



COLORADO
Division of Water Resources
Department of Natural Resources

1313 Sherman Street, Room 821
Denver, CO 80203

MEMORANDUM

TO: Robert P. Koehler, PhD, Oil & Gas Conservation Commission
FROM: Andrew Flor, Hydrogeologist
DATE: April 14, 2016
SUBJECT: Water Injection Project - Windy Hill # 3-17D (API 087-08145)
SENE Sec 17, T3N, R55W, 6th PM
Windy Hill Water Operations, LLC, Morgan County

On December 21, 2015 you sent a memo describing a proposal by Windy Hill Water Operations, LLC to use an existing well, Windy Hill # 3-17D, for injection into the J-Sandstone formation (5,130-5,300 feet below ground). The well is located in the SE¼ of the NE¼ of Section 17, Township 3 North, Range 55 West of the Sixth Principal Meridian. The well is located in east-central Morgan County approximately 4 miles southeast of Brush, CO. The uppermost injection formation crops out approximately 85 miles west of the well location.

The well completion information indicates that this well is constructed with 13-3/8 inch surface casing which is grouted from ground surface to a depth of 485 feet. 8-5/8 inch casing extends to a depth of 5,431 feet and is cemented from ground surface to the total depth of the well.

There are six completed water supply wells of record within ½ mile of the injection well, as shown on the attached Table 1. There are no water right structures within ½ mile of the injection well. A PDF output from Map Viewer delineating a ½ mile radius from the proposed injection well is attached. There are four dams within 10 miles of this injection well: Pawnee Evaporation Ponds A,B,C Dam (6.25 miles west), Pawnee Intermediate & High Quality Water Dam (6.4 miles west), Pawnee Raw Water Dam (6.5 miles west), and Pawnee Treated Water Dam (7 miles west). The dams and hazard ratings are shown on an attached map.

Most of the existing water supply wells in this area produce from the shallow (0-80 feet) Quaternary eolian sediments (see Table 1). The Pierre Shale underlies the eolian sediments at this location and extends to an approximate depth of 1,000-1,100 feet below ground surface (see Table 2). Recently, the Upper Pierre Aquifer has begun to be developed as a source of fresh water in Northern Colorado.

Windy Hill previously filed for an expansion of a nontributary water right from the same disposal/production interval as this injection well (Dakota J-Sands). Due to the proximity of this injection well to that production well we held several meetings together with COGCC, Windy Hill, Tetra Tech, and the EPA to discuss the potential impacts of these wells on each other. Specifically DWR was interested in addressing the following concerns:

- Several other oil and gas wells in the area were previously abandoned in the area leaving open boreholes filled with drilling fluid. These wells should be reoccupied to grout off to the base of the Upper Pierre Aquifer.
 - *Tetra Tech created a model that showed the potentiometric surface would not rise as high as the base of the Upper Pierre Aquifer, even under an "injection only" regime.*



- The area included in the EPA's aquifer exemption should be increased to more than just the quarter-quarters intersected by a ¼ mile radius around the injection well, and rather choose an area based on the subsurface flow area from the injection well to the production well.
 - *Tetra Tech's model identified the area of influence, and the aquifer exemption area was increased to include all of the quarter-quarters the injectate flow model intersects.*
- The nontributary application pertains to the entire property and an additional well is possible in the future. An additional model should be developed to include a secondary production well to show how the flow model would be affected.
 - *Tetra Tech staff indicated that adding a second production well to the model would be relatively simple and could be accomplished during the COGCC 5-year review process. DWR also agreed that the pumping effects caused by an additional well would disperse the injectate, but would likely not significantly affect the area identified for EPA aquifer exemption.*

Due to the depth and poor water quality of the injection zone formation (TDS=5,557 mg/L, hydrocarbon contamination from geologically recent hydrocarbon movement) it is not considered to be a source of potable groundwater at this location. Based on the information provided, injection to the J-Sandstone formations through a properly constructed well should not negatively impact existing groundwater or surface water resources in the vicinity.

