

Geology and Well Construction Considerations in Division 2 Arkansas River Basin



January 14, 2021

Andy Flor

DWR Hydrogeology Section



COLORADO
Division of Water Resources
Department of Natural Resources

Outline

- September 2020 Division 2 administrative memo
- February 2019 Dakota Memo
- Overview of Geology of Division 2
- Well Construction Requirements based on site-specific geology
 - Several examples
- Geologic resources for additional information
 - DWR MapViewer
 - CDSS Dakota/Cheyenne Aquifer Determination Tool
 - CGS Groundwater Atlas
 - Geologic Maps

Div 2 September 2020 Dakota Memo

- Concerns the administration of wells constructed into the Dakota Sandstone and Cheyenne Sandstone in Division 2
- “...wells completed into either the Dakota Sandstone or Cheyenne Sandstone are administered the same way in Division 2.”
- “Therefore, if the Dakota and Cheyenne sandstones were to be considered a combined “Dakota Group Aquifer” encompassing both units and permitted as such in the future, there is no conflict with this designation from an administrative perspective.”

Div 2 September 2020 Dakota Memo

- Clarifies that Dakota Sandstone and Cheyenne Sandstone are both considered to be a part of the Dakota Group Aquifer!
- Dakota mapped at the surface, Cheyenne is still a Type 2
- Only catch might be if the well is part of a decreed augmentation plan or substitute water supply plan AND is restricted to either the Dakota SS or Cheyenne SS...



February 2019 Dakota Memo

Dakota Group Aquifer in southeastern Colorado

- Includes: Dakota Sandstone and Cheyenne Sandstone
- Can be at the surface or below one or more aquifers:
 - Fort Hays Limestone
 - Codell Sandstone
 - Greenhorn Limestone
 - “...regardless of whether or not they are fully-saturated or produce significant quantities of water to wells”
- Construction requirements:
 - Type 2 - unconfined bedrock
 - Type 1 - penetrates a single confining unit
 - Type 1 - penetrating multiple confining units

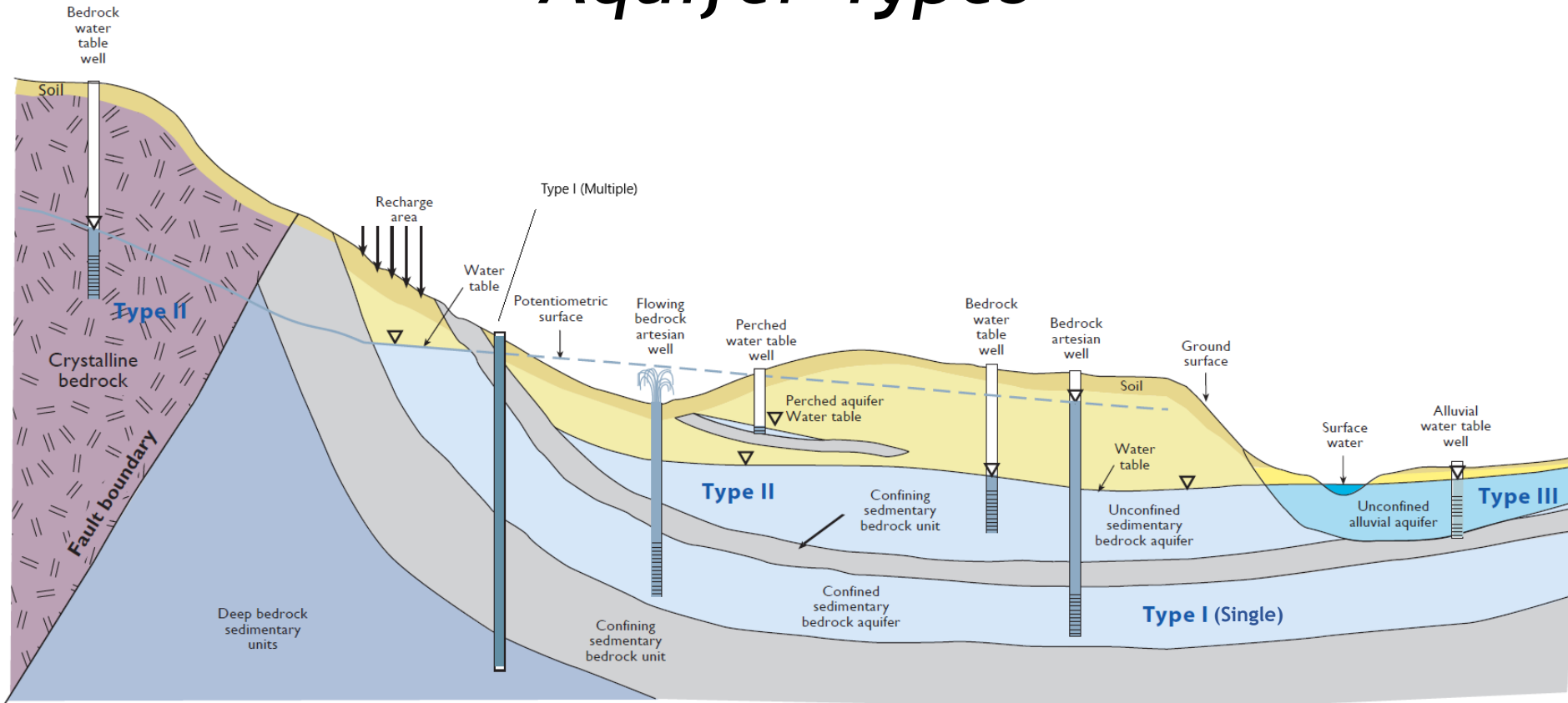


February 2019 Dakota Memo

- Hydrogeology review:
 - Should specify Dakota/Cheyenne on the permit application
 - Provide estimated depth & thickness of the aquifer
 - Provide aquifer type and relevant construction rules
 - When in doubt, please ask us!
- Depths & construction requirements are notes on permit, not as conditions
- Rule 10.1.2: “...all persons authorized to construct wells must investigate and become familiar with:
 - geology of potential aquifers and confining layers,
 - anticipated water quality problems,
 - known contaminated water-bearing zones
- that may be encountered in the area of the proposed drilling activity...



