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CONFIDENTIAL
July 26, 2019

Via Email <jhowalt@cityofclovis.org>

Justin A. Howalt, P.E.
City Manager
City Hall
321 N. Connelly
Clovis, NM 88101-0760

Re: Evaluation of Paleo-Channel Total Water Costs

Dear Mr. Howalt:

Wright Water Engineers, Inc. (WWE) was retained by the City of Clovis to provide a conceptual evaluation of a project that would involve curtailment of irrigation pumping of groundwater in the Ogallala Aquifer in the "paleo-channel" located to the west of Clovis. This letter report presents our findings as to the physical feasibility of the project and an engineering opinion of offering price for irrigation pumping curtailment.

The City of Clovis Commission approved a Master Water Assurance Plan on December 21, 2017. The Ogallala Aquifer is a prime water resource that sustains the community and economy. In recognition of the crucial nature of the water supply, the Assurance Plan outlines strategies to secure a sustainable water supply for the next 40 years. The plan prepared and submitted by the Water Policy Strategic Planning Team outlined five action plans: 1) Effluent Water Reuse, 2) Water Banking (converting agricultural wells to domestic wells), 3) Playa Lake Restoration, 4) Conservation Land and Water Trust (tax credits, enhanced land and water management area, perpetuity), and 5) Ute Water Pipeline Project. The work of WWE is focused primarily on action plans 2 and 4, but there are common elements with plans 3 and 5.

HYDROGEOLOGY

The water supply for Clovis is pumped from the High Plains Aquifer, which is defined as the saturated sediments of the Ogallala Formation. The High Plains Aquifer is also commonly referred to as the Ogallala Aquifer. The Aquifer extends under portions of eight states from Wyoming, South Dakota, and Nebraska to the north and Colorado, Kansas, Oklahoma, Texas, and New Mexico to the south. Six New Mexico counties along the state's east border overlie the Ogallala Aquifer.

The Ogallala Aquifer is a vast underground bathtub with little recharge from precipitation and surface water that infiltrates the ground and reaches the water table. Irrigation of crops accounts for over 90 percent of the groundwater withdrawals from the Aquifer. The advent of better pumping and sprinkler equipment along with more readily available electricity in the 1950s led to

the increasing construction of high capacity irrigation wells. As irrigation use increased, water tables began to decline. The mining or depletion of the Aquifer has long been recognized. Charles Vernon Theis, a well-known groundwater hydrologist, reached this conclusion in the 1930s. There are many technical reports addressing the High Plains Aquifer. Water level measurements have taken place over time and water level declines have been monitored.

The July 2017 report, Lifetime projections for the High Plains Aquifer in east-central New Mexico (Lifetime Projections Report), by the New Mexico Bureau of Geology and Mineral Resources, funded by Clovis, Curry County, and the Eastern New Mexico Water Utility Authority (ENMWUA), focuses on groundwater in Curry and Roosevelt Counties. WWE interviewed Ghassan Musharrafieh and Stacy Timmons, who were reviewers of the Lifetime Projections Report. The report gives aquifer lifetime projections for two scenarios: 1) time until total dewatering of the full saturated thickness of the aquifer, and 2) time until a 30-foot saturated thickness threshold is reached. The 30-foot water level represents a typical minimum water level to operate high capacity irrigation wells. Figures in the Lifetime Projections Report illustrate areawide saturated thickness over several decades and projected lifetimes for the two scenarios.

PALEO-CHANNEL

The figures in the Lifetime Projections Report show a finger of land with greater saturated thickness. The year 2010 saturated thickness in the finger extending northwest from Cannon Air Force Base is identified as being 31 to 60 feet (Lifetime Projections Report Figure 6). This finger is referred to as a "paleo-channel." The direction of the paleo-channel flow is from northwest to southeast. The lifetime projections given for the paleo-channel reach are outlined below:

Scenario	Paleo-channel Lifetime
1. Total dewatering of full saturated thickness (domestic, low intensity municipal and industrial use)	26-50+ years
2. 30-foot saturated thickness threshold reached	6-25 years

WWE obtained gridded modeling data files with estimated aquifer saturated thickness from Karl Frisch, New Mexico Office of the State Engineer (OSE) and using groundwater elevations, determined the geometry of the paleo-channel. Cross sections were reviewed to identify the deeper paleo-channel area. The approximate extent of the paleo-channel is shown on Figure 1 (end of report) along with existing wells.

The paleo-channel groundwater surface gradient (slope) is approximately 0.0002 (1-foot per mile), an extremely flat slope that results in a low velocity and long travel times. Permeabilities identified for the Aquifer ranged from 660 to 1,780 gallons per day per square foot (gpd/ft^2) with an average of 1,300 gpd/ft^2 (Tenth Biennial Report State Engineer of New Mexico 1930-1932). The pumping duration was relatively short and with a longer test, the permeability would have been lower. For purposes of estimation, a permeability of 1,200 gpd/ft^2 is adopted. Specific yield ranged from 8 to 13 percent. Porosity is estimated at 0.1.

