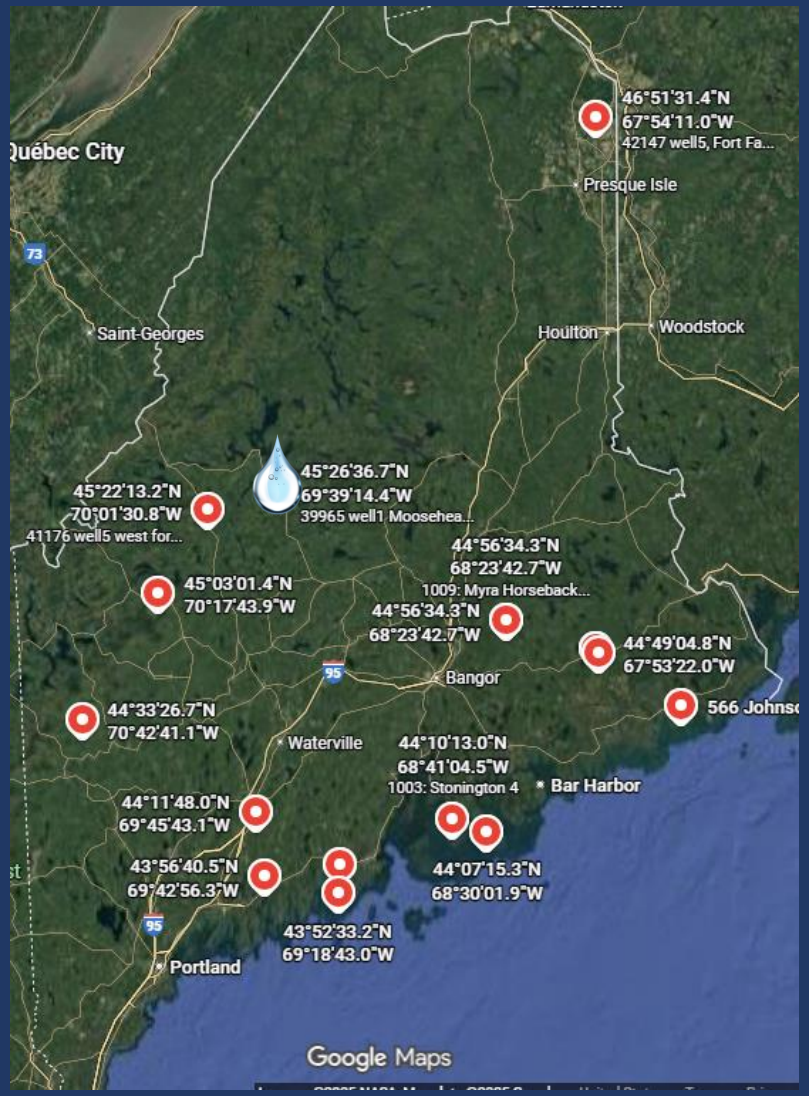
National Ground-Water Monitoring Network



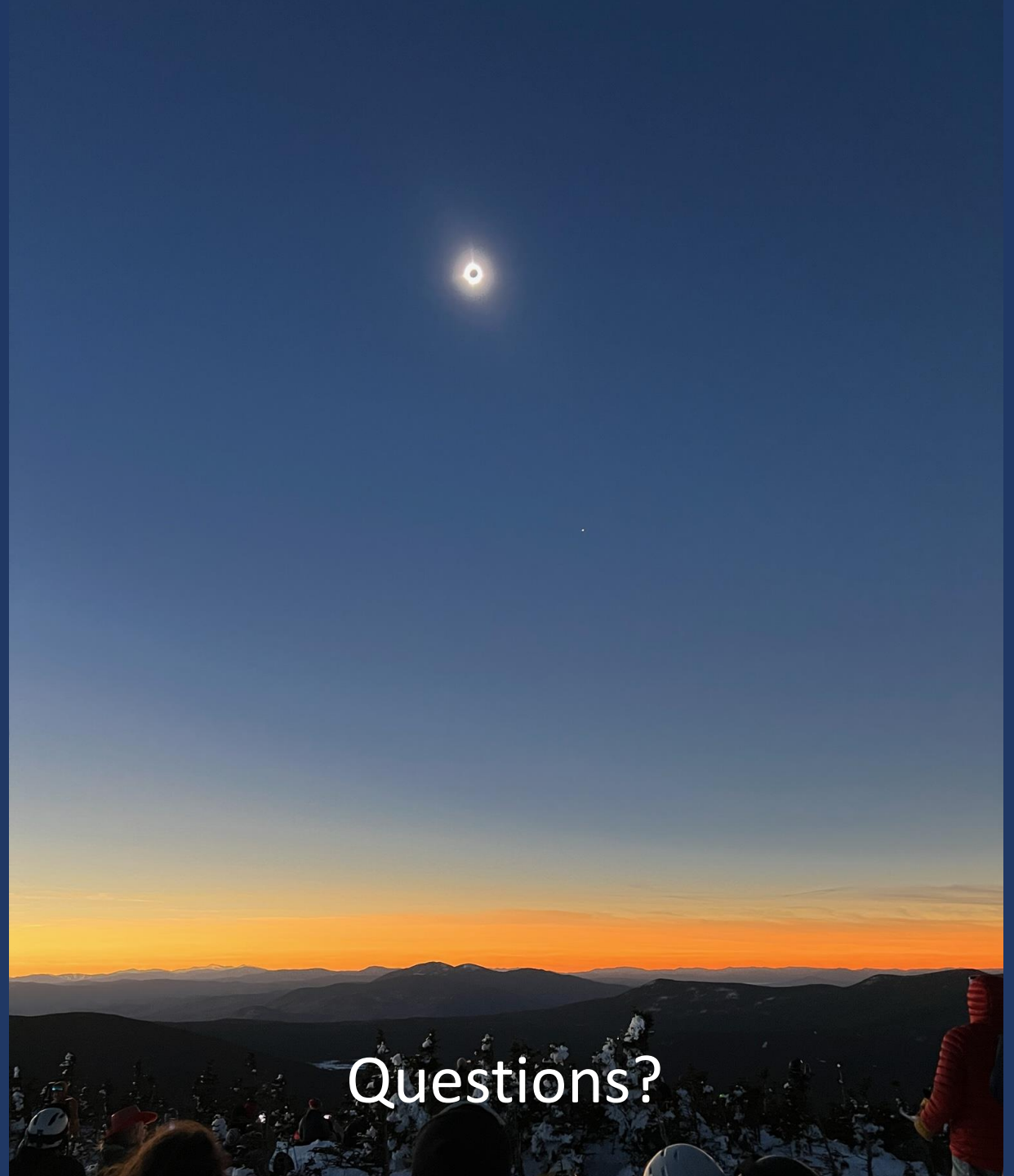
41176 Well 5 : West Forks Plantation



National Ground-Water Monitoring Network



39965 Well 1 : Moosehead Junction Township



Questions?