Aquifer Types



Modified from Colorado Geological Survey ON-010 Colorado Groundwater Atlas

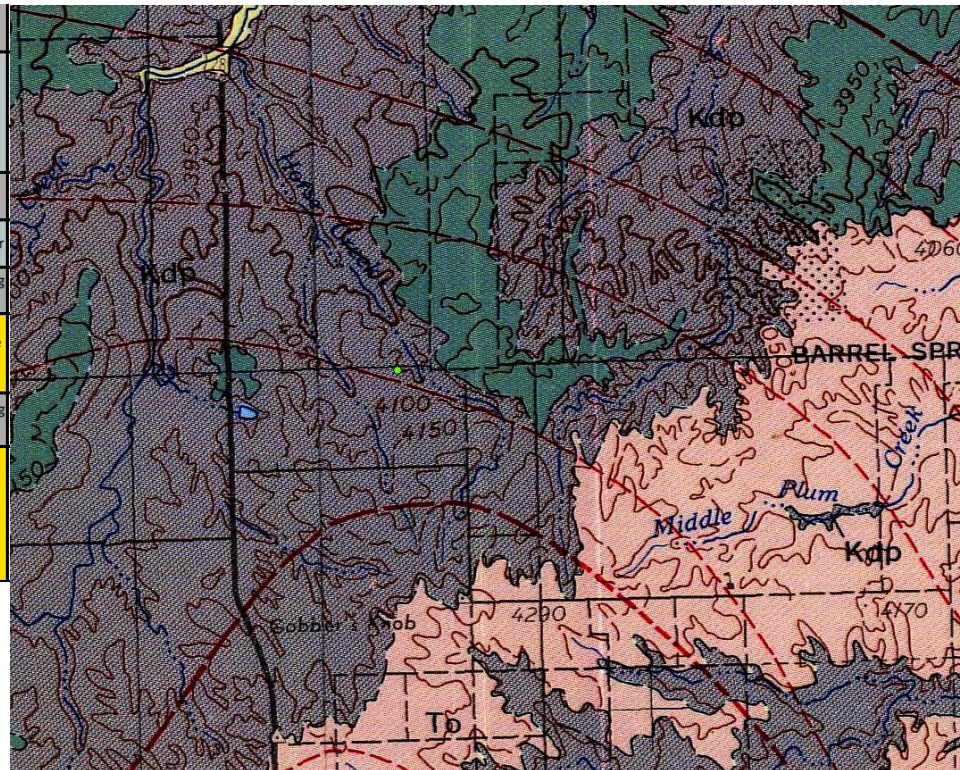


Colorado Piedmont Region

Geologic Period	Phase	Stratigraphic Unit		Unit Thickness (ft)	Physical Characteristics	Hydrogeologic Unit	Hydrologic Characteristics		
Quaternary	Modern-Glaciation	Alluvium associated with present rivers				Alluvial Aquifers			
Neogene	Extension	Nussbaum Alluvium		up to 175	Gravel on pediment; cobbly and pebbly gravel, silty sand	Nussbaum Aquifer	Local aquifer with numerous stock and irrigation wells		
		High Plains regional aquifer				High Plains Aquifer			
Paleogene	Laramide	Laramide basin formations form multiple aquifers; include Denver, Cheyenne and Raton basins				Multiple			
Cretaceous	Interior Seaway	Pierre Shale	Upper member		3,000-8,000	Interbedded fine-grained sand, siltstone and shale	Pierre confining unit	Sandstone layers might yield limited water	
			Upper Pierre sand				Upper Pierre Aquifer		
			Main body				Pierre confining unit		
		Niobrara Formation	Smokey Hill Member		150-500	Yellowish chalk and gray shale		Fort Hays-Codell Aquifer	ields water to stock wells and springs north of Arkansas River; increased yield when fractured
			Fort Hays Limestone		50-65	White to cream, chalky limestone with thin beds of gray calcareous shale			
		Carlile Shale	Codell Sandstone		0-34	Buff crossbedded calcareous sandstone and sandy shale		Carlile confining unit	ields water to a few stock wells
			Carlile Shale		200-235	Black, fissile shale; lower unit is chalky shale			
		Greenhorn Limestone		25-65	Upper unit chalky shale and thin limestone; lower unit hard crystalline limestone		Greenhorn Aquifer		
		Graneros Shale		85-200	Gray to black shale		Graneros confining unit		
		Dakota Group	Dakota Sandstone		150-235	Fine-grained, thin bedded to massive sandstone		Dakota-Cheyenne Aquifer	ields can be sufficient for industrial, municipal, and irrigation use; increased yields where fractured
Purgatoire Formation			60-350	Upper unit, Kiowa Shale, is gray to black clayey shale; lower unit, Cheyenne Sandstone, is massive fine-grained sandstone					
Jurassic	Mesozoic Sandstones	Morrison- Ralston Creek Formations		20-240	Red-brown, gray, yellowish-gray, claystone with beds of sandstone, limestone, siltstone and gypsum	Morrison confining unit	Minimal yield to wells from sandstone lenses		
		Entrada-Sundance Sandstone		>500	Fine- to medium-grained orange and red to buff and white sandstone interbedded with siltstone and shale; rare beds of carbonate and anhydrite		Entrada-Dockum Aquifer	imited extent but is a local source for domestic and stock uses	
		Jelm-Dockum Formations			Pink, orange, and red to buff calcareous sandstone, locally interbedded with siltstone and shale				

Example - North of Two Buttes

Niobrara Formation	Smokey Hill Member	150-500	Yellowish chalk and gray shale	Pierre confining unit
	Fort Hays Limestone	50-65	White to cream, chalky limestone with thin beds of gray calcareous shale	Fort Hays-Codell Aquifer
Carlile Shale	Codell Sandstone	0-34	Buff crossbedded calcareous sandstone and sandy shale	Carlile confining unit
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Jelm-Dockum Formations		Pink, orange, and red to buff calcareous sandstone, locally interbedded with siltstone and shale		

The permit application with receipt no. 3690265 has been referred to a Geologist for review of the underlying aquifer(s). According to the application, the location of the well is to be:

NW ¼ of the NE ¼, Section 3, Township 26S, Range 46W, 6th P.M., Prowers County
 962' from the North section line
 1559' from the East section line

LAMAR 2506 GEO QUAD
 MAPPED AS DAKOTA-PURGATOIRE
 AT THE SURFACE
 BASE PURGATOIRE: 3900

Easting: 713764
 Northing: 4188760

Elevation = ⁴⁰⁸⁵~~4140~~

The applicant is requesting to construct a new well in the Dakota aquifer. Please identify the interval for the Dakota aquifer at this location. Would like to issue as Rule 6.2.3. but they did submit UTM coordinates with the application, so that location may be the best location in the 35 acres.

PERMIT
 29587

ELEV
 4120

BASE PURGATOIRE
 3850

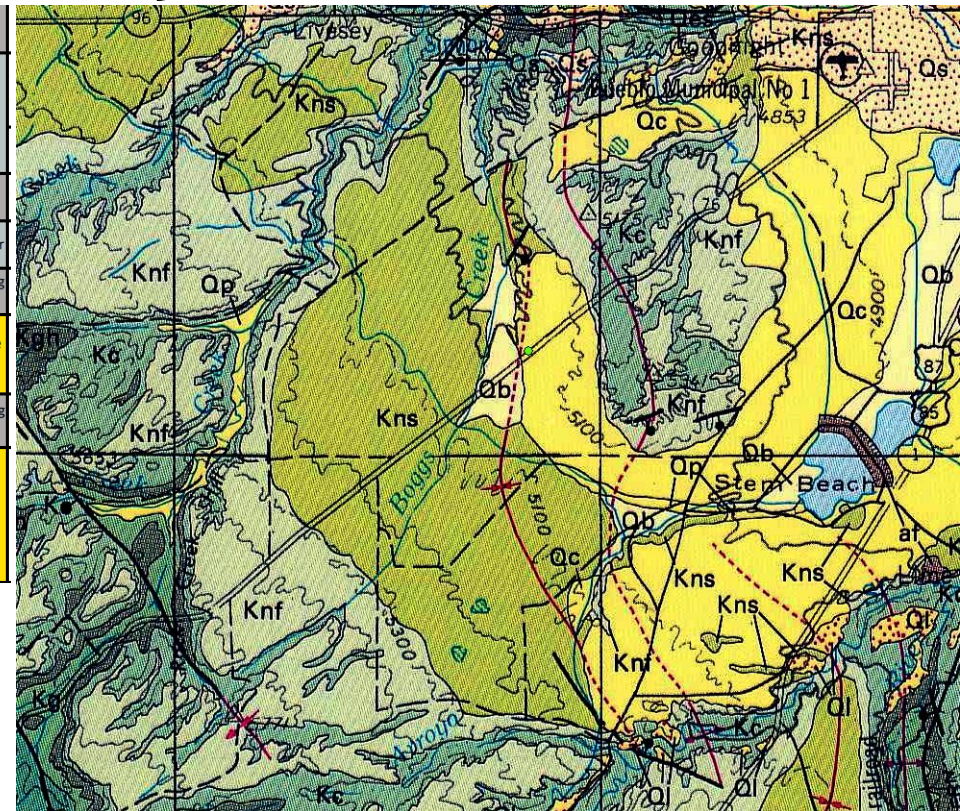
DAKOTA GROUP AQUIFER FROM SURFACE TO APPROXIMATELY 200 FEET

*RULE 10.4.6 (4085-3885 FEET)



