New Hampshire Geological Survey Groundwater Monitoring Network

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National Groundwater Monitoring Network Presentation, 2016

Network Goals

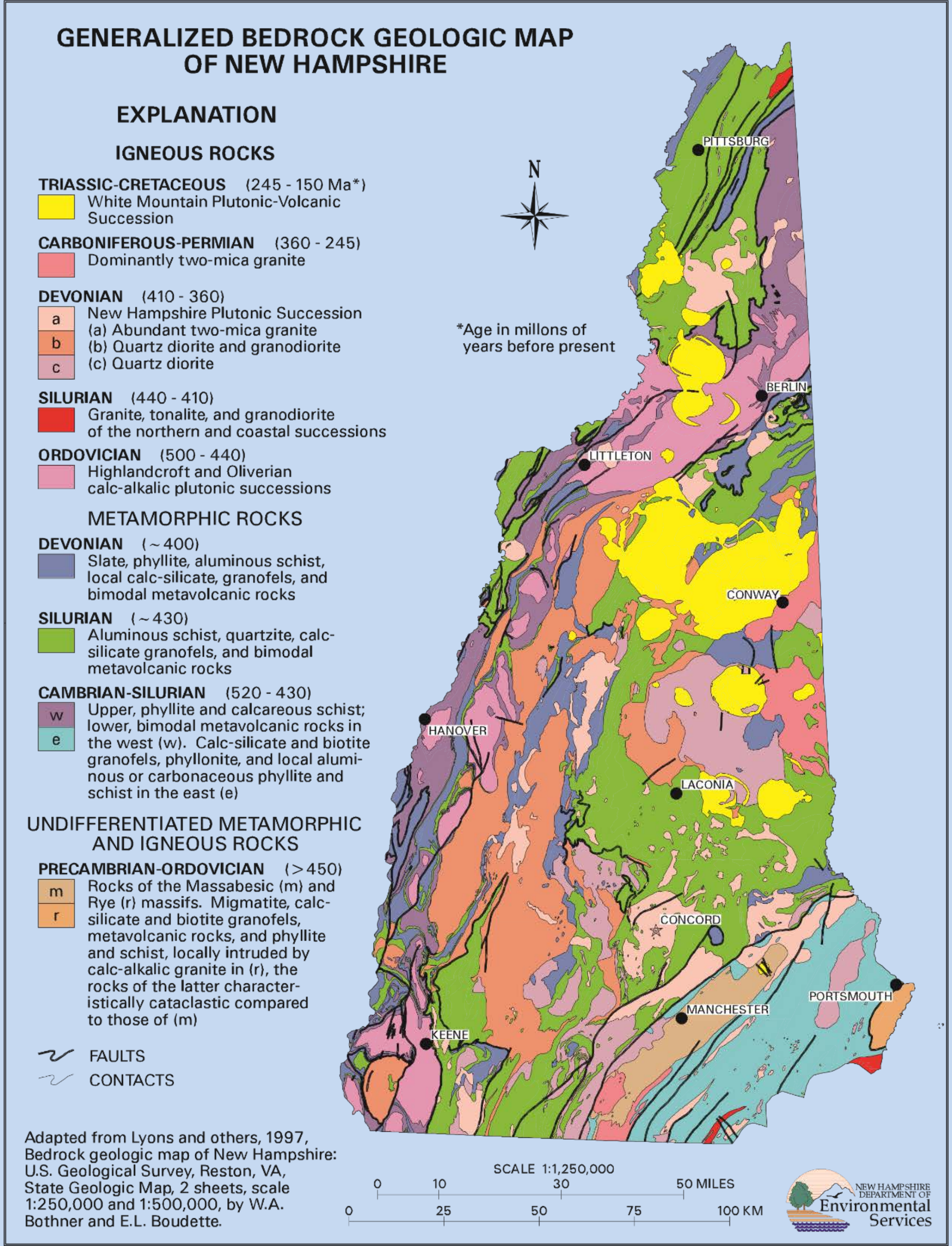
Basic data collection for ambient groundwater conditions

Specific use cases facilitated or know about:

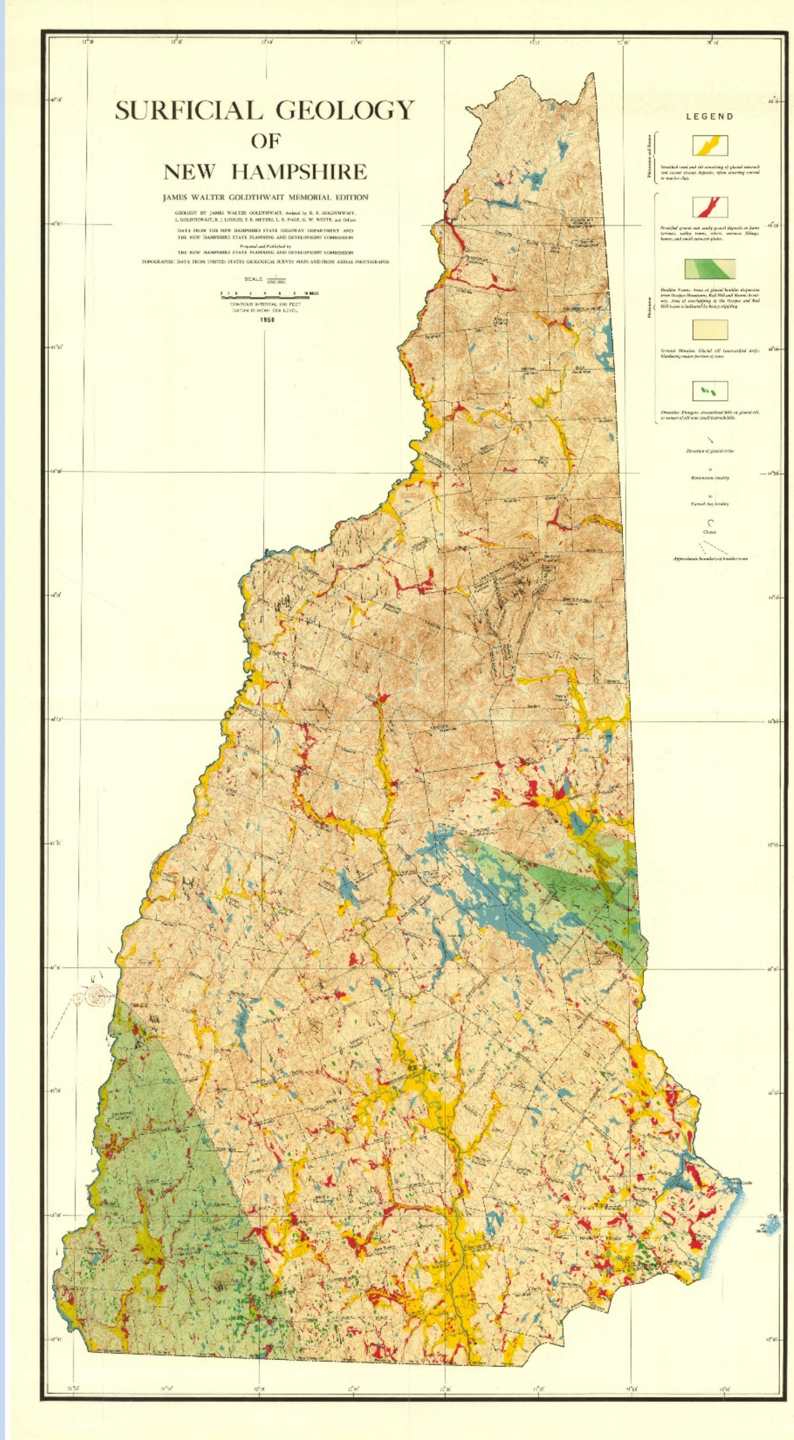
- Drought indicators
- Climate change trends
- Geographic/site specific inquiries
- Instream flows?

