

Colorado Signs on to the National Ground-Water Monitoring Network



September 11, 2018

Kevin Donegan, CPG-11939, Senior Hydrogeologist

Helen Malenda, Hydrogeologist

Hydrogeology Section



COLORADO

Division of Water Resources

Department of Natural Resources

National Ground-Water Monitoring Network (NGWMN)

- Voluntary, Cooperative, Integrated System
 - Data Collection, Management, and Reporting
- Aggregation of select sites from Data Providers
- Assess Baseline Conditions and Long-Term Trends
 - Water Levels and Water Quality
 - Regional, Multistate, and National Scales

NGWMN Organization

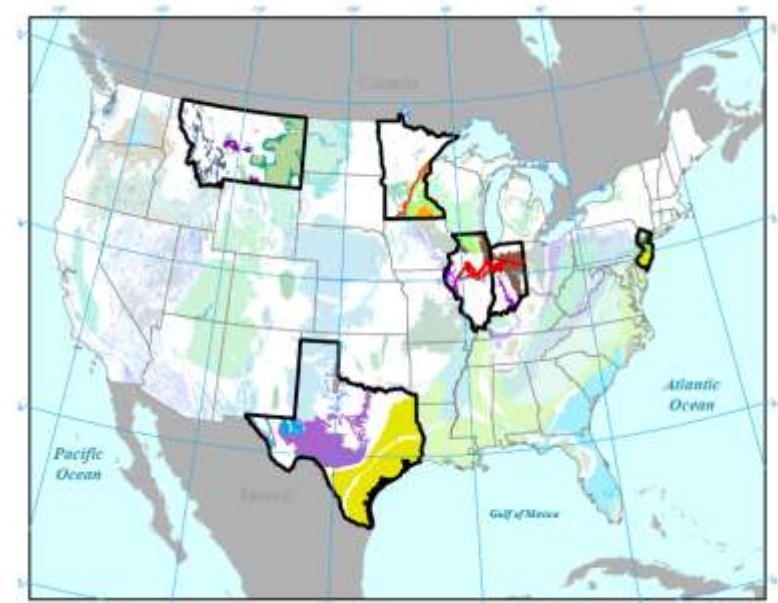
- Federal Advisory Committee on Water Information (ACWI)
 - Represent interests of water information users and professionals
 - Advise the Federal Government related to Federal water information programs and their effectiveness
- Subcommittee on Ground Water (SOGW)
 - Develop and encourage implementation of nationwide, long term groundwater quantity and quality monitoring framework
 - Planning, management, and development of groundwater supplies to meet current and future needs and ecosystem requirements

NGWMN Structure

- USGS NGWMN Management and Operations Group
 - Day to day network management
- NGWMN Program Board
 - Network growth, development and operation, evaluate proposals
 - M&O Group, SOGW, Data Providers
- NGWMN Data Providers
 - Federal, Tribal, State, or Local Agencies
 - Collect groundwater (quality or quantity) data and agree to provide

Early Formation

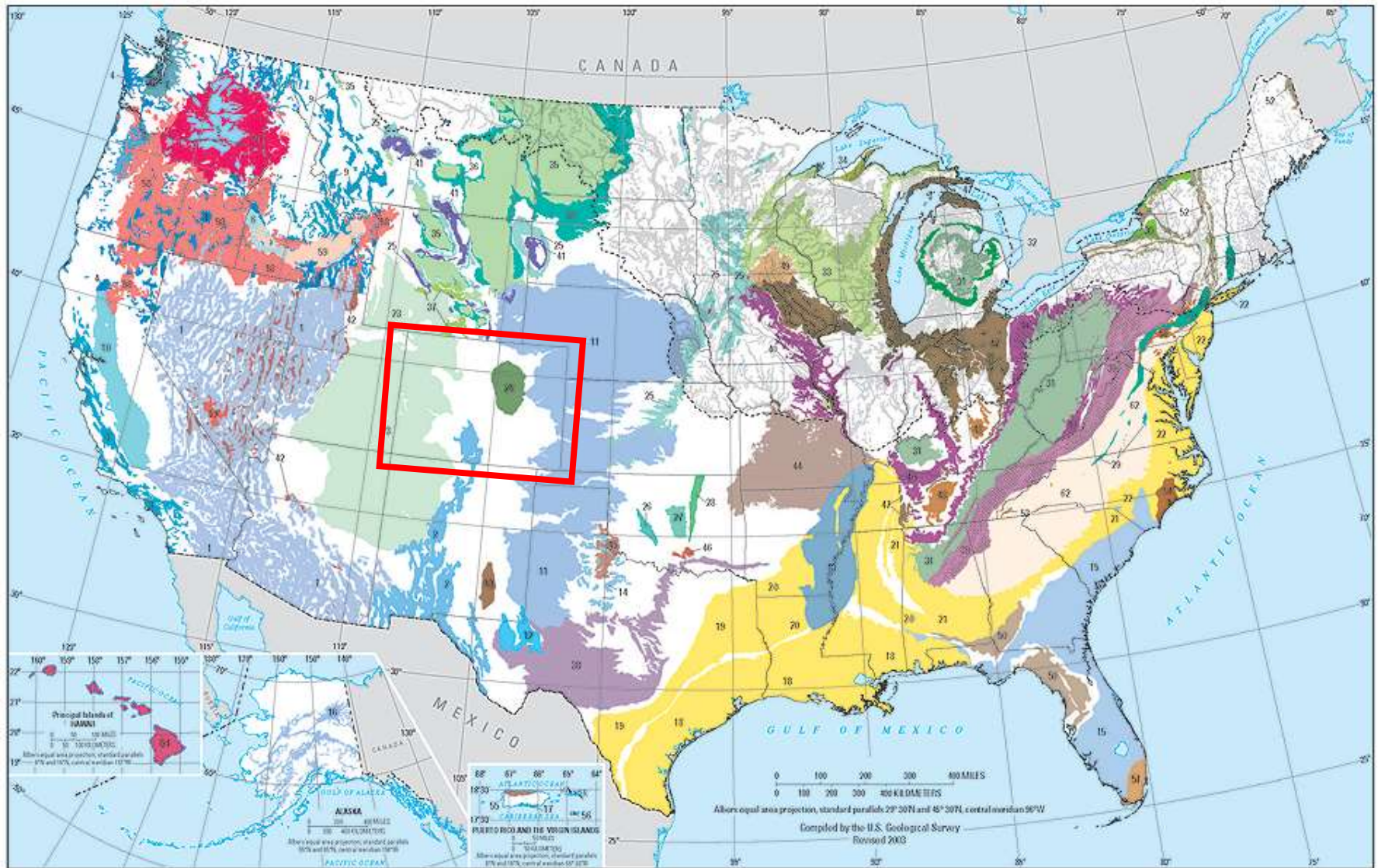
- NGWMN Pilot Project and Initial Framework - 2009



Revised Framework - 2013

https://acwi.gov/sogw/ngwmn_framework_report_july2013.pdf

Principal Aquifers of the United States



(<https://water.usgs.gov/ogw/aquifer/map.html>)

Colorado Division of Water Resources

- An agency of Department of Natural Resources
- Also known as Office of the State Engineer
 - Administer water rights
 - Issue well permits
 - Represent Colorado in interstate compacts
 - Monitor streamflow, water use, and groundwater
 - Approve construction/repair of dams/dam safety
 - Issue licenses for well drillers, ensure safe and proper construction of wells
 - Maintain databases of Colorado water information

Groundwater Data and Information

- SB 87-200 Groundwater Management Cash Fund
 - Create and maintain groundwater information management system
 - HydroBase
 - Water Information Team
 - Conduct groundwater related activities deemed necessary by the State Engineer
 - Hydrogeology Section
 - Water-level monitoring programs

Northern High Plains Designated Basin (NHP)

Southern High Plains Designated Basin (SHP)

Upper Black Squirrel Designated Basin

Kiowa-Bijou Designated Basin

Camp Creek Designated Basin

Lost Creek Designated Basin

Upper Big Sandy Designated Basin

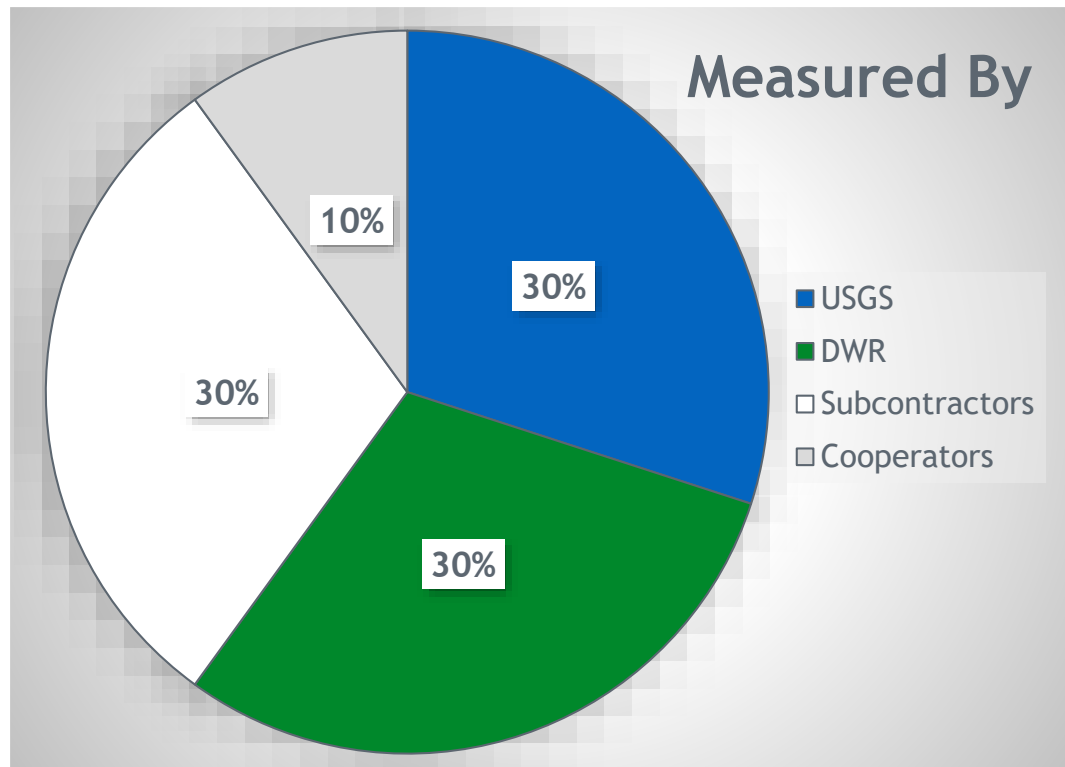
Denver Basin Bedrock Aquifers

Lower South Platte Alluvial Aquifer

West Slope Bedrock and Alluvial Aquifers

HydroBase - Water Level Database

- More than 22,500 wells
- Mostly USGS data populated through web services
- ~2,000 active water-level sites



