CITY OF PORTALES

2013 WATER CONSERVATION AND USE REPORT

Prepared for

City of Portales

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EXECUTIVE SUMMARY

This report describes and evaluates the effectiveness of the City of Portales' water use and conservation program during the 2012 calendar year. This evaluation has been prepared to assist in the water supply planning efforts of the City Council and the Water Utility Department, to document water supply and demand trends, to identify problems, and to provide a basis for periodically updating Portales' 40-Year Water Development Plan. The need for continued water planning is particularly important for Portales because of its sole reliance on the depleting Ogallala Aquifer as a water source.

The City's water use in 2012 was substantially lower than in 2011, even though both 2011 and 2012 were unusually dry years. The water saving in 2012 was 123 million gallons, a decrease of nearly 10 percent from the previous year, and about 360 million gallons below the projected 2012 demand with additional conservation measures in place. The total water savings since the year 2000 have amounted to over 1.6 billion gallons. Reducing the demand on the City's wellfields is becoming increasingly important to extend their useful lives in view of uncertainty in when an alternative municipal supply will become available.

The decrease in water demand in 2012 was primarily due to a sharp decline in industrial water use reflecting closure of the Abengoa Bioenergy Plant for most of the year. In addition, residential use dropped by about 60 million gallons in 2012 as compared with 2011 but was still higher than in earlier years. Commercial, ENMU, and other metered uses remained low and relatively unchanged from previous years. Unmetered use was approximately 100 million gallons in 2012. The most significant candidates for additional conservation are the residential users. Efforts should be made to keep industrial use low without affecting jobs, and additional metering will help show more precisely how much of the currently unmetered 100 million gallons is unaccounted-for, potentially wasteful, and avoidable.

In addition to actively reducing its water demand, the City has also pursued an aggressive program of improving its water supply. In 2011 the City initiated a program to convert 17 agricultural wells to municipal use which, when complete, would have the potential to nearly double its pumping capacity. These additional wells and others that will be needed in the future are necessary to maximize recovery of water from the City's groundwater reserve. The availability of these additional wells should allow pumping rates in existing wells to be reduced, thereby reducing groundwater depletion rates and minimizing wellbore damage from overstressing the aquifer. The overall effect of these measures will extend the lives of the existing wells and the aquifer.

Although the City's water conservation measures are clearly working as evidenced by the continuing decreases in water demand, the diagnostic data for the City's wellfields indicate that they are nearing the end of their useful lives as high yield sources of municipal supply. The nine-year average depletion rate of 2.9 feet/year in the City's primary Blackwater Wellfield compared with an average remaining aquifer thickness of 38 feet in January 2013 provides a very rough and perhaps optimistic estimate of about 13 years remaining aquifer life (to about 2026, if current conditions persist) as a high yield source of municipal supply. It will be necessary to continue to add new wells to the system to withdraw previously untapped water from the City's groundwater reserve but the number of new wells needed to meet the City's demand may not be financially feasible unless the demands on its wellfields are significantly reduced or alternative water supplies from sources other than the City's wellfields are obtained.

The best alternative water supply for Portales continues to be a renewable surface water supply from Ute Reservoir on the Canadian River. A pipeline to supply this water has been approved and construction began in 2013. Portales has reserved a Ute supply approximately equal to its 2013 total water demand. However, the Ute Reservoir supply will be reduced during droughts and the City will need to have a water supply reserve to draw upon if the curtailment is significant. Although the pipeline is scheduled to be completed by about 2025, delays are possible and perhaps even likely.

There is uncertainty over the timing of the need for the Ute supply and there is also uncertainty over when the Ute supply will be available to Portales. The availability of Ute water may be delayed due to funding and other constraints, and the need for that water may occur sooner than expected. In view of these uncertainties and of the consequences of a severe water supply shortfall, it is recommended that the City implement more stringent water conservation measures to substantially decrease wellfield demand. This will help prolong the lives of the City's wellfields and could also maintain a longer term water supply reserve if Ute supplies must be severely curtailed in drought years.

To provide context to a delay in Ute water delivery, if Ute Project completion is delayed by 5 years to 2030, it would be prudent for Portales to reduce its wellfield demand by 40% to abut 700 million gallons/year by 2016 to help bridge the gap caused by such a delay. Although a 40% reduction is significant, it can be accomplished by maintaining existing conservation measures in place, by using treated wastewater to irrigate City parks currently irrigated with water from the City's wellfields (reducing demand by an estimated 25 to 30%), and by converting residential and commercial landscaping to drought-resistant plants and hardscapes (reducing demand by an estimated 10 to 15%). The potential combined reduction in demand of 35 to 45 percent from these conservation measures would achieve the recommended goal.

Although the City has a groundwater reserve that is only now being tapped, the aquifer supplying the City is clearly a finite resource and the current management plan of satisfying the City's water needs by regularly increasing the number of wells and drawing on the City's groundwater reserve cannot continue indefinitely. The City's groundwater supply can be extended if the water demand is significantly reduced or if another source of supply is acquired. As in the past, it is recommended that the City continue its current management plan of decreasing demand through water conservation, regularly increasing the number of active wells, seeking opportunities to increase its groundwater reserve, and pursuing opportunities to develop a supplemental, renewable water supply. The most viable option for acquiring a supplemental, renewable water supply continues to be a surface water supply from Ute Reservoir. It is to the City's credit that each of these recommendations continues to be pursued diligently.

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1.0 INTRODUCTION

This report is part of a series of annual reports describing and evaluating the effectiveness of the City of Portales' Water Conservation Program. The need for annual evaluations was described in the City's Water Conservation Plan (Wilson 2001a) and in guidance provided by the Office of the State Engineer (OSE). These evaluations assist in the planning efforts of the City Council and the City's Water Utility Department, document water supply and demand trends, identify problems, and provide a basis for periodically updating the City's 40-Year Water Development Plan (Wilson 2001b). The need for continued water planning is particularly important to Portales because of its sole reliance on the depleting Ogallala Aquifer as a water source. This report describes the City's water use and supply, conservation measure implementation, and water use trends for the 2012 calendar year. It also updates information contained in the 40-Year Plan. Water conservation and use reports have been prepared annually by the author since 2002 and have covered calendar years 2000 through 2011. The most recent annual report was prepared by Wilson (2012).

2.0 WATER USE AND TRENDS

2.1 Water Demands

Water demands in the City's Water Utility Department service area are shown in Table 1 and plotted in Figures 1 and 2. A map of the service area is presented in the 40-Year Water Development Plan. Figure 1 shows the actual total water demand from 1995 through 2012 as well as the estimated future average demands as projected in the 40-Year Plan with and without additional water conservation. The City's total demands in 2012 were substantially lower than in 2011, even though both 2011 and 2012 were unusually dry years. The water saving in 2012 was 123 million gallons, a decrease of nearly 10 percent from the previous year and about 360 million gallons below the projected 2012 demand with additional conservation measures in place. As will be seen, reducing the demand on the City's primary Blackwater Wellfield is becoming increasingly important to extend its useful life in view of uncertainty in when an alternative municipal supply will become available.

Figure 2 shows water use trends for six categories of municipal use: residential; commercial; industrial; Eastern New Mexico University (ENMU); other metered uses; and unmetered uses. The figure shows that the decrease in water demand in 2012 was primarily due to a sharp decline in industrial water use reflecting closure of the Abengoa Bioenergy Plant for most of the year. Residential use dropped by about 60 million gallons in 2012 as compared with 2011 but was still higher than in earlier years. Commercial, ENMU, and other metered uses remained typically low and relatively unchanged from previous years. Unmetered use increased from an unusually and probably erroneously low value in 2011 to its more typical value of about 100 million gallons in 2012. Figure 2 illustrates that the most significant candidates for additional conservation are the residential users, that efforts should be made to keep industrial use low without affecting jobs, and that additional metering will help show more precisely how much of the currently unmetered 100 million gallons is unaccounted for, potentially wasteful, and unnecessary.

Residential uses represent the single largest use category within the service area. Residential uses include direct residential sales by the City's Water Utility Department as well as sales by the Roosevelt County Water Coop, which buys water from the City. Residential use has been consistently within the range of 600 million to 800 million gallons per year since 1995 and ran about 640 million gallons in 2012. Residential demand is normally sensitive to the City's water conservation measures and to precipitation, however the decrease in 2012 demand correlates with a precipitation that was well below average. This suggests that conservation measures outweighed the impacts of a dry year.

Commercial water use has been relatively stable and has generally ranged between 60 and 70 million gallons per year, although in 2012 it dropped slightly to 56 million gallons. ENMU's 2012 water use of 57 million gallons was slightly higher than the 52 million gallons used in 2011 but continues to be approximately half of its use a decade ago. ENMU's use of City water is now almost entirely for non-irrigation purposes and its landscape irrigation needs are supplied by onsite wells.

The "other metered uses" category in Table 1 includes non-taxed institutions such as churches, hospitals, government offices and facilities, City use, schools, and several rural area ranches. The total 2012 of 80 million gallons was about 20 million gallons higher than in 2011, probably because of the low precipitation.

Unmetered water use includes unmetered City uses, primarily for irrigating City parks, fire hydrant use, and system losses such as pipeline leaks and storage tank spills. As previously noted, unmetered water use returned to its normal range of about 100 million gallons in 2012 from an all time and probably erroneous low of 23 million gallons in 2011. Because unmetered water use is calculated as the difference between total pumping and total metered water use, and because pumped volumes from some City wells were estimated in 2011 due to flowmeter malfunctions, it is suspected that total pumping may have been underestimated in 2011.

Estimated allocations of unmetered water use have been prepared by the City and are presented in Table 2. The unmetered use that has been accounted for amounts to only about 10% of the total unmetered use. The remaining unmetered use not included in the City's estimates is unaccounted-for and may be primarily due to unknown pipeline leaks and errors in estimating total pumping. The unaccounted-for system losses were a very low 11.6 million gallons in 2011 and were subject to the same inaccuracies in wellfield pumping estimates as the unmetered water use. The unaccounted-for system losses increased in 2012 to about 104 million gallons, which is at the lower end of the normal range. Unaccounted-for system losses amounted to about 9.3% of total pumping in 2012. By comparison, values less than 10 percent are nominally considered good.

2.2 Water Use and Weather Conditions

Natural rainfall normally has a strong influence on the amount of water that must be supplied by the City, particularly for residential use. Total annual and five-year running average precipitation at Portales are presented in Table 3 and plotted in Figure 3 for the period from 1990 through 2012. The annual amounts can be quite variable and the five-year averages better illustrate longer-term trends. The total annual rainfall of 8.31 inches in 2012 was the third driest since 1990 and was about half of the long-term, 101-year average of 16.54 inches. However, the City's total water use of 1.12 billion gallons in 2012 was the lowest of any year since 1995. This combination of a very dry year and very low water use is unprecedented and due in large part from a significant reduction in industrial water use.

A plot of annual precipitation versus total annual water demand for Portales is shown in Figure 4 for the period from 1995 through 2012. This time period includes 8 years when the rainfall was greater than or equal to the long-term average of 16.54 inches and 10 years when the rainfall was less than that average. The 2012 data made the trend line on the figure almost flat, indicating that the annual water demand may have become only weakly influenced by precipitation.

2.3 Per Capita Water Demand

Population estimates for the City's Water Utility Department service area are shown in Table 4. These estimates are based in part on the 2010 U.S. Census Bureau data and are updated from those used in the City's 40-Year Water Development Plan. In addition to the census data, these estimates are based on ENMU planning staff information and Roosevelt County Water Coop information as explained in the footnotes on the table. The estimated 12,524 people living in the City of Portales in 2012 is based on the 2010 census data and the 2000-2010 annual rate of population increase. The service area population outside the City is based on the number of active Water Coop household hookups in December 2012 multiplied by the average number of persons per household from the 2010 U.S. Census Bureau data. The City's population is therefore supplemented by an estimated 3,842 people in the surrounding rural area served by the County Water Coop and by the 5,814 students enrolled in the 2012 fall semester at ENMU. The total water service area population in 2012 is estimated to be 22,180.

Per capita water use information is presented for the City's water service area in Table 5 and Figure 5. Between 1990 and 1999 the City's population estimates were erroneously high because the City grew at a slower rate than estimated by the U.S. Census Bureau. The City's population estimates between 2000 and 2009 are based on 2000 census data and a continuation of the actual 1990-2000 growth rate. As stated above, the City's 2012 population was determined by the 2010 census and a continuation of the 2000-2010 growth rate. Per capita use is each resident's share of the average daily water consumption for all uses benefiting those living within the service area. Per capita water use therefore includes water use for schools, parks, and industries as well as residential use. The OSE defines per capita water use as including all uses that are debited against the water rights of the public water supplier (Wilson et al. 2003, p. 10).

Per capita water use for Portales has been calculated with and without industrial consumption because extensive water use by a few water-consuming industries specific to Portales should not mask the advances Portales has made in water conservation when making comparisons with other communities. When including all water uses except industrial consumption, the per capita water use in 2012 was 117 gallons per person per day (gpcd). When industrial consumption is included, per capita water use in 2012 was 139 gpcd. These values are well below the standard American benchmark of 200 gcpd, which has been considered good. However, increasing water shortages in the American West are changing this outlook to one of how much individual communities with limited supplies can afford to use. The plotted data in Figure 5 demonstrate long-term, generally downward trends in per capita use both with and without industrial consumption, and it will be important for these trends to continue.

2.4 Water Supply

The City of Portales currently relies exclusively on pumping groundwater for its water supply. The principal source is the Blackwater Wellfield, located about 10 miles northeast of the City. A secondary source, used primarily during the higher demand summer months, is the older and smaller Sandhill Wellfield, located about 3 miles north of the City. Water is conveyed to the City in underground pipelines. The City has 9.26 million gallons of water storage capacity in five underground and surface tanks. To supplement the supply from its current wellfields, in 2001 the City purchased the Blackwater Farm and Las Lomas properties along with their appurtenant water rights to create a groundwater reserve adjacent to the City’s Blackwater Wellfield. The Las Lomas property has also been called the Ruther Farm. Together these two properties are herein called the Baker Farm, named after their former owner. The City has retired the farm’s irrigation wells from agricultural use and is progressively converting the irrigation wells to municipal use and tying them into the City’s Blackwater Wellfield conveyance system.

2.4.1 Groundwater Supply in City Wellfields

Portales' 2012 water supply was derived from 37 active wells, of which 32 are in the Blackwater Wellfield and five are in the Sandhill Wellfield. Sandhill Well SH-2 was taken out of service in 2003 and Blackwater Well BW-1 was taken out of service in 2004, both due to an insufficient depth of water. The active wells include 15 converted Baker Farm wells, of which seven were added to the Blackwater Wellfield system in 2011 and two more were added in 2012. The farm wells that have been identified for conversion have been renumbered as Blackwater Wells BW-19 through BW-42. As compared with the Sandhill Wellfield, production of the Blackwater Wellfield has averaged about 93% of total pumping since 2003 and amounted to 99% of total pumping in 2012. Because the contribution of the Sandhill Wellfield to the City’s water supply is small, emphasis in the following discussion is on the Blackwater Wellfield.

Blackwater Wellfield

The locations of the City's Blackwater and Baker Farm wells are shown on the wellfield map in Figure 6. The map shows the locations of Blackwater Wells BW-26 through BW-32, which were placed in service in 2011, and Blackwater Wells BW-41 and BW-42, which were placed in service in 2012. Blackwater Wells BW-33 through BW-40 are currently being converted and connected to the Blackwater conveyance system. A summary list of converted wells by OSE permit number is presented in Appendix D. Baker Farm wells that have not yet been converted to municipal use are identified by their OSE permit numbers in Figure 6 and are listed in Appendix C.

All City wells are withdrawing water from the Ogallala Aquifer, which due to high regional demand and low natural recharge, is being depleted at a relatively rapid rate. Because the groundwater in the aquifer is being regionally pumped at a rate that far exceeds the rate of recharge, it is effectively being mined and cannot be considered a renewable resource.

Table 6 presents a summary of how several diagnostic indicators of the health of the Blackwater Wellfield have changed over time. These indicators are the average long and short term aquifer depletion rates, the average remaining aquifer saturated thickness, and the average specific capacity of the active wells. Increasing depletion rates, decreasing aquifer thickness, and decreasing specific capacity are indicators of deteriorating wellfield conditions.

Aquifer depletion is commonly measured as the rate of decline of the water table. Historic average aquifer depletion rates at the City's Blackwater wells are summarized in Table 6 and detailed depletion data are presented in Appendix A. The average long-term (since the well was drilled) and short term (the last three to five years) depletion rates shown in Table 6 indicate that the rate of water table decline is variable but generally increasing. The average long term depletion rate has been relatively stable because many of the wells are decades old. The average short term depletion rate is more variable and more indicative of current wellfield health. The slow increase in the short term depletion rate in the Blackwater Wellfield observed since 2002 was reversed when the average short-term depletion rate dropped from 2.9 feet/year in 2004 to 2.3 feet/year in 2005 and to 0.3 foot/year in 2006. This decrease was likely due to the combined effects of adding five Baker Farm wells to the system in 2004 and to groundwater recharge following an unusually wet year, also in 2004.