Since there are existing and pending nontributary determinations in this area for industrial use of groundwater from the same aquifer as the injection well, any new injection well applications or new water production well applications for this aquifer in the vicinity of this well may affect the hydrogeologic assumptions on which this determination was made. If you have any questions or require additional information, please feel free to contact me (303-866-3581 x8218).



Table 1

RECEIPT	PERMIT	WELL NAME	USE	AQUIFER	DEPTH	OWNER	MORE INFO
3605166C	269978		OTHER	ALL UNNAMED AQUIFERS	60	UNOCAL WINDY HILL GAS STORAGE LLC	http://www.dwr.state.co.us/WellPermitSearch/View.aspx?receipt=3605166C
46055	46055-MH		OTHER	ALL UNNAMED AQUIFERS	79	BOSS BRUCE B FAMILY LLP	http://www.dwr.state.co.us/WellPermitSearch/View.aspx?receipt=0046055
3605166E	269980		OTHER	ALL UNNAMED AQUIFERS	79	UNOCAL WINDY HILL GAS STORAGE LLC	http://www.dwr.state.co.us/WellPermitSearch/View.aspx?receipt=3605166E
3605166F	269981		OTHER	ALL UNNAMED AQUIFERS	79	UNOCAL WINDY HILL GAS STORAGE LLC	http://www.dwr.state.co.us/WellPermitSearch/View.aspx?receipt=3605166F
3611967H	65856-F		OTHER	PERMAN SALT LAYER		WINDY HILL GAS STORAGE LLC	http://www.dwr.state.co.us/WellPermitSearch/View.aspx?receipt=3611967H
46051	46051-MH		OTHER	ALL UNNAMED AQUIFERS	62	BOSS BRUCE B FAMILY LLP	http://www.dwr.state.co.us/WellPermitSearch/View.aspx?receipt=0046051