The time of travel for the paleo-channel Ogallala Aquifer water from northwest to southeast has been calculated as follows using Darcy's Law:

$$v = \frac{PI}{7.48p} \quad \text{(Darcy's Law)}$$

where v = velocity in feet per day
P = coefficient of permeability in gallons per day per square foot
I = hydraulic gradient in feet per foot
7.48 = gallons per cubic foot
p = porosity in decimal form

$$v = \frac{1200 \times 0.0002}{7.48 \times 0.1} = 0.32 \text{ ft / day}$$

v = 111 ft / year
or 48 years to travel 1-mile

The depth of wells in the paleo-channel generally range from about 430 feet to 500 feet with the deeper wells located in the northwest portion of the paleo-channel. The depth to water ranges from about 330 feet to 440 feet. Excess irrigation water applied that infiltrates into the ground could hit impermeable layers that would prevent or slow the water from reaching the groundwater table and thus not recharge the Aquifer.

WATER RIGHTS

For the Curry County Basin, permitted irrigation diversions are limited to 3 acre-feet (AF) per acre times the acreage. The beneficial consumptive use of an irrigation right is limited to 1.29 AF per acre and the quantity of water applied to beneficial consumptive use is available for transfer. The 1.71 AF difference between the allowable pumping amount and the consumptive use limit would, if water not pumped for irrigation, remain in the Aquifer.

Curry County is within a declared Underground Water Basin (UWB). The Curry County Basin was declared in 1989 with the boundaries extended in 2005. The OSE issued guidelines dated June 1, 2010 for the review of water rights applications in the Curry County and Portales UWBs. The guidelines apply to water applications filed after November 13, 2009 when the State Engineer issued an order closing the High Plains Aquifer in the two UWBs.

An application may be made for a supplemental well for use in conjunction with an existing well where the well yield has declined over time. The maximum combined diversion is the permitted diversion for the existing permit or the beneficial use amount for a declared right. This means that as well yields decrease, additional wells may be constructed to maintain the permitted or decreed amount.

The guidelines state that groundwater availability in the UWB is limited and presents "a reasonable cause for non-use. The State Engineer will not seek to extinguish water rights through forfeiture because of non-use." This guideline would allow a water right owner with a valid permit to reinstitute use, meaning currently non-irrigated lands could potentially be irrigated again.

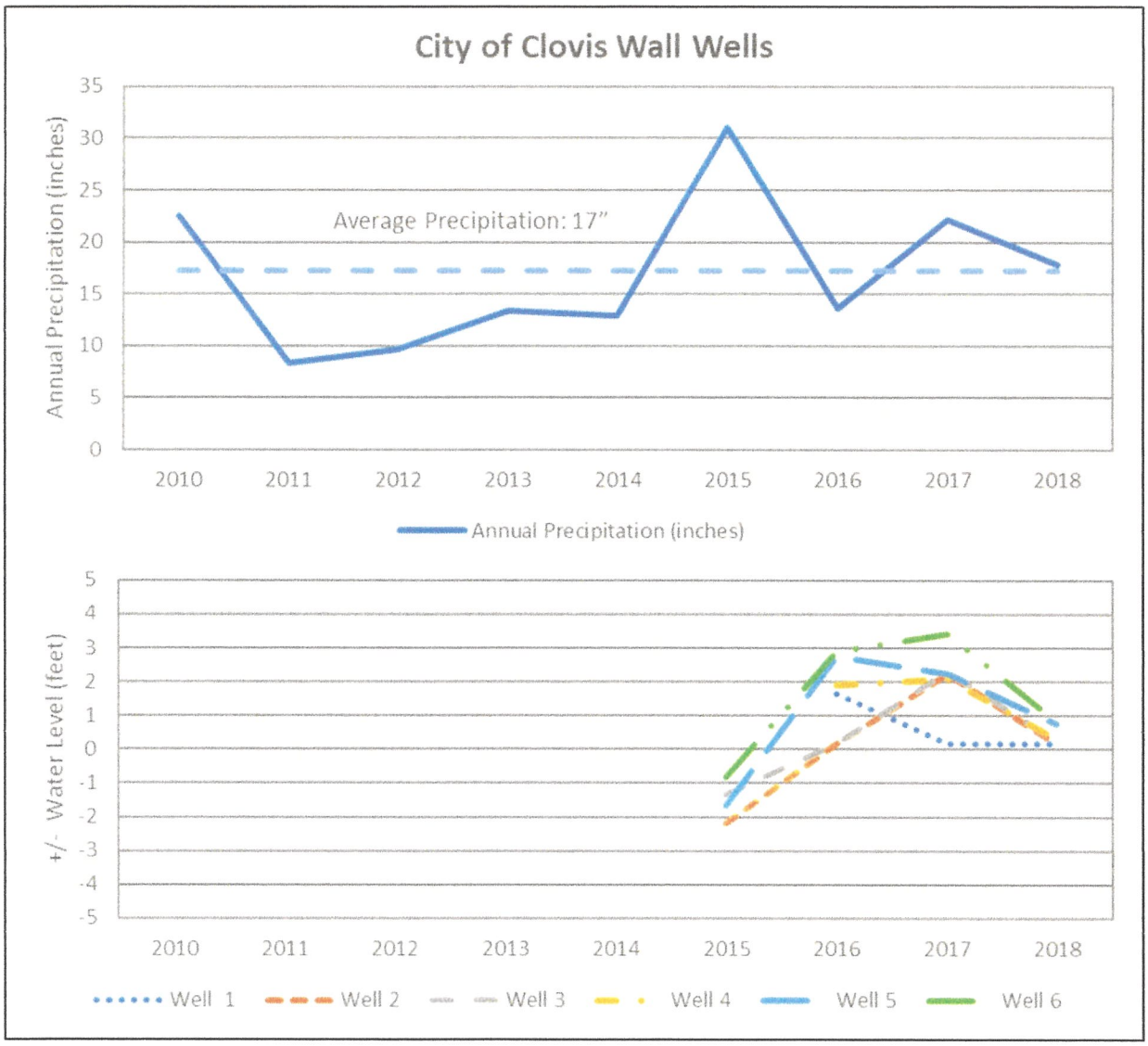
Administration and local assessment of effects of pumping are analyzed in a groundwater model. A 40-year planning period extending to January 1, 2050 was selected. In analyzing an application, the numerical model net effect is not to exceed 0.025 feet per year times the number of years. As an example, for calendar year 2019 to 2050 (31 years x 0.025 ft/year = 0.78 feet), 0.78 feet is the maximum net effect allowed. For local administration, the net effect on nearby wells is limited to a decline of one foot over a 40-year period.