After 2006 the average short-term depletion rate began to progressively increase, reaching a peak of 3.9 feet/year in 2011. The depletion rates would likely have been higher if Baker Farm wells had not been systematically added to the municipal system during this time. The extra wells allowed pumping rates on existing wells to be reduced by spreading the demand across a greater number of wells. As a result of the reduced wellfield demand in 2012 and the nine additional wells added to the system in 2011 and 2012, the average short-term depletion rate dropped from the aforementioned 3.9 feet/year in 2011 to 2.8 feet/year in 2012. The positive effect of this decrease is to extend the life of the wellfield.

The average remaining aquifer saturated thickness at the City’s Blackwater wells provides another indicator of wellfield health and is also shown on Table 6. These data represent winter measurements (usually January) of static water levels when pumping at the City’s wellfield and in neighboring agricultural and dairy wells is lowest and the data are most representative of general aquifer conditions. The average remaining aquifer thickness at the City’s Blackwater wells has progressively decreased from 64 feet in the winter of 2004 to 38 feet in the winter of 2013. Again, the rate of decline is variable and depends on the number of wells being pumped, the volume of water pumped during the previous year, and any groundwater recharge that may have occurred during the previous year. The average aquifer thickness at the Blackwater Wellfield has dropped 26 feet in nine years, for a nine-year average depletion rate of 2.9 feet/year.

Specific capacity is the production rate of a well divided by the pumping drawdown. It is a good diagnostic of a well's ability to produce water because as the aquifer thickness drops, the yield of a well tends to decrease and the drawdown tends to increase, with the result that the specific capacity drops. As shown in Table 6, the average specific capacity of the City's Blackwater wells has decreased from 16.9 gpm/ft in January 2005 to 7.9 gpm/ft in January 2012. The option of maintaining pumping rates and increasing drawdowns is not available at many wells because the remaining saturated thickness is too small. The only remaining option is to decrease pumping rates at individual wells and add more wells to the system while decreasing water demand and seeking additional supplies from a different source.

The City's strategy for dealing with the depleting aquifer is to encourage water conservation, to progressively add more wells to its system that draw upon the stored water in its groundwater reserve, and to eventually acquire an additional water supply from Ute Reservoir. Although the components of this strategy have been successful and construction of the Ute Pipeline has begun, as the aquifer approaches the end of its useful life as a high yield source of municipal water supply, increasingly significant reductions in water demand will be required pending receipt of supplemental supplies from Ute Reservoir or another, more temporary source. As long as the Blackwater Wellfield remains the City's primary source of water, the wellfield depletion rate will increase as the aquifer thickness decreases unless more wells are regularly added to the system and/or the volume pumped is reduced.

Long-term increases in the depth to water at the City's Blackwater Wellfield are shown graphically in Figures 7 through 11. As shown in the figures, the water table has been declining at a more or less regular rate for decades. These plots show that the brief water table stabilization observed in recent years has ended and the water table in most wells has dropped to levels consistent with the earlier rates of decline. Overall, the data indicate that the beneficial effects of groundwater recharge from the heavy rainfall in 2004 have ended.

Details on the performance of individual wells in the Blackwater Wellfield as of January 2013 are shown in Table 7. The remaining aquifer thickness ranged from 16.3 feet at BW-20 to 73.2 feet at the new well BW-38, which has not yet been placed in service. The average remaining aquifer thickness at wells where data was available was 38.3 feet. The specific capacity ranged from a very low 1.4 gpm/ft at BW-14 to 24.4 gpm/ft at BW 27 and averaged 7.9 gpm/ft. The production pumping rate ranged from 26 gpm at BW-31 to a healthy 320 gpm at BW-42 and averaged 112 gpm.

The unutilized saturated thickness takes pumping drawdown into account and includes a 5 ft minimum saturated zone buffer to provide a margin of safety when the well is nearing the end of its useful life. The unutilized saturated thickness ranged from 3.2 ft at BW-23 to 28.6 ft at BW-16. The average unutilized saturated thickness increased slightly from 13 ft in the winter of 2012 to 14 ft in the winter of 2013. Stabilization of the unutilized saturated thickness demonstrates the value of increasing the number of wells in the system and reducing the total demand on the wellfield.

A decreasing aquifer thickness is also accompanied by a decrease in well yields. The long-term declines in yield of the City's Blackwater wells are illustrated through the winter of 2013 in Figures 12 through 16. The declines in well yields are consistent with the declining saturated thickness of the aquifer and illustrate the importance of the City’s program to routinely add additional wells to the system and reduce wellfield demands. Several of the older Blackwater wells were acidized and swabbed in 2011 to remove well screen rust and improved performance. The most notable improvement was in the yield of well BW-8, which increased from 50 to 210 gpm. This increase is quite evident in Figure 12.

The City’s 2010 Water Conservation Report included a discussion of the adverse impacts of overpumping a well and damaging the aquifer by reducing its permeability. Overpumping is indicated when the pumping drawdown becomes a large percentage of the remaining saturated thickness. As examples, in January 2010 the drawdowns in Wells BW-4 and BW-12 were over 80 percent of the remaining saturated thickness. Although high pumping rates may occasionally be needed to obtain the necessary well yields to satisfy demands, overpumping can result in aquifer damage by clogging the aquifer and reducing water flow to the well. Except in emergency conditions, pumping drawdowns should be limited to 25 percent and not more than 50 percent of the saturated thickness.

Because of its importance to wellfield operations, the ratio of pumping drawdown to remaining saturated thickness is included in Table 7. The winter 2013 data indicate that 9 of the 26 wells with drawdown data have drawdown to saturated thickness ratios greater than 50 percent. The maximum ratio in 2013 was 72 percent (for BW-7 and BW-12). Reducing this ratio to less than 50 percent is especially important to not damage good producing wells such as BW-7. Production can preferentially be transferred to good producers with lower ratios such as BW-27 and BW-32. Balancing production by reducing pumping rates in high ratio wells and increasing pumping rates in low ratio wells would increase the average unutilized saturated thickness and prolong the life of the wellfield.

The production pumping rate was measured for 25 of the 33 active wells in the Blackwater Wellfield in January 2013. These totals do not include 8 farm wells (BW-33 to BW-40) that are in the process of being converted to municipal use and connected to the City’s conveyance system. As shown in Table 7, the combined pumping capacity of the active Blackwater wells with data was 2,793 gpm.

<u>Sandhill Wellfield</u>

Historic water levels in the City’s Sandhill Wellfield are shown in Figure 17. These data depict a long term decline similar to that observed for the Blackwater wells. Although the remaining average saturated thickness at Sandhill now only about 15 ft, concern for overpumping at Sandhill is less than at Blackwater because of the high permeability of the aquifer and Sandhill’s role as a supplemental water source. In addition, aquifer damage is likely to be less severe at Sandhill because of the greater uniformity of the sandy aquifer material. Historic yields of the Sandhill wells are shown in Figure 18. Although the data are scattered, the long term pattern shows that well yields are decreasing at Sandhill as well as at Blackwater.

Details on the performance of individual wells in the Sandhill Wellfield as of January 2013 are shown in Table 8. The remaining aquifer thickness ranged from 11.5 feet at SH-7 to 22.3 feet at SH-1 and averaged 15.4 feet. Specific capacity was only available for SH-1 and was 24.1 gpm/ft. The specific capacity of this well was among the best calculated for the Blackwater wells due to the aforementioned high aquifer permeability at Sandhill. The production pumping rate ranged from 54 gpm at SH-1 to 150 gpm at SH-3 and averaged 91 gpm for the three wells with data. Unutilized saturated thickness information was only available for two Sandhill wells and varied from 3.8 feet for SH-5 to 15.1 feet for SH-1.

The total production pumping rate at Sandhill was 274 gpm in January 2013. Although this is only about 10 percent of the total production pumping capacity at Blackwater, the high aquifer permeability at Sandhill and its resistance to damage from high pumping rates are expected to maintain Sandhill as a viable but low yield source of water for many years.

Combined Wellfield Performance

The combined performance of the City's Blackwater and Sandhill Wellfields is important when determining total pumping capacity. Total pumping capacity increased from 4250 gpm in January 2006 to 5025 gpm in January 2007 as new wells were added to the system and then decreased to 4163 gpm in January 2008. Subsequent pumping capacity data did not include all wells and therefore did not accurately indicate the total wellfield capacity. However, the January 2012 data were very comprehensive and included all active Blackwater wells as well as the additional wells that were being reconfigured for municipal use. The combined potential pumping capacity of these wells was a comfortable 5715 gpm. As of January 2013, eight of these additional wells had not yet been added to the system and the combined pumping capacity of the City's two wellfields for wells that had been added to the system was 3067 gpm.

Although the combined pumping capacity in January 2013 was low and is expected to increase when the 8 additional farm wells are converted and added to the system, maintaining an adequate pumping capacity is expected to remain difficult, requiring a continuing effort to add new wells to the system and simultaneously decrease wellfield demands through water conservation. A significant reduction in wellfield demand is expected to occur when reclaimed wastewater from the City's treatment plant becomes available for irrigating City parks. Additional discussion of this project is provided in Section 3.0 below.

2.4.2 Groundwater Supply in Baker Farm Wells

In recognition of the declining yields at the City's wellfields, the City of Portales purchased the Baker Farm and its water rights in September 2001 to provide a groundwater reserve. The locations of the Baker Farm wells not yet converted to municipal use and the original irrigation circles are shown in Figure 6. As previously mentioned, the farm property was purchased with the intent of retiring agriculture and using the associated groundwater supplies for municipal purposes. This required transferring water rights to the City and changing the location and type of water use from agricultural to municipal and industrial. Recovery of this water for City use required new pipeline laterals from the existing system, reconfiguring the existing irrigation wells to be suitable for supplying drinking water, and eventually drilling new wells. As previously mentioned, 24 of the agricultural wells have been converted and renamed as Blackwater Wells BW-19 through BW-42, and 16 of these were used as production wells in 2012. Eight additional irrigation wells (BW-33 through BW-40) are currently being converted to municipal use. Depletion rate data for farm wells that are being placed in municipal service are presented in Appendix A.

The eight remaining Baker Farm wells that are not currently being converted to municipal use are listed in Appendix C. The Baker Farm wells were intended for agricultural and stock use and were not equipped for simplified water level monitoring. No water level data have been collected from those wells since January 2006. Two of the eight remaining wells are low capacity stock wells and the rest are higher capacity irrigation wells. The stock wells and some of the irrigation wells are located near former irrigation wells that have been converted to municipal use, and are not good candidates for future conversion.

2.4.3 Standpipe Heights for Depth-to-Water Measurements

The depth to water in the City's wells is measured from the top of the well's standpipe and then corrected to a ground surface reference by subtracting the height of the standpipe above ground surface from the depth measurement. Standpipe heights for each well are presented in Appendix E.

2.4.4 OSE Point of Diversion Well Numbering System

The OSE is changing well permit numbers to a new Point of Diversion (POD) system. A correlation of the old numbering system with the new POD system is presented in Appendix F.

3.0 CONSERVATION MEASURES EMPLOYED

The City of Portales adopted a comprehensive Water Conservation Plan in June 2001 (Wilson 2001a). The Plan presents a summary of the City's water conservation measures and goals to the year 2040. The Conservation Plan was prepared in concert with the City's 40-Year Water Development Plan (Wilson 2001b), which shares the same 40-year planning period. The Conservation Plan recognized the City's current water conservation measures and added four additional measures designed to further enhance water conservation. The goal was to decrease the City's average annual water use to 167 gallons per person per day by the end of the planning period. Achieving this goal would require a 13 percent reduction in the City's water use as projected without additional conservation. This goal was considered achievable in view of the reductions in use that had already been made by the City. The City's water use has been declining since 2000 and passed the aforementioned goal of 167 gallons per person per day in 2010. As noted above in Section 2.3, the per capita water use in 2012 was 139 gpcd.

The following water conservation measures were in effect at the time the City's Water Conservation Plan was prepared.

- A 5-year program of 4% annual rate increases was adopted in 1995 to encourage water conservation and fund system improvements.
- A schedule of increasing block rates with increasing consumption to increase water costs and discourage excessive use. The water utility is financially self-supporting for present and future needs.
- The minimum monthly base rate including the first 2,000 gallons of water use was set at less than the expected minimum usage to encourage water use awareness.
- Water meter readings were monitored for excessively high and low values and checked for accuracy. High readings triggered onsite leak checks and informal water use surveys.
- Sewer rate schedules were tied to water use and were therefore also structured to encourage water conservation.
- Treated effluent was used to irrigate up to 300 acres of farmland thereby reducing agricultural groundwater demand.
- Low water pressures (40 to 60 psi) were maintained in the distribution system to reduce waste.
- Water metering was universal except for some parks. All new facilities were being metered and unmetered uses were being progressively eliminated.
- A water meter testing, repair and replacement program was implemented.
- A program for conducting internal, system-wide audits of the City's water utility was implemented to document water supply and use on an annual basis.
- Leak detection and pipe repair/replacement programs were implemented.
- The City was working with *Pride in Portales* and *New Mexico Clean and Beautiful* organizations to promote water-conserving landscaping on road medians and adjacent areas.
- Automatic, timed sprinkler systems were installed in City parks allowing for controlled use of water and nighttime watering.
- Sprinkler systems in City parks were designed with controlled nozzle sizes and equal overlap to minimize areas of overwatering.
- The City Council had given the City Manager emergency water management authority including drought management.

In addition to the foregoing measures, which were in effect at the time the City's Water Conservation Plan was prepared and continue to be implemented, the following water conservation measures were adopted as part of the City's Water Conservation Plan. These measures were selected by the City as being both effective and acceptable to the public.

- An expanded program offering free water conservation surveys for all water utility customers. The surveys identify areas of excessive water use and promote water conservation.

- A water conservation education and outreach program for water utility customers and the general public. The program provides presentations and water conservation information for public schools, community service groups, and major water users.
- A continuation of annual water block rate increases.
- Cooperate in conversion to drought-resistant landscaping at ENMU.

These additional conservation measures were considered to be consistent with and mutually supportive of the existing measures. Increasing the cost of water and educating the public on the decreasing water availability were expected to provide incentives for conservation, while the water conservation surveys, water conservation outreach program, and ENMU's conversion to drought-resistant landscaping were expected to provide information and examples of how to reduce water use. The potential water savings from these additional conservation measures were estimated and are summarized below.

Potential Water Savings from Additional Conservation Measures

Additional Conservation Measure	Potential Overall System Savings	Notes
Conservation Water Audits	2%	Assume 20% of customers get 10% savings
Education and Outreach Program	3%	Program will also support other conservation measures
Conservation Water Rates	7%	Savings expected to range from 5% to 10%
Cooperate in Conversion to Drought-Resistant Landscaping at ENMU	1%	Assume 15% savings for 9% of system use
Total Potential System Savings	**13%**	

The comparison in Figure 1 of the actual total water pumped against the projected water uses demonstrates that the City has regularly exceeded its water conservation goals, with total water demands that are less than those expected both with and without additional conservation. The current 5-year average per-capita water use of 163 gpcd is down from over 200 gpcd a decade ago and exceeds the 167 gpcd goal.

Significant accomplishments in water conservation since the water conservation plan was adopted are identified below.

City Hall Rainwater Harvesting and Xeric Landscaping Demonstration. This example of xeric landscaping supplements the example provided by ENMU and is ongoing. Rainwater from the City Hall roof is collected in two 1,500-gallon tanks and pumped to a xeric demonstration garden in front of the Portales City Hall. The irrigation demand is expected to be about 5,000 gallons per year. The system became operational in September 2005 and is designed to harvest an average of 7,500 gallons per year. The City of Portales has prepared a brochure describing the system and providing information on xeric landscaping.

Water Rates. The five-year schedule of increasing water rates was renewed by the City Council in 2001 and again in 2007 and 2012. The current schedule extends to 2017 and raises most rates by 10% in the first year and 5% per year thereafter. Raising water rates has been found to be one of the most effective methods for increasing conservation awareness. Higher water rates also provide funding for rising water costs and help cushion "rate shock" when more expensive water must eventually be used.

Roadside Demonstration Gardens. Three xeric demonstration gardens were developed in 2005, located along highway NM 206 connecting Portales with Lovington and at the north and south entrances to town along US 70. In addition, a mile-long xeric garden was established in 2009 in the median along US 70 north of town. These gardens provide ongoing examples of xeric landscaping.

Hardscaping of Residential Gardens. An increasing number of residences are converting their gardens to xeric hardscaping by replacing grass and shrubs with decorative gravel and highly drought-resistant plants. These conversions are believed to be encouraged by increasing water rates and the availability of educational information on xeric landscaping.

Alternating Day Watering. In 2012 the City initiated a voluntary program of watering every other day with no watering on Mondays or between 10 am and 6 pm daily. Flyers announcing the program were prepared in English and Spanish and distributed with water quality testing results in the City's Consumer Confidence Report. The alternate day watering program is expected to further increase awareness of water conservation and reduce residential water demands.

Water Meter Replacement. Replacement water meters were installed at 554 locations in 2012. The old meters often measured less than the actual flow and the improved accuracy and reliability of the replacement meters is expected to result in additional water savings. Many of these replacement meters support the City's new Automatic Meter Reading (AMR) system.

Expanded Water Metering. The City reduced its unmetered water use in 2011 by installing meters at the City's swimming pool and in City parks. In addition, portable meters have been provided for fire hydrant and street department use.

Automatic Water Metering. The City is installing a fixed base Automatic Meter Reading (AMR) system that will allow water meters to be read at City Hall through a wireless network. The City is progressively replacing existing water meters with automatic meters that are more accurate and the increased accessibility to consumption data is expected to reduce water losses. The AMR system became operational in 2010.