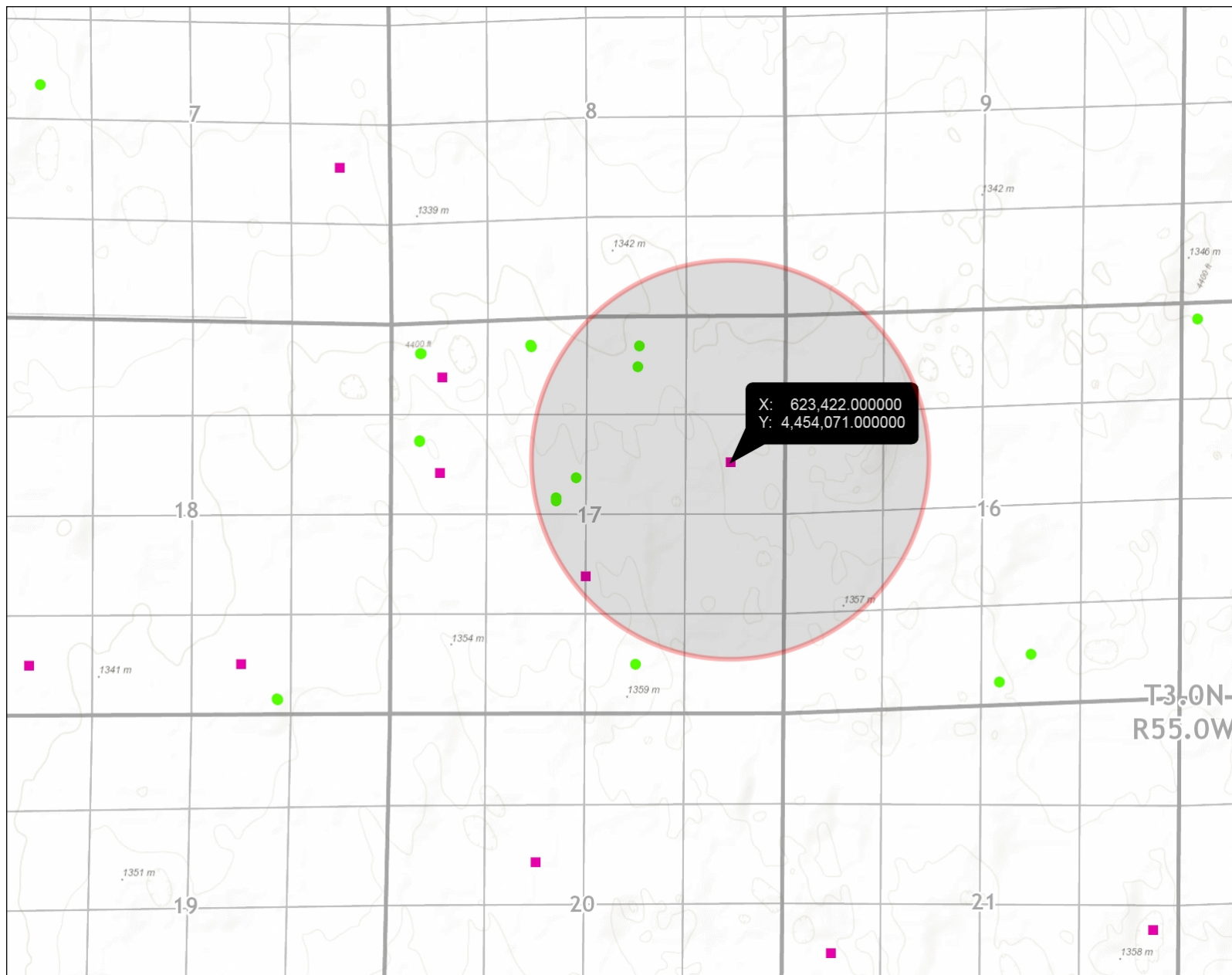
API	Company	Name	Location	TD	Surface casing	Spud	Abandoned	KB Elevation (ft)	Depth to Base Kpu (ft BKB)	Base Kpu Calc (ft)	Base Kpu Elev (ft)
05-087-07588	Rincon Operating	Chvatal #1	SW SW 18 3N 55W	5196	131 ft; open hole below	4/18/1981	8/8/1981	4397	950	3447	3445
05-087-07636	Morgan Oil Co	Chvatal #2	SW SE 18 3N 55W	5175	129 ft; open hole below	12/5/1981	3/13/1982	4409	1000	3409	3410
05-087-05996	Plains Ex	John A Fries et al (L-2768) #1	SW NW 17 3N 55W	5250	159 ft; open hole below	2/21/1961	2/8/1962	4454	1045	3409	3410
05-087-07909	Winslow Resources	Bewley Construction Co #1	NE SE 7 3N 55W	5185	94 ft	6/12/1986		4371	960	3411	3410
05-087-08137	Windy Hill Water Operations	UWHGS #1-17	NW 17 3N 55W	6508	355 ft; cased below	9/15/2004		4412	1020	3392	3390
05-087-08146	Windy Hill Gas Storage	Windy Hill 7-17S	NE SW 17 3N 55W	4760	465 ft; well plugged back and sidetracked	2/6/2007	4/17/2015	4499	1100	3399	3400
05-087-08145	Windy Hill Water Operations	Windy Hill #3-17D	SE NE 17 3N 55W	5350?	455 ft; cased below			4481	1015	3466	3465
05-087-05957	Skelly Oil Company	J.A. Fries #1	SE NW 20 3N 55W	5190	172 ft	11/20/1960		4445	1060	3385	3385