If the City arranges for cessation of pumping on one property but not on an adjacent or nearby property, the on-going irrigator could, therefore, receive a benefit in terms of more sustainable water yield.

CLOVIS WATER NEED

Clovis is supplied water by the private company EPCOR Water, which pumps water from the High Plains Aquifer. The City has acquired water with the purchase of the Wall Farm located north of Cannon Air Force Base. New wells have been constructed on the property with well depths averaging 420 feet. The saturated thickness ranges from 29 feet in the southeast Well 8 to 53 feet for Well 2 located along the west boundary of the property.

The average annual precipitation at Clovis is approximately 17 inches. The following graph shows annual precipitation in inches for the period 2010-2018. Precipitation was below average in years 2011 thru 2014. Measurement of the changes in water levels in the westerly wells are shown beginning in 2015 for four wells and for two additional wells in 2016. The precipitation was high at about 30 inches in 2015 and the measured water levels indicated rises ranging from 1.5 to 4 feet. With the 2016 precipitation of 15 inches, three of the water levels remained level or decreased, while three other water levels increased. The relationship between the water level and the annual precipitation is inconsistent due to other factors including level of groundwater pumping. With high precipitation, there was likely less pumping from irrigation wells in the vicinity.



The Ute Water Pipeline Project, action plan 5, is a long-term undertaking. In the near future, the City will need interim water supply and will look to the paleo-channel for that supply. The reported water quality of the High Plains Aquifer is such that only disinfection treatment is required.

PLAYA RESTORATION

The many playas of Curry County are ecological treasures that are defined as Waters of the State and are protected by the State's water quality standards. However, the playas are threatened by nutrient loadings, excessive stormwater runoff, sedimentation, over grazing, invasive species, and noxious weeds. Playa management is essential and can be furthered by implementing:

- Managed grazing,
- Planting of buffers,
- Remediation of pits,
- Restoration of natural runoff to the playa,
- Removing exotic/invasive species, and
- Other activities.

The protection and restoration of playas will result in improvement of wildlife and natural playa plant communities.

Though small, the playas of the High Plains represent the most likely main source of recharge to the Ogallala Aquifer.

An overall goal for playas in Curry County should be to conserve the natural functions for present and future public benefits. Selected playas, based on present conditions, ecological importance, future threat outlook, cost of restoration, potential success of restoration, educational potential, and recreational importance can be chosen for priority actions.

For the purpose of recharge to the Clovis paleo-channel, it must be noted that only a few playas exist on currently irrigated farms and that the volume of annual recharge to the underlying Ogallala Aquifer is not relevant to this investigation. Nevertheless, acquisition of water rights by Clovis should include appropriate playa conservation efforts, soil stewardship and long-term aquifer management via utilization of a conservation easement.

PALEO-CHANNEL IRRIGATED LANDS

WWE reviewed topography and aerial view maps of the paleo-channel vicinity. The paleo-channel and the Wall property where the City has wells is identified on Figure 1. Basic data for irrigated farms within the paleo-channel including acres of land, water rights, irrigated area, wells, crops, and federal payments are presented in Table 1.

WWE retrieved data from the New Mexico Water Rights Reporting System. The average depth of the wells ranged from approximately 400 to 500 feet with the deeper wells generally to the northwest. The depths to water range from approximately 330 feet to 440 feet.

WWE reviewed a May 28, 2017 aerial image and estimated irrigated acres as shown in dark green on the aerial on that date of 4,750 acres (46 percent of the total acres). Although the balance of land is allocated to dryland or playa areas, it is likely that some areas that were not irrigated on that date were irrigated at other times of the year which would result in an underestimation of irrigated acres and an overestimation of dryland and plays areas.

The reported well yields in gallons per minute (GPM) for the 70 wells total 11,950 GPM, a calculated average yield of 170 GPM per well (approximately 0.4 cfs per well).

As background information, Federal Farm Program data is listed in Table 1 including recorded crops grown, average annual payments under the Conservation Reserve Program (CRP), and total payments under Federal Programs including CRP, commodity payments, disaster payments, and others. The payments listed include all payments for land in Curry County and may overstate the payments for the paleo-channel lands.