Wastewater Recycling. A wastewater reuse study commissioned by the City was completed in 2009. The study concluded that the City may benefit from wastewater recycling and recommended a more detailed study. A Preliminary Engineering Report for upgrading the City's wastewater treatment plant was completed in 2012 and the upgrade is planned to be completed in the summer of 2015. The treated wastewater is planned to be used to irrigate the City's parks and golf course. Wastewater recycling could supply more than 25% of the City's current water demand and is expected to significantly reduce demands on the City's wellfields.

4.0 CONSERVATION MEASURE PERFORMANCE

As shown in Figure 1, the City's water use has been consistently below the goals established in the 40-Year Water Plan since 2006. The City's long term ability to exceed its water use reduction goals is attributed to the continuing effectiveness of the City's conservation measures despite a very dry year. Since the year 2000, the first year of the projection, the City's total water use has averaged over 125 million gallons per year less than the projected average water demand with additional conservation measures, indicating that the City is exceeding its conservation goals. The total water savings in this period amounted to 1.6 billion gallons.

An increasing conservation ethic is demonstrated in other measures as well as in total water use. Residential water use is most sensitive to the City's water conservation measures and was 160 million gallons below the peak demand of a decade ago in 2012 despite a very dry year. Per capita water use has also continued to decline. As previously noted, the per capita water use in 2012 was 139 gallons per person per day (gpcd). By comparison, values less than 200 gpcd are considered good. The City's conservation measures are working and the City remains on track in progressively reducing its total water demand.

5.0 RECOMMENDED ACTIONS AND IMPROVEMENTS

Although the City's water conservation measures are clearly working as described above, the diagnostic data for the City's wellfields indicate that they are nearing the end of their useful lives as high yield sources of municipal supply. The City's total pumping capacity in January 2013 was on the order of 3,000 gpm, whereas a more comfortable capacity would be 5,000 gpm. The nine-year average depletion rate of 2.9 feet/year compared with an average remaining aquifer thickness of 38 feet in January 2013 provides a very rough estimate of about 13 years remaining aquifer life (to about 2026 if current conditions persist) as a high yield source of municipal supply. This is not to say the aquifer will cease to exist, but some wells would be dry and those that have water would likely be unable to support current water demands. It will be necessary to continue to add new wells to the system to withdraw previously untapped water from the City's groundwater reserve if the average depletion rate is to be kept below 3 feet/year, but the number of new wells needed to maintain this depletion rate may not be economically feasible unless the demands on its wellfields are significantly reduced or supplemental water supplies from sources other than the City's wellfields are obtained.

In 2013 the City requested a review of alternative sources of water supplies (Wilson 2013). In summary, this review provided the following conclusions.

Shallow Groundwater. Shallow groundwater in the area around Portales is drawn from the Ogallala Aquifer, the same aquifer that supplies the City's wellfields. This aquifer is being rapidly depleted due to regional pumping and the remaining water is insufficient to provide a long term municipal supply. However, the aquifer could provide a short term, interim supply at some locations.

Deep Groundwater. Deep groundwater from below the Ogallala Aquifer would be expensive to extract, of poor quality requiring extensive treatment, likely of low quantity, and would not provide a renewable supply. Deep groundwater is not a promising source of municipal supply for Portales and is not recommended to be pursued.

Surface Water. The only viable surface water supply for Portales is from Ute Reservoir on the Canadian River. A pipeline to supply this water has been approved and construction began in 2013. Portales has participated in this project from its conception and has reserved a supply approximately equal to its 2013 total water demand. Although the pipeline is scheduled to be completed by about 2025, delays are possible and perhaps even likely. A big advantage of a Ute Reservoir supply is that it is renewed by precipitation in the Canadian River watershed. However, the Ute Reservoir supply will be reduced during droughts and the City will need to have a water supply reserve to draw upon if the curtailment is significant.

The eight additional wells that are being prepared as additions to the Blackwater Wellfield are expected to increase the City's pumping capacity and help keep the depletion rate low. However, the beneficial effects of these additional wells may only last a few years unless accompanied by even more wells and/or substantial decreases in wellfield demand. The ongoing improvements in water conservation, and especially the upcoming availability of treated wastewater for irrigating City parks, will significantly reduce wellfield demands. Together these efforts will extend the useful lives of the wellfields for several years. It is also prudent to reduce demand so that a groundwater reserve can be maintained for use in drought years when the supply from an alternative source, such as Ute Reservoir, is inadequate to meet demand.

It is fortunate for Portales that an alternative, renewable source of water supply is available from Ute Reservoir. It is also fortunate that the projected timing of the availability of that supply is consistent with the projected timing of the need for that supply. However, both the timing of the Ute supply and the timing of the need for that supply are uncertain. The availability of Ute water may be delayed due to funding and other constraints, and the need for that water may occur sooner than expected. As documented in the aforementioned water supply alternatives report, it is recommended that the City take steps to reduce the risk of future water supply shortfalls by implementing increasingly stringent water conservation measures. To provide context to a delay in Ute water delivery, if Ute Project completion is delayed by 5 years to 2030, it would be prudent for Portales to reduce its wellfield demand by 40% to abut 700 million gallons/year by 2016 to help bridge the gap caused by such a delay. Although such a reduction is significant, it can be accomplished by maintaining existing conservation measures in place and by focusing on the following additional measures:

- Using treated wastewater to irrigate City parks currently irrigated with water from the City's wellfields, reducing demand by an estimated 25 to 30 percent, and
- Converting residential and commercial landscaping to drought-resistant plants and hardscapes, reducing demand by an estimated 10 to 15 percent.

The potential combined reduction in demand of 35 to 45 percent from these two conservation measures would achieve the recommended goal. Even if the Ute Project is completed and

Canadian River water is available in Portales by 2025, the additional water stored in the City's wellfields would help provide an emergency supply during drought years when deliveries of Canadian River water are strictly curtailed.

In summary, a strengthening of the City's overall management program for both its water demand and supply sides is needed to keep up with the declining aquifer and maintain a strategic reserve for drought years. The fact remains, however, that the aquifer supplying the City is a finite resource and the current management plan of satisfying the City's water needs by regularly increasing the number of wells cannot continue indefinitely even if the City drastically decreases its water demand. In the long term, Portales needs to find another source of supply. As in the past, it is recommended that the City strengthen its current management plan by aggressively decreasing demand through water conservation, by regularly increasing the number of active wells, by seeking opportunities to increase its groundwater reserve, and by pursuing opportunities to develop a supplemental, renewable water supply. The most viable option for acquiring a supplemental, renewable water supply continues to be a surface water supply from Ute Reservoir.

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Table 1. Water Consumption Summary (thousands of gallons)

Year	Metered Water Use						Unmetered Water Use	Total Water Use	Percent Unmetered
	Residential	Commercial	Industrial	ENMU	Other	Total			
1995	711,197	64,171	182,696	148,658	121,616	1,228,338	233,900	1,462,238	16.0
1996	677,391	64,479	114,751	124,913	109,396	1,090,930	171,797	1,262,727	13.6
1997	649,535	54,643	141,197	110,127	106,352	1,061,854	149,715	1,211,569	12.4
1998	793,650	59,699	196,016	129,068	138,792	1,317,225	94,705	1,411,930	6.7
1999	673,804	61,260	196,293	117,404	99,275	1,148,036	61,420	1,209,456	5.1
2000	807,178	63,306	214,943	103,939	83,290	1,272,656	163,815	1,436,471	11.4
2001	738,274	65,897	233,632	103,490	88,948	1,230,241	129,281	1,359,522	9.5
2002	747,317	63,822	240,073	139,837	71,031	1,262,080	124,520	1,386,600	9.0
2003	755,034	66,096	311,904	148,632	67,070	1,348,736	119,539	1,468,275	8.1
2004	660,681	64,718	327,268	90,935	49,804	1,193,406	104,194	1,297,600	8.0
2005	715,339	64,523	356,571	80,216	71,147	1,287,796	154,164	1,441,960	10.7
2006	717,229	65,046	329,008	80,421	85,986	1,277,690	101,716	1,379,406	7.4
2007	603,512	67,695	386,589	54,378	72,414	1,184,588	120,827	1,305,415	9.3
2008	629,508	69,034	345,454	57,300	71,002	1,172,298	73,894	1,246,192	5.9
2009	600,659	66,914	248,014	59,170	69,485	1,044,242	194,667	1,238,909	15.7
2010	590,263	61,067	245,839	55,305	55,417	1,007,891	241,742	1,249,633	19.3
2011	700,542	61,762	350,086	51,939	60,818	1,225,147	22,899	1,248,046	1.8
2012	641,811	56,348	173,895	57,365	79,730	1,009,149	115,759	1,124,908	10.3
Five-Year Averages								**1,221,538**	**10.6**

Table 2. Unmetered Water Use Estimates (thousands of gallons)

Year	City Parks	Fire Hydrants	Storage Tank Overflows	Known Leaks	Other Unmetered[a]	Unaccounted For	Total Unmetered	Total Water Use	Percent Unaccounted For
1999	20,435	12,506	5,000	1,000	0	22,479	61,420	1,209,456	1.9
2000	20,212	1,335	20	100	0	142,148	163,815	1,436,471	9.9
2001	10,217	1,170	0	250	0	117,644	129,281	1,359,522	8.7
2002	10,217	203	0	275	650	113,175	124,520	1,386,600	8.2
2003	10,217	175	0	150	625	108,372	119,539	1,468,275	7.4
2004	7,400	1,045	[b]	[b]	[b]	95,749	104,194	1,297,600	7.4
2005	10,217	175	0	150	625	142,997	154,164	1,441,960	9.9
2006	10,217	175	0	150	625	90,549	101,716	1,379,406	6.6
2007	10,217	225	50	1,250	650	108,435	120,827	1,305,415	8.3
2008	10,217	225	50	150	625	62,627	73,894	1,246,192	5.0
2009	10,217	225	50	150	625	183,400	194,667	1,238,909	14.8
2010	10,217	225	50	150	625	230,475	241,742	1,249,633	18.4
2011	10,217	225	50	150	625	11,632	22,899	1,248,046	0.9
2012	10,217	225	50	150	625	104,492	115,759	1,124,908	9.3
Five-Year Averages								**1,221,538**	9.7

a. The "Other Unmetered" category includes Roosevelt County, sewer truck, and Fire Department uses.
b. In 2004, fire hydrant use included storage tank overflows, known leaks, and other unmetered uses.
c. Estimates of unmetered water use were not available for 2012 and were assumed the same as in 2011.

Table 3. Annual Precipitation at Portales

Calendar Year	Total Annual Precipitation (inches)	Five-Year Running Average Precipitation (inches)
1990	13.99	18.63
1991	21.06	19.28
1992	18.99	18.01
1993	16.37	17.05
1994	11.17	16.32
1995	15.56	16.63
1996	17.93	16.00
1997	20.96	16.40
1998	13.16	15.76
1999	17.15	16.95
2000	16.00	17.04
2001	12.74	16.00
2002	16.35	15.08
2003	7.66	13.98
2004	25.87	15.72
2005	13.27	15.18
2006	17.91	16.21
2007	17.91	16.52
2008	13.90	17.77
2009	17.13	16.02
2010	17.07	16.78
2011	8.11	14.82
2012	8.31	12.90
Average (1990-2012)	**15.59**	**- -**
Long Term Average (1912-2012)	**16.54**	**- -**

Table 4. Population Estimates for Water Utility Department Service Area

Date	City of Portales	Surrounding Rural Area	Eastern New Mexico University[3]	Total Service Area Population
1950	8,112	- -	- -	- -
1960	9,695	- -	- -	- -
1970	10,554	- -	- -	- -
1980	10,750	- -	3,701	- -
1990	10,690	- -	3,683	- -
1995	11,438[1]	2,710[4]	3,632	17,780
2000	11,131	2,588[4]	3,224	16,943
2001	11,160[2]	2,581[4]	3,251	16,992
2002	11,220[2]	2,654[4]	3,638	17,512
2003	11,280[2]	2,716[4]	3,725	17,721
2004	11,320[2]	2,790[4]	3,959	18,069
2005	11,358[2]	2,886[4]	4,052	18,296
2006	11,404[2]	2,944[4]	4,135	18,483
2007	11,450[2]	2,999[4]	4,180	18,629
2008	11,497[2]	3,077[4]	4,300	18,874
2009	11,590[2]	3,121[4]	4,685	19,349
2010	12,280	3,740[4]	5,080	21,100
2011	12,401[5]	3,761[4]	5,574	21,736
2012	12,524[5]	3,842[4]	5,814	22,180

Data are April 1 figures from U.S. Census Bureau unless otherwise stated.
1. Population is July 1 estimate from U.S. Census Bureau, June 30, 1999.
2. Estimates based on 1990-2000 rate of population increase.
3. Fall semester student populations from planning staff, Eastern New Mexico University.
4. Estimates based on number of active Roosevelt County Water Coop hookups in December of the subject year, an average of 2.7 persons per household in 1995, an average of 2.3 persons per household from 2000 to 2009 (based on 2000 U.S. Census Bureau data), and an average of 2.7 persons per household in 2010 and subsequent years (based on 2010 U.S. Census Bureau data).
5. Estimates based on 2000-2010 rate of population increase.

Table 5. Per Capita Water Use

Year	Estimated Service Area Population[1]	Consumption without Industrial Use		Consumption with all Uses	
		Total Water Use[2] (1000 gallons)	Per Capita Water Use (gpcd)	Total Water Use[2] (1000 gallons)	Per Captia Water Use (gpcd)
1995	17,780	1,279,542	197	1,462,238	225
1996	18,300	1,147,976	172	1,262,727	189
1997	18,700	1,070,372	157	1,211,569	178
1998	19,300	1,215,914	173	1,411,930	200
1999	19,700	1,013,163	141	1,209,456	168
2000	16,943	1,221,528	198	1,436,471	232
2001	16,992	1,125,890	182	1,359,522	219
2002	17,512	1,146,527	179	1,386,600	217
2003	17,721	1,156,371	179	1,468,275	227
2004	18,069	970,332	147	1,297,600	197
2005	18,296	1,085,389	163	1,441,960	216
2006	18,483	1,050,398	156	1,379,406	204
2007	18,629	918,826	135	1,305,415	192
2008	18,874	900,738	131	1,246,192	181
2009	19,349	990,895	140	1,238,909	175
2010	21,100	1,003,794	130	1,249,633	162
2011	21,736	897,960	113	1,248,046	157
2012	22,180	951,013	118	1,124,908	139
Five-Year Average	**- -**	**- -**	**126**	**- -**	**163**

Notes:

1. Population estimates from Table 4.
2. Water use data from Table 1.

Table 6. Diagnostic Data for City of Portales Blackwater Wellfield

Year	Average Depletion Rate (feet/year)		Average Aquifer Saturated Thickness (feet)	Average Well Specific Capacity (gpm/foot)
	Long Term	Short Term		
2002	2.4	2.5	- -	- -
2003	2.6	2.7	- -	- -
2004	2.7	2.9	64	- -
2005	2.6	2.3	61	16.9
2006	2.4	0.3	60	15.1
2007	2.7	2.3	68	15.5
2008	2.7	3.0	55	15.3
2009	2.8	3.4	56	- -
2010	2.8	3.5	42	- -
2011	2.8	3.9	43	10.9
2012	2.7	2.8	38	8.7
2013			38	7.9

Table 7. Estimated Winter 2013 Aquifer Characteristics in the City of Portales Blackwater Wells

Well Number	(1) Depth to Static Water in Winter 2013[1] (ft)	(2) Depth to Top of Redbeds[4] (ft)	(3) = (2) – (1) Total Saturated Thickness in Winter 2013 (ft)	(4) Pumping Drawdown in Winter 2013[1] (ft)	(5) = (4) / (3) Ratio of Pumping Drawdown to Saturated Thickness	(6) Production Pumping Rate in Winter 2013[1] (gpm)	(7) = (6) / (4) Specific Capacity of Well in Winter 2013 (gpm/ft)	(8) = (3) – (4) – 5 ft Unutilized Saturated Thickness Remaining in Winter 2013[2] (ft)
BW-1[3]	Out of Service	170						
BW-2	134.47	172	37.5	23.6	0.63	162	6.9	9.0
BW-3	147.27	190	42.7	12.7	0.30	53	4.2	25.0
BW-4	142.54	180	37.5	8.6	0.23	49	5.7	23.9
BW-5	161.50	198	36.5	15.6	0.43			15.9
BW-6	139.65	198	58.4	25.1	0.43	100	4.0	28.3
BW-7	156.49	205	48.5	34.9	0.72	180	5.2	8.6
BW-8	165.42	205	39.6	18.5	0.47	100	5.4	16.1
BW-9	152.90	179	26.1					
BW-10	152.71	202	49.3					
BW-11	164.60	196	31.4	22.4	0.71	90	4.0	4.0
BW-12	164.36	195	30.6	22.1	0.72	68	3.1	3.5
BW-13	176.41	223	46.6	23.6	0.51	140	5.9	18.0
BW-14	175.08	212	36.9	22.1	0.60	30	1.4	9.8
BW-15	134.32	200	65.7					
BW-16	133.36	200	66.6	33.1	0.50	153	4.6	28.6
BW-17	165.61	211	45.4	18.7	0.41	150	8.0	21.7
BW-18	166.44	210	43.6	23.6	0.54	134	5.7	15.0
BW-19	151.94	172	20.1					
BW-20	163.69	180	16.3	6.2	0.38	45	7.2	5.1
BW-21	151.09	170	18.9	2.3	0.12	42	18.5	11.6
BW-22	167.01	190	23.0			29		
BW-23	157.38	182	24.6	16.5	0.67	31	1.9	3.2
BW-24	167.88	185	17.1	5.6	0.33			6.5
BW-25	177.95	200	22.1					
BW-26	154.64	180	25.4	12.5	0.49	184	14.7	7.8
BW-27	150.48	185	34.5	6.3	0.18	155	24.4	23.2
BW-28	166.93	199	32.1	13.8	0.43	112	8.1	13.2
BW-29	172.15	206	33.9					
BW-30	146.72	179	32.3	15.4	0.48	82	5.3	11.9
BW-31	171.22	190	18.8	2.7	0.15	26	9.5	11.1
BW-32	126.50	170	43.5	16.9	0.39	205	12.1	21.6

Table 7. Estimated Winter 2013 Aquifer Characteristics in the City of Portales Blackwater Wells (Continued)

Well Number	(1) Depth to Static Water in Winter 2013[1] (ft)	(2) Depth to Top of Redbeds[4] (ft)	(3) = (2) – (1) Total Saturated Thickness in Winter 2013 (ft)	(4) Pumping Drawdown in Winter 2013[1] (ft)	(5) = (4) / (3) Ratio of Pumping Drawdown to Saturated Thickness	(6) Production Pumping Rate in Winter 2013[1] (gpm)	(7) = (6) / (4) Specific Capacity of Well in Winter 2013 (gpm/ft)	(8) = (3) – (4) – 5 ft Unutilized Saturated Thickness Remaining in Winter 2013[2] (ft)
BW-33	135.00							
BW-34	130.48	168	37.5					
BW-35	116.67	170	53.3					
BW-36	113.94	168	54.1					
BW-37	117.46	165	47.5					
BW-38	123.82	197	73.2					
BW-39	130.74	178	47.3					
BW-40	127.48							
BW-41	139.97	175	35.0	19.4	0.55	153	7.9	10.6
BW-42	158.51	200	41.5	19.6	0.47	320	16.3	16.9
2013 Total						2793		
2013 Average	150.07	189	38.3	17.0	0.46	112	7.9	14.2

Note: Blank cells indicate no data.