Network Hydrogeologic Framework

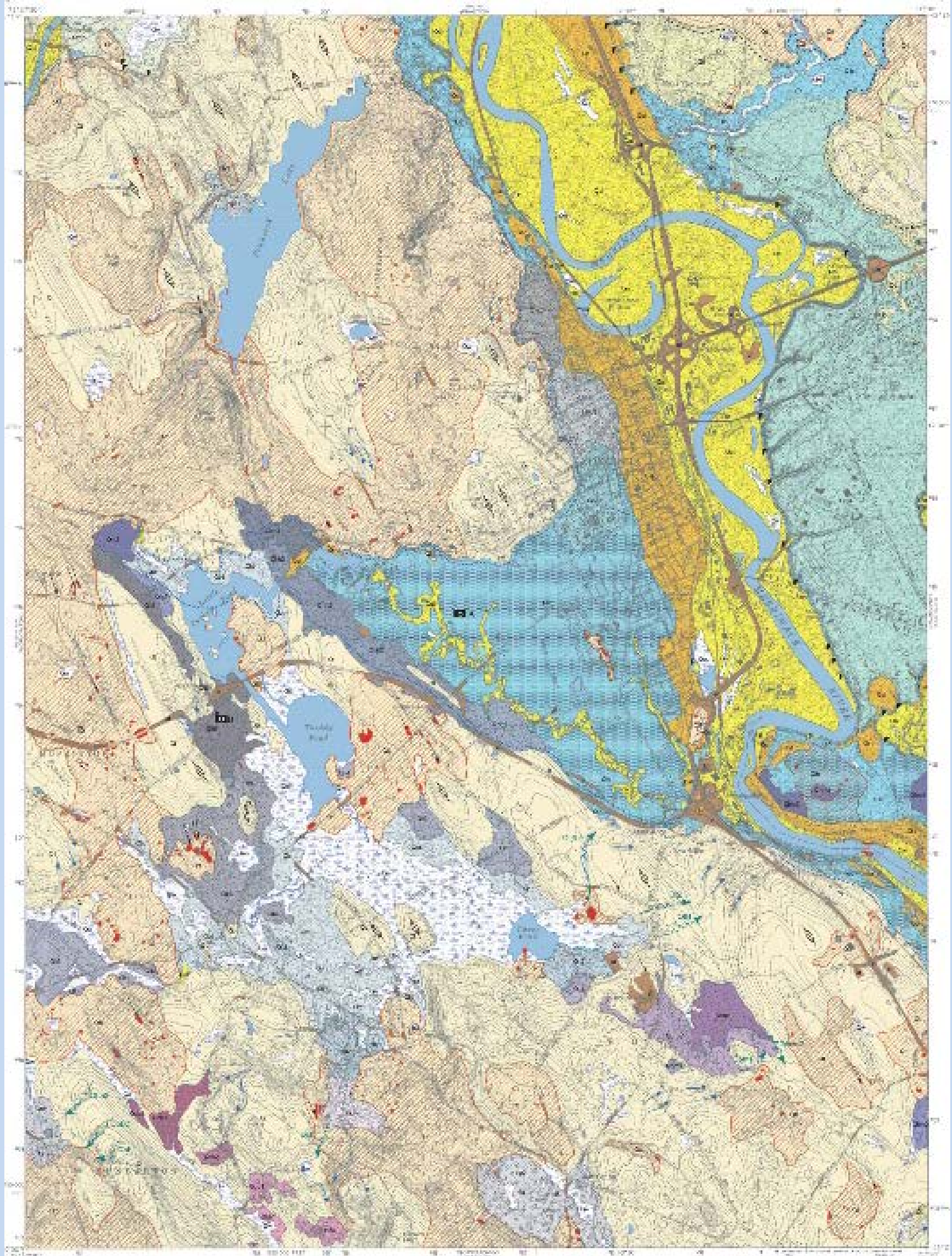
- Heterogeneous bedrock geology
- Heterogeneous overburden
- 40+ inches of precipitation per year with snowpack storage