Table 1. Basic Data Irrigated Farms

1	Total Acres	10,290
2	Water Right @ 3 ft/ac, annual AF	30,870
3	Approximate Depths of Wells, ft	400 to 500 feet
4	Approximate Depths to Water, ft	330 to 430 feet
5	Irrigated Acres	7,705
6	WWE Estimated May 28, 2017 Irrigated Acres	4,750
7	WWE Estimated Dryland Acres	5,540
8	Well Total GPM	11,950
9	Well Total cfs	26.6
10	Number of Wells	70
11	Saturated Thickness, ft	40
12	Duty - Current Irrigated Acres/cfs	178
13	Water Right @ 1.29 ft/ac	9,939
14	Typical Crops	Sorghum, Wheat, & Corn. Some Barley and Oats
15	Livestock	Half of Properties
16	CRP Average Annual Payment*	$233,987
17	Federal Program Avg Annual $ (Includes CRP)*	$522,276
18	Federal $/Total Acres*	$51
19	Federal Programs 2017 $*	$881,371

* Some owners have properties beyond the paleochannel and the federal payments could include additional properties.

The duty of water (acres irrigated /cfs) based upon the May 28, 2017 irrigated land is 178 acres per cfs. Table 2 summarizes irrigation requirements for common Curry County crops. As an example of duty, the average annual net irrigation requirement for sorghum grain is 17.3 inches (1.44 feet) and the peak month demand is 6 inches (0.5 feet). One cfs flowing continuously is equal to approximately 2 AF per day and 60 AF per month. Sixty AF for a peak month divided by the peak month irrigation requirement of 0.5 foot per acre gives a duty of 120 acres for one cfs.

Table 2. Crop Net Irrigation Requirement
(From NRCS Curry County)

Row	Crop	Season	Net Irrigation Requirement, inches		Avg. Yr. Peak Month, inches	Peak Month Daily ET, inches
			Average	Dry Yr		
1	Sorghum, grain	6/1-10/31	17.34	18.88	6.04	0.30
2	Wheat, winter silage	10/1 - 5/20	12.10	12.88	3.38	0.17
3	Corn, grain	4/1 - 8/25	23.90	24.52	8.24	0.33
4	Corn, silage	4/1 - 8/15	19.63	20.95	6.29	0.34

Two approaches to arrive at an offering price were used, an income approach and a sales (listing price) comparison approach.

Income Approach. In the income approach to value, the annual net income from irrigated cropland is capitalized to arrive at a "Before cessation of pumping present worth" and, similarly, the annual net income from the irrigated land converted to dryland crops is capitalized to arrive at an "After cessation of pumping present worth." The difference between these two values is the indicated value of the cessation of pumping.

Data for the preparation of Table 3 was obtained from the New Mexico State University Crop and Return Model Input supplemented by annual New Mexico Agricultural Statistics. **The model is based upon a representative farm in the County with above-average management and will not fit any particular farm.** For the unit income from crops, the larger of the 2019 projected price (Row 4) and the Farm Service Agency (FSA - Row 5) target price was used to calculate the gross income per acre. For informational purposes, as available, the average unit price for years 2008-2017 from New Mexico Agricultural Statistics is given. For the irrigated lands, sorghum grain is the most profitable crop and is used in the income analysis. For a dryland operation, sorghum grain has an estimated net profit per acre of $81 while wheat is roughly a breakeven operation.

Table 3. Net Annual Operating Profit Irrigated and Dryland Crops
(Unit expense data from NMSU Crop and Return Model Input (2017-2019)

Row	Description	Sorghum, grain	Wheat	Corn, grain	Corn, silage
1	Unit	cwt	bu (60#)	bu (56#)	Ton
2	Avg. Yield (Sprinkler)	65	75	187	30
3	Avg. Yield (Dryland)	18	18	-	21
Crop Income					
4	Projected Price (2019)	$11.29	$5.10	$3.85	$30.00
5	FSA Target Price	$12.32	$4.78	$4.17	-
6	Average Price 2008-2017	$13.66		$4.99	
Irrigated Lands (Sprinkler) Net Operating Profit					
7	Gross Income/Acre	$801	$383	$780	$900
8	Pre-Harvest Operations	$72	$54	$68	$68
9	Irrigation, Electric	$83	$58	$114	$94
10	Seed, Fertilizer, Chemicals & Crop Insurance	$122	$128	$300	$300
11	Harvest Operations	$41	$37	$39	$39
12	Overhead Expenses	$117	$93	$114	$114
13	Total Expenses	$435	$369	$635	$615
14	Net Operating Profit/Acre	$366	$13	$144	$285
Dryland Net Operating Profit					
15	Gross Income/Acre	$222	$92		
16	Pre-Harvest Operations	$54	$29		
17	Seed, Fertilizer, Chemicals & Crop Insurance	$40	$20		
18	Harvest Operations	$13	$12		
19	Overhead Expenses	$33	$30		
20	Total Expenses	$141	$91		
21	Net Profit/Acre Dryland Crops	$81	$1		

Based upon the net income per acre for irrigated crops and dryland crops from Table 3, the annual net income is calculated in Table 4. A sorghum grain crop at a net profit of $366 per acre and a winter irrigated wheat crop at $13 per acre is used for the calculation of annual irrigated land net profit. In an after cessation of pumping condition, a dryland sorghum crop at $81 per acre is used to calculate annual net profit. The total difference in the before and after cessation of irrigation pumping is $1,494,800 annually.