1. Information from City of Portales well logs and monitoring data. Water levels and production pumping rates were measured in January 2013.
2. Residual saturated zone thickness during pumping taken as 5 feet.
3. Well BW-1 was taken out of service in 2004.
4. Depth to top of redbeds estimated based on total well depth for BW-31 (193 ft), BW-34 (170 ft), BW-38 (200 ft), and BW-39 (180 ft). No driller's logs are available for these wells.

Table 8. Estimated Winter 2013 Aquifer Characteristics in the City of Portales Sandhill Wells

Well Number	(1) Depth to Static Water in Winter 2013[1] (ft)	(2) Depth to Top of Redbeds[1] (ft)	(3) = (2) – (1) Total Saturated Thickness in Winter 2013 (ft)	(4) Pumping Drawdown in Winter 2013[1] (ft)	(6) Production Pumping Rate in Winter 2013[1] (gpm)	(7) = (6) / (4) Specific Capacity of Well in Winter 2013 (gpm/ft)	(8) = (3) – (4) – 5 ft Unutilized Saturated Thickness Remaining in Winter 2013[2] (ft)
SH-1	112.69	135	22.3	2.2	54	24.1	15.1
SH-2	Dry	132					
SH-3	116.77	130	13.2		150		
SH-4		122			70		
SH-5	109.32	126	16.7	7.8			3.8
SH-6	99.65	113	13.4				
SH-7	96.49	108	11.5				
2013 Total	- -	- -	- -	- -	274	- -	- -
2013 Average	106.98	124	15.4	5.0	91	24.1	9.5

Note: Blank cells indicate no data.