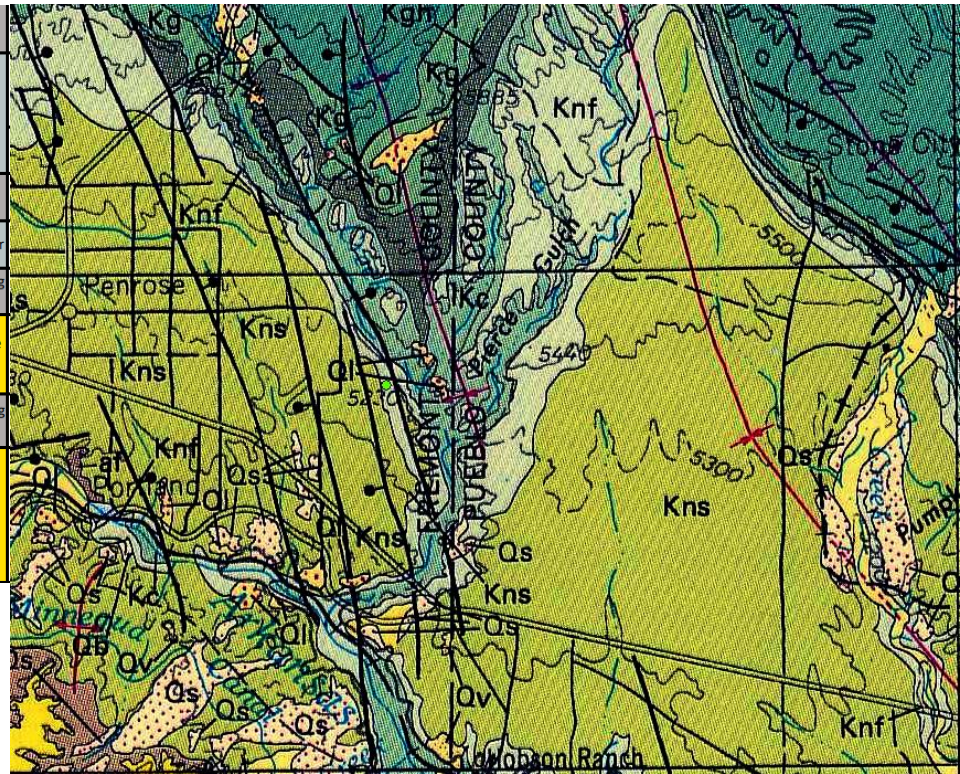
Example - Hwy 76

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Jelm-Dockum Formations			Pink, orange, and red to buff calcareous sandstone, locally interbedded with siltstone and shale	



Example - Penrose

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INTEROFFICE MEMORANDUM

TO: PERMIT FILE FOR RECEIPT NO. 10006072
MATT SARES, KEVIN DONEGAN & ANDY FLOR

FROM: GEOFF DAVIS, FOR TEAM 2,3,7

SUBJECT: APPLICATION RECEIPT NO. 10006072

DATE: OCTOBER 13, 2020

PUEBLO Z50K GEO QUA
MARKED AS FT HAYS LS (int)

LOCATED IN UPTHROWN
BLOCK (HORST) IN
SERIES OF PARALLEL
FAULTS, ADJACENT TO
THE BEAVER (SALT CANYON)
ANTICLINE

AQUIFER → FT HAYS LS
CONFINING → CARLISLE SHALE
AQUIFER → GREENHORN LS
CONFINING → GRANEROS SHALE
AQUIFER → DAKOTA SS
KIOWA SHALE
CHEYENNE SS

The permit application with receipt no. 10006072 has been referred to a Geologist for review of an application that seeks to construct a well in the Dakota aquifer. According to the application, the location of the well is:

SE ¼ of the NW ¼, Section 12, Township 19S, Range 68W, 6th P.M., Fremont County
2375' from North section line
1575' from West section line

CCS OFR 02-03
TOP DAKOTA: 5000

E: 504042
N: 4251475
ELEV: 5320

Please give me the depths of the Dakota aquifer.

PERMIT	ELEV	TOP DAKOTA
23962-FR	5270	4830
267960-A	5320	4780
217022-A	5140	4595
9318	5320	4800
281863	5380	4825

DAKOTA GROUP AQUIFER FROM APPROXIMATELY
400 FEET TO 600 FEET

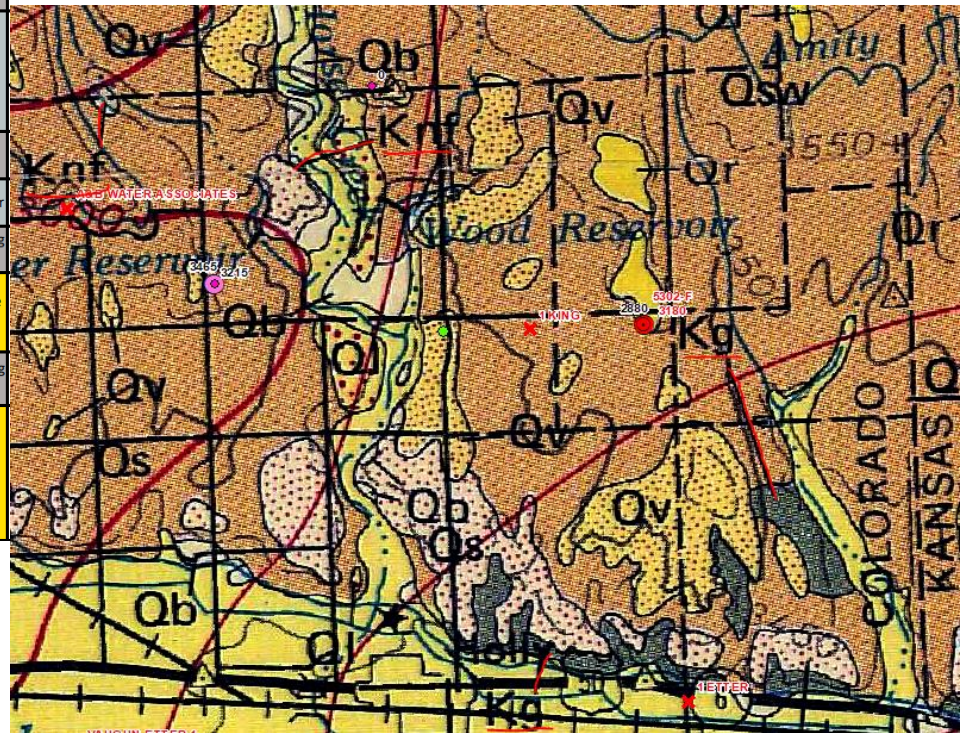
*TYPE I MULTIPLE CONFINING (4920 - 4720 FEET)
(RUELOM.SZ) UNITS

→ THESE DEPTHS ARE VERY APPROXIMATE;
SITE-SPECIFIC CONDITIONS MAY REQUIRE
MODIFICATION OF THE AQUIFER INTERVAL.



Example - Seufer

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COLORADO
Division of Water Resources
Department of Natural Resources

Bedrock Aquifer Determination Evaluation Tool Dakota/Cheyenne - Aquifer Determination Tool

Applicant: SEUFFER, JEWELL
Location: NW 1/4 of NW 1/4 of Sec. 35, T.22S, R.42W, (654 NSL, 651 WSL)
Ground Surface Elevation: 3495
Receipt Number: 3884241
Evaluated By: GABERT, JOHN

Warning! The depth intervals estimated in this area may vary from actual conditions due to lack of data and/or structural complexity.

Surface	Elevation (ft)	Depth To (ft)
Top of Dakota	2992	503
Base of Dakota	2777	718
Top of Cheyenne	2687	808
Base of Cheyenne	2617	878

	ELEV	TOP DAKOTA	BASE DAKOTA	TOP CHEYENNE	BASE CHEYENNE
1 KING	3516	3016	2796	2681	2611
099-06296	3555	2965	2745	2680	2555
A: B: WATER ASSOCIATES	3593	3012	2806	-	-
PN	3490	3010	-	-	-

E: 752790
N: 4220855
Elev: 3495

Lamar 2506 Geo Quad
MAPPED AS VERDUS ALUMINUM (Q)
PLOTS BETWEEN OUTCROPS
OF FORT HAYS LS (Kf) AND
GREENHORN LS (Kg)

ALLUVIAL AQUIFER FROM SURFACE TO 30 FEET
* RULE 10.U.1.7 → TYPE 3 (3495-3465 FEET)

COBELL SANDSTONE FROM 30 FEET TO 50 FEET
* RULE 10.U.1.6 → TYPE 2 (3465-3445 FEET)

GREENHORN FROM APPROXIMATELY 380 FEET TO 420 FEET
* RULE 10.U.S.1 → TYPE 1 SINGLE (315-3075 FEET)

DAKOTA SANDSTONE FROM 500 FEET TO 720 FEET (2995-2775 FEET)

CHEYENNE SANDSTONE FROM 780 FEET TO 905 FEET (2715-2590 FEET)

DAKOTA GROUP AQUIFER FROM 500 FEET TO 905 FEET
* RULE 10.U.S.2 → TYPE 1 MULTIPLE (2995-2590 FEET)