Table 4. Annual Net Operating Profit for Irrigated Crops and Dryland Crops

1	Net Profit Irrigated Sorghum	$1,812,200
2	Net Profit Irrigated Wheat	$66,500
3	Net Annual Income Irrigated	$1,878,700
4	Net Annual Profit Dryland Sorghum & Wheat	$383,900
5	Difference Annual Income Irrigated less Dryland	$1,494,800

Table 5 converts the annual net profit difference from Table 4 into a present worth cost. For the irrigated farms, the present worth of the series of annual net profits is calculated based upon an aquifer life of 25 years and a discount rate of 5 percent. The dry crop present worth is based upon a term of 100 years to reflect perpetuity. The present worth of the net difference between irrigated and dryland profit is $18,859,000.

Table 5. Analysis of Crop Income Before and After Cessation of Pumping

		Irrigated Land	Dryland
	Capitalization rate	5%	5.0%
	Term, years	25	100
		Total	
1	Net Annual Profit Irrigated Land	$1,878,700	
2	Net Annual Profit Dryland	$383,900	
3	BEFORE Present Worth Irrigated Sorghum Crop Income	$26,479,000	
4	AFTER Present Worth Dryland Wheat Crop Income	$7,620,000	
5	DIFFERENCE	$18,859,000	

The sensitivity to the interest rate and also to the term for irrigation is shown below:

Sensitivity to Capitalization Rate	Indicated Value
4%	$21,730,000
5%	$18,859,000
6%	$16,394,000
Sensitivity to Term for Irrigation @ 5%	**Indicated Value**
20 years	$15,793,000
25 years	$18,859,000
30 Years	$21,262,000

The engineering opinion for an offering price from the income approach is $18,859,000.

Sales Comparison Approach. A search was made for publicly available real estate data with listings sought for properties over 100 acres in size and without residential or commercial structures. No interviews were made of real estate brokers or financial institutions as requested in order to maintain confidentiality. Only two listings of farm and ranch properties were identified in Curry County and both of these properties are dryland properties. The search for listings and sales was expanded into Parmer and Bailey Counties in Texas. Table 6 (next page) is a summary grid of the properties identified, which included irrigated lands and drylands. Figure 2 shows the locations of the properties identified. The properties with irrigation are labeled by number and the dryland properties are labeled by letter.

The dryland properties have an indicated value of $580 per acre. To arrive at the cost of irrigated land, for the irrigated properties, a deduction is made from the total value of the dryland acres multiplied by the dryland value of $580 per acre. Some of the properties listed income from participation in CRP. The present worth of the annual CRP payments was deducted from the value. The remaining value divided by irrigated acres gives a cost per acre of irrigated land.

The value per acre ranged from $1,460 per acre to $3,600 per acre with an average and median value of $2,500 per acre. Exclusion of the high and low unit prices, coincidentally, gives an average value of water of $2,500 per acre.

Table 6. Summary Grid of Farm and Ranch Listings and Sales

3/4/2019 (Not confirmed with parties to transactions)

Location ID	Sold Contract Listing	County	City	Street Address	Total Acres	Listing Price	Price per Acre	Irrigated Acres	Acres Dryland	Percent Irrigated	CRP Payments PV	Indicated Costs Dryland	Indicated Costs Irrigated Land	Water Duty acres per cfs	Comments
1	Listing	Bailey, TX	Muleshoe	Near FM 3125; 10 mi. SE of Farwell & 14 mi. NW of Muleshoe	1,266	$1,487,555	$1,175	360	906	28%			$2,672	294	10 wells to produce 500-600 gpm, 10 wells domestic & Stock, irrigation wells, 6 pivots. Combination row crop and cattle operation; 4 farms contiguous or within 2 mi. 1.22 cfs
2	Listing	Parmer, TX	Lazbuddie	242 CR 29	320	$400,000	$1,250	120	200	38%			$2,370	180	Waddell Tract. 3 working wells, 1 new well drilled not connected. 200 gpm pivot, 120 ac sprinkler or 60 acres drip (not enough water for both). (Estimate 0.67 cfs)
3	Listing	Parmer	Bovina	CR 6 and CR W	160	$200,000	$1,250	125	35	78%			$1,460		175 gpm well, ctr pivot not owned by seller
4	Listing	Bailey & Parmer, TX	Muleshoe	0 N CR 163	160	$280,000	$1,750	90	70	56%			$2,660	279	145 gpm pivot. 0.32 cfs
5	Listing	Parmer	Lazbuddie	Hwy 145	640	$1,152,000	$1,800	480	160	75%	$8,597		$2,190	196	Property extends a small distance into Castro County on east boundary. 5 wells (3 electric & 2 gas) with 1,100 gpm, 4 center pivots; 98.8 acres in CRP. 2.45 cfs
6	Listing	Parmer, TX	Lazbuddie	2955 Farm Rd 145	475	$1,000,000	$2,105	240	235	51%			$3,600	308	Referred to as Miller 3/4. Farm has 350 gpm water. 3-4 wells, 2 pivots (300 gpm). 0.78 cfs Located adjacent to a Conservation Easement property which does not have wells
7	Listing	Roosevelt, NM	Portales	Unknown, Wm Turner listing	2,560	$4,280,000	$1,672	1,420	1,140	55%			$2,550		The total acreage appears to also include lease land, Well pump rate not available.
A	Sold	Curry, NM	Clovis	CR 17 and CR AC	1,592	$994,725	$625	0	1,592		?	$ 625			May have been enrolled in CRP according to listing, but search does not show payments made to seller
B	Listing	Curry, NM	Melrose	16 mi. w of Clovis, 2 mi E of Melrose	160	$72,000	$450	0	160			$ 450			Frontage on Highway 60
C	Sold	Parmer, TX	Bovina		1,280	$1,056,000	$825	0	1,280		151,402	$ 707			2 separate tracts; CRP 472 acres contracts; wells for cattle watering
D	Contract	Bailey, TX	Stegall		328.2	$180,510	$550	0	328		25,991	$ 471			CRP & grassland
E	Listing	Bailey, TX	Stegall		326.2	$301,762	$925	0	326		148,462	$ 470			CRP and Grassland
F	Listing	Bailey, TX	Muleshoe	CR 1272	320	$248,000	$775	0	320			$ 775			Dryland
G	Sold	Bailey	Enochs	CR 97 and CR 113 an	851	$582,935	$685	0	851		86,673	583			Two tracts of land 3/4 mi. apart. Tract I 320

