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Project Name |	Groundwater Elevation Measurements	**Date** |	10/16/2019
To / Contact info |	BCWD Managers		
Cc / Contact info |	Karen Kill, District Administrator; Camilla Correll, District Engineer		
From / Contact info |	Stu Grubb, PG		
Regarding |	2019 Groundwater Elevation and Trends		

Background

EOR has measured groundwater elevations in wells in the BCWD since 2012. DNR also measures groundwater elevations in three observation wells. The measurements help identify trends in groundwater elevations that relate to groundwater/surface water interactions in Brown's Creek and other groundwater-dependent natural resources. This was the first year that water levels in these wells were measured by Cameron Blake of the Washington Conservation District.

Analysis

Residential Wells

Groundwater elevation data from the residential wells (and DNR observation wells) are shown in Table 1. Groundwater elevations generally increased from 2018 to 2019 by an average of 2.45 feet. The increase in elevations was anticipated in response to the record precipitation.

Figure 1 shows the yearly change in water levels since 2012. In 2018, groundwater elevations fell despite above-normal precipitation. This is due to the fact that much of the rainfall came in late Summer and early Fall when less recharge occurs. Spring rainfall in 2018 was less than in the previous two years. Spring rainfall tends to recharge aquifers more than later-season rainfall because less of the rainfall is intercepted or stored in the ground. In Spring the ground is still saturated from snow melt, there are fewer leaves on trees to intercept the rainfall, and evapotranspiration rates are much lower. Similarly, groundwater elevations increased dramatically in 2019 because the extreme rainfall has come throughout the Spring, Summer, and Fall.

DNR Observation Wells

DNR measures water elevations monthly in three observation wells:

- Brown's Creek Park – Deep well completed in the Jordan aquifer
- Brown's Creek Park – Shallow well completed in the Quaternary (glacial) aquifer
- Withrow School – Well completed in the Prairie du Chien aquifer

Groundwater elevation data from the DNR observation wells are shown on Figure 2. The data for the Withrow well shows it has reached its previous high point recorded back in 1996. The groundwater elevation in the Brown's Creek Park – Shallow well does not fluctuate much from year to year because it is hydraulically connected to and influenced by the elevation of Brown's Creek. The Brown's Creek Park – Deep well groundwater elevations increased over 10 feet. This may be a recording error. We will have DNR check their records before trying to determine why the water elevation increased so dramatically in this particular well, which has been subject to errors in previous years.

Golf Course Wells

The golf course wells showed similar trends to the other wells (see Table 1). The water level in Irrigation well #4 at Stillwater Oaks Golf Course varies a lot from year to year, suggesting that something mechanical is affecting the measurements. We will continue to investigate possible causes of these variations. The irrigation well at the Stillwater Country Club is difficult to measure because it is deep and has several obstructions in the well pipe. We will are still looking for reliable ways to measure the water level in this well.

Recommendations

BCWD should continue to collect groundwater elevation data on an annual basis. The long-term data and analyses are important for understanding conditions throughout the District, particularly the thermal impairment of Brown's Creek. The data will also be useful for calibrating and refining a groundwater model of the watershed district when this becomes a cost-effective option.