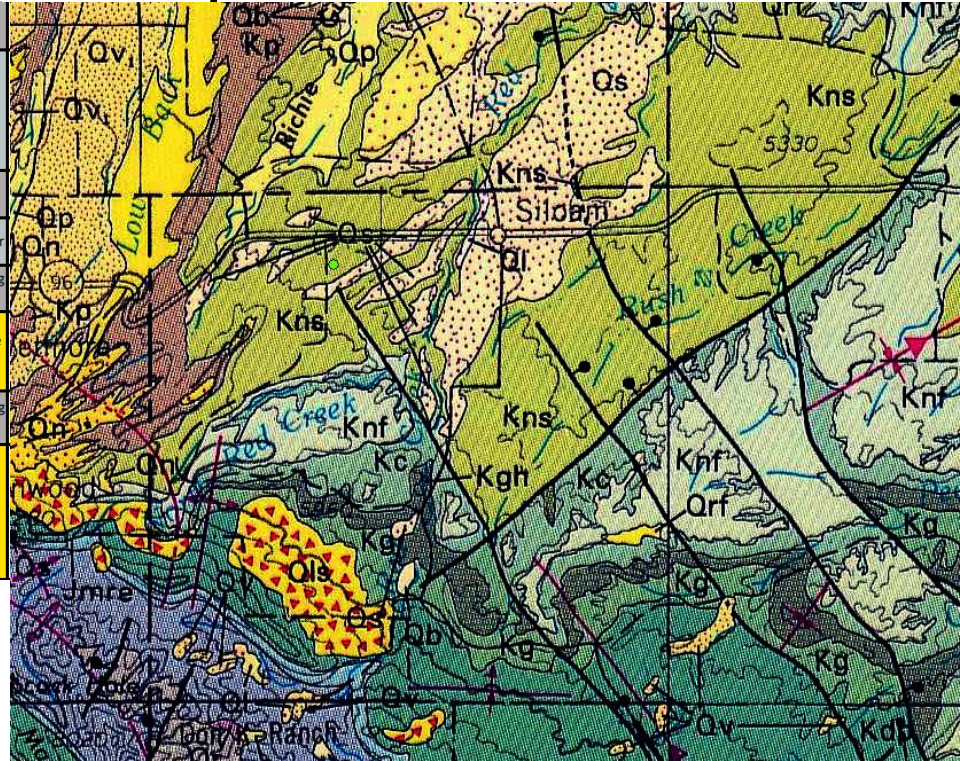
Kf FORT HAYS LS 75-100 FT.
Kc CARLISLE SHALE 125-200 FT.
 JUNEA LOREZ 0-3 FT.
 COBELL SS 0-30 FT.
 BLUE HILL SHALE 50-60 FT.
 FAIRPORT CHALKY SHALE 110 FT.
Kg GREENHORN LS 135 FT.
 BRIDGE CREEK LS 70 FT.
 HARTMAN SHALE 28 FT.
 LINCOLN LS 35 FT.
Kgr GRANEROS SHALE 125 FT.
Kd DAKOTA SS 50+ FT.



COLORADO
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Example - Pueblo Complex Area

Niobrara Formation	Smokey Hill Member	150-500	Yellowish chalk and gray shale	Pierre confining unit
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Evaluator: Kate Fuller
 Receipt No: 3693286
 Location: SW¼, SW¼, Section 4, Township 21 South, Range 68 West, 6th P.M.
 Easting: **499114.5** Northing: **4233122.9**
 Elevation: **5565**
 Aquifer(s) Requested: **Dakota**

VIAKLEK OF E 82-3
 TOP DAKOTA - 4850
 MORE 21K QUAD
 MAPPED AS NIORARA-SMOKEY HILL
 Kns - smokyhill - 700ft
 Knf - Fort Hays 40ft
 Kc - Carlile - 40ft
 Kgh - Greenhorn LS - 80ft
 Kg - Graneros - 105ft +
 Kdp - Dakota

Request: **Depth Interval**

Consultation Recommendations:	TOP	BASE
PERMIT	ELEV	DAKOTA
286304	5440	5035
79931-F	5430	4710
298472	5430	4790
80312-F	5430	4720
80641-F	5485	4915

Special Permit Conditions: DAKOTA AQUIFER FROM APPROXIMATELY 665 FEET TO 865 FEET
 * RULE 10.M.S. 2 → TYPE I MULTIPLE (4900 - 4700 FEET)



Example - Pueblo Complex Area

Niobrara Formation		Smokey Hill Member	150-500	Yellowish chalk and gray shale	Pierre confining unit	1. Well Permit Number: 315372 Receipt Number: 3693286					2. Owner's Well Designation:					3. Well Owner Name: LINDSEY FREEMAN					4. Well Location Street Address: 1180 HOLMES RD, PUEBLO CO 81005					5. As Built GPS Well Location (required): <input type="checkbox"/> Zone 12 <input checked="" type="checkbox"/> Zone 13 Easting: 498951.0 Northing: 4232941					6. Legal Well Location: SW 1/4, SW 1/4, Sec., 4 Twp. 21 <input type="checkbox"/> N or S <input checked="" type="checkbox"/> E or W <input checked="" type="checkbox"/> 6 P.M.				
		Fort Hays Limestone	50-65	White to cream, chalky limestone with thin beds of gray calcareous shale	Fort Hays-Codell Aquifer	6. County: PUEBLO					Subdivision: _____, Lot _____, Block _____, Filing (Unit) _____					7. Ground Surface Elevation: _____ feet Date Completed: 11/18/2019 Drilling Method: AIR ROTARY					8. Completed Aquifer Name: _____ Total Depth: 422 feet Depth Completed: 422 feet														
		Codell Sandstone	0-34	Buff crossbedded calcareous sandstone and sandy shale		Carille confining unit	9. Advance Notification: Was Notification Required Prior to Construction? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No, Date Notification Given: _____					10. Aquifer Type: <input checked="" type="checkbox"/> Type I (One Confining Layer) <input type="checkbox"/> Type I (Multiple Confining Layers) <input type="checkbox"/> Laramie-Fox Hills (Check one) <input type="checkbox"/> Type II (Not overlain by Type III) <input type="checkbox"/> Type III (Overlain by Type III) <input type="checkbox"/> Type III (alluvial/colluvial)					11. Geologic Log:					12. Hole Diameter (in.)													
		Carille Shale	200-235	Black, fissile shale; lower unit is chalky shale	Greenhorn Aquifer		13. Plain Casing					14. Filter Pack:					15. Packer Placement:																		
		Greenhorn Limestone	25-65	Upper unit chalky shale and thin limestone; lower unit hard crystalline limestone		Graneros confining unit	OD (in) Kind Wall Size (in) From (ft) To (ft)					Material Amount Density Interval Method					Material Amount Density Interval Method																		
		Graneros Shale	85-200	Gray to black shale	Dakota-Cheyenne Aquifer		7 STEEL .188 +2 39					N/C 65GAL 94LB/6G 0-39 TREMIE					N/C 65GAL 94LB/6G 0-39 TREMIE																		
Dakota Group		Dakota Sandstone	150-235	Fine-grained, thin bedded to massive sandstone		Morrison confining unit	16. Grouting Record					Remarks: DRY HOLE - NO WATER- NO CASING INSTALLED -OWNER NOTIFIED OF ABANDONMENT REQUIREMENTS.																							
		Purgatoire Formation	60-350	Upper unit, Kiowa Shale, is gray to black clayey shale; lower unit, Cheyenne Sandstone, is massive fine-grained sandstone	Entrada-Dockum Aquifer																														
		Morrison- Ralston Creek Formations	20-240	Red-brown, gray, yellowish-gray, claystone with beds of sandstone, limestone, siltstone and gypsum		Entrada-Dockum Aquifer																													
		Entrada-Sundance Sandstone	>500	Fine- to medium-grained orange and red to buff and white sandstone interbedded with siltstone and shale; rare beds of carbonate and anhydrite	Entrada-Dockum Aquifer																														
		Jelm-Dockum Formations		Pink, orange, and red to buff calcareous sandstone, locally interbedded with siltstone and shale		Entrada-Dockum Aquifer																													