Average	$583	$2,500	$2,488	Average excluding high and low
Median	$583	$2,550		
Min	$450	$1,460		
Max	$775	$3,600		
Indicated Costs Dryland	**$580**	**$2,500**		**Indicated Cost Irrigated Land**

Notes by Column:

8 Column 7/Column 6

9 Irrigated acres reported in listing or as shown in aerial image.

10 Colum 6 - Column 9

11 Column 9/Column 6 expressed as percentage

12 Present worth of series an annual CRP payments at rate of 5% with data from real estate listings.

The unit cost of irrigated land of $2,500 per acre is used as a method to estimate the offering price. The area in acres to be used as a multiplier is a challenging issue because the water right is based on the entire acreage, but the current irrigated area is substantially less. To arrive at an offering price, the total acres are used because the total acres define the amount of water that can be pumped. The estimated offering price from the sales comparison approach is $25,725,000.

Table 7. Estimated Offering Price for Paleo-Channel Water from Farm and Ranch Listings

		per irrigated acre	$2,500
1	Total Acres		10,290
2	WWE Estimated May 28, 2017 Irrigated Acres		4,750
3	Total GPM		11,950
4	Total cfs		27
5	Value of Water		$25,725,000

Reconciliation of Indicated Costs. The two methods of evaluating costs are reconciled in Table 8. The total cost from the income method is $18.9 million and from the real estate listings is $25.7 million. Of note is that for farms with a higher percentage of irrigated lands, the income method gives higher price. Both methods are considered with a 1/3 weight given to the income method and 2/3 weight given in the real estate listings. The total reconciled cost is $23.4 million. The cost per AF for transferrable water is $2,360 ($23,435,000 / 9,939 AF).

Table 8. Reconciliation of Indicated Acquisition Costs

1	Total Acres	10,290
2	WWE Estimated May 28, 2017 Irrigated Acres	4,750
3	Indicated Value from Income Approach	$18,859,000
4	Indicated Value from Sales Comparison Approach - Irrigated Land	$25,725,000
5	Approaches weighed 1/3_2/3	**$23,435,000**
6	Water right at 1.29 AF/acre, AF	9,939
7	Cost per AF of Transferrable water	$2,360

The farms have been awarded water rights of 3 AF per acre by OSE without regard to the actual pumping quantities. The number of acres actually irrigated on each property varies. The larger irrigated acreages represent more "wet water" currently being used. For this reason, the firming up and better defining the physical water availability will be needed. This could include testing of the wells and consideration of the measured thickness of the aquifer.

Nonirrigated Lands with Wells in the Paleo-channel. There are farms in the central area of the paleo-channel that have valid well permits but who are not currently irrigating. These farmers and other farmers who have valid irrigation water permits could reactivate irrigation, which is a possibility of which the City should be aware. To acquire cessation of groundwater pumping on these farms based on the reconciled values from Table 8, the cost may be in the $6 million range as shown in Table 9.

Table 9 - Tabulation of Nonirrigated Lands with Wells in Paleo Channel

	From Table 8	Unit Price	Paleo Channel Nonirrigated Lands	Prorated Price
Reconciled Total Price	$23,435,000			
Total Acres	10,290	$ 2,277	2,665	$ 6,070,000
Permitted Diversion, AF	31,019	$ 756	7,994	$ 6,040,000

Conservation Easement Tax Credit. The conservation purpose of the proposed donation is watershed preservation and natural resource conservation to conserve the Ogallala Aquifer in Curry County, New Mexico. This purpose is consistent with the purposes of the New Mexico Land Conservation Incentives Act (47-12-1 NMSA) and the objectives of the New Mexico State Engineer. The means of proceeding with the conservation of the waters of the Ogallala Aquifer is to reduce the draft upon the aquifer by reducing agricultural irrigation in Curry County. Specifically, the conservation purpose would be manifested in the encumbrance of the water rights permitted for the irrigation of agricultural crops in the area overlying the paleochannel.