Figure 1. Actual and Projected Total Water Demands

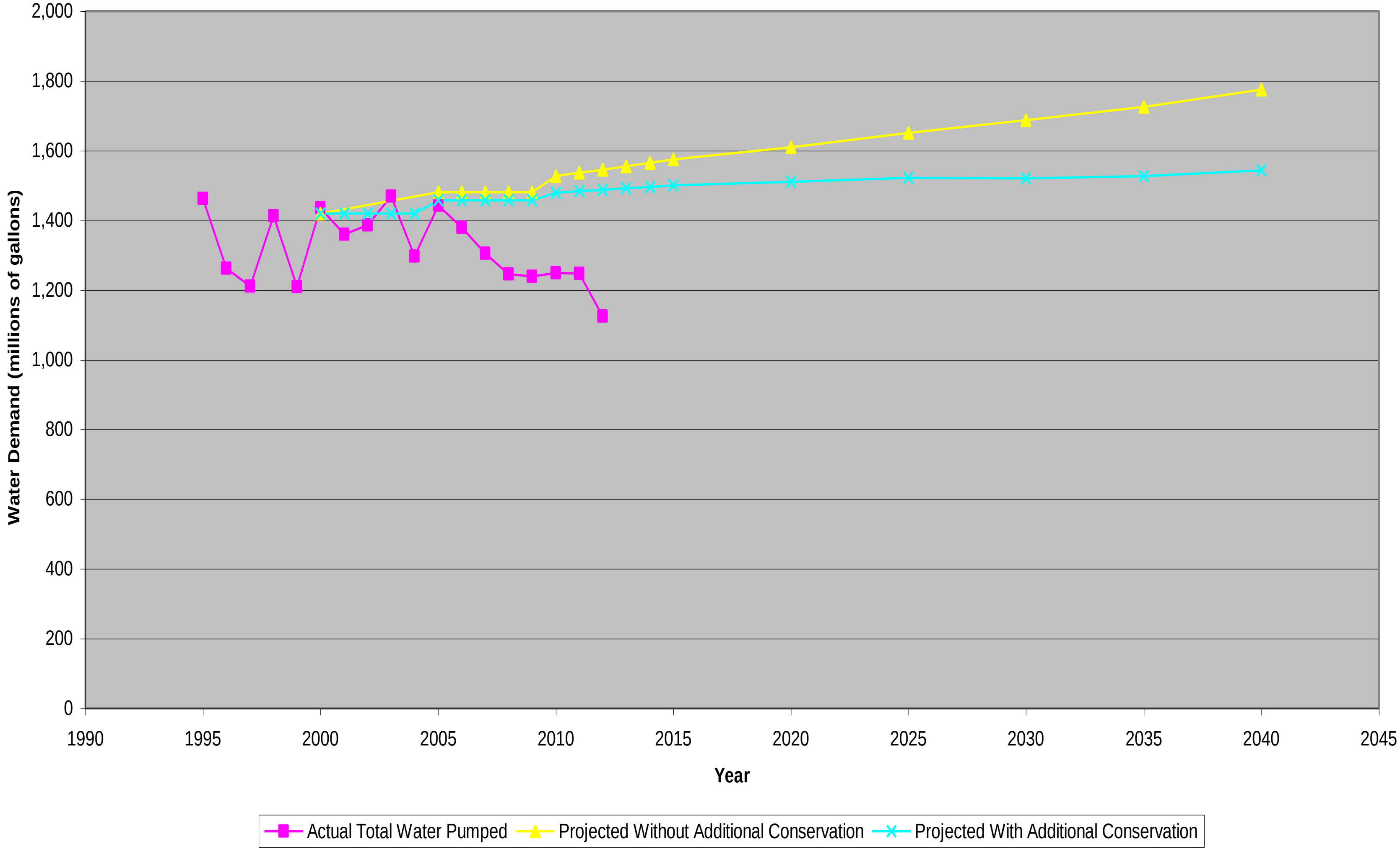


Figure 2. Historic Annual Water Demand by Category

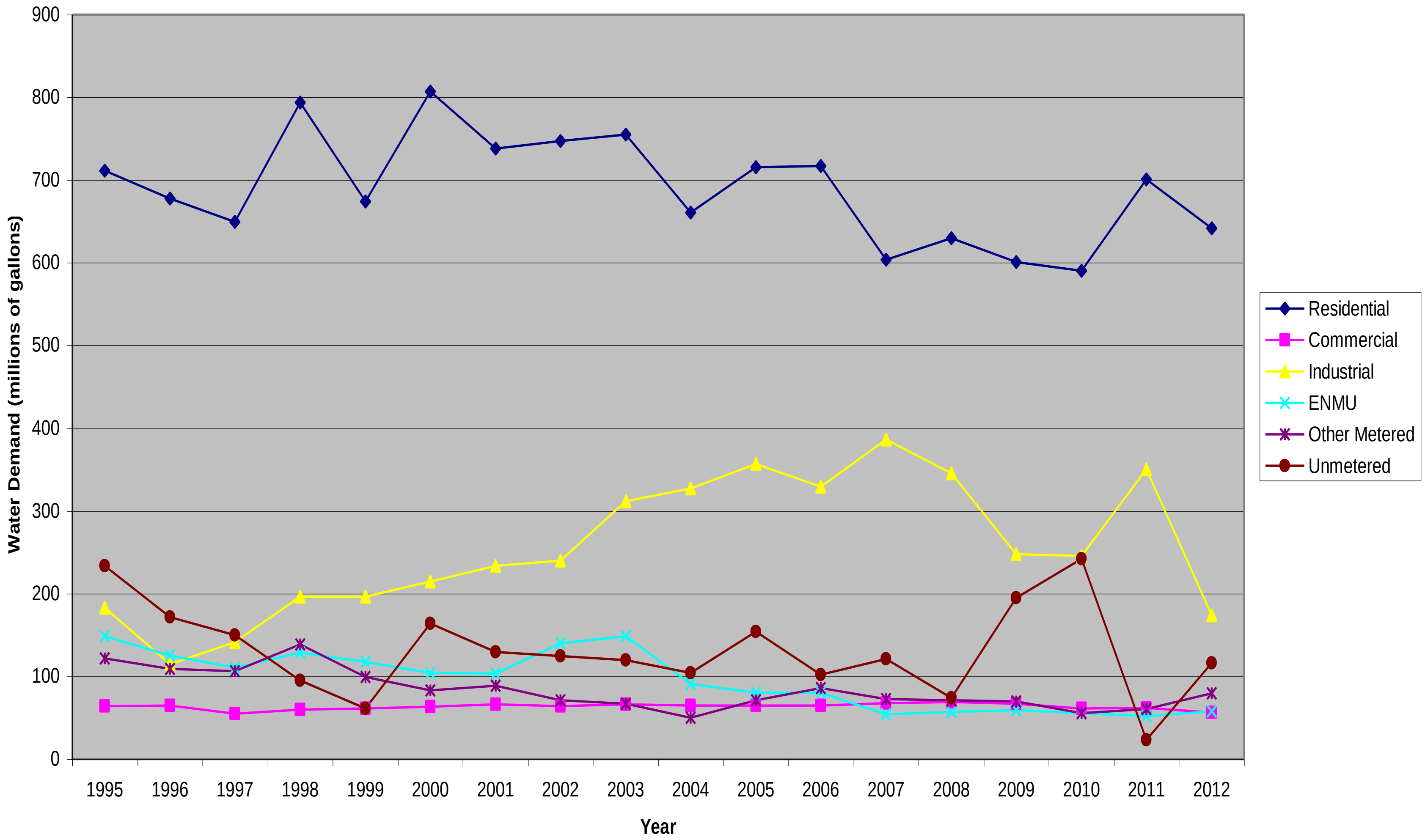


Figure 3. Annual Precipitation at Portales

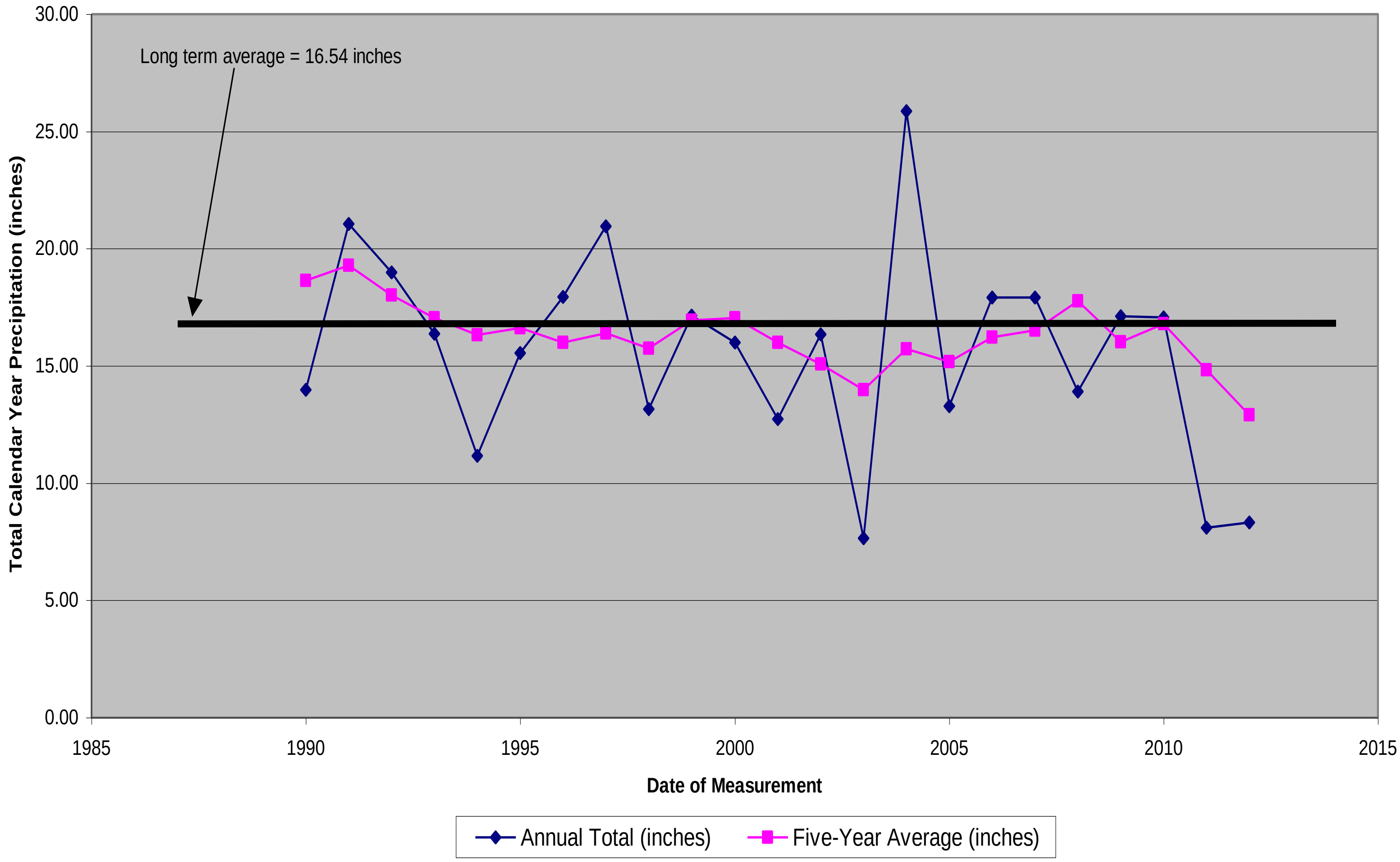


Figure 4. Precipitation vs. Water Demand

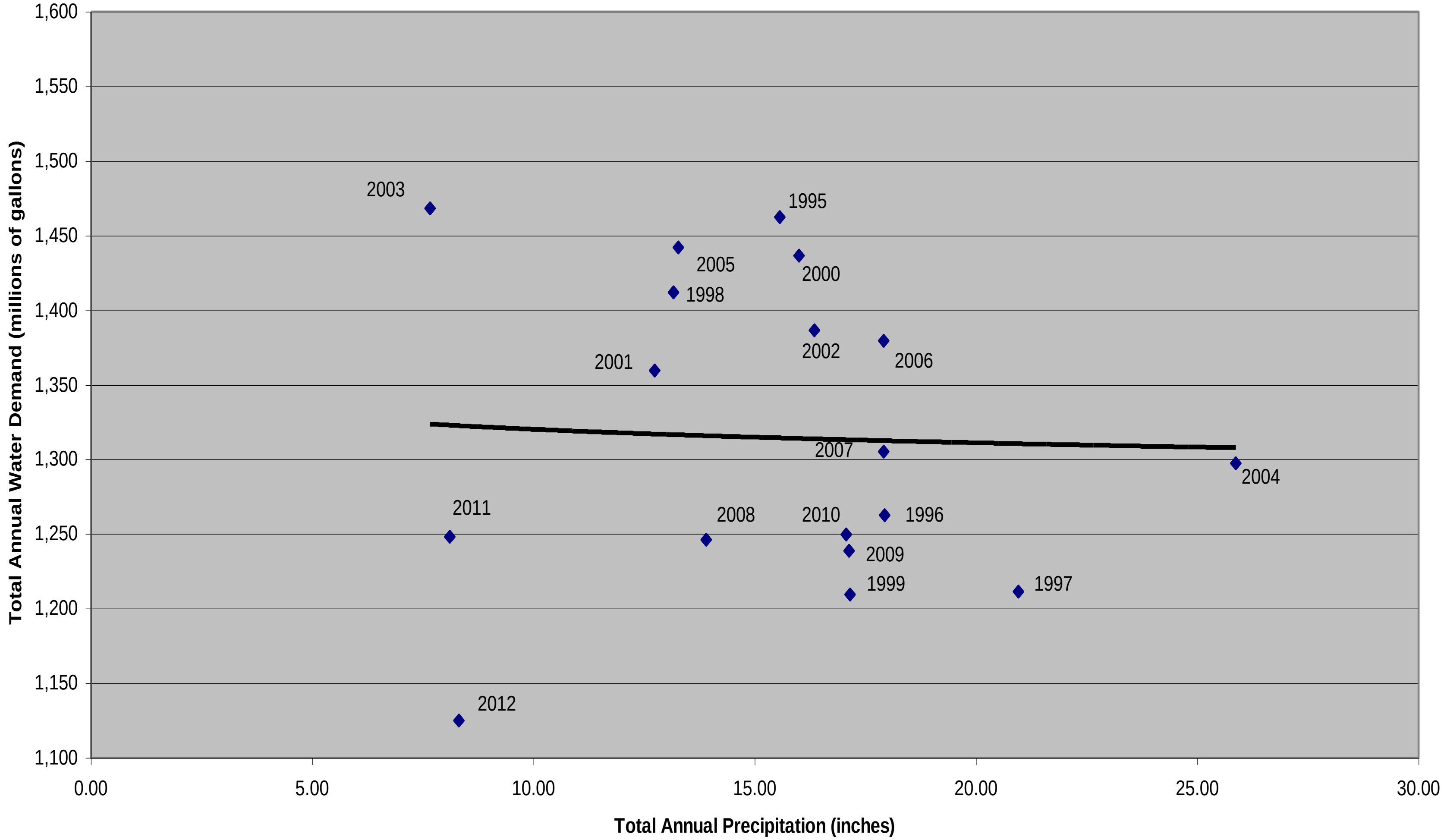
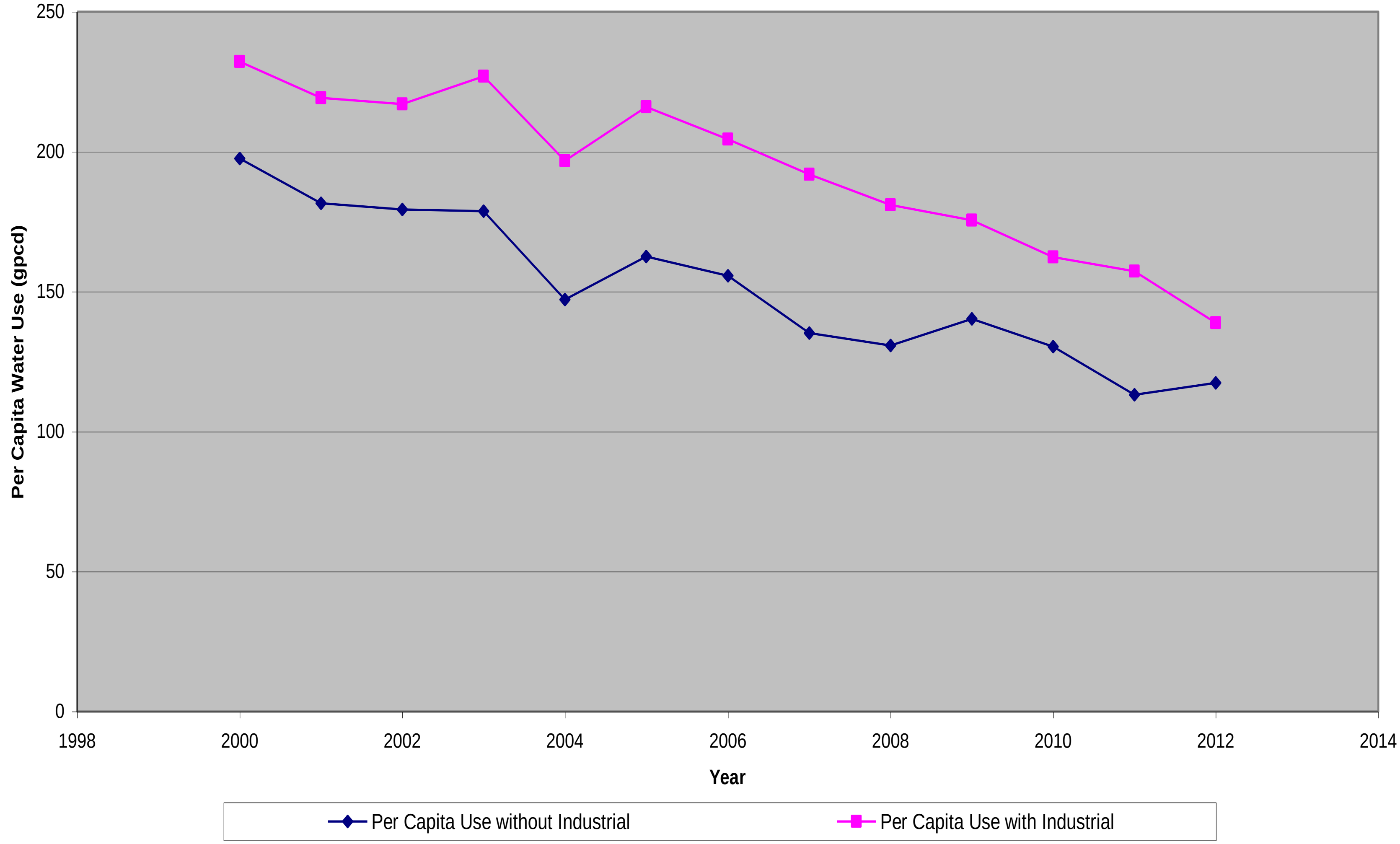