GENERALIZED BEDROCK GEOLOGIC MAP OF NEW HAMPSHIRE
EXPLANATION
IGNEOUS ROCKS
TRIASSIC-CRETACEOUS (245 - 150 Ma*)
White Mountain Plutonic-Volcanic Succession
CARBONIFEROUS-PERMIAN (360 - 245)
Dominantly two-mica granite
DEVONIAN (410 - 360)
a
b
c
New Hampshire Plutonic Succession
(a) Abundant two-mica granite
(b) Quartz diorite and granodiorite
(c) Quartz diorite
SILURIAN (440 - 410)
Granite, tonalite, and granodiorite of the northern and coastal successions
ORDOVICIAN (500 - 440)
Highlandcroft and Oliverian calc-alkalic plutonic successions
METAMORPHIC ROCKS
DEVONIAN (~400)
Slate, phyllite, aluminous schist, local calc-silicate, granofels, and bimodal metavolcanic rocks
SILURIAN (~430)
Aluminous schist, quartzite, calc-silicate granofels, and bimodal metavolcanic rocks
CAMBRIAN-SILURIAN (520 - 430)
w
e
Upper, phyllite and calcareous schist; lower, bimodal metavolcanic rocks in the west (w). Calc-silicate and biotite granofels, phyllonite, and local aluminous or carbonaceous phyllite and schist in the east (e)
UNDIFFERENTIATED METAMORPHIC AND IGNEOUS ROCKS
PRECAMBRIAN-ORDOVICIAN (>450)
m
r
Rocks of the Massabesic (m) and Rye (r) massifs. Migmatite, calc-silicate and biotite granofels, metavolcanic rocks, and phyllite and schist, locally intruded by calc-alkalic granite in (r), the rocks of the latter characteristically cataclastic compared to those of (m)
FAULTS
CONTACTS
Adapted from Lyons and others, 1997, Bedrock geologic map of New Hampshire: U.S. Geological Survey, Reston, VA, State Geologic Map, 2 sheets, scale 1:250,000 and 1:500,000, by W.A. Bothner and E.L. Boudette.
N
*Age in millons of years before present
PITTSBURG
BERLIN
LITTLETON
CONWAY
HANOVER
LACONIA
CONCORD
PORTSMOUTH
MANCHESTER
KEENE
SCALE 1:1,250,000
0
10
30
50 MILES
0
25
50
75
100 KM
NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire State Surficial Geologic Map 1950 1:250,000 scale

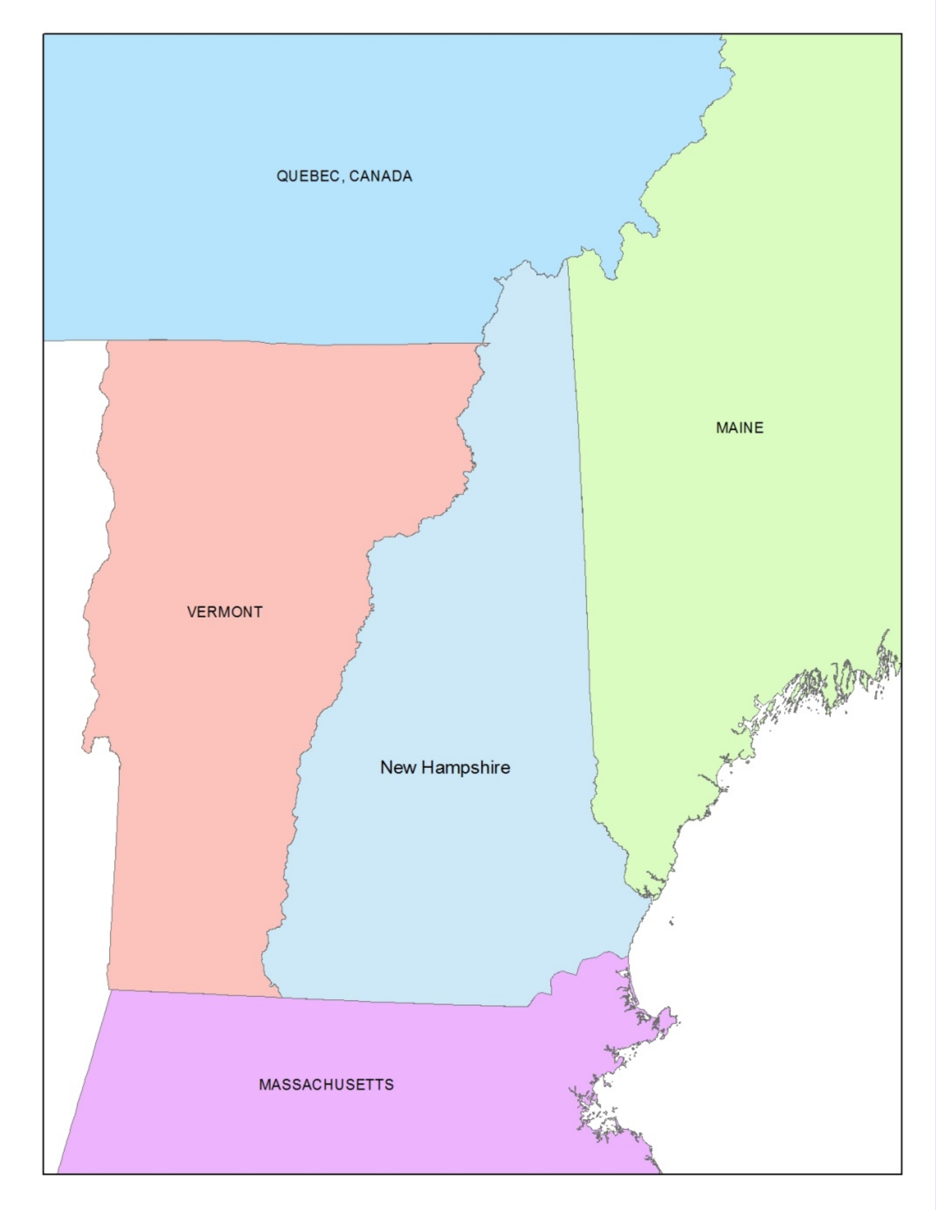


Concord Quadrangle
2005 1:24,000 scale



Trans-boundary Issues

- Currently not considered or coordinated
- Three neighboring states (MA, VT & ME) and PQ
- Represents opportunity for conversation