Implementation of the conservation easement tax credit alternative will require consideration of the New Mexico Energy, Minerals and Natural Resources Department's Land Conservation Incentives Act Guidelines, obtaining support from the New Mexico State Engineer explaining the watershed preservation and natural resource conservation benefits of conserving the waters of the Ogallala Aquifer, and the preparation of appropriate applications, including supporting documentation (baseline conservation reports, appraisals, legal opinions, etc.)necessary to obtain Federal tax deductions and NM Conservation Easement Tax Credits by the various grantees.

The conservation purpose would be achieved by ceasing irrigation in perpetuity, which would result in a net benefit to the aquifer of 1.71 AF per acre per year, while permitting the production of 1.29-AF per acre per year for other beneficial uses.

CONCLUSION

This engineering opinion of value has been performed based upon publicly available data and has not included interviews with landowners or real estate agents. **The described engineering evaluation of the suggested offering prices to acquire the groundwater rights in the paleo-channel is not an appraisal, but a generalized estimate of cost based on a combination of**

available parcel-specific information, county-wide information, and assumptions outlined above. The evaluation has determined that:

- Lack of management of the Ogallala Aquifer during the last 90 years has resulted in critical and significant aquifer depletion due to pumping for agricultural irrigation for crops.
- Water levels in the Ogallala Aquifer have fallen in Curry County since the 1932 report of the New Mexico State Engineer in which a noted hydrologist described the need to balance pumping rates with recharge.
- Irrigated farms have been awarded 3 AF per acre water rights from the Ogallala Aquifer.
- Ceasing irrigation in perpetuity would result in a potential net benefit to the aquifer of 1.71 AF per acre per year, while allowing the production of 1.29 AF per acre per year for other beneficial uses.
- Falling water levels have tended to reduce the yield of individual wells. New supplemental wells should be prohibited.
- The engineering opinion of the total offering price to obtain cessation of irrigation pumping on the identified irrigated lands is $23.435 million, which is equivalent to a cost of $2,360 per AF of transferrable groundwater.
- The City of Clovis should acquire all the water rights, including both currently irrigated and potentially irrigated lands, in the paleo-channel west of Clovis and end irrigation.

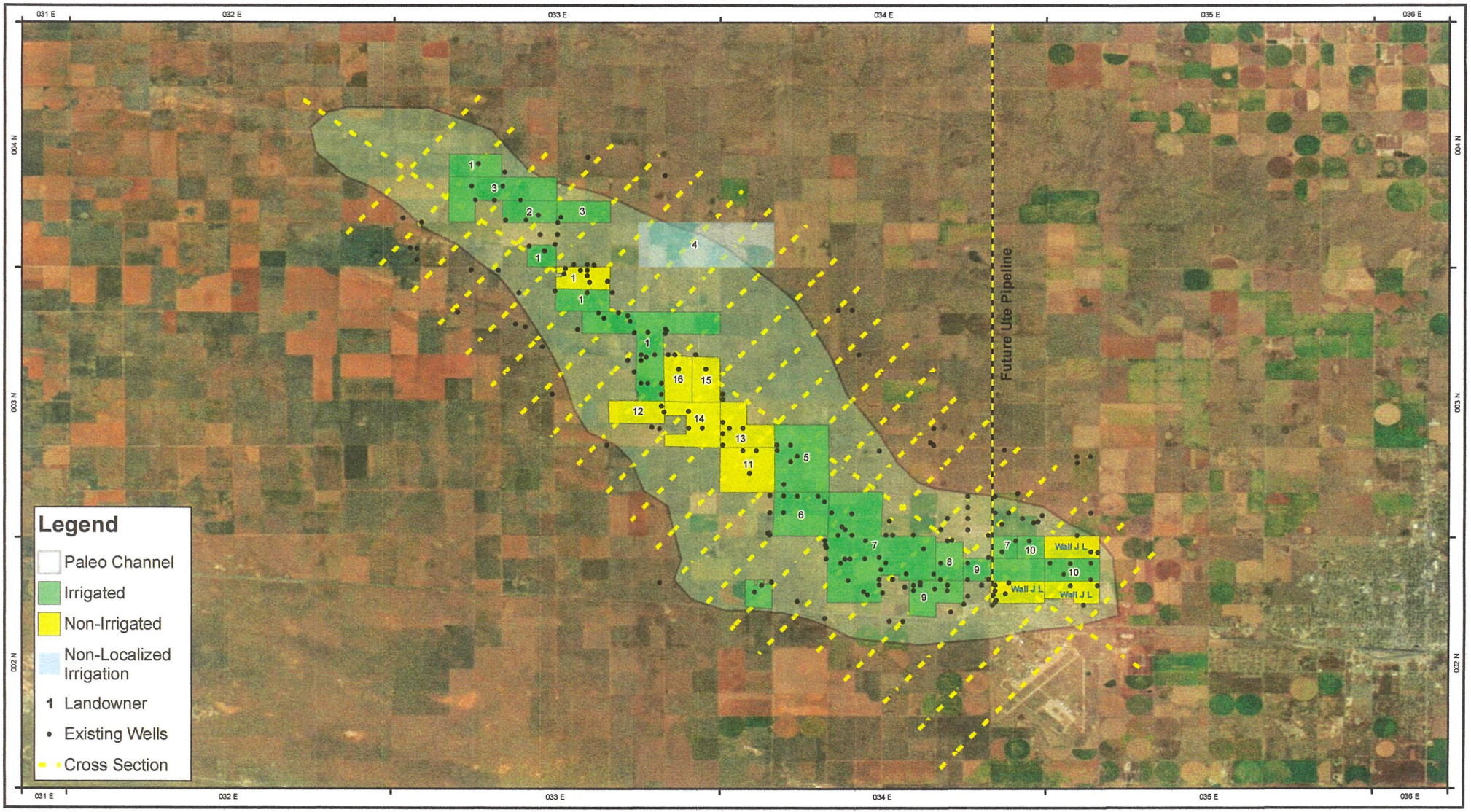
Sincerely,
WRIGHT WATER ENGINEERS, INC.