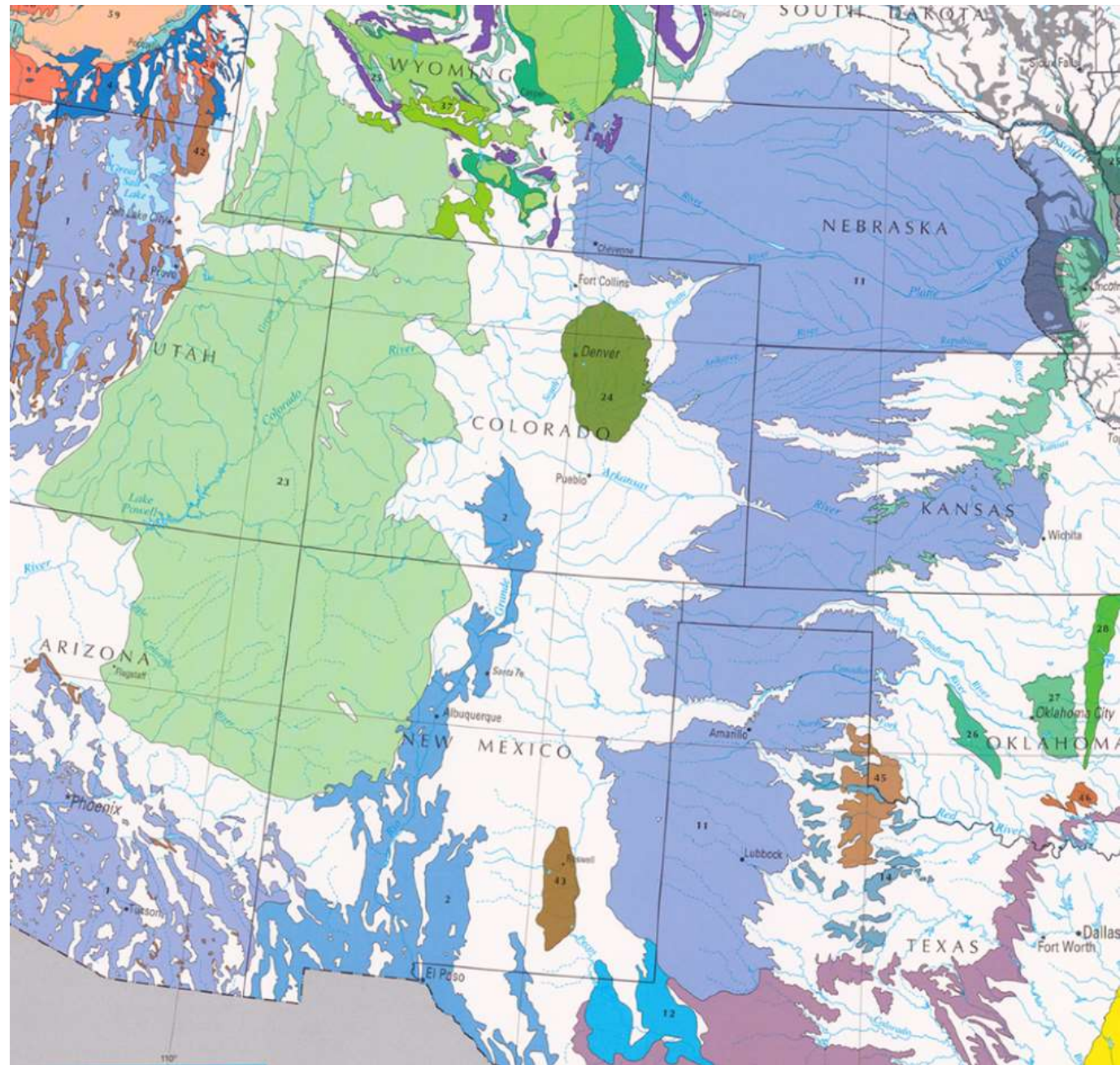
Principal Aquifers

2 - Rio Grande aquifer system

11 - High Plains aquifer

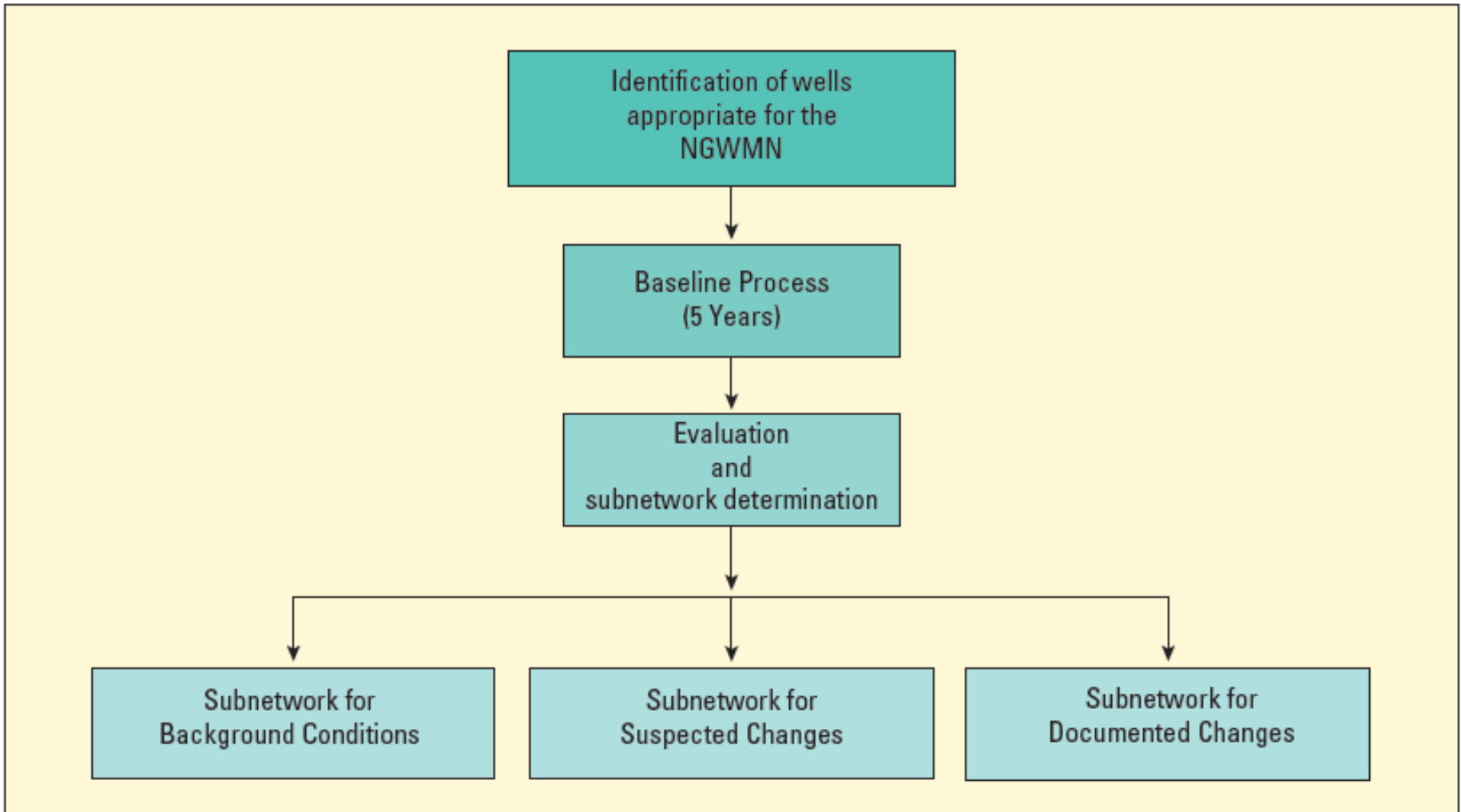
23 - Colorado Plateaus aquifers

24 - Denver Basin aquifer system



(nationalatlas.gov)

Site Selection and Classification

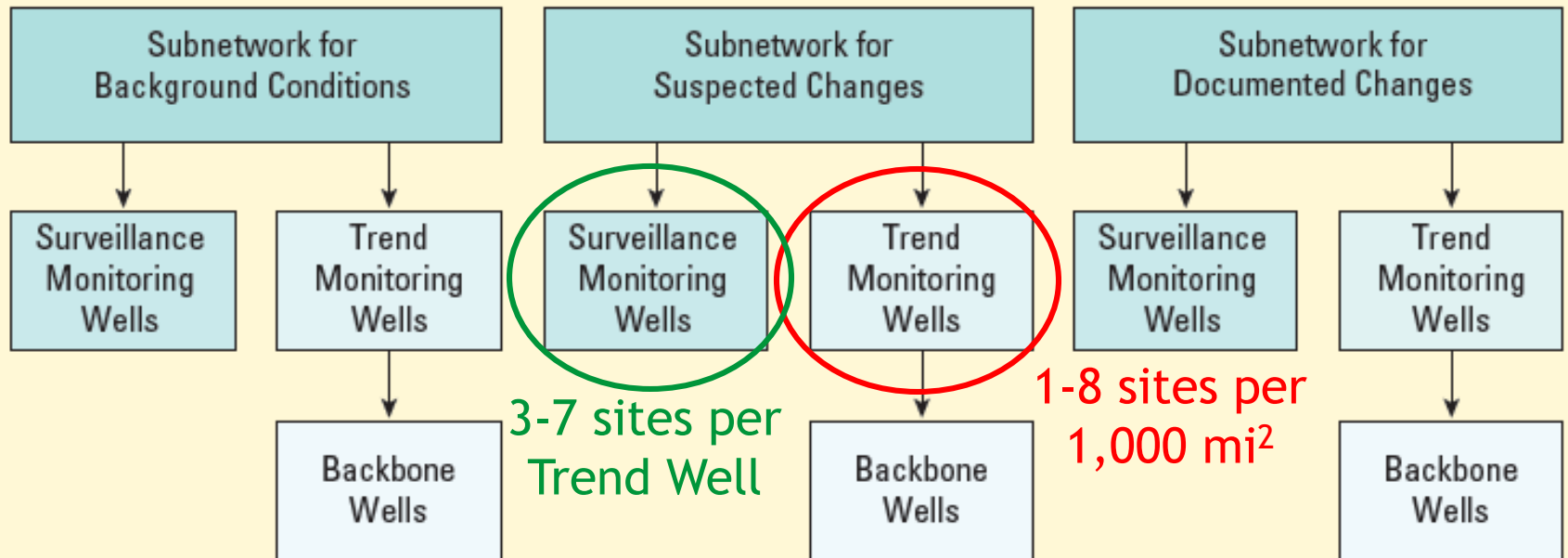


(<https://cida.usgs.gov/ngwmn/>)