Table 1. Groundwater Elevations

Unique Number	Name	2013 Water Elevation	2014 Water Elevation	2015 Water Elevation	2016 Water Elevation	2017 Water Elevation	2018 Water Elevation	2019 Water Elevation		Change since last measure
Approximate Date		Aug-13	Aug-14	Sep-15	Oct-16	Oct-17	Oct-18	Oct-19		
Golf Course Wells										
515171	Applewood Hills	887.34			891.84	895.42	894.14			
151580	Oak Glen Country Club				825.50	825.88	823.56	826.12		2.56
151581	Oak Glen Country Club				829.71	830.12	828.16	828.23		0.07
208038	Stillwater Country Club				769.17	>200	>200	>200		
Stillwater	Stillwater Oaks Golf Club				910.31	913.42	910.11	912.41		2.30
Stillwater	Stillwater Oaks Golf Club				908.89	910.27	909.05	913.60		4.55
Stillwater	Stillwater Oaks Golf Club	906.36			910.27	911.26	910.07	911.90		1.83
Stillwater	Stillwater Oaks Golf Club				963.06	Artesian	957.69	970.29		12.60
566145	Logger's Trail Golf Course	900.21			904.41	905.62	904.16	905.93		1.77
667998	Logger's Trail Golf Course				911.29	906.28	905.10	907.34		2.24
761112	Logger's Trail Golf Course				900.53	901.16	900.09	901.94		1.85
Domestic Wells										
428563	Ed and Laurie Francis	896.14	898.01	897.56	900.51	902.53	900.91	903.36		2.45
410987	Dan and Lori Gunderson	900.01	900.99	901.89	904.96	906.98	905.62	907.22		1.60
196839	Louis J. Bruno	860.70			862.92	867.75	866.75	866.40		-0.35
Leiser	Craig Leiser	929.84	932.13	931.27	932.63	935.11	933.99	935.85		1.86
James	Alan and Molly James		939.00	937.59	939.62	941.71	940.20	942.14		1.94
184049	Kirk and Tracy Hillquist	940.29	940.86	939.20	942.27		942.48	944.77		2.29
Thatcher	Jyneen Thatcher	947.88	951.97	950.55	953.76	955.68	953.19	957.18		3.99
138188	Rick Vanzwol	927.24	935.48	934.74	937.89	940.02	939.36	941.45		2.09
479665	John and Michelle Weaver	900.99		899.73	907.27	907.41	906.86	907.77		0.91
493250	Mark and Sharon Olien	713.74	720.64		721.88	719.97	721.50	721.54		0.04
525197	James and Marilyn Opp	907.93	909.80	910.04	912.08	913.88	913.02	914.69		1.67
505390	Larry J and Pamela J Larson		925.98		928.67	930.48	929.18	932.29		3.11
153485	John P and Carolyn A Rydel	893.98	896.20	895.51	897.42	899.51	898.47	899.31		0.84
138904	Duane and Margaret Burmeister		828.79	827.21	829.25	829.91	828.41	830.33		1.92
406204	Michael and Rita Wiersma	938.96	939.12	939.00	941.10	941.38	940.98			
Boughten	Larry Boughten					953.73	951.32	954.28		2.96
DNR Observation Wells										
595649	Brown's Creek Park - Deep	861.74	862.15	862.51	866.32	864.77	865.81	876.84		11.03
623066	Brown's Creek Park - Shallow	875.43	874.91	874.03	875.53	875.77	875.05	876.84		1.79
551565	Withrow Elementary School	947.80	949.40	951.27	954.28	956.88	954.91	958.64		3.73
								Average		*2.45*