Figure 5. Per Capita Water Use



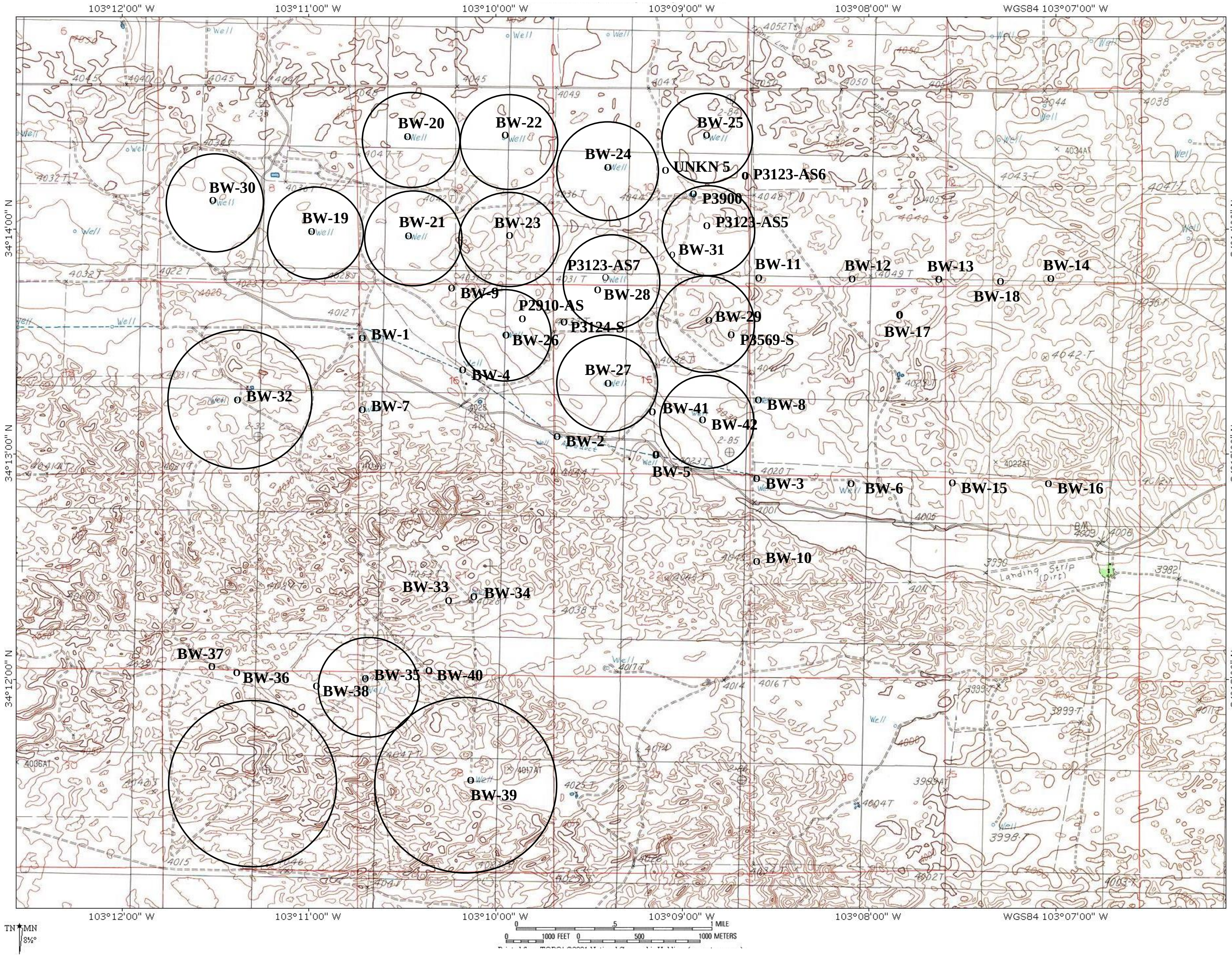


Figure 6. Map of the Blackwater Wellfield

Figure 7. Historic Water Levels in Wells BW-1 through BW-9

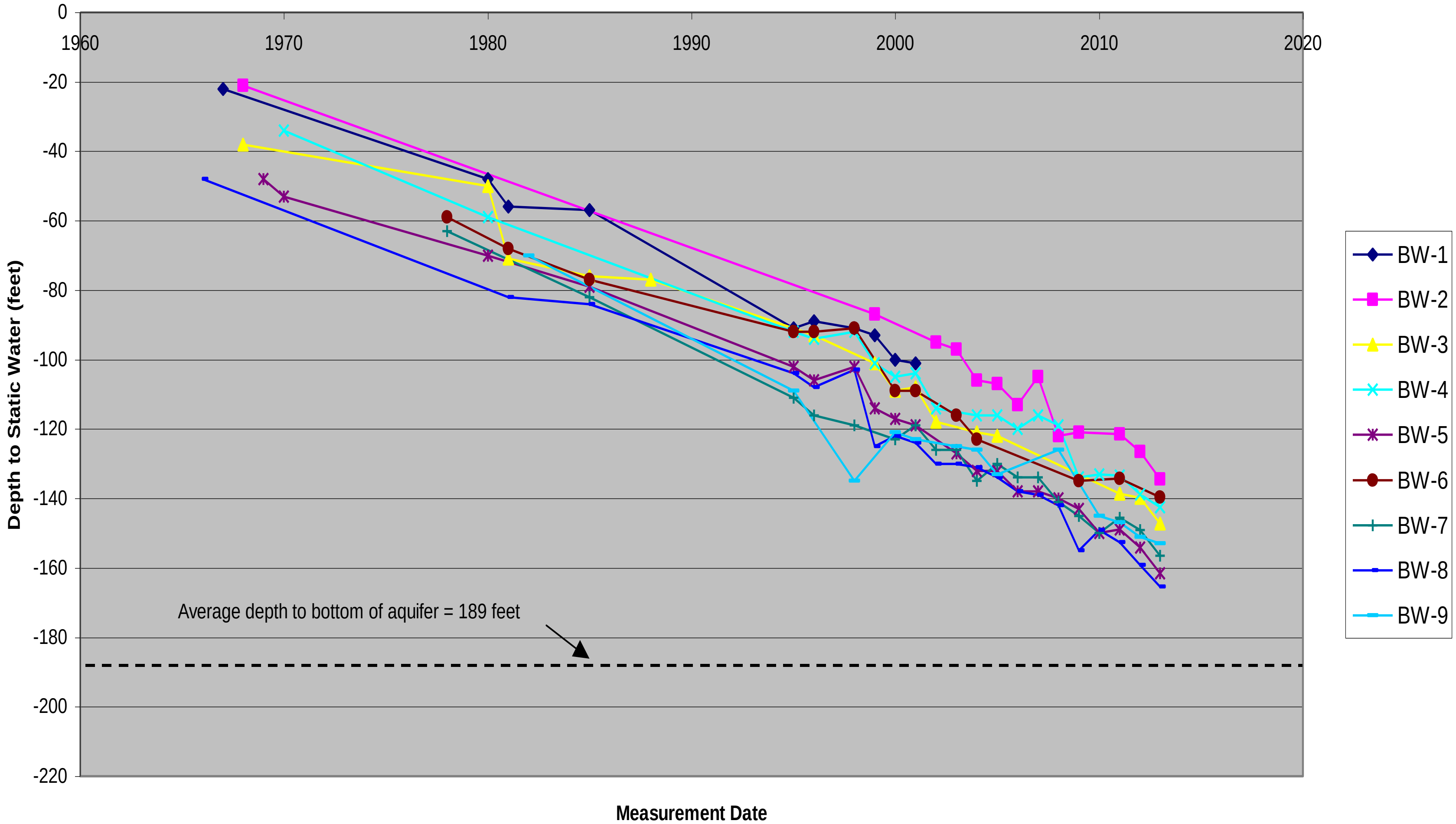


Figure 8. Historic Water Levels in Wells BW-10 through BW-18

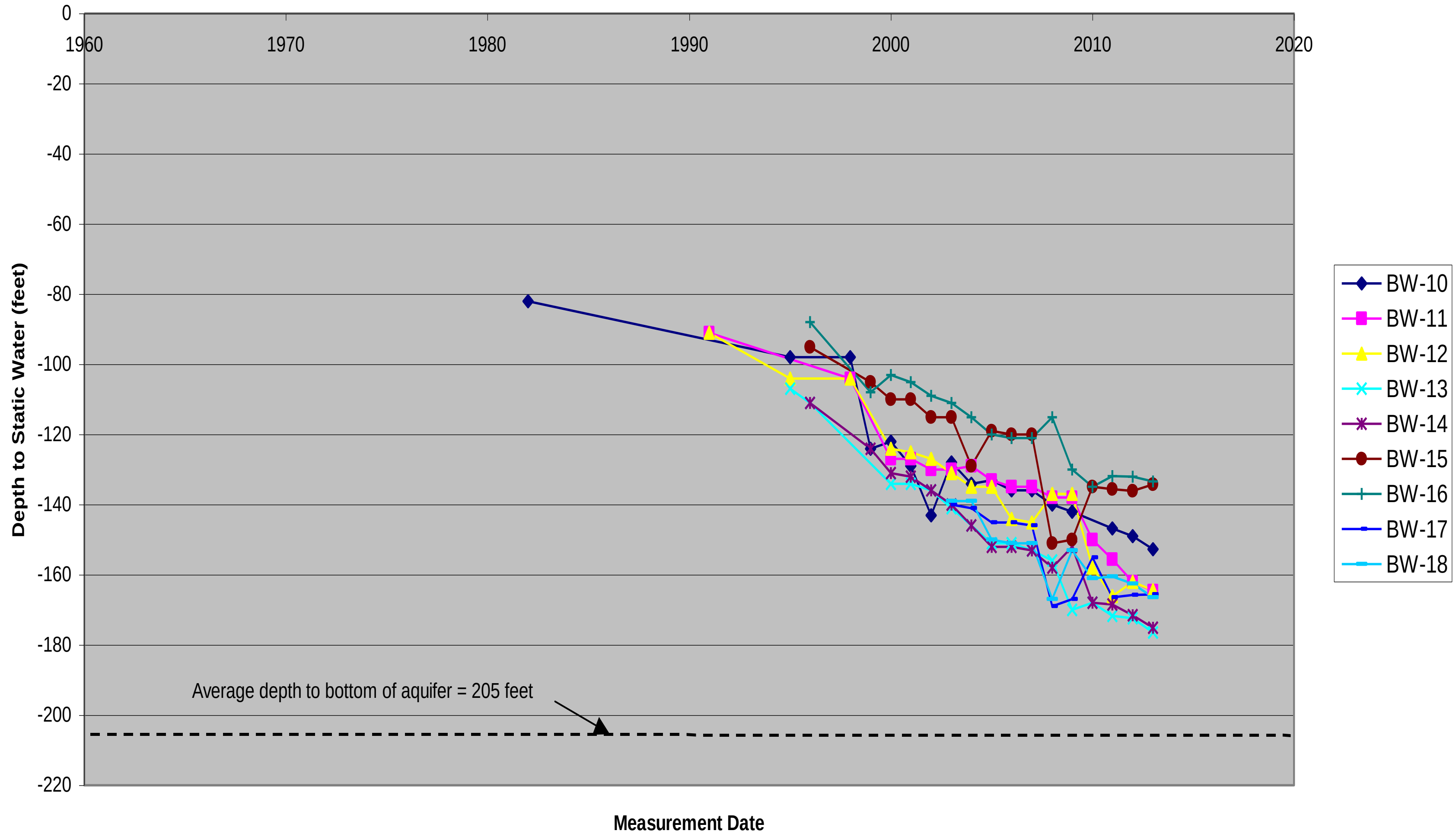


Figure 9. Historic Water Levels in Wells BW-19 through BW-27

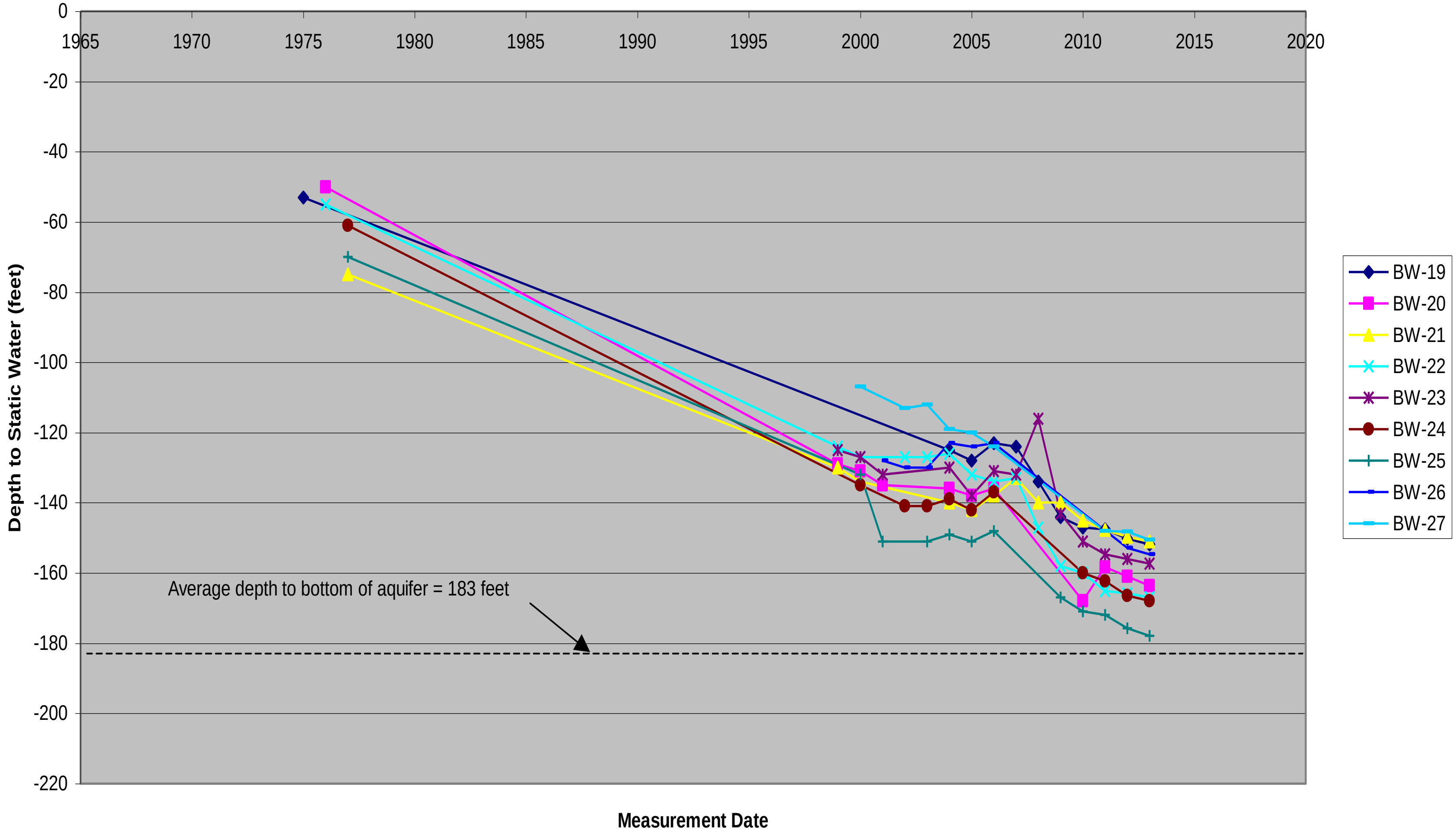


Figure 10. Historic Water Levels in Wells BW-28 through BW-36

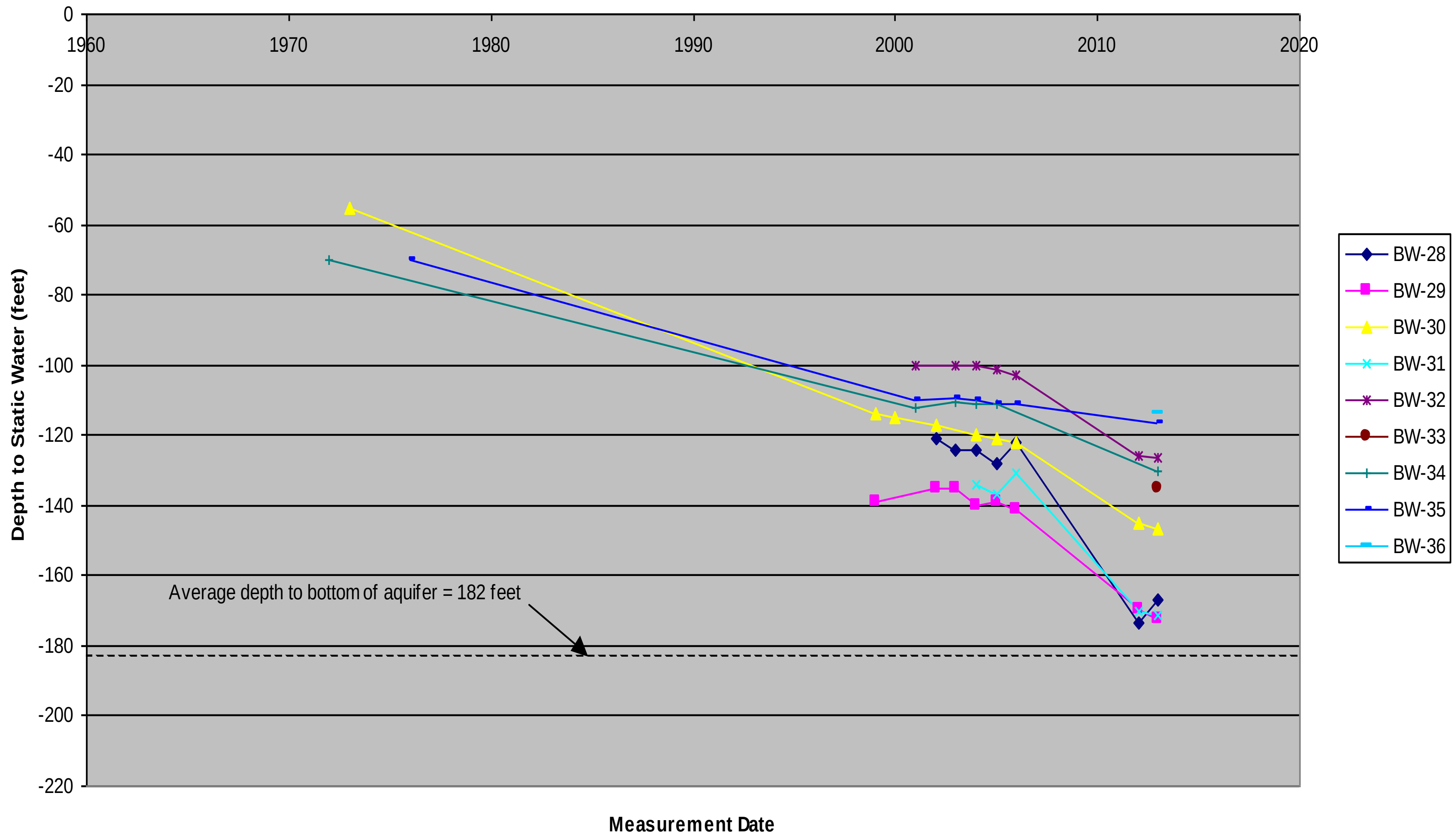


Figure 11. Historic Water Levels in Wells BW-37 through BW-42

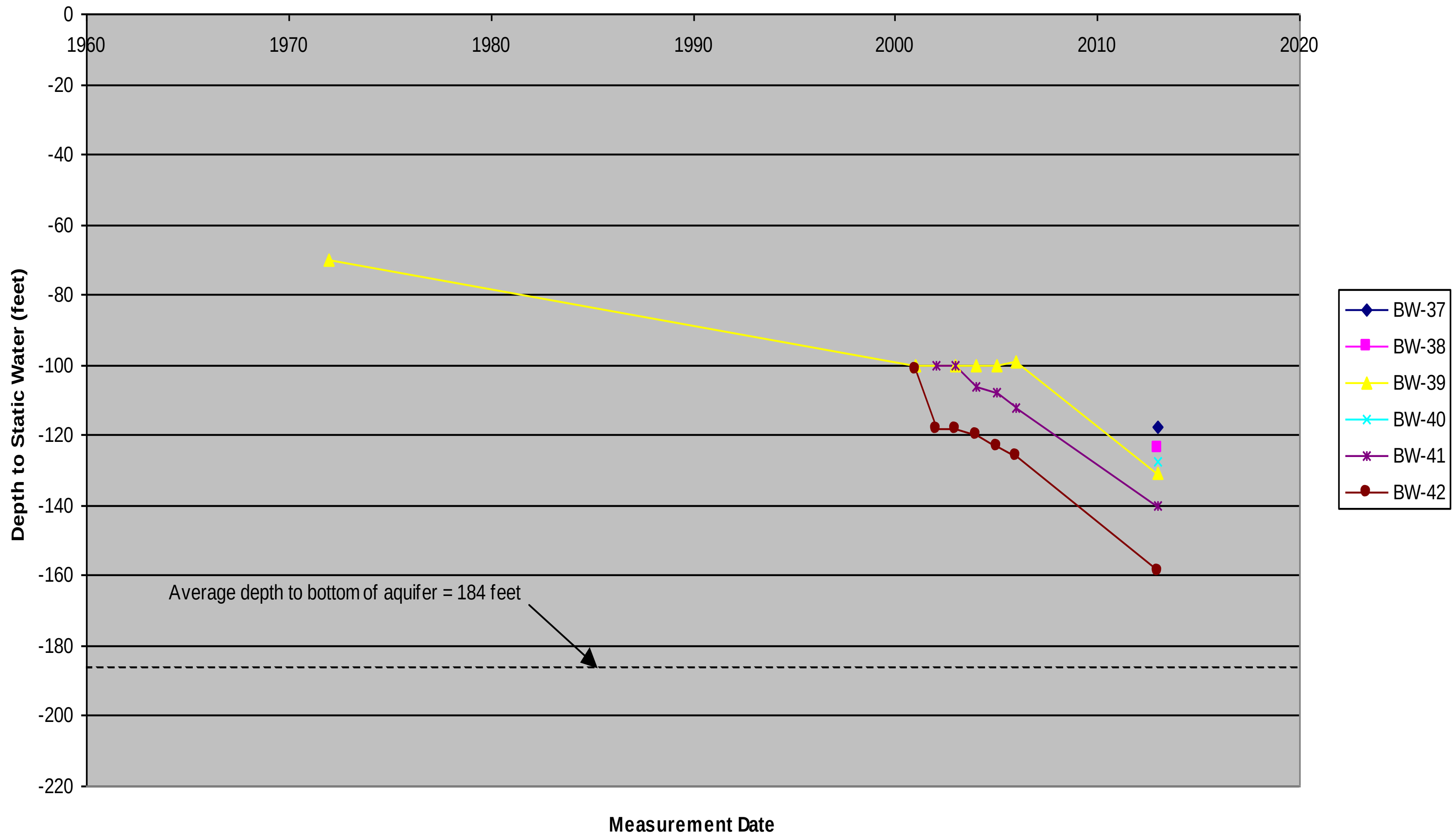


Figure 12. Historic Yields in Wells BW-1 through BW-9

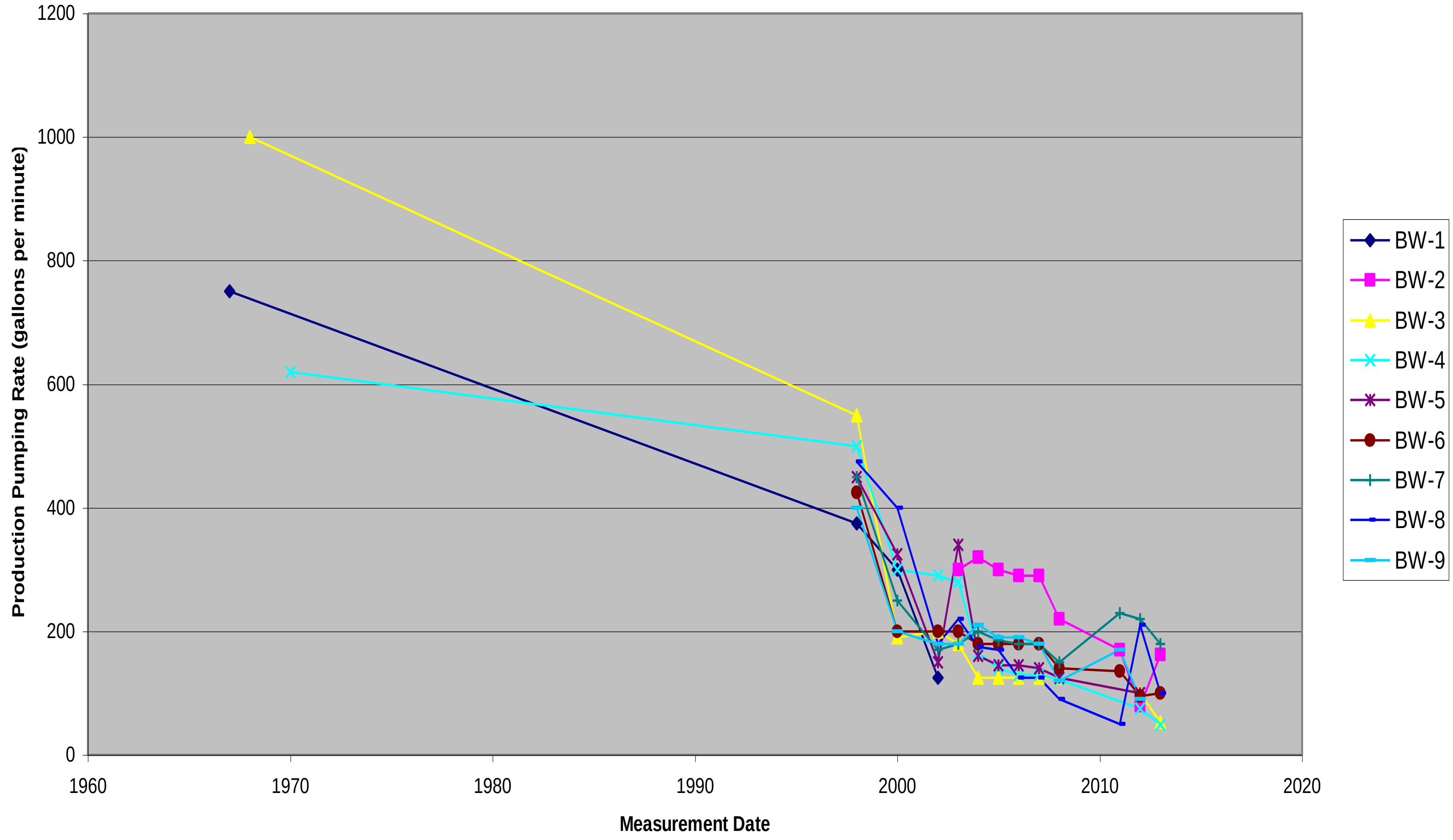


Figure 13. Historic Yields in Wells BW-10 through BW-18

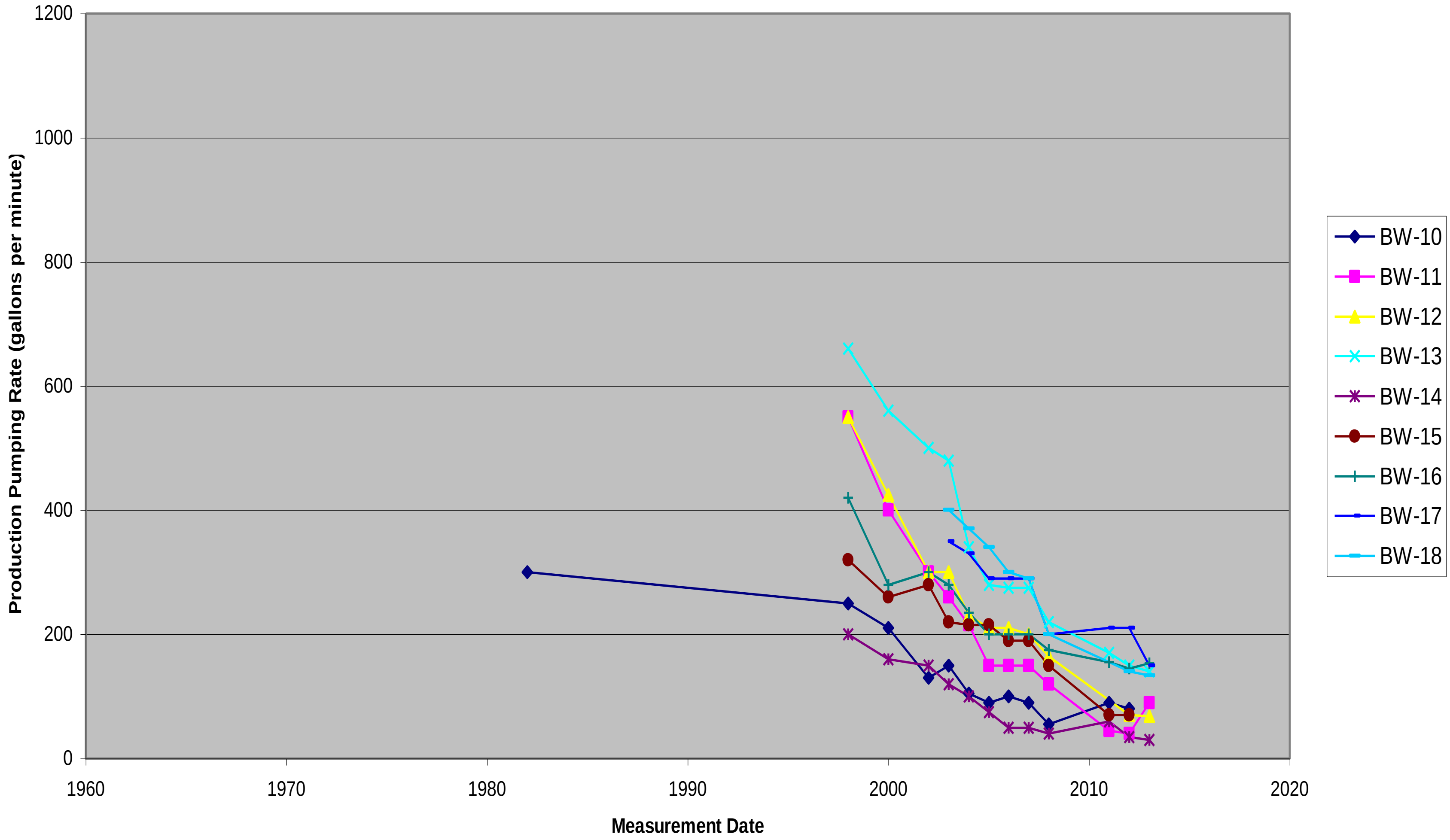


Figure 14. Historic Yields in Wells BW-19 through BW-27

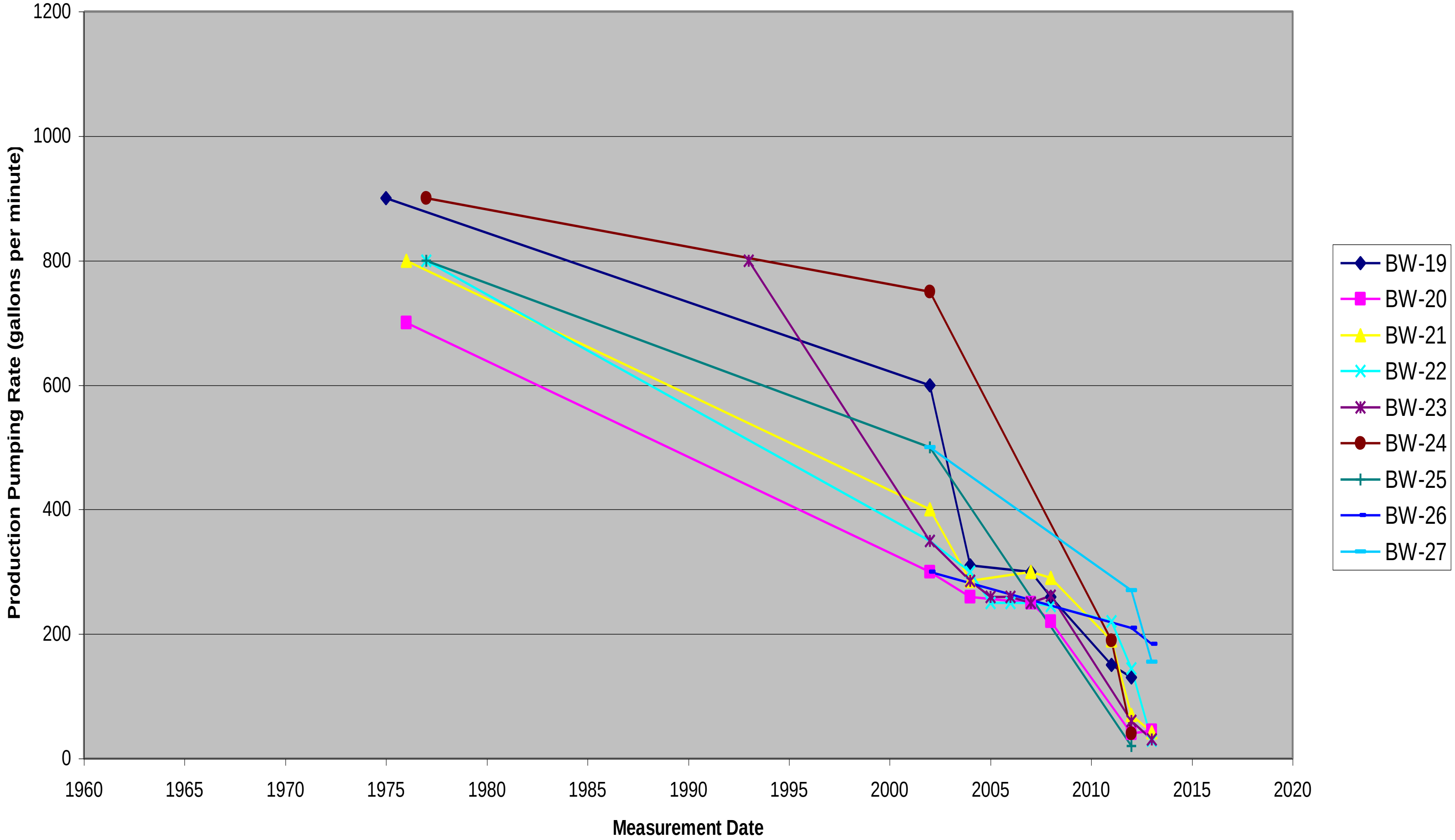


Figure 15. Historic Yields in Wells BW-28 through BW-36

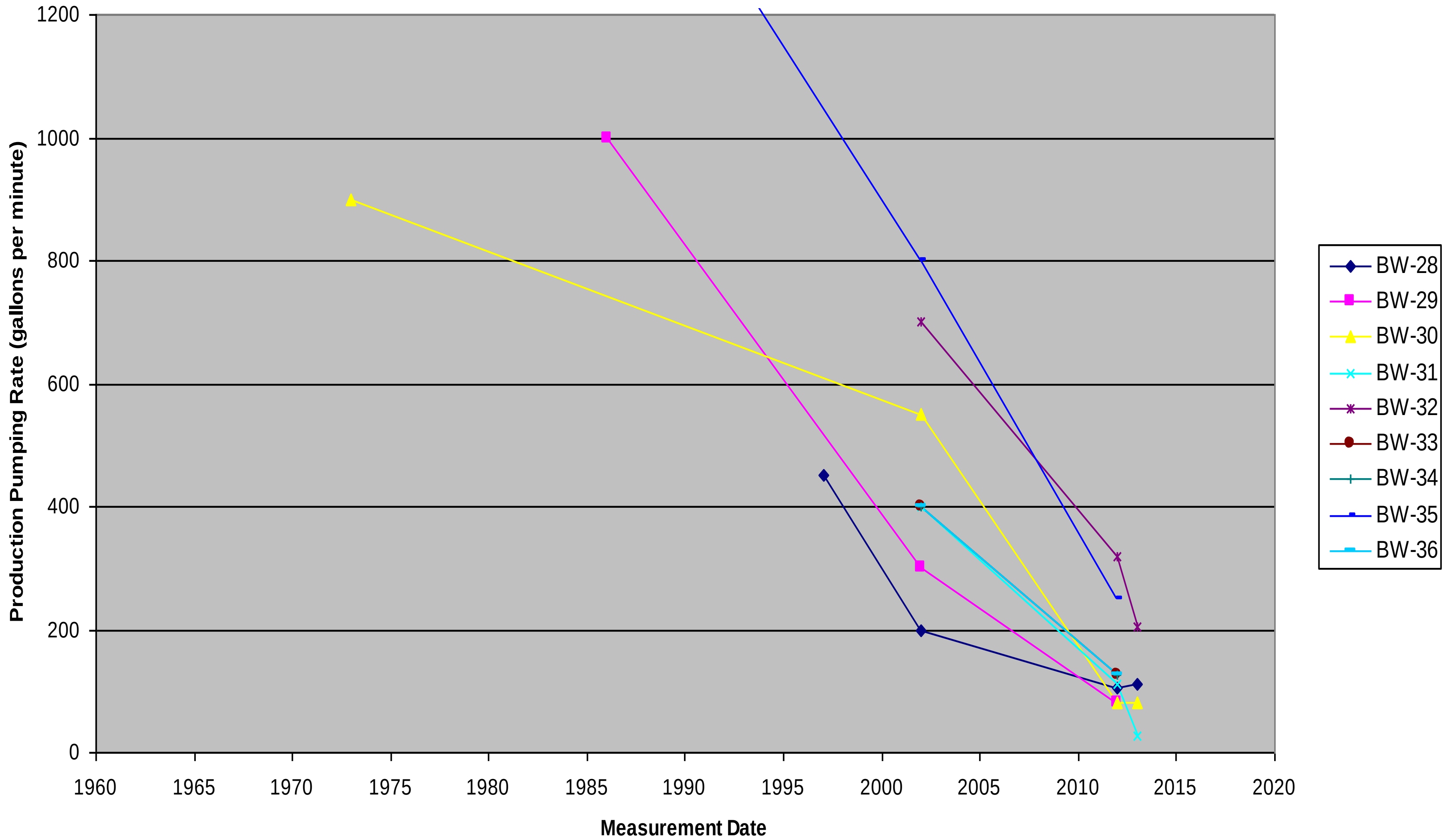


Figure 16. Historic Yields in Wells BW-37 through BW-42

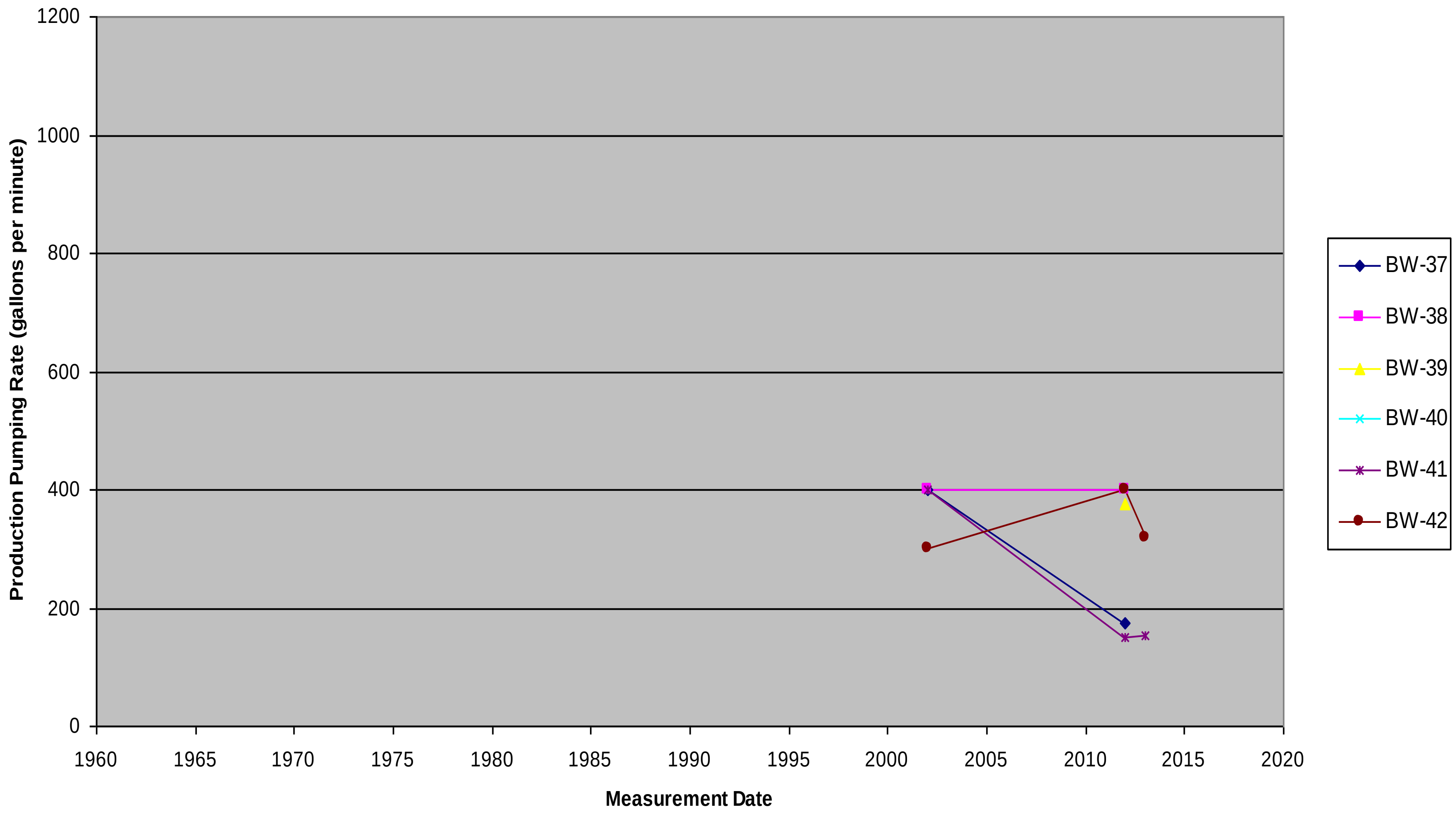


Figure 17. Historic Water Levels in Wells SH-1 through SH-7

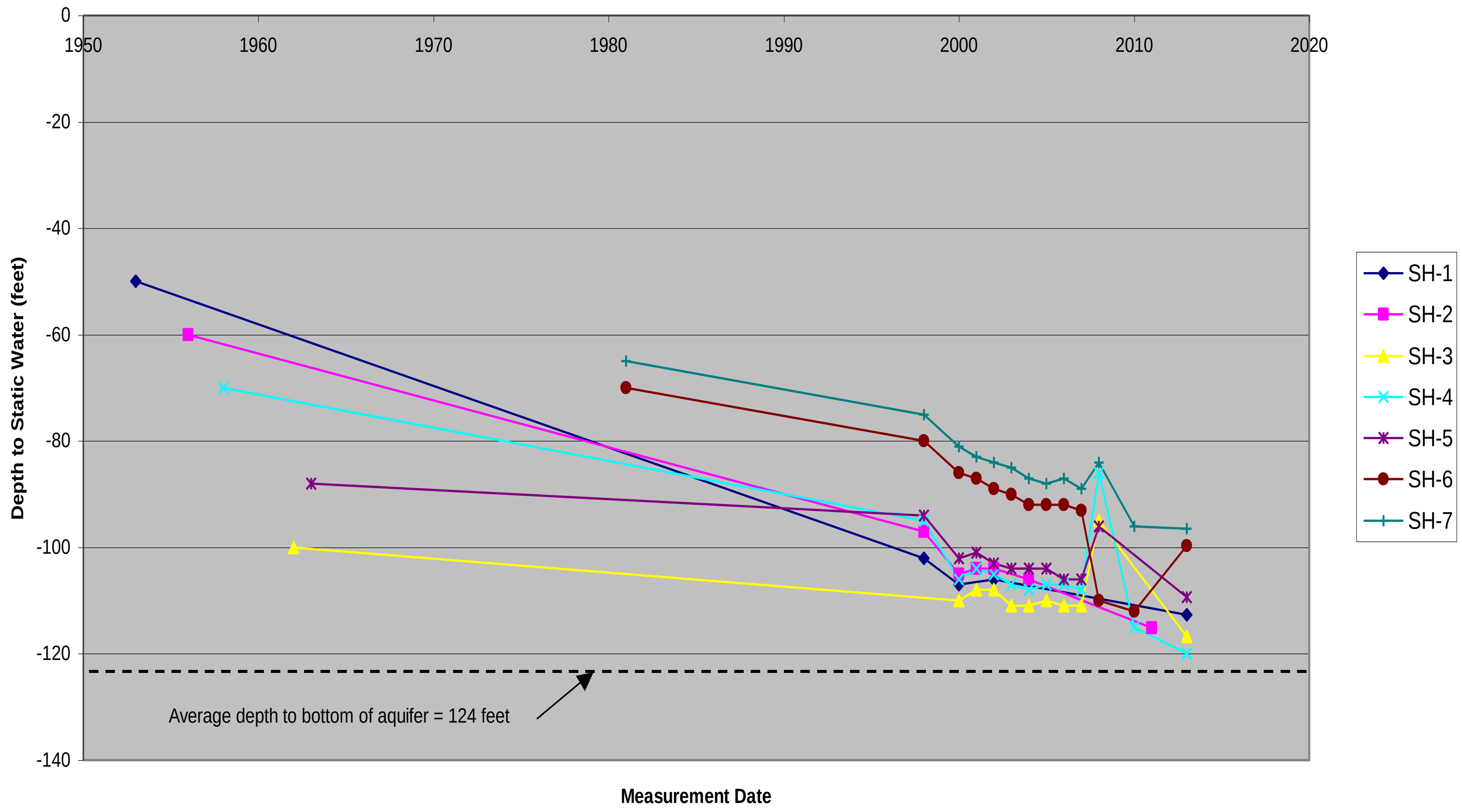
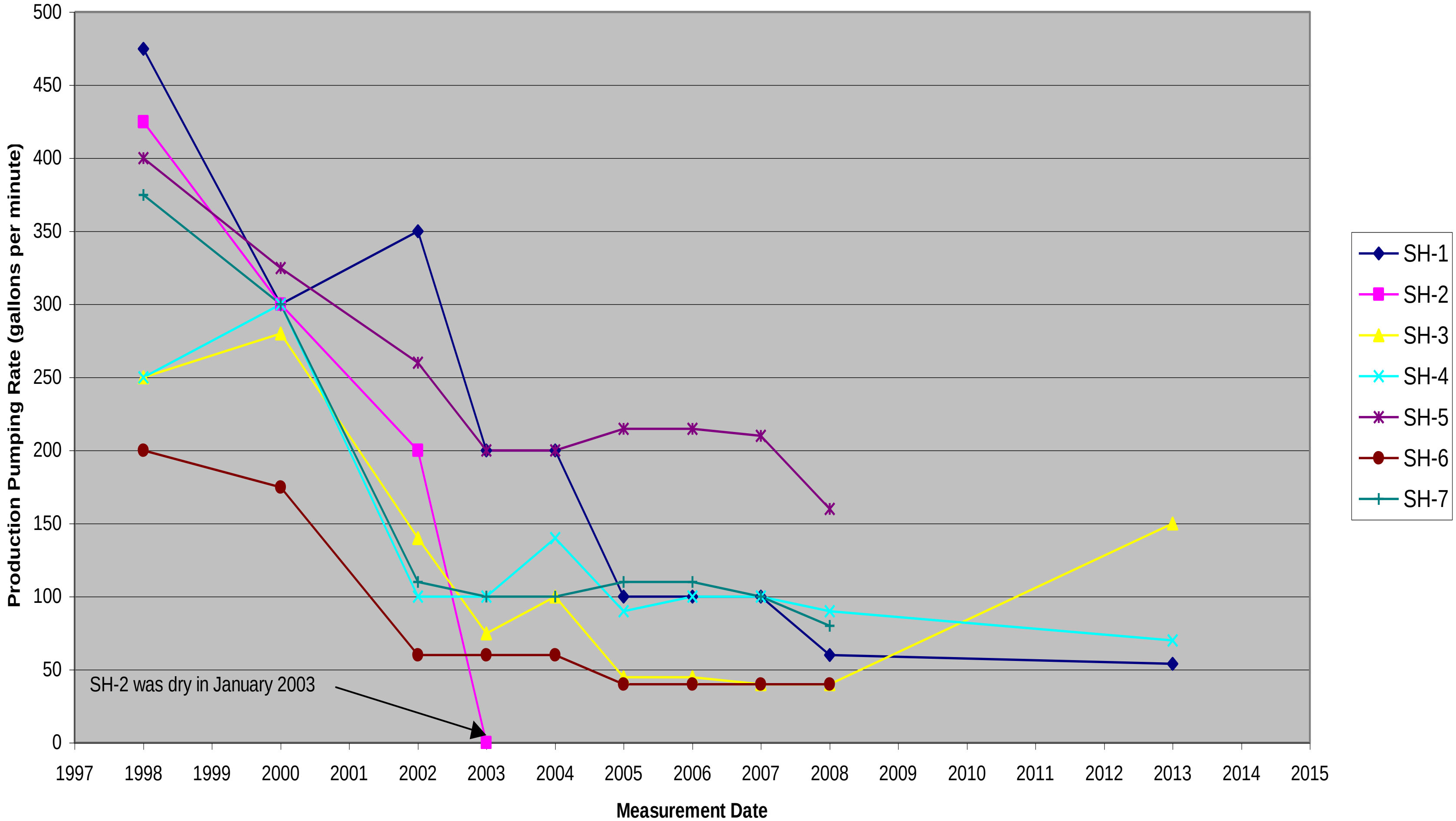


Figure 18. Historic Yields in Wells SH-1 through SH-7



Appendix A

Historic Depletion Rates in the City of Portales Blackwater Wells

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2201 (BW-1)	1967	1967	750	22	- -
		1980	- -	48	- -
		June 1981	- -	53	- -
		December 1981	- -	56	- -
		1985	- -	57	- -
		1995	- -	91	- -
		1996	- -	89	- -
		1998	375	91	- -
		April 1999	- -	93	- -
		January 2000	300	100	- -
		January 2001	- -	101	- -
		January 2002	125	(4)	- -
		January 2003	- -	(4)	- -
		January 2004	- -	(4)	- -
		January 2005	- -	Out of Service	- -
	Long Term Average				**Out of Service**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2201-S (BW-2)	1968	February 1968	800	21	- -
		April 1999	- -	87	- -
	2001[5]	September 2001	- -	No Data	- -
		January 2002	300	95	- -
		January 2003	300	97	- -
		January 2004	320	106	- -
		January 2005	300	107	- -
		January 2006	290	113	- -
		January 2007	290	105	- -
		January 2008	220	122	- -
		January 2009	- -	121	- -
		January 2010	- -	No Data	- -
		March 2011	170	122	- -
		January 2012	200	126.56	- -
		January 2013	162	134.47	- -
	Long Term Average				**-2.5**
	Current Five -Year Average				**-2.5**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2202 (BW-3)	1968	1968	1,000	38	- -
		1980	- -	50	- -
		June 1981	- -	66	- -
		December 1981	- -	71	- -
		1985	- -	76	- -
		1988	- -	77	- -
		1996	- -	93	- -
		1998	550	70[1]	- -
		April 1999	- -	101	- -
		January 2000	190	109	- -
		January 2001	- -	108	- -
		January 2002	200	118	- -
		January 2003	180	(4)	- -
		January 2004	125	121	- -
		January 2005	125	122	- -
		January 2006	125	No Data	- -
		January 2007	125	No Data	- -
		January 2008	125[13]	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		March 2011	- -	139	- -
		January 2012	- -	139.89	- -
		January 2013	53	147.27	- -
	Long Term Average				**-2.4**
	Current Five -Year Average				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2201-S-2 (BW-4)	1969	1970	620	34	- -
		1980	- -	59	- -
		June 1981	- -	62	- -
		1995	- -	92	- -
		1996	- -	94	- -
		1998	500	92	- -
		April 1999	- -	101	- -
		January 2000	300	105	- -
		January 2001	- -	104	- -
		January 2002	290	114	- -
		January 2003	280	(4)	- -
		January 2004	165	116	- -
		January 2005	140	116	- -
		January 2006	130	120	- -
		January 2007	130	116	- -
		January 2008	122	119	- -
		January 2009	- -	134	- -
		January 2010	- -	133	- -
		March 2011	- -	133	- -
		January 2012	147	138.79	- -
		January 2013	49	142.54	- -
	Long Term Average				**-2.5**
	Current Five -Year Average				**-4.7**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2401 Renumbered P-2201-S-3 In 1977 (BW-5)	1968	1969	- -	48	- -
		1970	- -	53	- -
		1980	- -	70	- -
		June 1981	- -	89	- -
		1985	- -	79	- -
		1995	- -	102	- -
		1996	- -	106	- -
		1998	450	102	- -
		April 1999	- -	114	- -
		January 2000	325	117	- -
		January 2001	- -	119	- -
		January 2002	150	(4)	- -
		January 2003	340	127	- -
		January 2004	160	132	- -