NGWMN Subnetworks

- Background Conditions
 - No (or minimal) anthropogenic effects, past and future
- Suspected Changes
 - May have been affected by humans
 - Anticipated changes
- Documented Changes
 - Known anthropogenic effects
 - Heavily pumped or substantial recharge
 - Managed groundwater resources
 - Declining water levels or known water quality issues

Subnetwork Classification

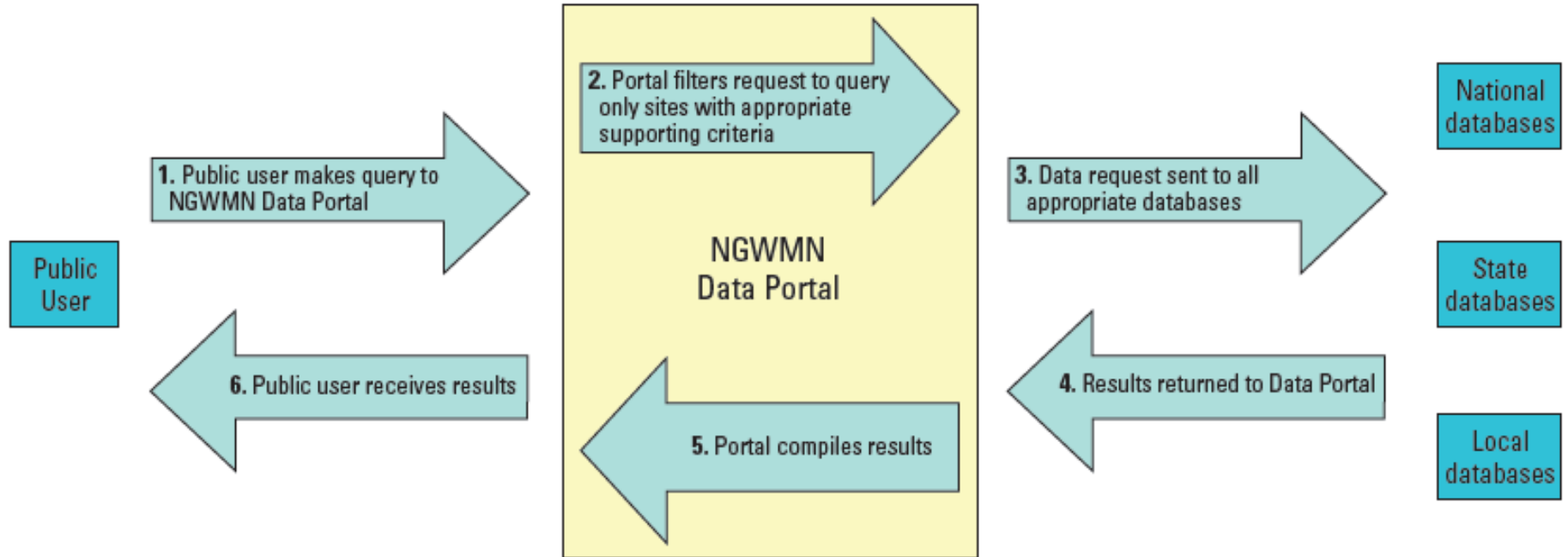


Monitoring Categories

Monitoring Category	Aquifer Type	Nearby Long-Term Aquifer Withdrawals		
		Small Withdrawals	Moderate Withdrawals	Large Withdrawals
Trend Monitoring Category	Unconfined			
	“low” recharge (<5 in/yr)	Once per quarter	Once per quarter	Once per month
	“high” recharge (>5 in/yr)	Once per quarter	Once per month	Once per day
	Confined			
	“low” hydraulic conductivity (<200 ft/d)	Once per quarter	Once per quarter	Once per month
	“high” hydraulic conductivity (>200 ft/d)	Once per quarter	Once per month	Once per day
Surveillance Monitoring Category	Unconfined			
	“low” recharge (<5 in/yr)	Every three years	Once per year	Twice per year
	“high” recharge (>5 in/yr)	Every three years	Twice per year	Once per quarter
	Confined			
	“low” hydraulic conductivity (<200 ft/d)	Every three years	Every two years	Once per year
	“high” hydraulic conductivity (>200 ft/d)	Every three years	Every two years	Once per year

(A National Framework for Ground-Water Monitoring in the United States, SOGW/ACWI, 2013)

NGWMN Data Portal



NGWMN NETWORKS

Water level: ?

Subnetwork: ?

- Background
- Suspected Changes
- Documented Changes

Monitoring Category: ?

- Surveillance
- Trend
- Special

Water quality: ?

Subnetwork: ?

- Background
- Suspected Changes
- Documented Changes

Monitoring Category: ?

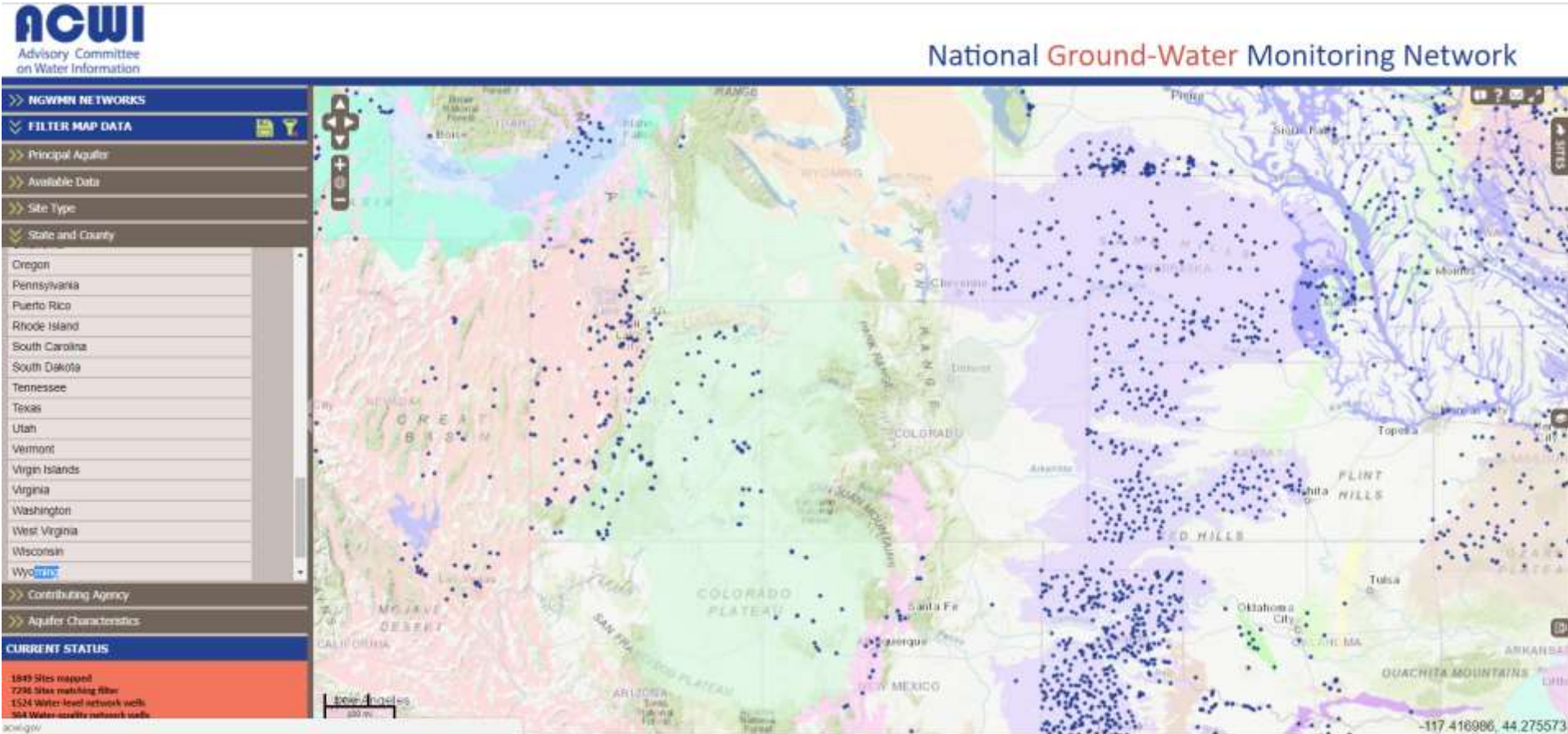
- Surveillance
- Trend
- Special

FILTER MAP DATA

- Principal Aquifer
- Available Data
- Site Type
- State and County
- Contributing Agency
- Aquifer Characteristics