Figure 1. Yearly Change in Groundwater Elevation – BCWD Wells

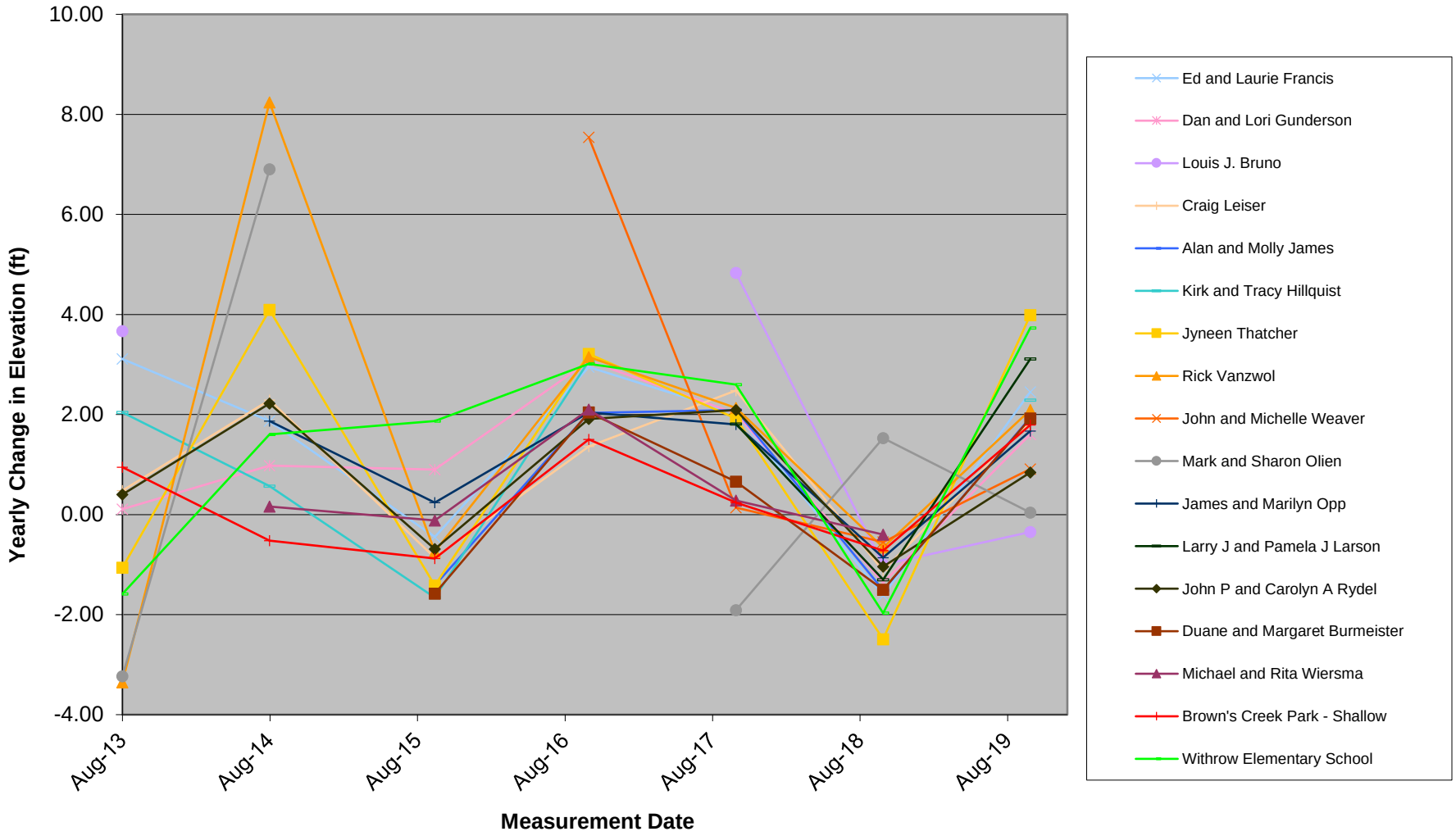
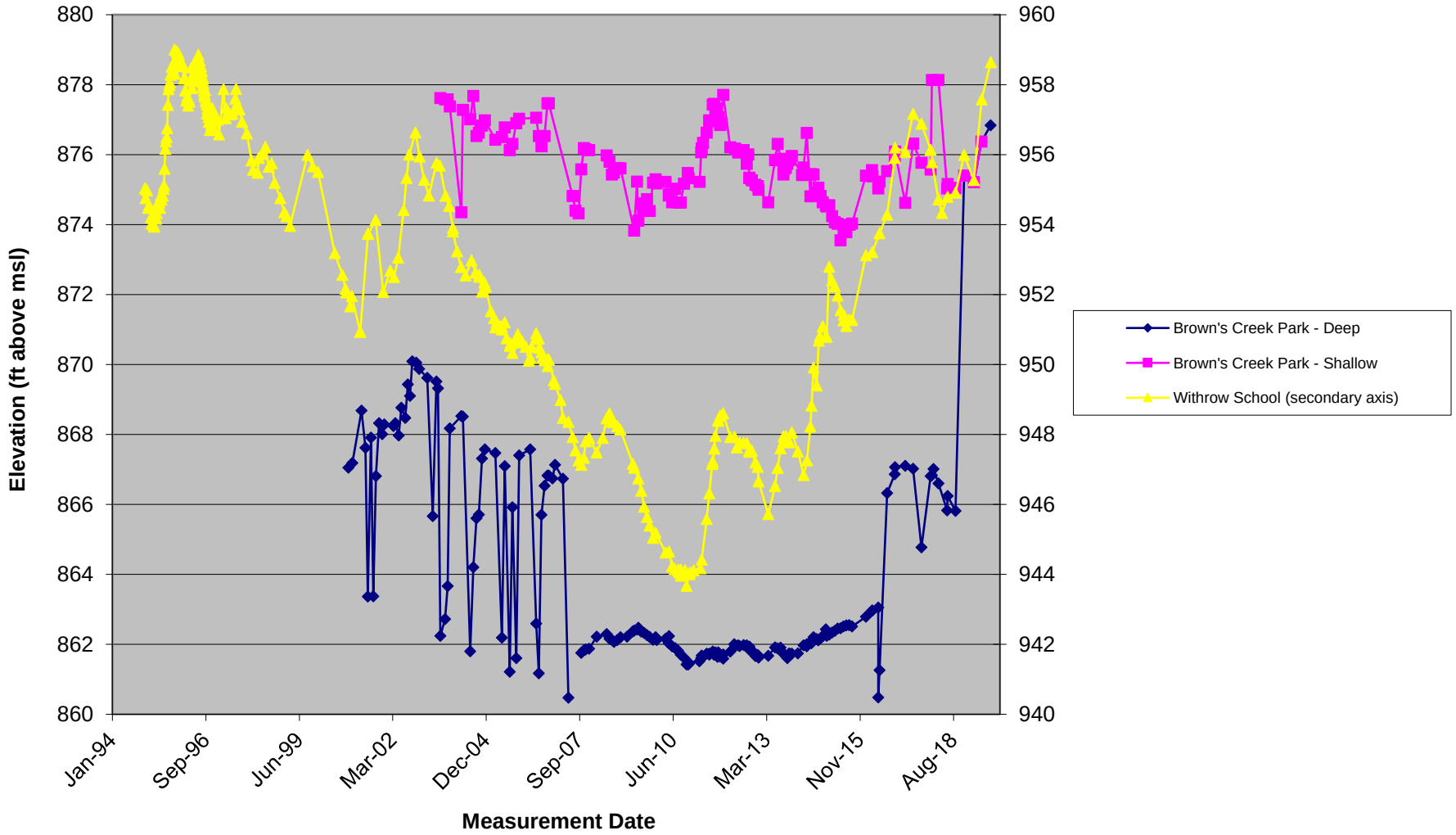
Figure 2. Groundwater Elevations – DNR Observation Wells