		January 2005	145	132	- -
		January 2006	145	138	- -
		January 2007	140	138	- -
		January 2008	125[13]	140	- -
		January 2009	- -	143	- -
		January 2010	- -	150	- -
		March 2011	- -	149	- -
		January 2012	- -	154.10	- -
		January 2013	- -	161.50	- -
	Long Term Average				**-2.6**
	Current Five -Year Average				**-4.3**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2403 (BW-6)	1978	1978	- -	59	- -
		June 1981	- -	62	- -
		December 1981	- -	68	- -
		1985	- -	77	- -
		1995	- -	92	- -
		1996	- -	92	- -
		1998	425	91	- -
		January 2000	200	109	- -
		January 2001	- -	109	- -
		January 2002	200	(4)	- -
		January 2003	200	116	- -
		January 2004	180	123	- -
		January 2005	180	No Data	- -
		January 2006	180	No Data	- -
		January 2007	180	No Data	- -
		January 2008	140[13]	No Data	- -
		January 2009	- -	135	- -
		January 2010	- -	No Data	- -
		March 2011	135	134	- -
		January 2012	- -	No Data	- -
		January 2013	100	139.65	- -
	Long Term Average				**-2.3**
	Current Five -Year Average				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3475-S (BW-7)	1978	1978	- -	63	- -
		June 1981	- -	81	- -
		1985	- -	82	- -
		1995	- -	111	- -
		1996	- -	116	- -
		1998	450	119	- -
		January 2000	250	123	- -
		January 2001	- -	119	- -
		January 2002	170	126	- -
		January 2003	180	126	- -
		January 2004	200	135	- -
		January 2005	185	130	- -
		January 2006	180	134	- -
		January 2007	180	134	- -
		January 2008	150[13]	141	- -
		January 2009	- -	145	- -
		January 2010	- -	150	- -
		March 2011	230	146	- -
		January 2012	187	149.09	- -
		January 2013	180	156.49	- -
	Long Term Average				**-2.7**
	Current Five -Year Average				**-3.1**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2402 (BW-8)	1966	1966	1,100	48	- -
		June 1981	- -	75	- -
		December 1981	- -	82	- -
		1985	- -	84	- -
		1995	- -	104	- -
		1996	- -	108	- -
		1998	475	103	- -
		April 1999	- -	125	- -
		January 2000	400	122	- -
		January 2001	- -	124	- -
		January 2002	180	130	- -
		January 2003	220	130	- -
		January 2004	175	130.5	- -
		January 2005	170	134	- -
		January 2006	125	138	- -
		January 2007	125	139	- -
		January 2008	90[14]	142	- -
		January 2009	- -	155	- -
		January 2010	- -	149	- -
		March 2011	50	153	- -
		January 2012	- -	159.22	- -
		January 2013	100	165.42	- -
	Long Term Average				**-2.5**
	Current Five -Year Average				**-4.7**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3475 (BW-9)	1982	1982	- -	70	- -
		1995	- -	109	- -
		1998	400	135	- -
		January 2000	200	121	- -
		January 2001	- -	123	- -
		January 2002	180	(4)	- -
		January 2003	180	125	- -
		January 2004	210	126	- -
		January 2005	190	133	- -
		January 2006	190	No Data	- -
		January 2007	180	No Data	- -
		January 2008	120	126	- -
		January 2009	- -	No Data	- -
		January 2010	- -	145	- -
		March 2011	170	147	- -
		January 2012	90	151.12	- -
		January 2013	Pumps Air	152.90	- -
	Long Term Average				**-2.7**
	Current Five -Year Average				**-5.4**
P-2403-S (BW-10)	1982	1982	300	82	- -
		1995	- -	98	- -
		1998	250	98	- -
		April 1999	- -	124	- -
		January 2000	210	122	- -
		January 2001	- -	129	- -
		January 2002	130	143	- -
		January 2003	150	128	- -
		January 2004	105	134	- -
		January 2005	90	133	- -
		January 2006	100	136	- -
		January 2007	90	136	- -
		January 2008	55	140	- -
		January 2009	- -	142	- -
		January 2010	- -	No Data	- -
		March 2011	90	147	- -
		January 2012	85	149.02	- -
		January 2013	- -	152.71	- -
	Long Term Average				**-2.3**
	Current Five -Year Average				**-2.5**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2203-S (BW-11)	1991	1991	- -	91	- -
		1998	550	104	- -
		January 2000	400	127	- -
		January 2001	- -	127	- -
		January 2002	300	130	- -
		January 2003	260	130	- -
		January 2004	215	129	- -
		January 2005	150	133	- -
		January 2006	150	135	- -
		January 2007	150	135	- -
		January 2008	120	138	- -
		January 2009	- -	138	- -
		January 2010	- -	150	- -
		March 2011	45	156	- -
		January 2012	- -	162.05	- -
		January 2013	90	164.60	- -
	Long Term Average				**-3.3**
	Current Five -Year Average				**-5.3**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2203 (BW-12)	1991	1991	- -	91	- -
		1995	- -	104	- -
		1998	550	104	- -
		January 2000	425	124	- -
		January 2001	- -	125	- -