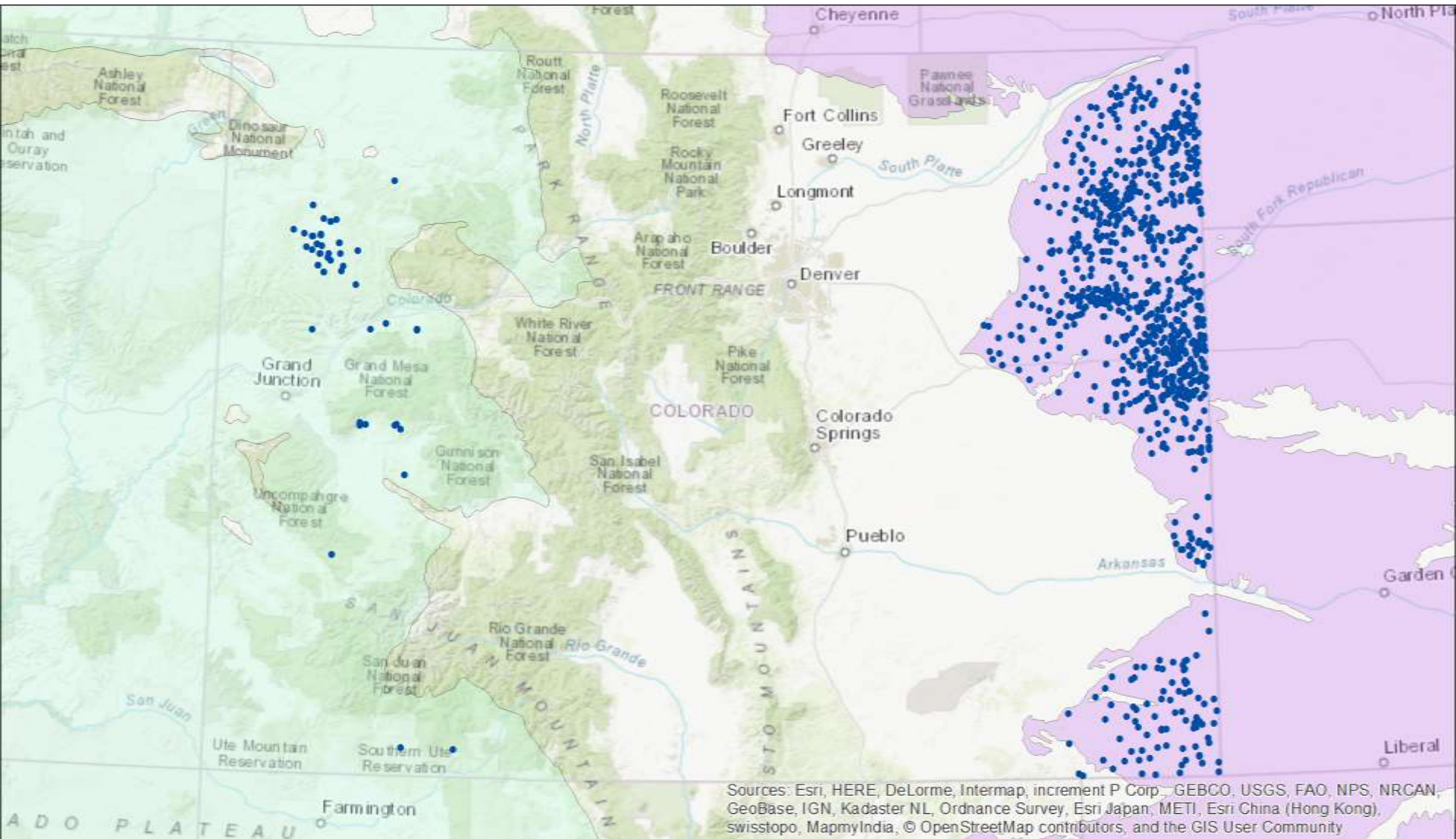
(<https://cida.usgs.gov/ngwmn/index.jsp>)

Colorado in the NGWMN



(<https://cida.usgs.gov/ngwmn/index.jsp>)

Qualified Baseline Wells



Initial Selection for All Wells

- Drop any abandoned or inaccessible wells
- Higher measurement frequency relative to nearby
- Long monitoring record relative to nearby
- Complete lithology and/or well construction info

A Tale of Two Networks...

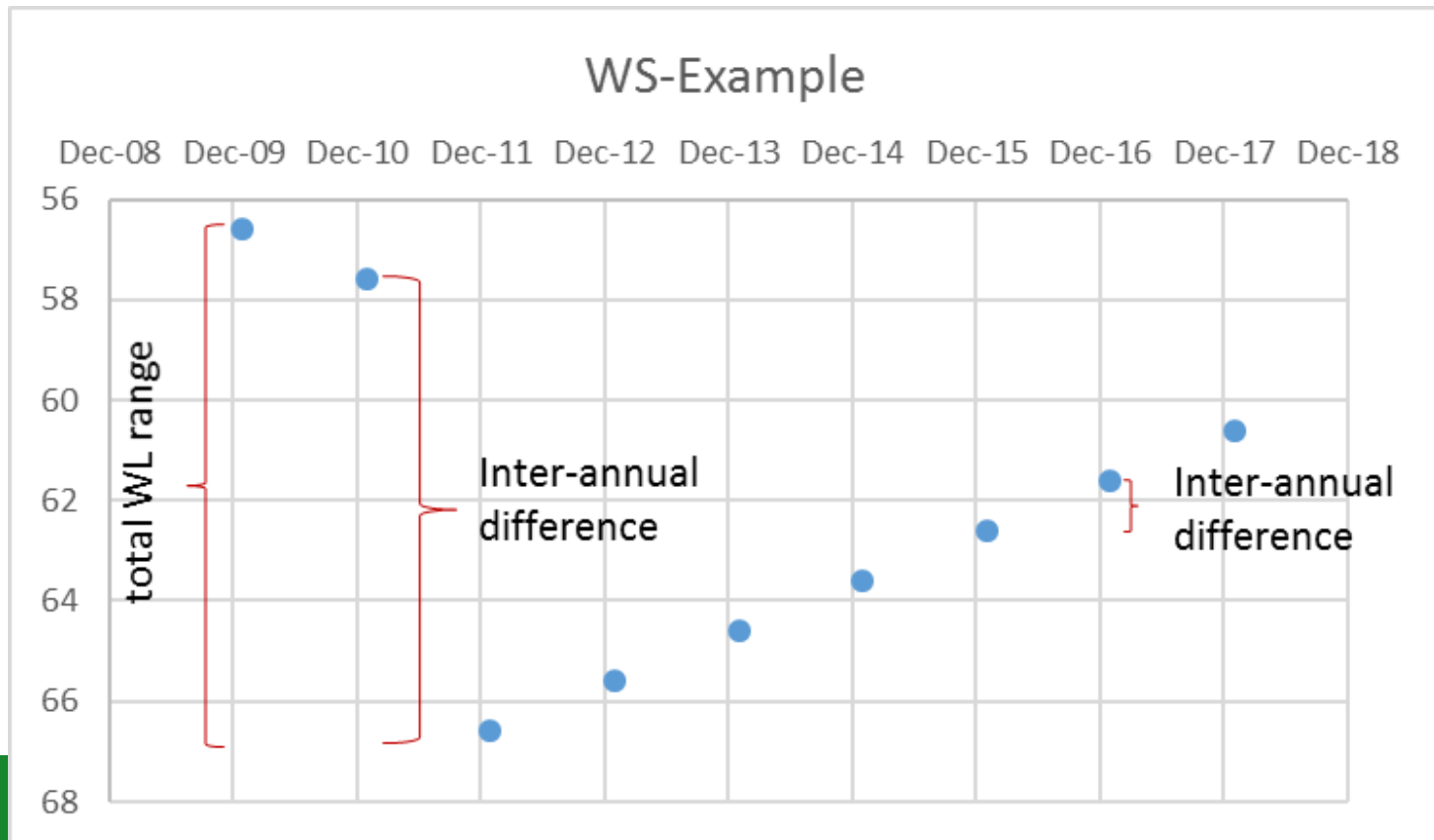
- Colorado Plateaus (West Slope)
 - Vast geographic extent, Four major aquifers/locally more
 - Sparse well spatial coverage and uneven distribution
 - Little groundwater development and spotty well records
 - Easy Selection, Difficult Classification
- High Plains (Eastern Plains)
 - Vast geographic extent, one aquifer
 - Too many wells, too dense
 - Extreme groundwater development, complicated well records
 - Difficult Selection, Easy Classification

Colorado Plateaus Well Selection

- So few wells
- Any well still accessible and currently measured

Colorado Plateaus Classification

- Background Conditions (all three attributes)
 - No reported water withdrawal or use
 - Minimal short- and long-term water level changes
 - Inter-annual change <5 feet, Total water level range <15 feet

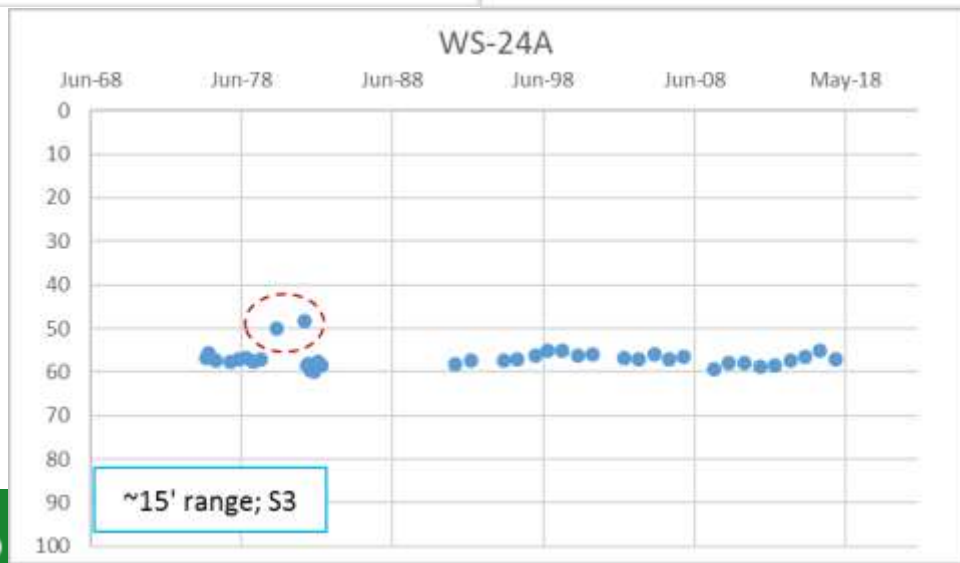
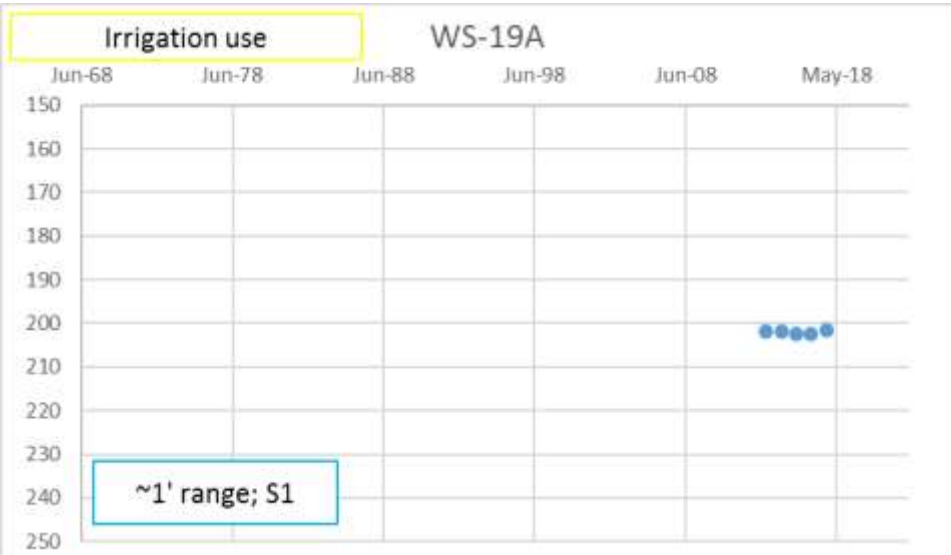