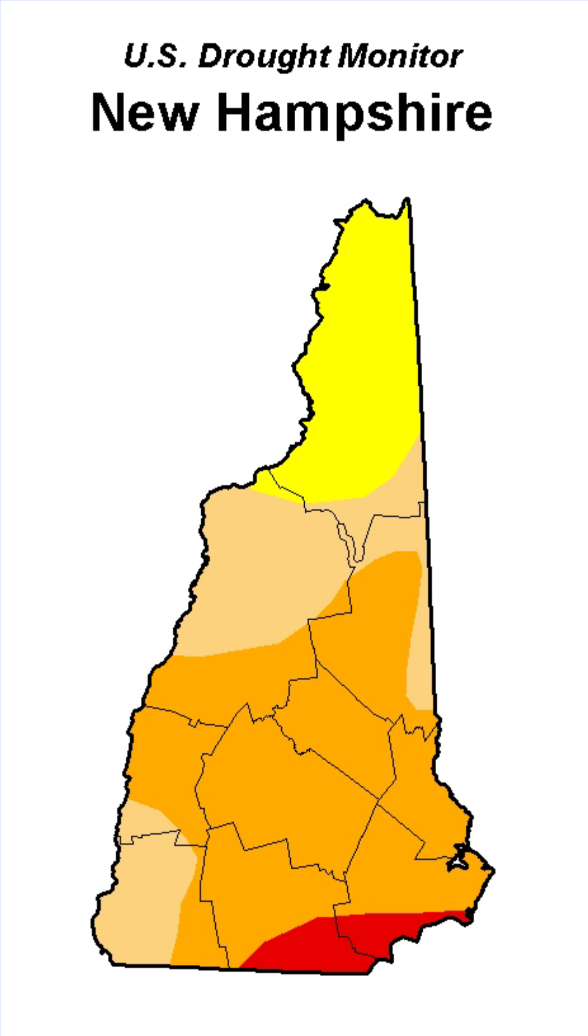


NH Drought Management Team

Develop drought indicators

Integrate into Drought Management Teams business process:

- Determine how team wants to interact with data
- Design and build applications to do that

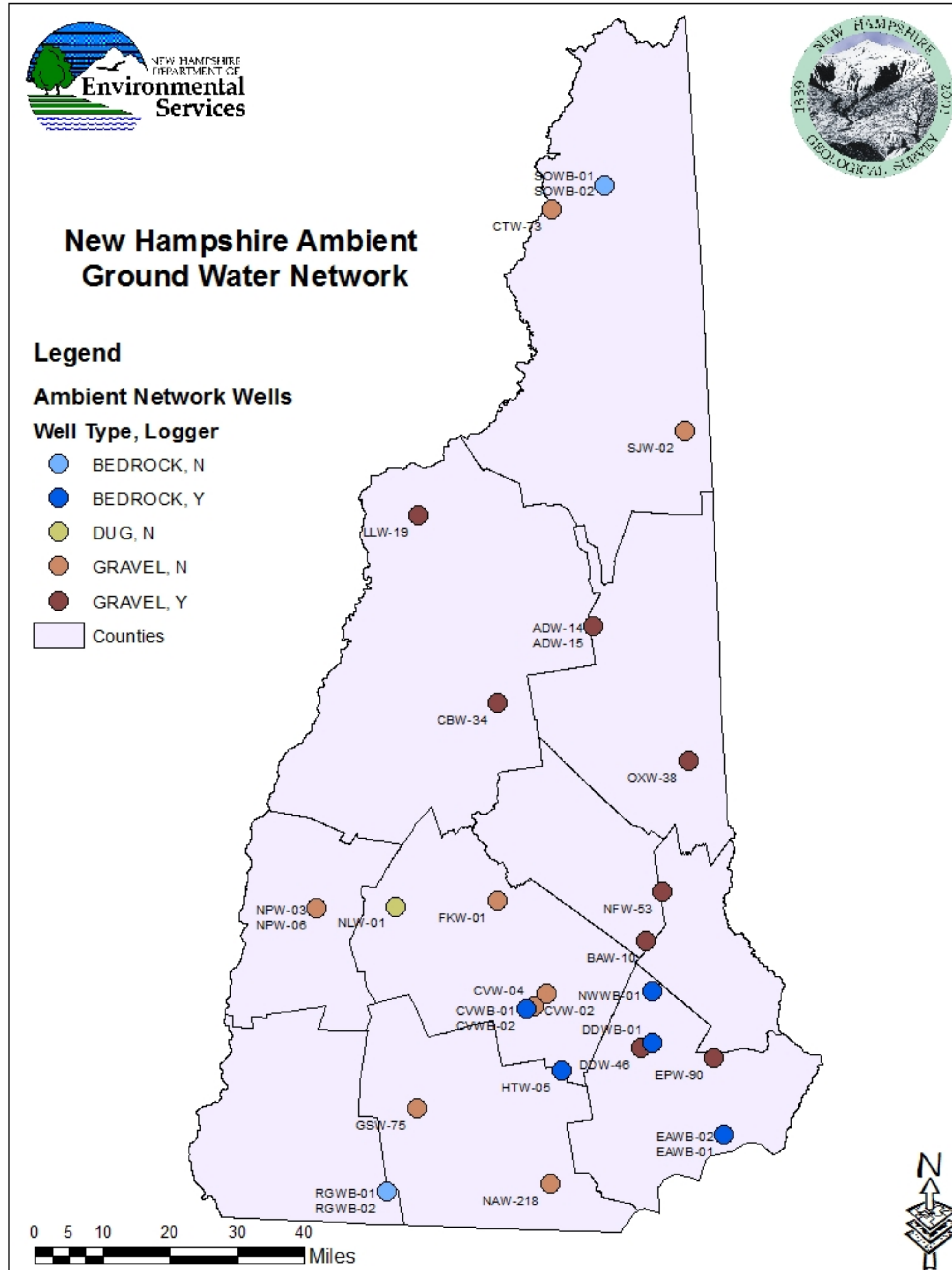


Progress To Date

- CUAHSI HIS Server – Serves time-series data as WaterML 1.1
- Web Service components loaded on dev server
- Classifying Wells
- Qa/Qc of 5 years hourly data
- Developing and documenting standardized methods for:
  - Logger setup
  - Data handling procedures