By Patricia K. Flood
Patricia K. Flood
Senior Consultant

By
Kenneth R. Wright, P.E.
Principal Engineer

Attachments:
Figure 1 Area of Paleo-channel Extent
Figure 2 Location of Listings

cc: Peter D. Nichols



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WRIGHT WATER ENGINEERS, INC.

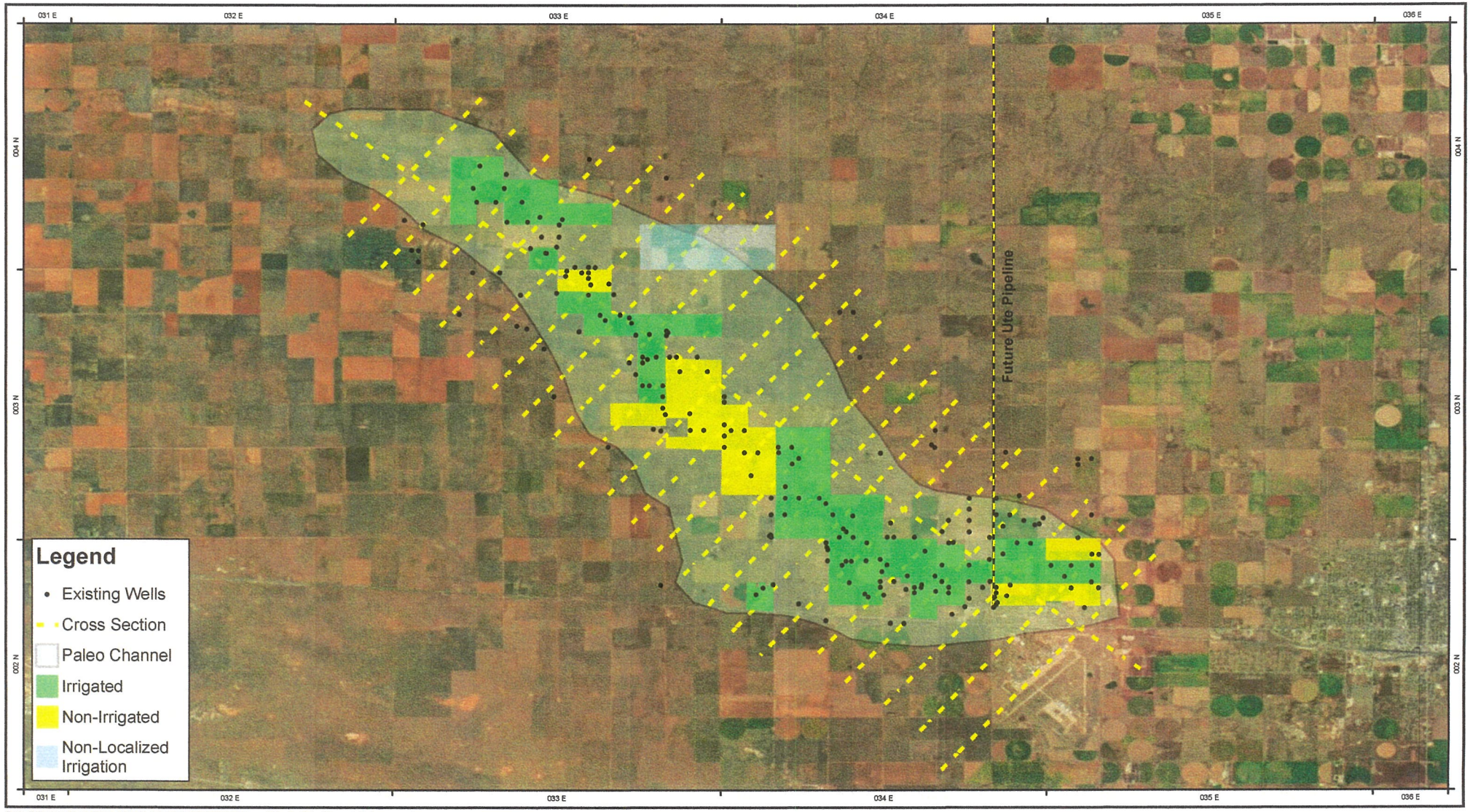
AREA OF PALEO-CHANNEL EXTENT

CLOVIS, NEW MEXICO

0 1 2 Miles

PROJECT NO. 181-124.000

FIGURE 1



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AREA OF PALEO-CHANNEL EXTENT

CLOVIS, NEW MEXICO

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FIGURE
1