Colorado Plateaus Classification

- Suspected/Anticipated Changes (any one attribute)
 1. Permitted or noted in file for water allowable withdrawals
or
 2. More than one inter-annual change >5 feet
or
 3. Total water level range 15-50 feet

Colorado Plateaus Classification

- Suspected/Anticipated Changes Examples

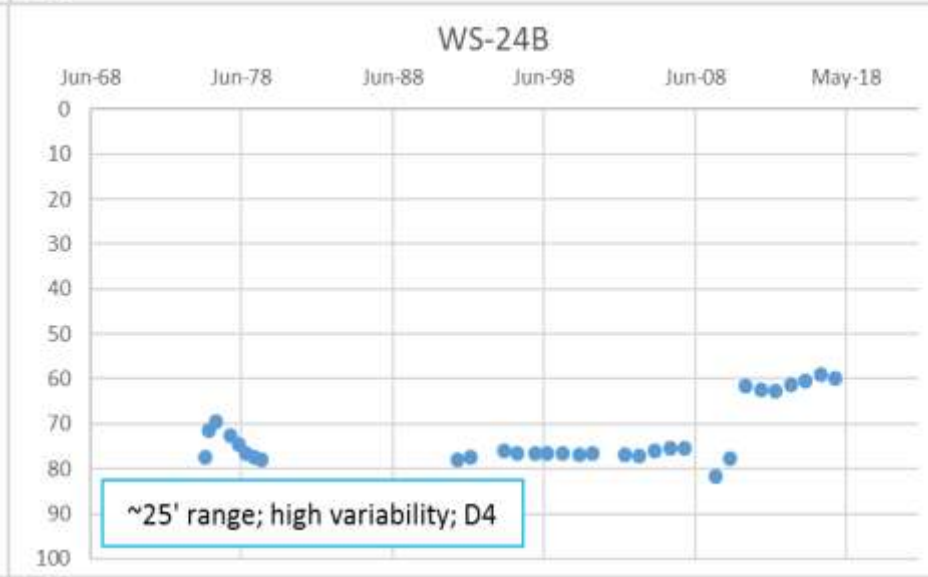
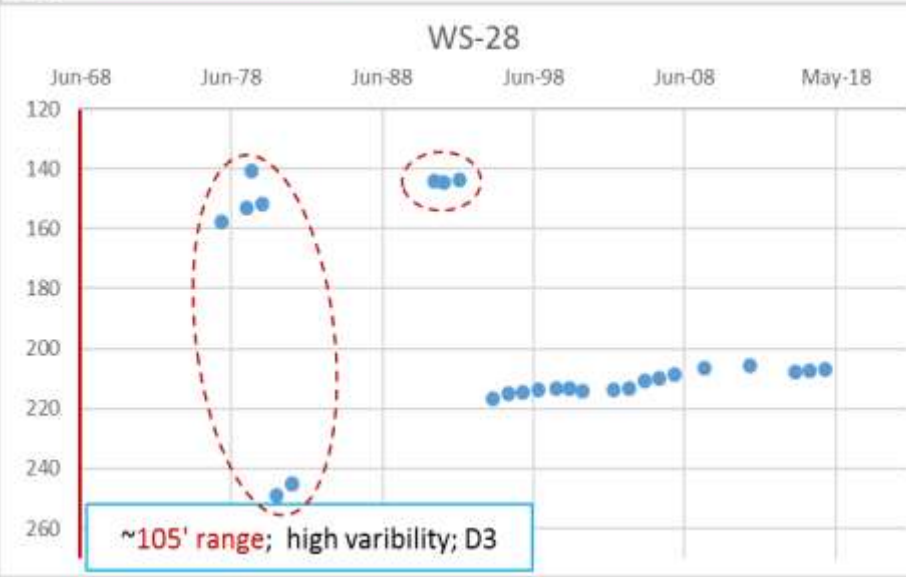
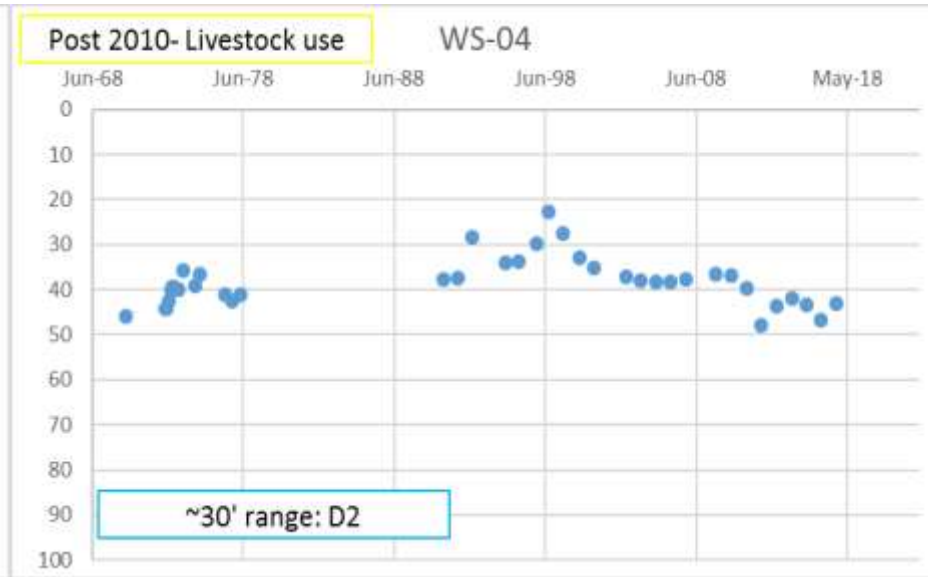


Colorado Plateaus Classification

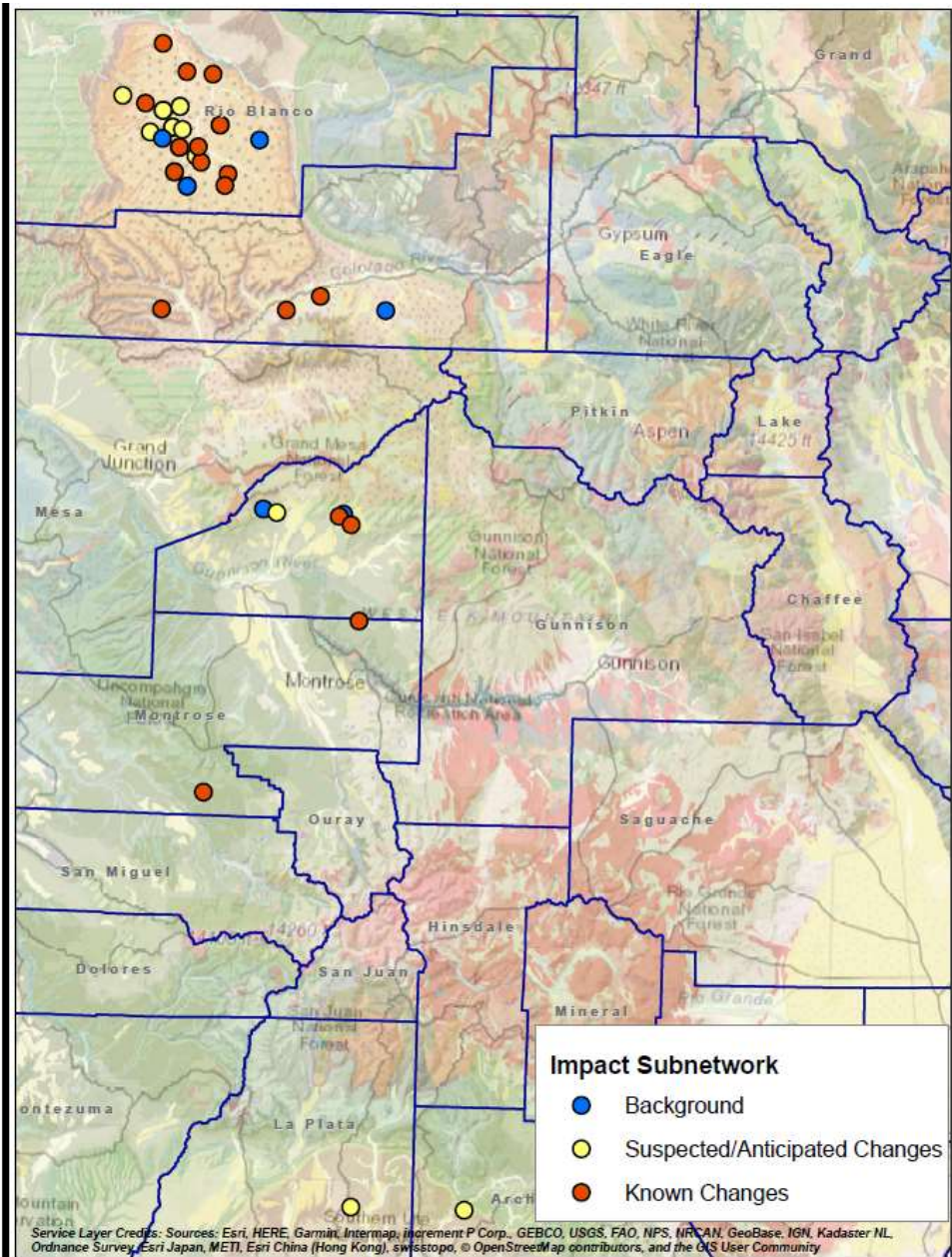
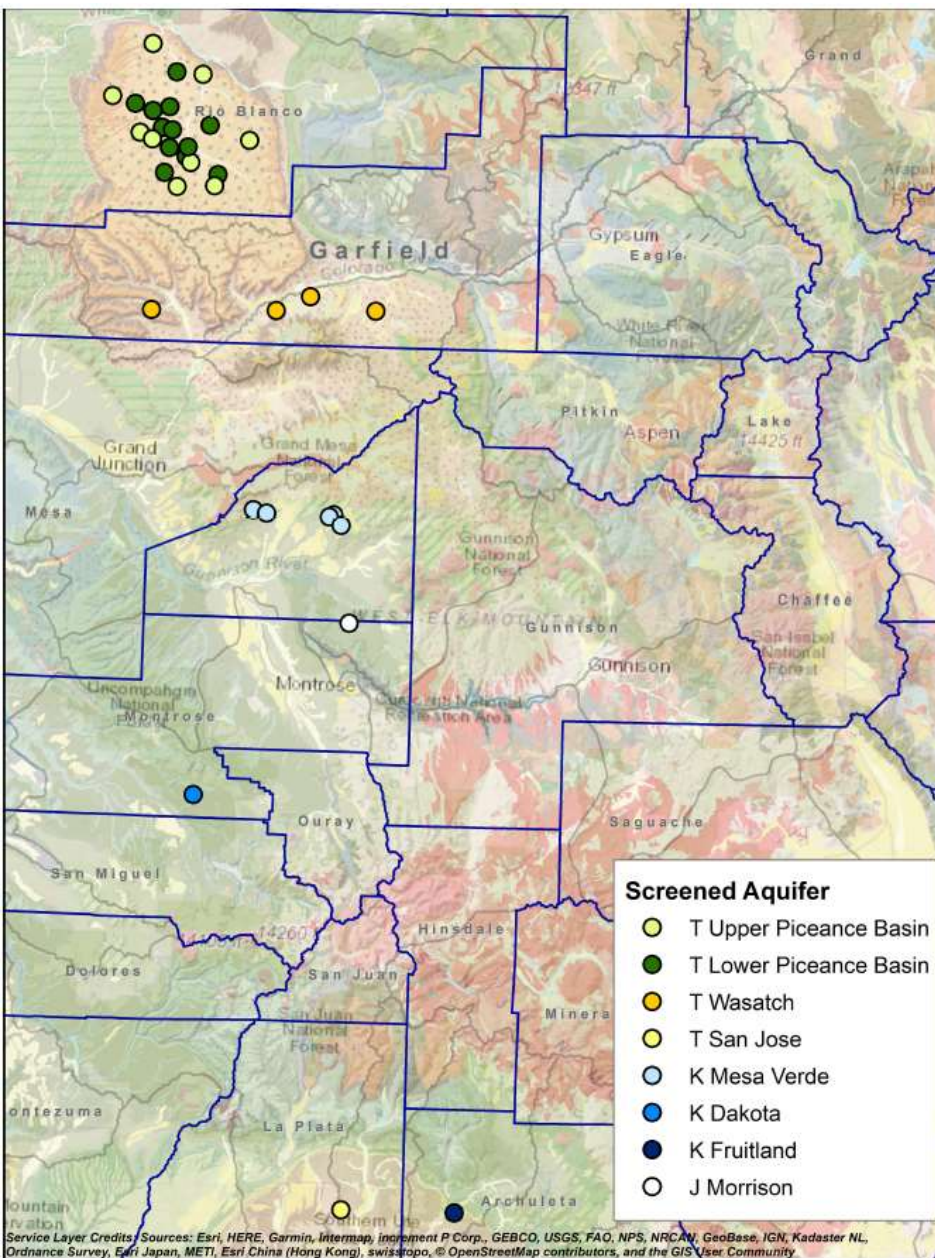
- Documented/Known Changes (any one of the four)
 1. Active pumping recorded in field notes or pumping records
 2. Permitted for water withdrawal AND EITHER
 - Inter-annual change >5 feet
or
 - Total water level range 15-50 feet
 3. More than one inter-annual change >15 feet
 4. Total water level range >50 feet