Network Wells

- 29 Wells
- 11 Bedrock/18 Overburden
- 29 Monthly/18 Hourly
- POR to the late '40s and early '60's



Network History

- 12 Initial locations from USGS Basic Data Collection Program
- Late 1990's expanded network up to 22 wells
- During 2009, 9 additional bedrock wells added
- Principle criteria for monitoring was representative of ambient groundwater conditions.
- Period of record length also considered

Well Classification

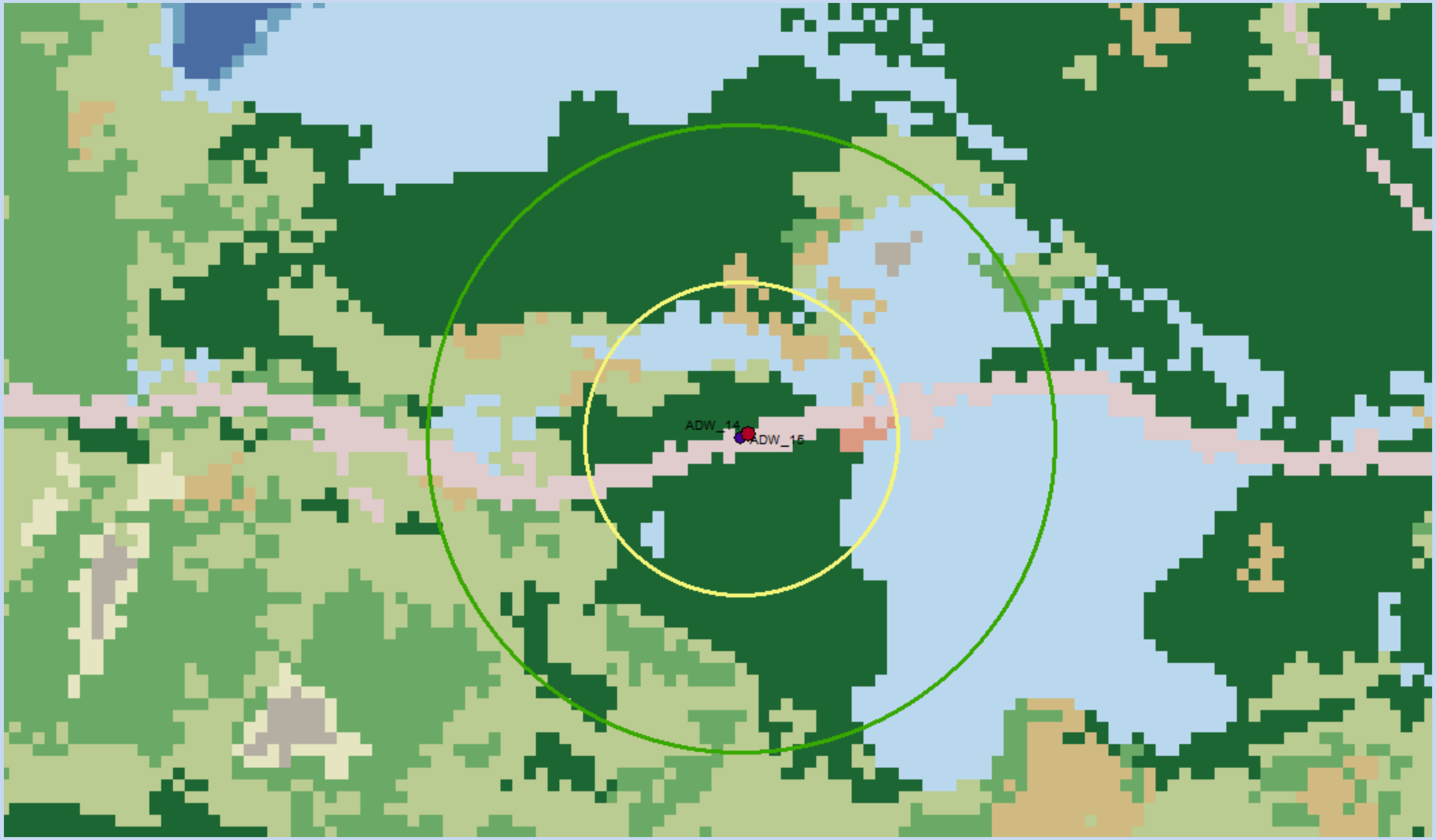
Preclassification – 29 wells measuring ambient conditions assumed

Metrics to aid classification generated in GIS

- Calculate neighboring LCLU
- Quantify hydrologic modifications (road & sewage/drainage infrastructure)
- Topographic position (hypsometry & observation)
- Groundwater withdrawals