Colorado Piedmont Region

Geologic Period	Phase	Stratigraphic Unit		Unit Thickness (ft)	Physical Characteristics	Hydrogeologic Unit	Hydrologic Characteristics		
Quaternary	Modern-Glaciation	Alluvium associated with present rivers				Alluvial Aquifers			
Neogene	Extension	Nussbaum Alluvium		up to 175	Gravel on pediment; cobbly and pebbly gravel, silty sand	Nussbaum Aquifer	Local aquifer with numerous stock and irrigation wells		
		High Plains regional aquifer				High Plains Aquifer			
Paleogene	Laramide	Laramide basin formations form multiple aquifers; include Denver, Cheyenne and Raton basins				Multiple			
Cretaceous	Interior Seaway	Pierre Shale	Upper member		3,000-8,000	Interbedded fine-grained sand, siltstone and shale	Pierre confining unit	Sandstone layers might yield limited water	
			Upper Pierre sand				Upper Pierre Aquifer		
			Main body				Pierre confining unit		
		Niobrara Formation	Smokey Hill Member		150-500	Yellowish chalk and gray shale		Fort Hays-Codell Aquifer	ields water to stock wells and springs north of Arkansas River; increased yield when fractured
			Fort Hays Limestone		50-65	White to cream, chalky limestone with thin beds of gray calcareous shale			
		Carlile Shale	Codell Sandstone		0-34	Buff crossbedded calcareous sandstone and sandy shale		Carlile confining unit	ields water to a few stock wells
			Carlile Shale		200-235	Black, fissile shale; lower unit is chalky shale			
		Greenhorn Limestone		25-65	Upper unit chalky shale and thin limestone; lower unit hard crystalline limestone		Greenhorn Aquifer		
		Graneros Shale		85-200	Gray to black shale		Graneros confining unit		
		Dakota Group	Dakota Sandstone		150-235	Fine-grained, thin bedded to massive sandstone		Dakota-Cheyenne Aquifer	ields can be sufficient for industrial, municipal, and irrigation use; increased yields where fractured
Purgatoire Formation			60-350	Upper unit, Kiowa Shale, is gray to black clayey shale; lower unit, Cheyenne Sandstone, is massive fine-grained sandstone					
Jurassic	Mesozoic Sandstones	Morrison- Ralston Creek Formations		20-240	Red-brown, gray, yellowish-gray, claystone with beds of sandstone, limestone, siltstone and gypsum	Morrison confining unit	Minimal yield to wells from sandstone lenses		
		Entrada-Sundance Sandstone		>500	Fine- to medium-grained orange and red to buff and white sandstone interbedded with siltstone and shale; rare beds of carbonate and anhydrite		Entrada-Dockum Aquifer	imited extent but is a local source for domestic and stock uses	
		Jelm-Dockum Formations			Pink, orange, and red to buff calcareous sandstone, locally interbedded with siltstone and shale				

Southern High Plains Designated Ground Water Basin Well Construction

Policy 2017-3: Wells Constructed into Type II Aquifers Within the Boundaries of the Southern High Plains Designated Basin

- includes the alluvium, Ogallala, Dakota, Cheyenne and Dockum Aquifers
- those aquifers “shall be administered as a single geo-hydraulic system”

Issue: The Rules (10.4.6.3) would ordinarily require the alluvium to be fully isolated when completing a well in one of the bedrock aquifers.

Policy: Water wells constructed within the Southern High Plains Designated Groundwater Basin must be constructed in accordance with the construction standards for Type II aquifers (unconfined bedrock) found in Rule 10.4.6.

Southern High Plains Designated Ground Water Basin Well Construction

	COLORADO Division of Water Resources Department of Natural Resources	WELL PERMIT NUMBER 320025- RECEIPT NUMBER 10008036
---	---	---

ORIGINAL PERMIT APPLICANT(S)

BLAKE COLE

APPROVED WELL LOCATION

Water Division: 2 Water District: 66

Designated Basin: SOUTHERN HIGH PLAINS

Management District: SOUTHERN HIGH PLAINS

County: BACA

Parcel Name: N/A

Physical Address: N/A

NE 1/4 SW 1/4 Section 25 Township 32.0 S Range 43.0 W Sixth P.M.

Well to be constructed on specified tract of land

PERMIT TO CONSTRUCT A NEW WELL

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

- 1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of this permit does not ensure that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
- 2) The construction of this well shall be in compliance with the Water Well Construction Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 18.
- 3) Approved pursuant to CRS 37-90-105 for a well on a tract of land of 40 acres described as the NE1/4 of the SW1/4 of Section 25, Township 32 South, Range 43 West of the Sixth P.M., Baca County.
- 4) Water from this well shall be used for the watering of livestock on range and pasture. This well cannot be used for any other purpose without first obtaining a new permit for said use from the state engineer.
- 5) The pumping rate of this well shall not exceed 30 GPM.
- 6) The annual withdrawal of groundwater from this well shall not exceed 5 acre-feet.
- 7) Production is limited to the Southern High Plains single geohydraulic system.



Geologic/Hydrogeologic Resources

- DWR Map Viewer
- CDSS Dakota/Cheyenne Aquifer Determination Tool
- Colorado Geological Survey Groundwater Atlas
- Geologic Maps/Reports

<https://www.sandatlas.org/shale/>

Map Viewer

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Map Viewer

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Home Draw Measure Find Edit (Login Required) Tool Labels

Home Identify Pan Zoom In Zoom Out Initial View Previous Extent Next Extent Bookmarks Export Upload Data Add Layers Layer Catalog Share Print Open Save Save as

Navigation Sharing

Layers **Quick Tools**

Filter Layers... Filter

- Structure (Admin/Decreed)
- Structure (Points of Interest)
- Well Application - INTERNAL ONLY
 - All Well Applications
 - Well Constructed
 - Permit Issued
 - Well Abandoned
 - OGCC Well
- Final Permit
- Ground Water
- Surface Water Current Conditions
- Surface Water Station (Historic)
- Dam Safety - INTERNAL ONLY
- Climate Station
- Climate Isohyet
- Hydrography

Well Constructed 211860- 2 of 2

☆ Well Constructed 211860-

Receipt = 0430409
Permit = 211860-
Well Name =
Applicant = EPLY, SUSAN
Case No =
Aquifers = DAKOTA
Uses = Domestic Stock
Yield =
Well Depth = 505
Location Accuracy = Spotted from section lines


[Add to Results](#) [View Additional Details](#)

Basemaps UTM Zone 13, NAD83 X 525919.54259 Y 4204354.1462 Scale 1: 36,112 0 0.2 0.4mi

Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, (



Well Permit Info


Well Permits

Overview
Construction Data
Permit History
Applicant/Contact
Imaged Documents

Permit Number	211860-	Receipt	0430409
Permit Category	Residential	WDID	
Permit Status	Well Constructed		

Search Fields Hide

Well Permit Information

Template

Division Filing (0)

Geophysical Logs (0)

Substitute Water Supply Plans

Water Court (0)

Well Permit Information (3)

Document Type

	Receipt	Permit No	Permit Suf	Permit Rpl	Type
View	0430409	211860			Original File
View	0430409	211860			Original File
View	0430409	211860			Maps, Deeds & Legal Descriptions

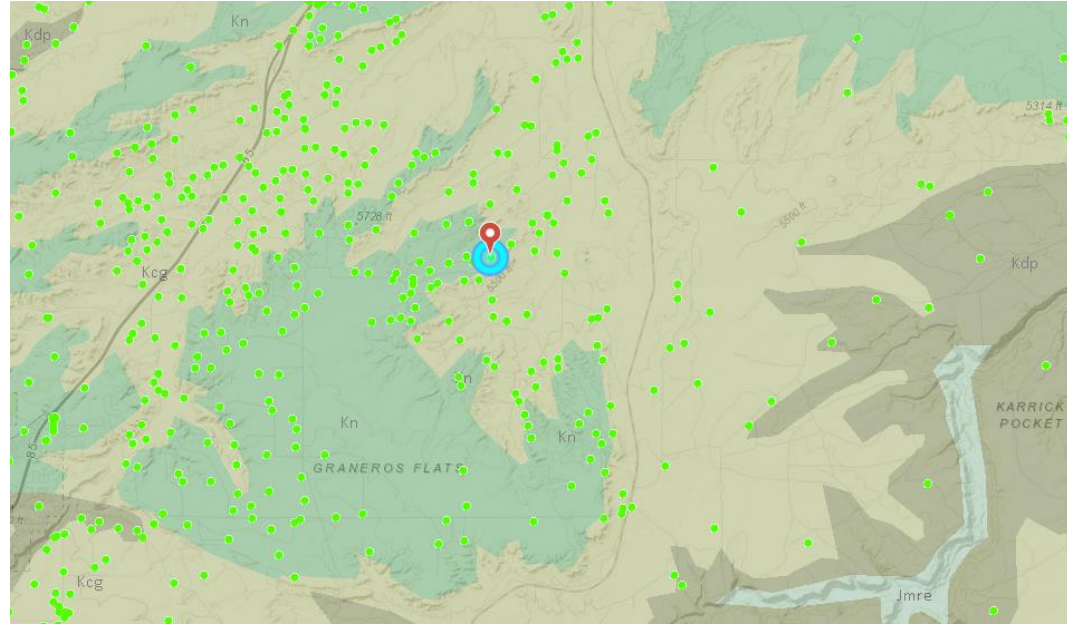
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◀