Colorado Plateaus Classification

- Documented/Known Changes Examples



Colorado Plateaus NGWMN Wells



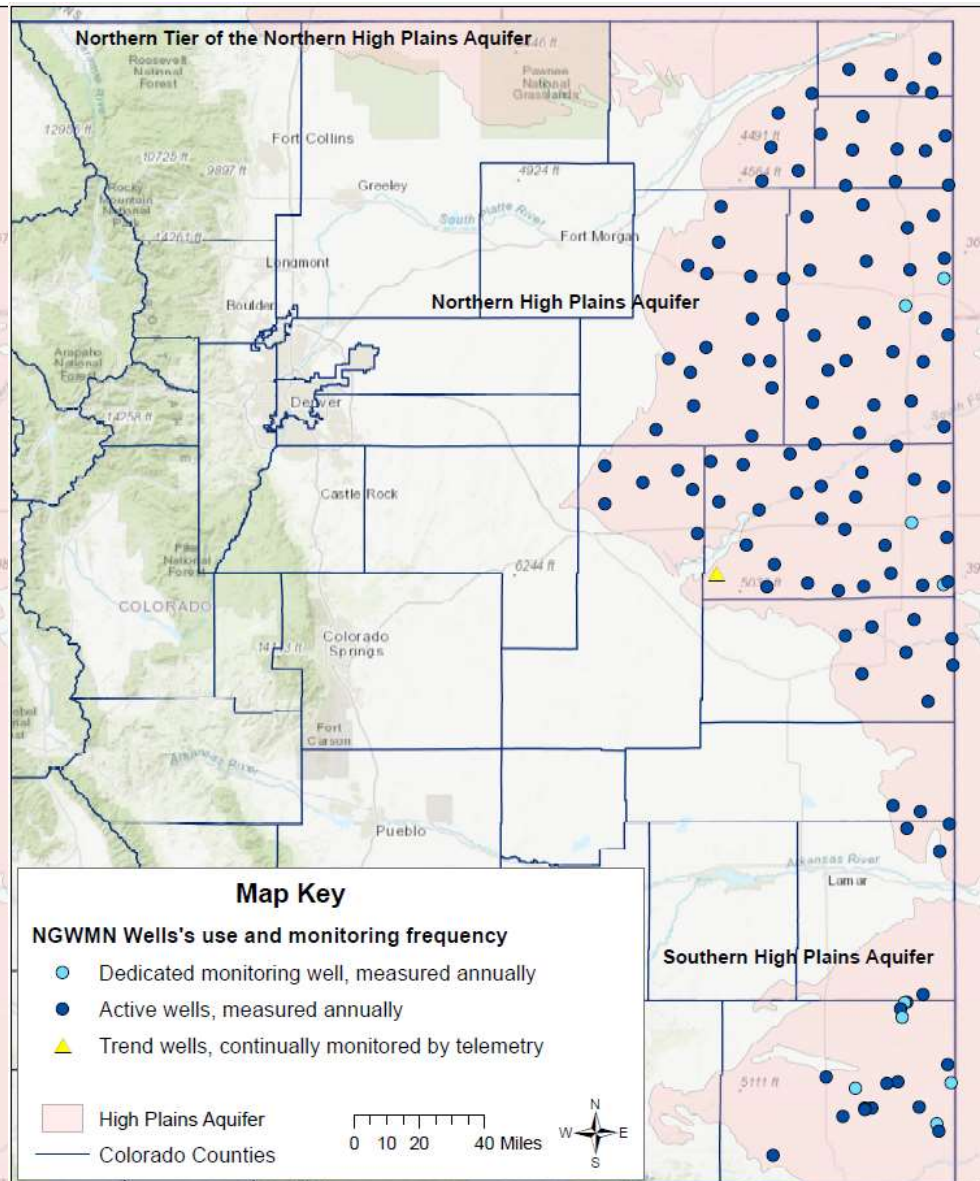
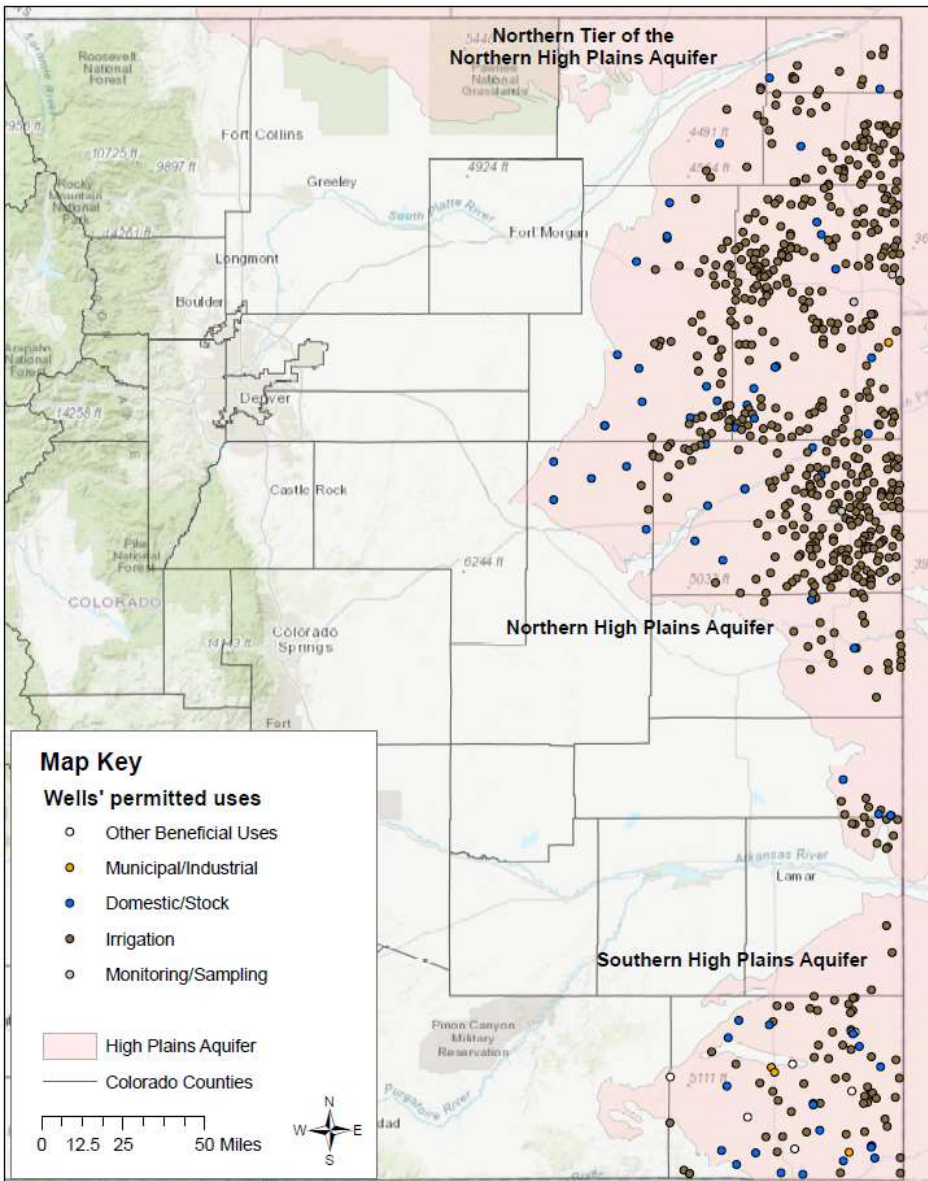
High Plains Well Selection