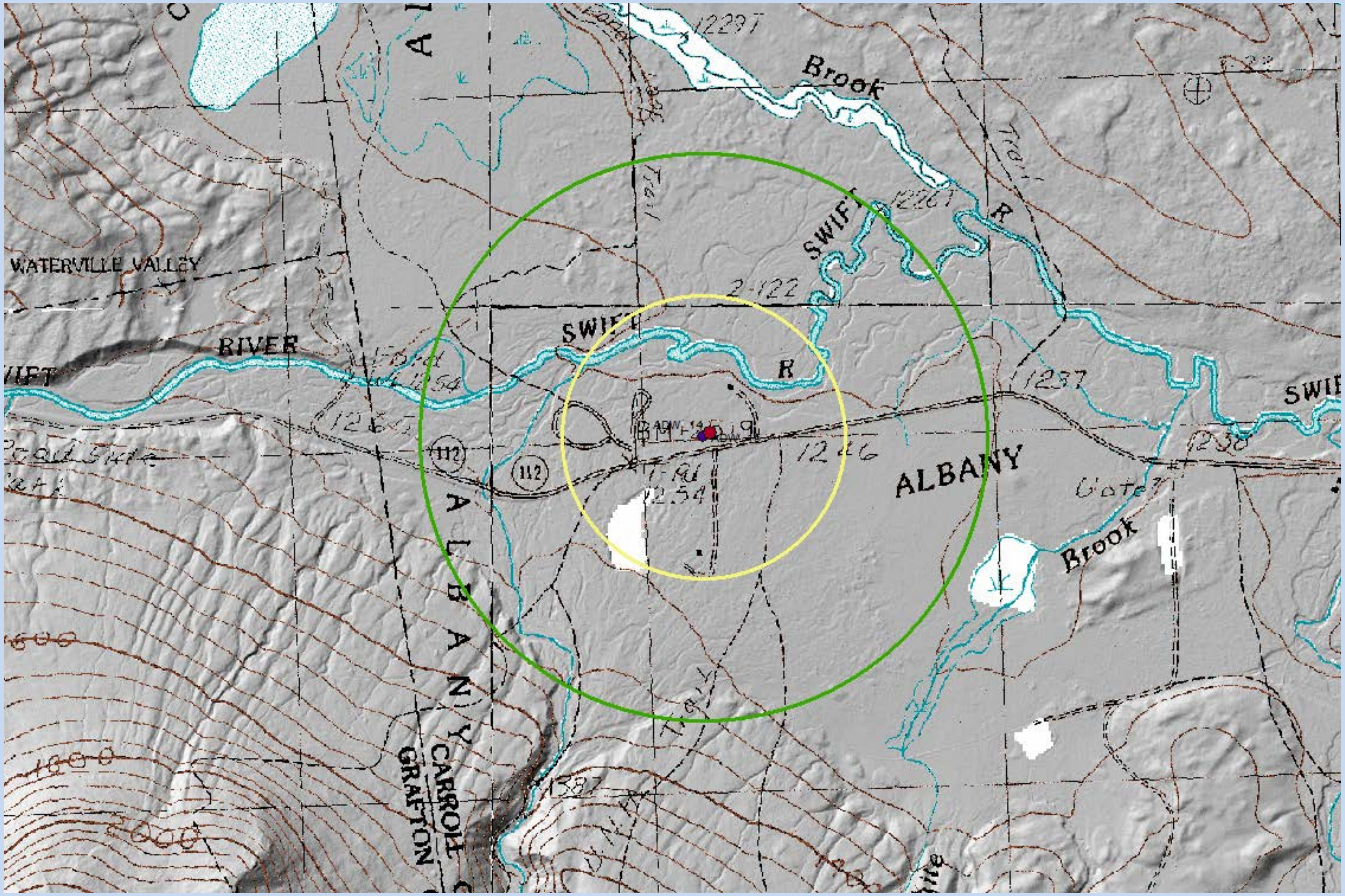
GIS Metrics (cont.)

Calculate neighboring LCLU



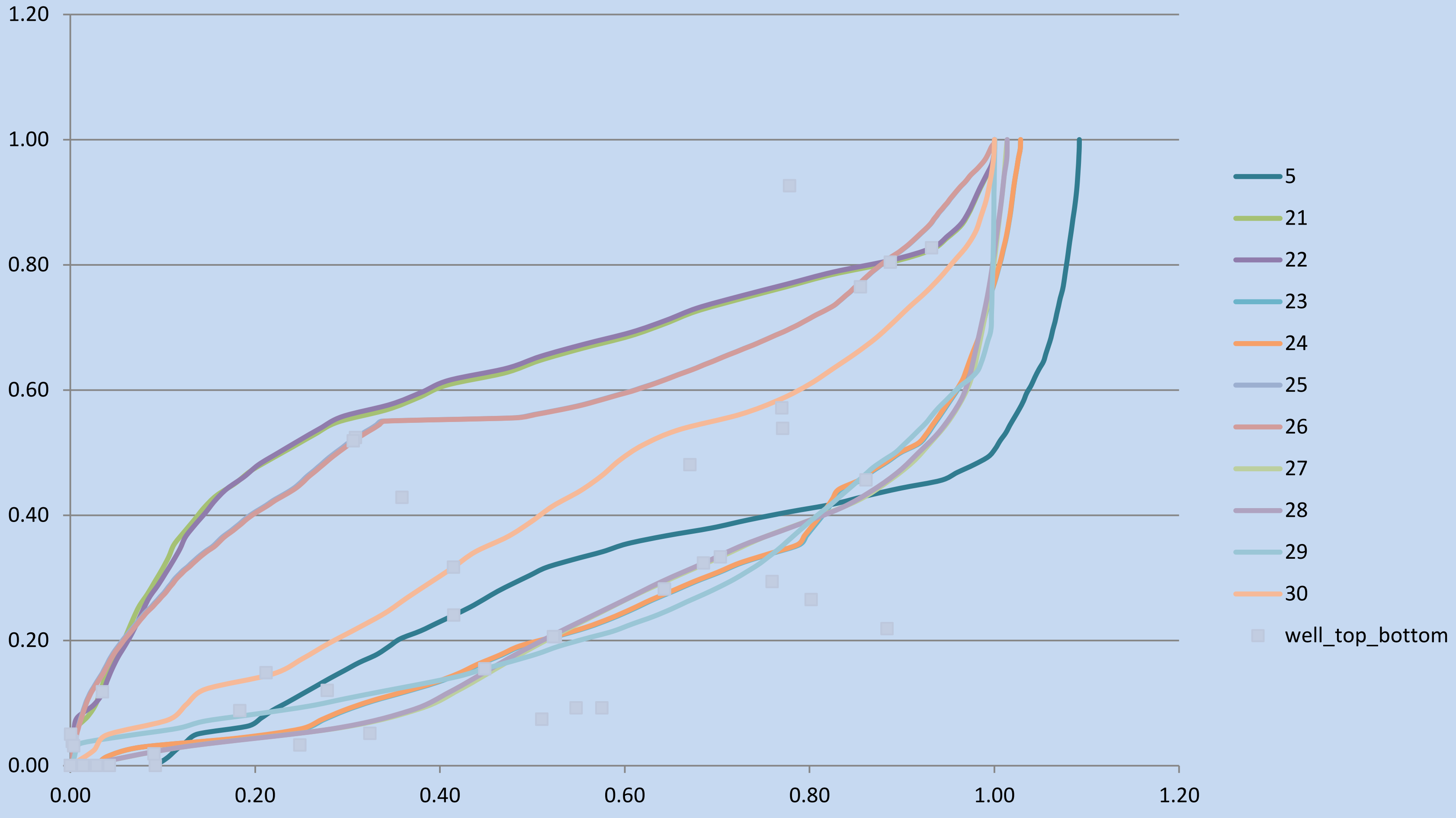
GIS Metrics (cont.)