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▶

items per page

Lithologic Log

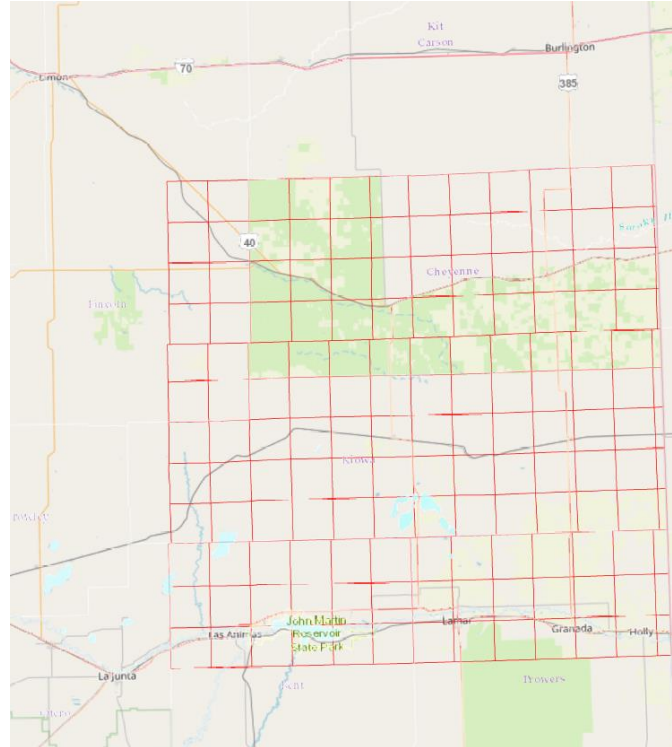
FORM NO. GWS-81 3/94 WELL CONSTRUCTION AND TEST REPORT STATE OF COLORADO, OFFICE OF THE STATE ENGINEER		For Office Use only <u>0430409</u>															
1. WELL PERMIT NUMBER <u>211860</u>		AUG 21 2000 STATE ENGINEER COLO.															
2. OWNER NAME(S) <u>SUSAN EPLIY</u> Mailing Address <u>40 KAWBAG CT</u> City, St. Zip <u>CARBONATE, CO 81629</u> Phone (970) <u>963-1046</u>																	
3. WELL LOCATION AS DRILLED: <u>NW 1/4 SW 2 1/4, Sec. 34 Twp. 23 S, Range 65 W</u> DISTANCES FROM SEC. LINES: <u>1750</u> ft. from <u>South</u> Sec. line and <u>900</u> ft. from <u>West</u> Sec. line OR <small>(North or East)</small> SUBDIVISION: <u>Hatch et Ranch</u> LOT <u>92</u> BLOCK _____ FILING (UNIT) <u>111A</u> . STREET ADDRESS AT WELL LOCATION: _____																	
4. GROUND SURFACE ELEVATION _____ ft. DRILLING METHOD <u>Rotary Air</u> DATE COMPLETED <u>8-3-00</u> TOTAL DEPTH <u>505</u> ft. DEPTH COMPLETED <u>505</u> ft.																	
5. GEOLOGIC LOG: <table border="1"> <thead> <tr> <th>Depth</th> <th>Description of Material (Type, Size, Color, Water Location)</th> </tr> </thead> <tbody> <tr> <td><u>0-25</u></td> <td><u>Limestone white</u></td> </tr> <tr> <td><u>25-28</u></td> <td><u>SAND gray</u></td> </tr> <tr> <td><u>28-251</u></td> <td><u>CONCRETE BLK</u></td> </tr> <tr> <td><u>251-467</u></td> <td><u>SAND gray</u></td> </tr> <tr> <td><u>467-505</u></td> <td><u>SANDSTONE gray</u></td> </tr> </tbody> </table>		Depth	Description of Material (Type, Size, Color, Water Location)	<u>0-25</u>	<u>Limestone white</u>	<u>25-28</u>	<u>SAND gray</u>	<u>28-251</u>	<u>CONCRETE BLK</u>	<u>251-467</u>	<u>SAND gray</u>	<u>467-505</u>	<u>SANDSTONE gray</u>	6. HOLE DIAM. (in.) From (ft) To (ft) <u>2 3/4</u> 0 20 <u>6 1/2</u> 20 505			
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7. PLAIN CASING <table border="1"> <thead> <tr> <th>OD (in)</th> <th>Kind</th> <th>Wall Size</th> <th>From (ft)</th> <th>To (ft)</th> </tr> </thead> <tbody> <tr> <td><u>7</u></td> <td><u>STEEL</u></td> <td><u>188</u></td> <td><u>-11</u></td> <td><u>20</u></td> </tr> <tr> <td><u>4 1/2</u></td> <td><u>PVC</u></td> <td><u>214</u></td> <td><u>5</u></td> <td><u>465</u></td> </tr> </tbody> </table>		OD (in)	Kind	Wall Size	From (ft)	To (ft)	<u>7</u>	<u>STEEL</u>	<u>188</u>	<u>-11</u>	<u>20</u>	<u>4 1/2</u>	<u>PVC</u>	<u>214</u>	<u>5</u>	<u>465</u>	PERF. CASING: Screen Slot Size: <u>200</u> <u>4 1/2</u> <u>PVC</u> <u>214</u> <u>465</u> <u>505</u>
OD (in)	Kind	Wall Size	From (ft)	To (ft)													
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8. FILTER PACK: Material _____ Size _____ Interval _____		9. PACKER PLACEMENT: Type <u>Ballston</u> Depth <u>20-465</u>															
10. GROUTING RECORD: <table border="1"> <thead> <tr> <th>Material</th> <th>Amount</th> <th>Density</th> <th>Interval</th> <th>Placement</th> </tr> </thead> <tbody> <tr> <td><u>CEMENT</u></td> <td><u>846</u></td> <td><u>14300</u></td> <td><u>0-37</u></td> <td><u>PUMPED</u></td> </tr> <tr> <td></td> <td><u>468</u></td> <td></td> <td><u>465-465</u></td> <td><u>PUMPED</u></td> </tr> </tbody> </table>		Material	Amount	Density	Interval	Placement	<u>CEMENT</u>	<u>846</u>	<u>14300</u>	<u>0-37</u>	<u>PUMPED</u>		<u>468</u>		<u>465-465</u>	<u>PUMPED</u>	
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	<u>468</u>		<u>465-465</u>	<u>PUMPED</u>													
REMARKS: <u>water AT 467</u>																	
11. DISINFECTION: Type <u>6.5% HTH</u> Amt. Used <u>1.5 cup.</u>																	
12. WELL TEST DATA: <input type="checkbox"/> Check box if Test Data is submitted on Form No. GWS 39 Supplemental Well Test. TESTING METHOD <u>AIR LIFT</u> Static Level <u>30.3</u> ft. Date/Time measured <u>8-3-00 10:30 AM</u> Production Rate <u>20</u> gpm. Pumping level <u>505</u> ft. Date/Time measured <u>8-3-00 12:30 PM</u> Test length (hrs.) <u>2</u> Remarks _____																	



CDSS Tools

<https://dwr.state.co.us/Tools/DakotaLocation>

Romero, J.C. and VanSlyke, G.D. The Dakota and Cheyenne Aquifers in the Cheyenne Wells - Las Animas Region, Colorado. DWR WRI-94-1. [Direct Download](#)



CDSS Tools

<https://dwr.state.co.us/Tools/DakotaLocation>

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- Well Permits**
Application History & Well Details
- Call Analysis Tools**
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Denver Basin & Dakota/Cheyenne

Denver Aquifer - Specific Location

Denver Aquifer - Tract of Land

Dakota/Cheyenne Aquifer

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Dakota/Cheyenne Aquifer - Determination Tool

Report Help

Input

Receipt No: [Search By Receipt](#)

Applicant:

Evaluated By:

Elevation (feet): [Get USGS Elevation](#)

Location

Latitude/Longitude WGS84 (Decimal Degrees)

Latitude: Longitude:

[Run Aquifer Determination](#) [Reset](#)

Table [Map](#)

Applicant: BROWN AND SONS INC (BROWN, TERRY) Receipt No: 10008044
Location: SW 1/4 of SE 1/4 of Sec. 24, T.19S, R.46W. (667 SSL, 1711 ESL) Evaluated By: FULLER, KATE
Ground Surface Elevation: 3813

Warning! The depth intervals estimated in this area may vary from actual conditions due to lack of data and/or structural complexity.