- Too many wells
- USGS previously selected ~125 wells for the NGWMN
 - Removed abandoned or inaccessible
 - Reviewed/updated well location, construction metadata
- Additional CODWR Monitoring Wells
 - Priority on overall length of monitoring period
 - Preferred wells with well permit/construction information
 - Spatial analysis for appropriate density

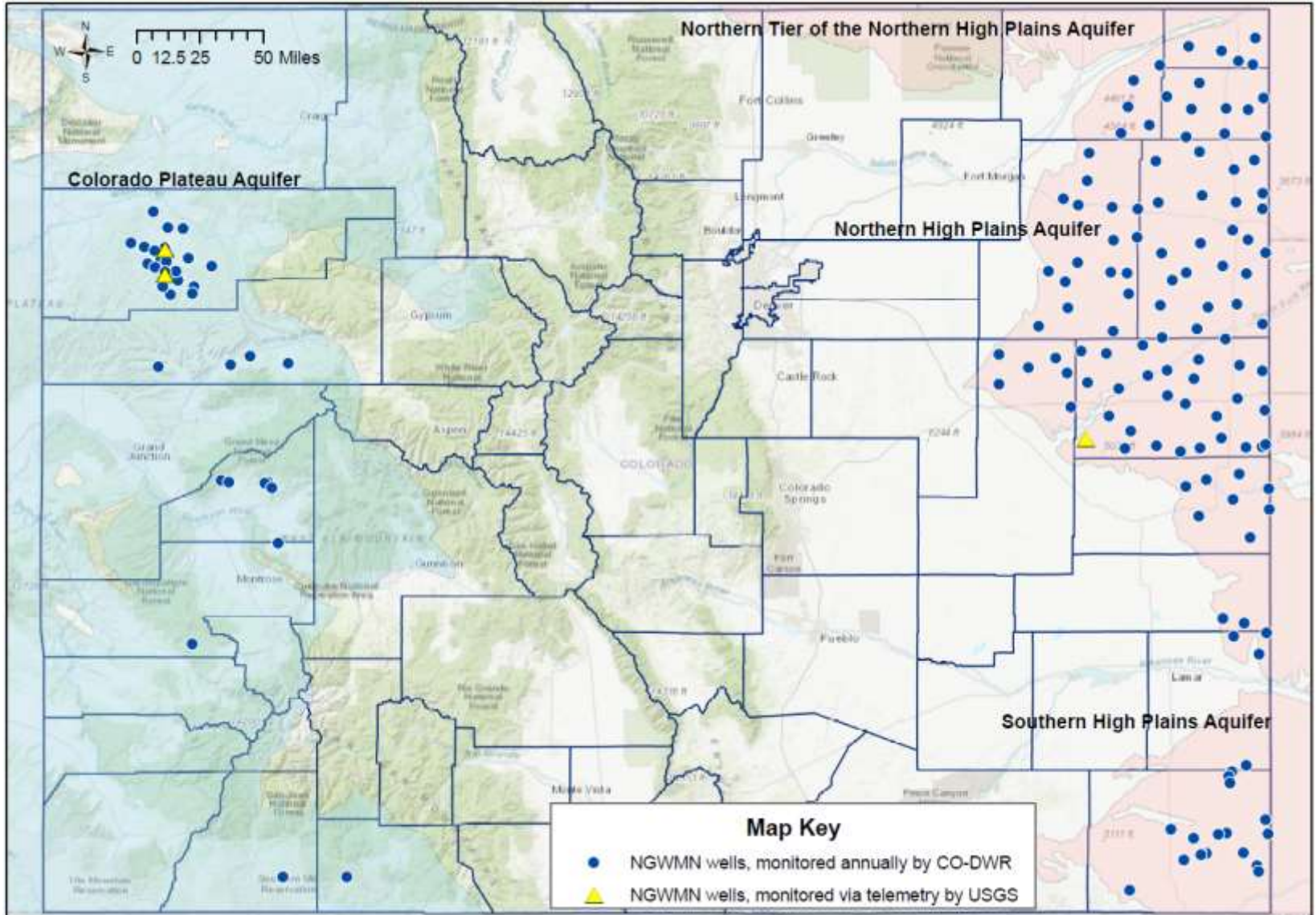
High Plains Well Classification

- Extreme groundwater development and management
- Drastic water level declines
- All wells classified as Documented/Known Changes

High Plains NGWMN Wells



Colorado NGWMN Wells



Continued Work - Current Program Agreement

WELL-DESCRIPTION CARD

NAME AS ON MASTER CARD: Depth well: 1228 Ft. 1228 No. 6

Depth cased (first perf.): 60 ft. 60 ft. Casing Steel diam. 10 3/8 in. 1:1

Flight: (C) porous gravel w. screen, (D) gravel w. screen, (E) horiz. open hole, (F) perf., screen, sd. pi., shored, (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z) (AA) (AB) (AC) (AD) (AE) (AF) (AG) (AH) (AI) (AJ) (AK) (AL) (AM) (AN) (AO) (AP) (AQ) (AR) (AS) (AT) (AU) (AV) (AW) (AX) (AY) (AZ) (BA) (BB) (BC) (BD) (BE) (BF) (BG) (BH) (BI) (BJ) (BK) (BL) (BM) (BN) (BO) (BP) (BQ) (BR) (BS) (BT) (BU) (BV) (BW) (BX) (BY) (BZ) (CA) (CB) (CC) (CD) (CE) (CF) (CG) (CH) (CI) (CJ) (CK) (CL) (CM) (CN) (CO) (CP) (CQ) (CR) (CS) (CT) (CU) (CV) (CW) (CX) (CY) (CZ) (DA) (DB) (DC) (DD) (DE) (DF) (DG) (DH) (DI) (DJ) (DK) (DL) (DM) (DN) (DO) (DP) (DQ) (DR) (DS) (DT) (DU) (DV) (DW) (DX) (DY) (DZ) (EA) (EB) (EC) (ED) (EE) (EF) (EG) (EH) (EI) (EJ) (EK) (EL) (EM) (EN) (EO) (EP) (EQ) (ER) (ES) (ET) (EU) (EV) (EW) (EX) (EY) (EZ) (FA) (FB) (FC) (FD) (FE) (FF) (FG) (FH) (FI) (FJ) (FK) (FL) (FM) (FN) (FO) (FP) (FQ) (FR) (FS) (FT) (FU) (FV) (FW) (FX) (FY) (FZ) (GA) (GB) (GC) (GD) (GE) (GF) (GG) (GH) (GI) (GJ) (GK) (GL) (GM) (GN) (GO) (GP) (GQ) (GR) (GS) (GT) (GU) (GV) (GW) (GX) (GY) (GZ) (HA) (HB) (HC) (HD) (HE) (HF) (HG) (HH) (HI) (HJ) (HK) (HL) (HM) (HN) (HO) (HP) (HQ) (HR) (HS) (HT) (HU) (HV) (HW) (HX) (HY) (HZ) (IA) (IB) (IC) (ID) (IE) (IF) (IG) (IH) (II) (IJ) (IK) (IL) (IM) (IN) (IO) (IP) (IQ) (IR) (IS) (IT) (IU) (IV) (IW) (IX) (IY) (IZ) (JA) (JB) (JC) (JD) (JE) (JF) (JG) (JH) (JI) (JJ) (JK) (JL) (JM) (JN) (JO) (JP) (JQ) (JR) (JS) (JT) (JU) (JV) (JW) (JX) (JY) (JZ) (KA) (KB) (KC) (KD) (KE) (KF) (KG) (KH) (KI) (KJ) (KK) (KL) (KM) (KN) (KO) (KP) (KQ) (KR) (KS) (KT) (KU) (KV) (KW) (KX) (KY) (KZ) (LA) (LB) (LC) (LD) (LE) (LF) (LG) (LH) (LI) (LJ) (LK) (LL) (LM) (LN) (LO) (LP) (LQ) (LR) (LS) (LT) (LU) (LV) (LW) (LX) (LY) (LZ) (MA) (MB) (MC) (MD) (ME) (MF) (MG) (MH) (MI) (MJ) (MK) (ML) (MN) (MO) (MP) (MQ) (MR) (MS) (MT) (MU) (MV) (MW) (MX) (MY) (MZ) (NA) (NB) (NC) (ND) (NE) (NF) (NG) (NH) (NI) (NJ) (NK) (NL) (NM) (NO) (NP) (NQ) (NR) (NS) (NT) (NU) (NV) (NW) (NX) (NY) (NZ) (OA) (OB) (OC) (OD) (OE) (OF) (OG) (OH) (OI) (OJ) (OK) (OL) (OM) (ON) (OO) (OP) (OQ) (OR) (OS) (OT) (OU) (OV) (OW) (OX) (OY) (OZ) (PA) (PB) (PC) (PD) (PE) (PF) (PG) (PH) (PI) (PJ) (PK) (PL) (PM) (PN) (PO) (PP) (PQ) (PR) (PS) (PT) (PU) (PV) (PW) (PX) (PY) (PZ) (QA) (QB) (QC) (QD) (QE) (QF) (QG) (QH) (QI) (QJ) (QK) (QL) (QM) (QN) (QO) (QP) (QQ) (QR) (QS) (QT) (QU) (QV) (QW) (QX) (QY) (QZ) (RA) (RB) (RC) (RD) (RE) (RF) (RG) (RH) (RI) (RJ) (RK) (RL) (RM) (RN) (RO) (RP) (RQ) (RR) (RS) (RT) (RU) (RV) (RW) (RX) (RY) (RZ) (SA) (SB) (SC) (SD) (SE) (SF) (SG) (SH) (SI) (SJ) (SK) (SL) (SM) (SN) (SO) (SP) (SQ) (SR) (SS) (ST) (SU) (SV) (SW) (SX) (SY) (SZ) (TA) (TB) (TC) (TD) (TE) (TF) (TG) (TH) (TI) (TJ) (TK) (TL) (TM) (TN) (TO) (TP) (TQ) (TR) (TS) (TT) (TU) (TV) (TW) (TX) (TY) (TZ) (UA) (UB) (UC) (UD) (UE) (UF) (UG) (UH) (UI) (UJ) (UK) (UL) (UM) (UN) (UO) (UP) (UQ) (UR) (US) (UT) (UU) (UV) (UW) (UX) (UY) (UZ) (VA) (VB) (VC) (VD) (VE) (VF) (VG) (VH) (VI) (VJ) (VK) (VL) (VM) (VN) (VO) (VP) (VQ) (VR) (VS) (VT) (VU) (VV) (VW) (VX) (VY) (VZ) (WA) (WB) (WC) (WD) (WE) (WF) (WG) (WH) (WI) (WJ) (WK) (WL) (WM) (WN) (WO) (WP) (WQ) (WR) (WS) (WT) (WU) (WV) (WW) (WX) (WY) (WZ) (XA) (XB) (XC) (XD) (XE) (XF) (XG) (XH) (XI) (XJ) (XK) (XL) (XM) (XN) (XO) (XP) (XQ) (XR) (XS) (XT) (XU) (XV) (XW) (XX) (XY) (XZ) (YA) (YB) (YC) (YD) (YE) (YF) (YG) (YH) (YI) (YJ) (YK) (YL) (YM) (YN) (YO) (YP) (YQ) (YR) (YS) (YT) (YU) (YV) (YW) (YX) (YZ) (ZA) (ZB) (ZC) (ZD) (ZE) (ZF) (ZG) (ZH) (ZI) (ZJ) (ZK) (ZL) (ZM) (ZN) (ZO) (ZP) (ZQ) (ZR) (ZS) (ZT) (ZU) (ZV) (ZW) (ZX) (ZY) (ZZ)