Quantify hydrologic modifications (road & sewage/drainage infrastructure)



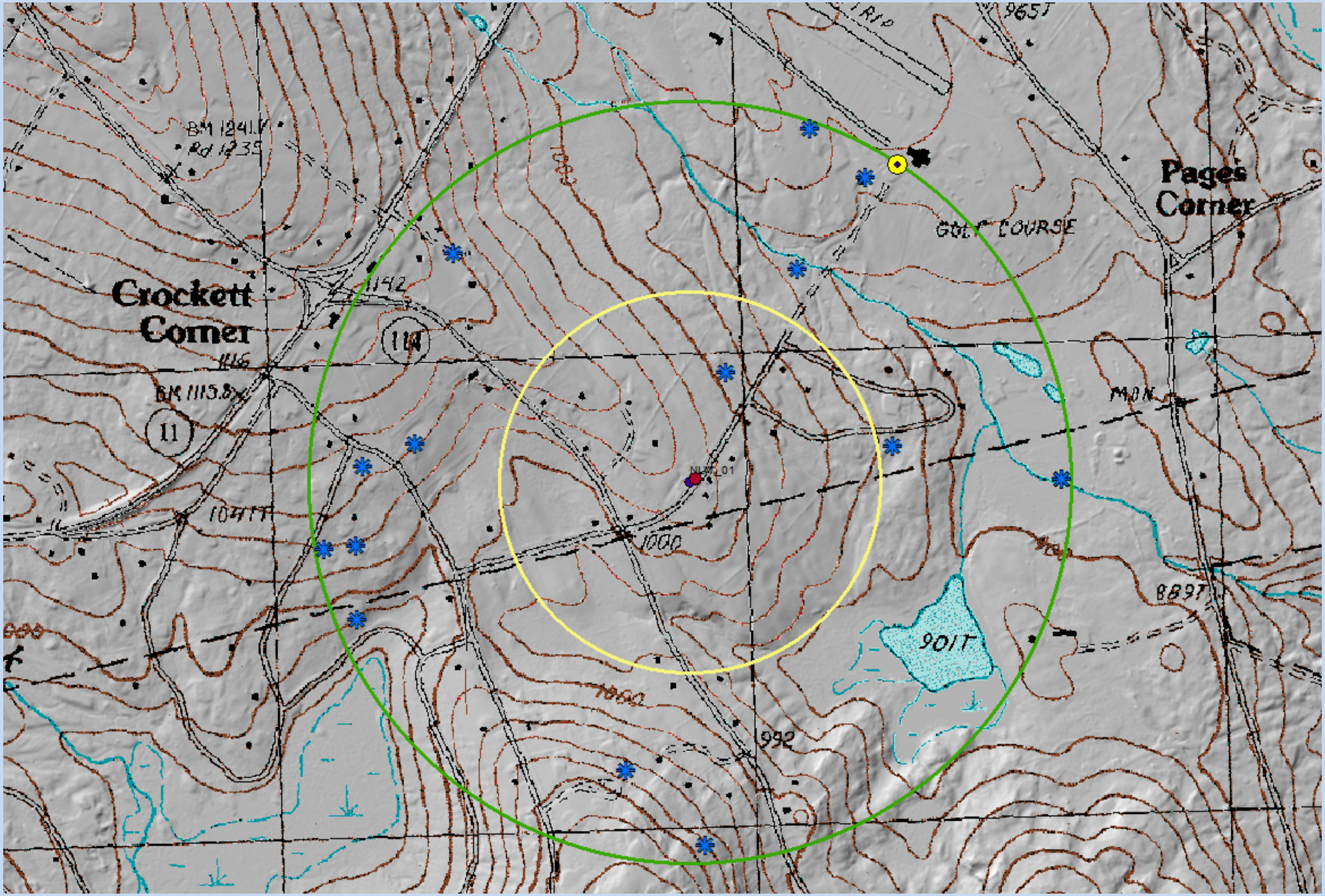
GIS Metrics (cont.)

Topographic position (hypsometry & observation)



GIS Metrics (cont.)