Surface	Elevation (ft)	Depth (ft)
Top of Dakota	3238	575
Base of Dakota	3026	787
Top of Cheyenne	2950	863
Base of Cheyenne	2859	954



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Bedrock Aquifer Determination Evaluation Tool Dakota/Cheyenne - Aquifer Determination Tool

Applicant: BROWN AND SONS INC (BROWN, TERRY)

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Colorado Groundwater Atlas

<https://coloradogeologicalsurvey.org/water/colorado-groundwater-atlas/>

Interactive online GIS Map

Aquifer Regions/Basins and Hydrostratigraphy

Coming Soon: Dakota Group Aquifer structure & isopach maps!

Dakota/Kiowa/Cheyenne top & bottom

Dakota/Kiowa/Cheyenne thicknesses



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Geologic map data (1880-2020)
Source: NGMDB Map Catalog - USGS/AASG

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204 maps on screen (Center X: -103.408, Y: 37.889)
Near: 81050, La Junta, Colorado
Select by Map Scale Bin

500K 250K 125K 100K 62K 48K 24K 12K

Filter results by title or author keyword

Selected Geologic Maps Here (NGMDB Map Catalog)

Sync Record Table Returns with Selected Scale Bin

Title Author Agency Year Scale

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Nicovich, S.R. and Schmitt, J.G., 2017, *Geological mapping of the Zapata and Blanca sections of the northern Sangre de Cristo range-front fault system, south-central Colorado, series unknown*, Montana State University, 1:24,000. [Beta](#) [Surf](#) [In View](#)

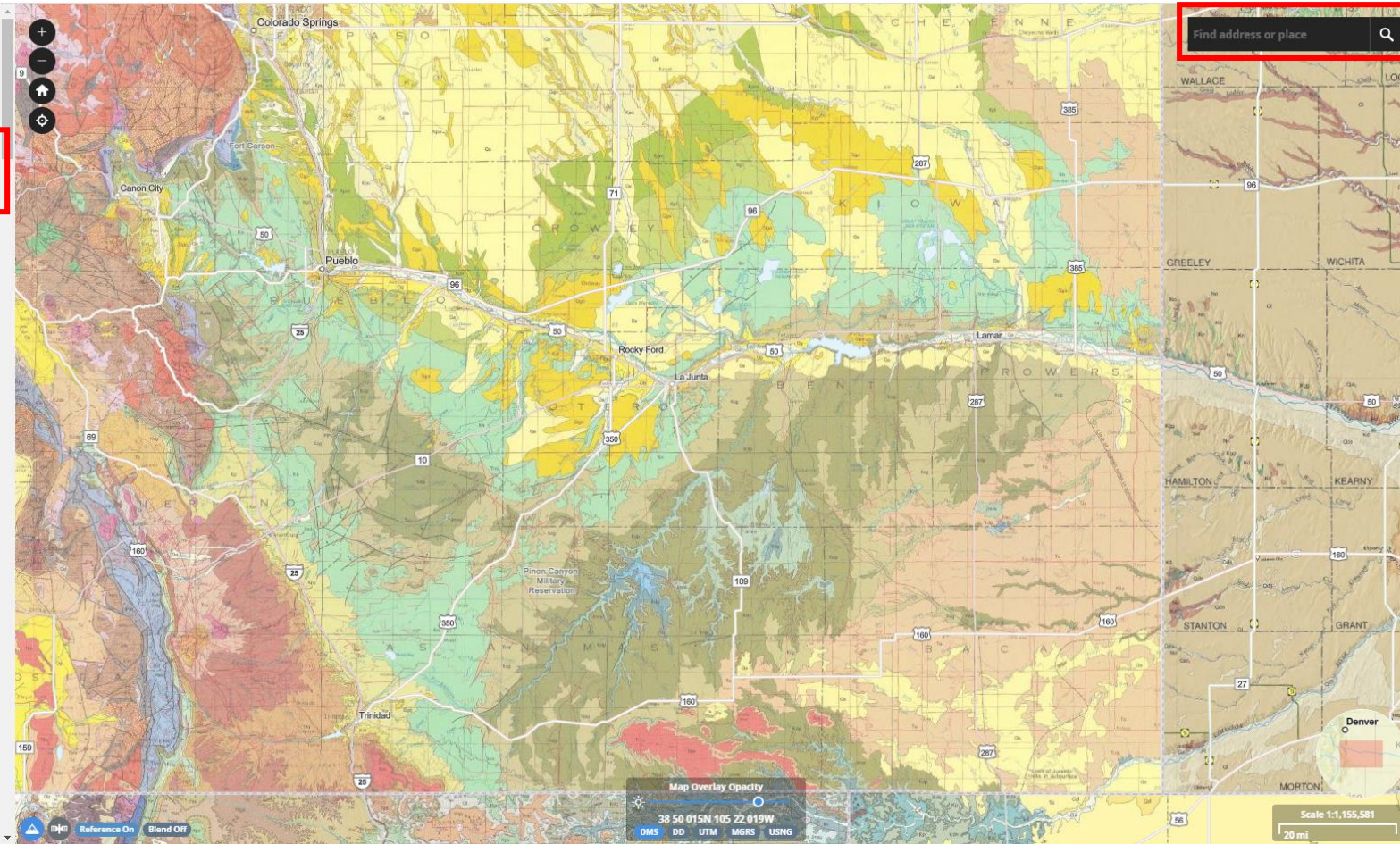
White, J.L., Lindsey, K.O., Morgan, M.L., and Mahan, S.A., 2017, *Geologic Map of the Fountain Quadrangle, El Paso County, Colorado*, Open-File Report 17-05, Colorado Geological Survey, 1:24,000. [Beta](#) [Surf](#) [GIS](#) [In View](#)

Madole, R.F., VanSistine, D.P., and Romig, J.H., 2016, *Geologic map of Great Sand Dunes National Park, Colorado*, Scientific Investigations Map SIM-3362, U.S. Geological Survey, 1:35,000. [Surf](#) [GIS](#)

Thompson, R.A., Shroba, R.R., Machette, M.N., Fridrich, C.J., Brandt, T.R., and Cosca, M.A., 2015, *Geologic map of the Alamosa 30' x 60' quadrangle, south-central Colorado*, Scientific Investigations Map SIM-3342, U.S. Geological Survey, 1:100,000. [GIS](#)

Rawling, G.C., 2015, *Generalized geology and groundwater surface of Union County and the Clayton Underground Water Basin, northeast New Mexico*, Open-File Report 670, New Mexico Bureau of Geology and Mineral Resources, 1:200,000. [Beta](#) [Surf](#) [In View](#)

Lindsey, D.A., Klein, T.L., Valdez, Andrew, and Webster, R.J., 2012, *Geology along Mosca Pass Trail, Great Sand Dunes National Park and Preserve, Colorado*, Circular 1374, U.S.



Geologic map data (1880-2020)
Source: NGMDB Map Catalog - USGS/AASG
MapView lets you explore some of our favorite geologic maps from the NGMDB (USGS/AASG). Note this interface is in beta, so feel free to send us any [comments](#), [bug reports](#), and [suggestions](#) as we continue to improve the interface.