CDSS

Colorado's Decision Support Systems

#3-17D - Water Well & Oil/Gas Well Locations



Legend

- Well Constructed
- OGCC Well
- Township
- Section
- Q40

Location



Notes

4,000 0 2,000 4,000 Feet

1: 24,000



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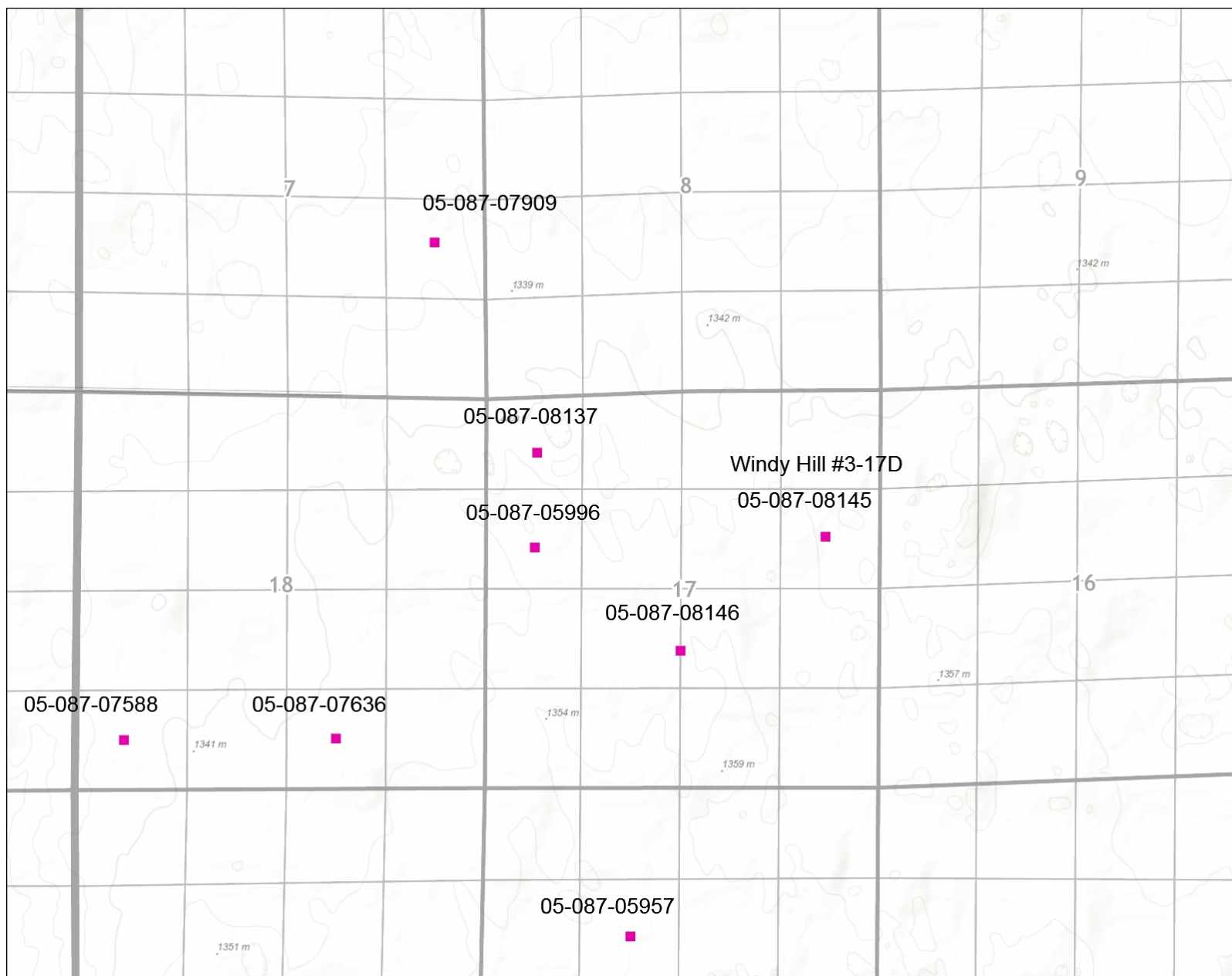
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CDSS

Colorado's Decision Support Systems

#3-17D - Nearby Geophysical Logs



Legend

- OGCC Well
- Township
- Section
- Q40

Location



Notes

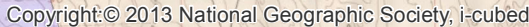
4,000 0 2,000 4,000 Feet

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1 inch = 4,000 feet