Groundwater withdrawals

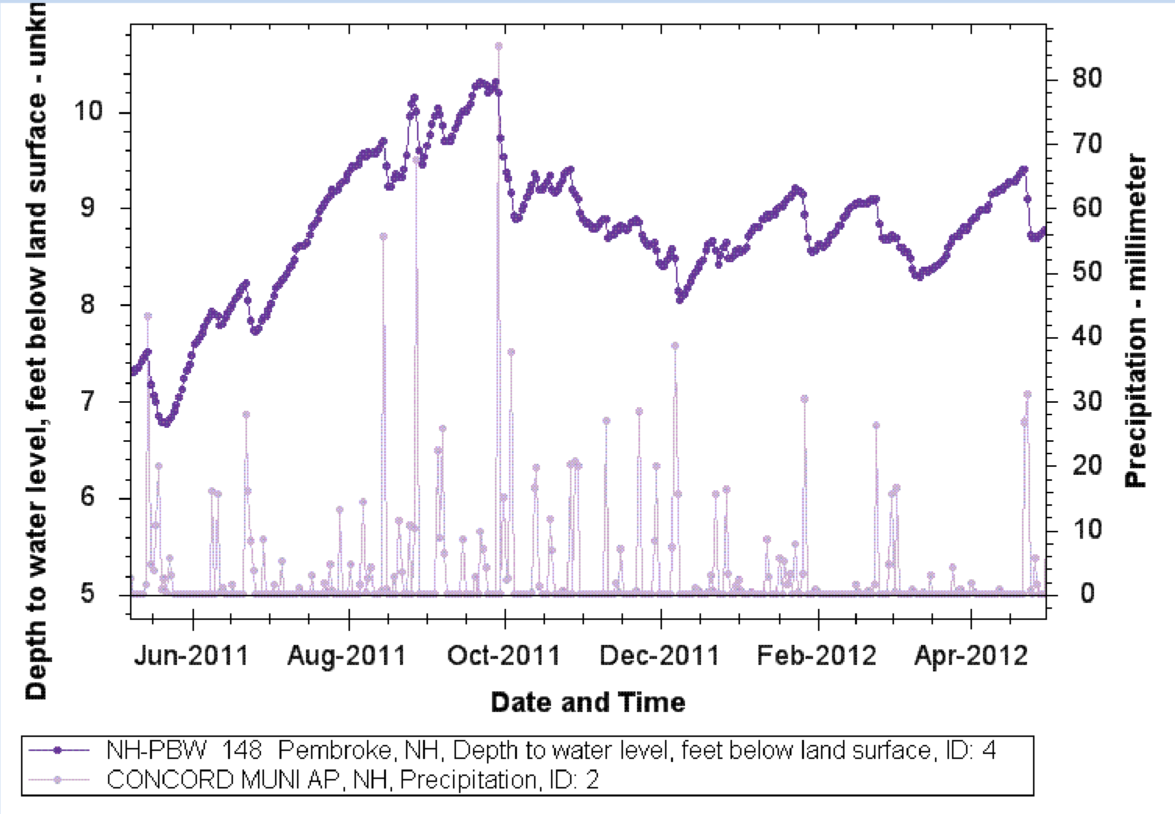


Initial Summary Ranking Table

Well	Water Withdrawals Rank	Hydro Modification Rank	LCLU Ranking	Cells >10% Impervous Surfaces Rank	rank average % Impervious Surfaces	Water Level Flucuation Rank	Water Level Std dev rank
ADW_14	9	14	18	20	20	6	8
ADW_15	9	14	18	20	20	3	3
BAW_10	14	29	12	22	22	11	13
CBW_34	9	4	4	4	4	7	10
CTW_73	21	11	5	9	9		
CVW_02	21	2	1	2	1		
CVW_04	30	5	3	3	3		
CVWB-1	1	6	9	6	7		
CVWB-2	1	3	8	5	5	1	1
DDW_46	14	19	14	16	16	13	14
DDWB-1	21	20	26	29	26	10	7
EAWB-1	9	27	29	24	27		
EAWB-2	14	28	28	27	29	4	2
EPW_90	5	23	25	23	23	5	6
FKW_01	30	16	13	11	12		
GSW_75	14	26	20	19	19		
HTW_05	30	1	2	1	2	8	5
LLW_19	21	24	7	10	10	2	4
NAW_218	30	13	11	8	8		
NFW_53	5	10	6	7	6	12	12
NLW_01	21	7	15	15	15		
NPW_03	3	8	17	13	13	14	11
NPW_06	3	8	16	13	13	9	9
NWWB-1	9	12	10	12	11		
OXW_38	21	30	30	30	30	15	15
RGWB-1	14	22	24	25	24		
RGWB-2	14	21	23	26	25		
SJW_02	14	25	27	28	28		
SOWB-1	7	17	22	17	17		
SOWB-2	7	18	21	18	18		

Well Classification (cont.)

- Key determining factor will be hydrographs
- Given time, will also use daily precip variance per Chapman, et al, 2010. to discriminate anthro impacts vs. ET, earth tides and barometric fluxes



Chapman, M.J., Almanaseer, Naser, McClenney, Bryce, and Hinton, Natalie, 2011, Fluctuations in groundwater levels related to regional and local withdrawals in the fractured-bedrock groundwater system in northern Wake County, North Carolina, March 2008–February 2009: U.S. Geological Survey Scientific Investigations Report 2010–5219, 60 p.

Final Classifications

- Based in the ACWI triage of subnetworks and monitoring frequency
- Likely outcome – All wells classified as background and trend monitoring frequency

Data Collectors

- Part time NHGS person
- 4-5 Volunteers
- 2 University Students
- High school teacher
- Volunteer
- Commercial water provider

Need for good communication and coordination

Data Collection Methods

- Data collection practices commensurate with ACWI guidance
- Since 2000 almost all monthly measurements with electronic tape
- 2011-2012 hourly measurements from 18 wells
- Data loggers calibrated per manufactures instructions.

Other Web Hosted Data

- Hydroserver will also be hosting legacy stream temperature data
- Many GIS Services (>40 services of geological data)

http://xml2.des.state.nh.us/arcgis/rest/services

- 2 Web mapping applications for water level data and stream temperature under development.

Future Network Enhancements

- Aging wells will need maintenance (sediment removal).
- Measurement point (MP) back up. Ground surface and MP elevation re-derivation (LiDAR).
- USGS Pembroke began efforts to replace one well this month
- Likely add one other well
- Will be consulting internal stakeholders but preliminary items:
  - Evaluate well hydrologic properties
  - Additional data loggers
  - Emerging contaminants (ex., PFOS & PFOA)

Questions for the Audience

- How have you created your web services for time-series data?
- Lithology and construction?

Contact Information:

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