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Filter results by state or water region

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Showing 1-50 of 204 records. Next

White, J.L., Lindsey, K.O., Morgan, M.L., and Mahan, S.A., 2017, Geologic Map of the Fountain Quadrangle, El Paso County, Colorado, Open-File Report 17-05, Colorado Geological Survey, 1:24,000. [Bed](#) [Surf](#) [GIS](#) [In View](#)

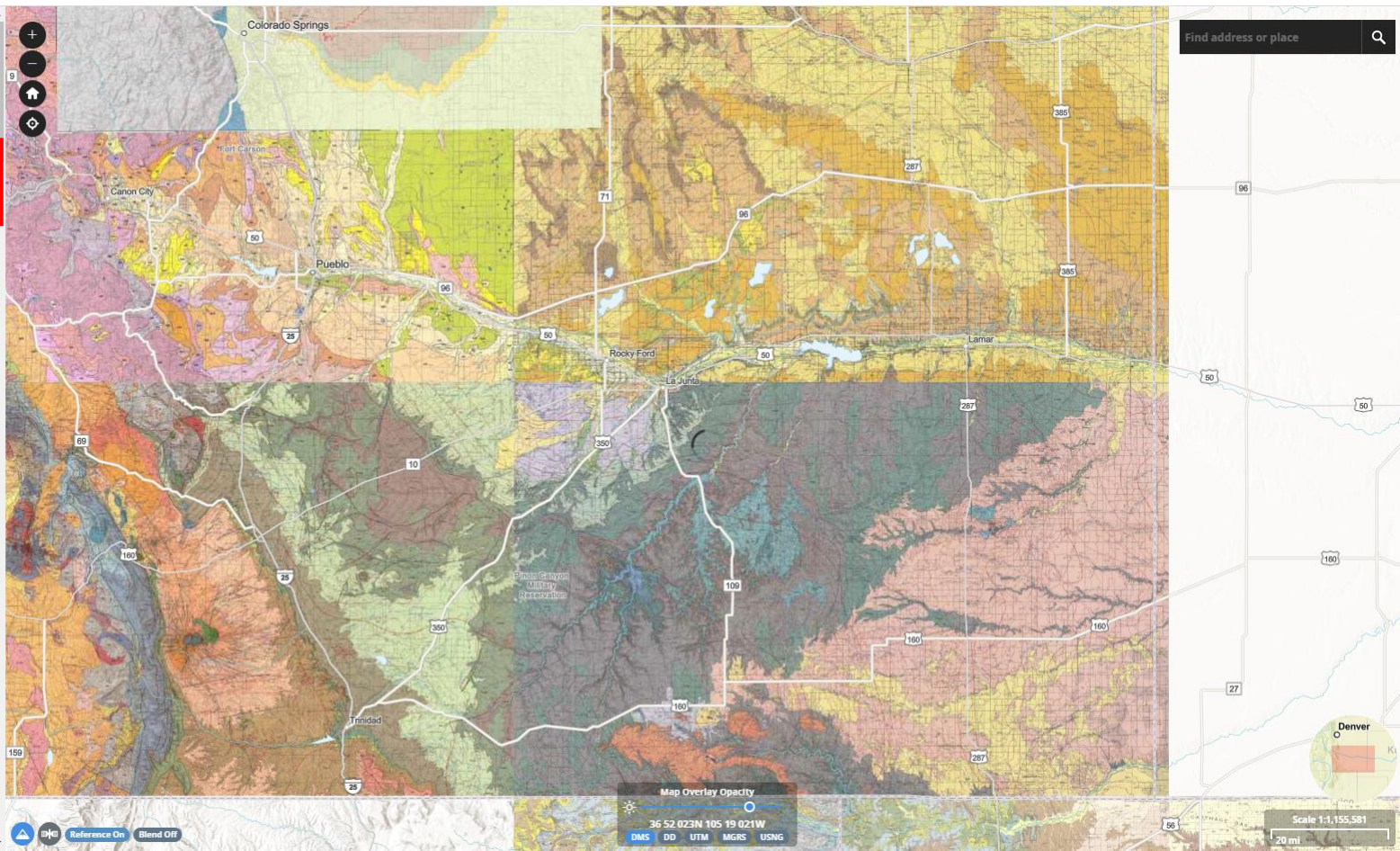
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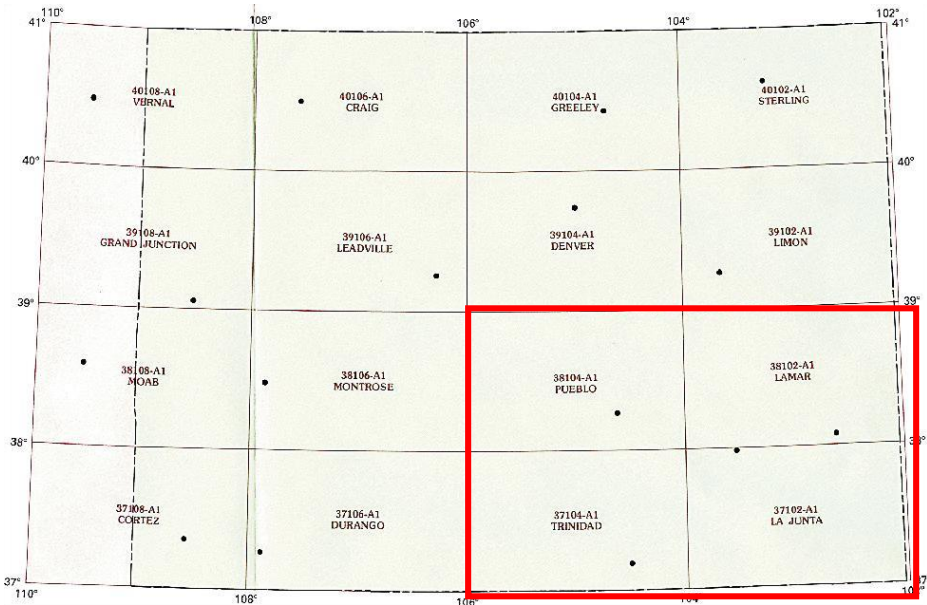
1:250,000 Geologic Quads

Pueblo: https://ngmdb.usgs.gov/Prodesc/proddesc_3946.htm

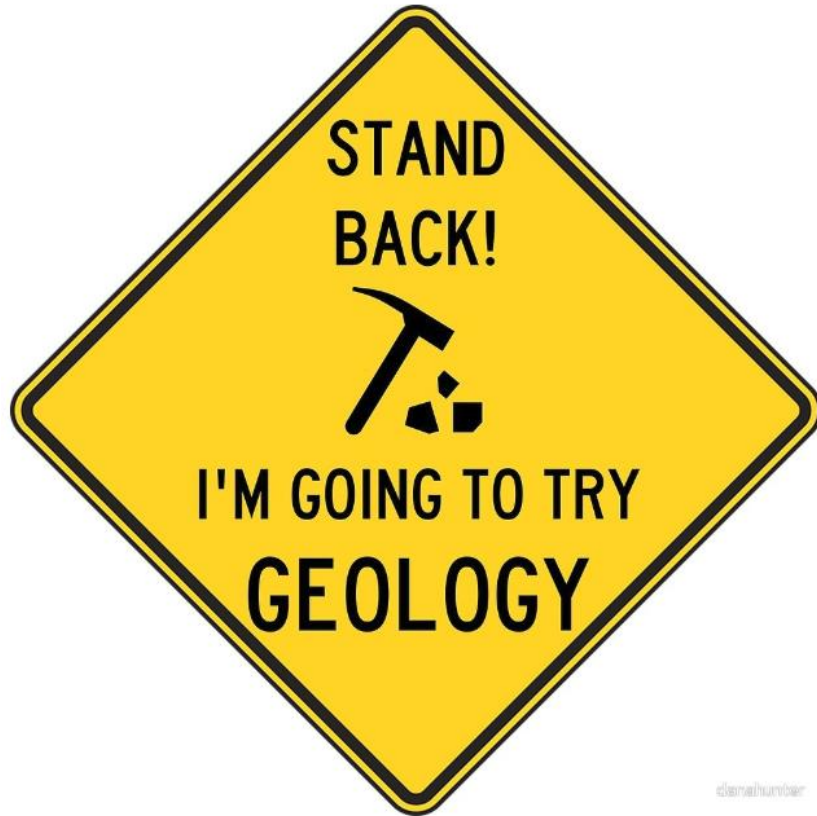
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Questions?



- Ashley Lennon, Hydrogeologist
 - Ashley.Lennon@state.co.us x8283
- Andy Flor, Hydrogeologist
 - Andrew.Flor@state.co.us x8218
- Kevin Donegan, Senior Hydrogeologist
 - Kevin.Donegan@state.co.us x8221
- Matt Sares, Chief - Hydrogeology Section
 - Matt.Sares@state.co.us x8221

Well Construction/Pump Installation Questions

- Doug Stephenson, Chief Well Inspector
 - Douglas.Stephenson@state.co.us x8270
- Chris Jones, Well Inspector
 - Chris.Jones@state.co.us 720-618-9982