Method Drilled: rot.

Bore Drilled: rot.

Driller: LONGVIEW

COLORADO DIVISION OF WATER RESOURCES
1313 Sherman Street - Room 818
Denver, Colorado 80203

RECEIVED
MAR 09 78
WATER RESOURCES
STATE ENGINEER
CO. 8

SUBMITTED BY: **DAVID BROWN**
COMPLETION BED HERE: **BLACK**

WELL COMPLETION AND PUMP INSTALLATION REPORT
PERMIT NUMBER 21627-F

David Brown
Wray Rt Box 3
Lycke, Colo 80734

SW 6 % of the NE 44 % of Sec. 30
T. 6 N. R. 44 W. 6 P.M.

June 24, 1977

HOLE DIAMETER
26 in. from 0 to 353 ft.
_____ in. from _____ to _____ ft.
_____ in. from _____ to _____ ft.

DRILLING METHOD Reverse rotary
CASING RECORD: Plain Casing
Size 16 & kind Steel from 0 to 254 ft.
Size _____ & kind _____ from _____ to _____ ft.
Size _____ & kind _____ from _____ to _____ ft.

Perforated Casing
Size 16 & kind Steel from 254 to 354 ft.
Size _____ & kind _____ from _____ to _____ ft.
Size _____ & kind _____ from _____ to _____ ft.

Receipt 9007476 Permit 80256- Current Status **Well Constructed**

Construction Report Received: Includes Geophysical Log Confidential Log Requested

Location Information
Well Location Address: _____
Address: _____ GPS Well Location: Easting [utm x]: _____ Northing [utm y]: _____
City, State, Zip: _____ Legal Well Location: Q40 Q160 Section Township Range PM

Construction Details
Ground Surface Elevation: _____ Date Completed: _____ Drilling Method: _____
Aquifer: _____ Total Depth: _____ Depth Completed: _____
Aquifer Type: _____

Casing Type	Material	Casing OD	Wall Thickness	Borehole Top	Bottom	Grout Top	Grout Bottom	Grout Material	Grout Method

Filter Pack Interval Top: _____ Filter Pack Interval Bottom: _____
 Disinfection Performed Dry Hole

Static Water Level: _____ Measurement Date: _____ Estimated Yield: _____

Individual/Company responsible for drilling the Well
License Number: _____
Email: _____
Phone Number: _____

Acceptance Criteria
Analysis Description

Casing Interval Editor

Casing Type: _____ Grout From/Top: _____ To/Bottom: _____
Material: _____ Material: _____
Outside Diameter: _____ Method: _____
Wall Thickness: _____
From/Top: _____
To/Bottom: _____
Bore Hole Diameter: _____

Save Undo Close

Continued Work - Future Programs

- Future Programs
 - Create Lithology Database & Connect Web Services
 - Add Denver Basin and Rio Grande Aquifer Systems
 - Lower South Platte Alluvial Aquifer - Daily Telemetry

Continued Work - Future Programs

THIS FORM MUST BE SUBMITTED
WITHIN 60 DAYS OF COMPLETION
OF THE WORK DESCRIBED HERE-
ON. TYPE OR PRINT IN BLACK
INK.

COLORADO DIVISION OF WATER RESOURCES

1313 Sherman Street - Room 818
Denver, Colorado 80203

WELL COMPLETION AND PUMP INSTALLATION REPORT
PERMIT NUMBER 21627-F

RECEIVED
MAR 09 78
WATER RESOURCES
STATE ENGINEER
COOL

WELL OWNER David Brown
Wray Rt Box 3
ADDRESS Holyoke, Colo 80734
DATE COMPLETED June 24, 1977

DRILLERS TEST LOG

CUSTOMERS NAME Dr. Earl Berens DATE July 14, 1985
STREET ADDRESS 48525 Hogan Dr. TEST # 2 E. LOG yes
CITY & STATE Burlington, CO 80807 DRILLER Livingston
COUNTY Kit Carson QUARTER NE SECTION 9 TOWNSHIP 10 RANGE 46

LOCATION 300 ft. north of well

WELL LOG

From	To	Type and Color of Material	Water Loc.
0	30	Sand	
30	147	Clay, limestone, sandstone & gravel	1
147	200	Sand & gravel, light clay streaks	10
200	210	Sand & gravel	
210	230	Clay	55
230	285	Sand & gravel	X
285	294	Clay	9
294	353	Sand & gravel	X

WELL LOCATION

%	FOOTAGE		DESCRIPTION OF STRATA	Static Water Level
	From	Pay To		Proposed Well Depth
	0	2	Top soil	
	2	41	Brown sandy clay and fine sand streaks	
	41	61	Sand fine to medium, small gravel few clay and cemented streaks	
	61	80	Brown sandy clay, limerock cemented sand	
	80	107	Sand fine to medium, cemented and clay streaks	
	107	121	Sand fine to medium, small gravel cemented	
	121	127	Brown sandy clay limerock	
	127	141	Sand fine to medium, coarse	
	141	147	Cemented sand	
	147	151	Sandy clay and sand streaks	
	151	160	Sand fine to medium, and clay streaks	
	160	187	Sand fine to medium, small gravel and few cemented streaks and clay streaks	
	187	191	Cemented sand and clay streaks	
60	191	09 200	Sand fine to medium, coarse, small gravel cemented ledges	
70	200	25 225	Sand fine to medium, coarse, small gravel few medium gravel loc	
	225	232	Yellow soapstone	
				Total Depth 230'
				Set up North
				Pit on the East

Benefits of joining NGWMN

- Well database information clean-up
 - Basic well metadata
 - Found well construction records
 - Permit associations & redrilled/replaced wells
- Better understanding of web services and data sharing
- Interagency cooperation within Colorado
- Relationships with USGS and other states
- Hired a temporary employee who is now permanent

Where Can I Sign Up?

<https://www.usgs.gov/news/usgs-seeks-national-ground-water-monitoring-network-proposals-2019>



SCIENCE

Topics, centers, missions

PRODUCTS

Maps, data, publications

NEWS

Releases, I'm a reporter

CONNECT

Contact, chat, social media

ABOUT

Organization, jobs, budget



USGS Seeks National Ground-Water Monitoring Network Proposals for 2019

Release Date: SEPTEMBER 4, 2018

The U.S. Geological Survey will award up to \$2 million in cooperative agreements to support participation in the National Ground-Water Monitoring Network (NGWMN)

The USGS is working with the Federal Advisory Committee on Water Information's (ACWI) Subcommittee on Ground Water (SOGW) to develop and administer the network. The NGWMN is designed as a cooperative groundwater data collection, management, and reporting system that will be based on data from selected wells in existing federal, state, tribal, and local groundwater monitoring networks. The network is envisioned as a long-term collaborative partnership among federal and non-federal data providers that will help address present and future groundwater management questions facing the nation. The NGWMN will provide the data needed to determine regional and national trends in groundwater levels and groundwater quality, and facilitate the evaluation of transboundary groundwater resources.

Cooperative agreements will provide support for both new and existing data providers in the NGWMN. The USGS will fund new data providers to select and classify sites within existing monitoring programs, to set up web services that will link the data to the [NGWMN portal](#), and to produce a report describing this process. Existing data providers will receive funds to maintain web services and keep site information current. Existing data providers may also receive funding to collect data to improve site information, to maintain wells, and to drill new or replacement network wells. The maximum allowable funds for any data provider agency is \$150,000 per year.

Contacts

Department of the Interior,
U.S. Geological Survey

Office of Communications and Publishing
12201 Sunrise Valley Drive
Reston, VA 20192
United States
Phone: 703-648-4460

Daryll A Pope

Hydrologist

Daryll Pope

Email: dpope@usgs.gov

Phone: 609-771-3933



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Questions?

Subcommittee on Ground Water

<https://acwi.gov/sogw/index.html>

National Ground-Water Monitoring
Network

<https://cida.usgs.gov/ngwmn/>

Colorado Division of Water
Resources (DWR) Website

<http://water.state.co.us>

Colorado Decision Support Systems
(CDSS) - aka HydroBase

[http://dnrweb.state.co.us/cdss/Ground
Water/GroundWaterSearch](http://dnrweb.state.co.us/cdss/GroundWater/GroundWaterSearch)

303-866-3581 x8221

Kevin.Donegan@state.co.us