		January 2002	300	127	- -
		January 2003	300	131	- -
		January 2004	230	134.5	- -
		January 2005	210	135	- -
		January 2006	210	144	- -
		January 2007	200	145	- -
		January 2008	165	137	- -
		January 2009	- -	137	- -
		January 2010	- -	158	- -
		March 2011	- -	166	- -
		January 2012	63	162.07	- -
		January 2013	68	164.36	- -
	Long Term Average				**-3.3**
	Current Five -Year Average				**-5.5**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2560 (BW-13)	1995	1995	- -	107	- -
		1996	- -	111	- -
		1998	660	No Data	- -
		January 2000	560	134	- -
		January 2001	- -	134	- -
		January 2002	500	136	- -
		January 2003	480	141	- -
		January 2004	340	146	- -
		January 2005	280	151	- -
		January 2006	275	151	- -
		January 2007	275	153	- -
		January 2008	220	156	- -
		January 2009	- -	170	- -
		January 2010	- -	168	- -
		March 2011	170	172	- -
		January 2012	200	172.37	- -
		January 2013	140	176.41	- -
	Long Term Average				**-3.9**
	Current Five -Year Average				**-4.1**
P-2560-S (BW-14)	1996	1996	- -	111	- -
		1998	200	No Data	- -
		April 1999	- -	124	- -
		January 2000	160	131	- -
		January 2001	- -	132	- -
		January 2002	150	136	- -
		January 2003	120	140	- -
		January 2004	100	146	- -
		January 2005	75	152	- -
		January 2006	50	152	- -
		January 2007	50	153	- -
		January 2008	40	158	- -
		January 2009	- -	152	- -
		January 2010	- -	168	- -
		March 2011	60	168	- -
		January 2012	60	171.48	- -
		January 2013	30	175.08	- -
	Long Term Average				**-3.8**
	Current Five -Year Average				**-3.4**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2565 (BW-15)	1996	1996	- -	95	- -
		1998	320	No Data	- -
		April 1999	- -	105	- -
		January 2000	260	110	- -
		January 2001	- -	110	- -
		January 2002	280	115	- -
		January 2003	220	115	- -
		January 2004	215	129	- -
		January 2005	215	119	- -
		January 2006	190	120	- -
		January 2007	190	120	- -
		January 2008	150[13]	151	- -
		January 2009	- -	150	- -
		January 2010	- -	135	- -
		March 2011	70	136	- -
		January 2012	68	136.05	- -
		January 2013	- -	134.32	- -
	Long Term Average				**-2.3**
	Current Five -Year Average				**+3.3**
P-2565-S (BW-16)	1996	1996	- -	88	- -
		1998	420	No Data	- -
		April 1999	- -	108	- -
		January 2000	280	103	- -
		January 2001	- -	105	- -
		January 2002	300	109	- -
		January 2003	280	111	- -
		January 2004	235	114.5	- -
		January 2005	200	120	- -
		January 2006	200	121	- -
		January 2007	200	121	- -
		January 2008	175	115	- -
		January 2009	- -	130	- -
		January 2010	- -	135	- -
		March 2011	155	132	- -
		January 2012	- -	132.03	- -
		January 2013	153	133.36	- -
	Long Term Average				**-2.7**
	Current Five -Year Average				**-3.7**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2454[7] (Stock Well in T01S R36E Section 14)	1977	June 1977	Windmill	No Data	- -
		January 2001	- -	115	- -
		January 2002	- -	117	- -
		January 2004	- -	126	- -
		January 2005	- -	129	- -
		January 2010	- -	No Data	- -
		March 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	- -	No Data	- -
	Long Term Average **Current Five -Year Average**				**Insufficient Data**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2565-S-2 (BW-17)	2001	October 2001	- -	140[6]	- -
		January 2002	- -	No Data	- -
		January 2003	350	140	- -
		January 2004	330	141	- -
		January 2005	290	145	- -
		January 2006	290	145	- -
		January 2007	290	146	- -
		January 2008	200[13]	169	- -
		January 2009	- -	167	- -
		January 2010	- -	155	- -
		March 2011	210	166	- -
		January 2012	210	164.84	- -
		January 2013	150	165.61	- -
	Long Term Average **Current Five -Year Average**				**-2.6** **+0.7**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2565-S-3 (BW-18)	2001	September 2001	- -	140[6]	- -
		January 2002	- -	No Data	- -
		January 2003	400	139	- -
		January 2004	370	138.5	- -
		January 2005	340	150	- -
		January 2006	300	151	- -
		January 2007	290	151	- -
		January 2008	200[13]	167	- -
		January 2009	- -	153	- -
		January 2010	- -	161	- -
		March 2011	- -	161	- -
		January 2012	146	162.56	- -
		January 2013	134	166.44	- -
	Long Term Average				**-2.7**
	Current Five -Year Average				**+0.1**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2713-A-A (BW-19) [9]	1972	July 1975	900	53	- -
		January 2002	600[12]	No Access	- -
		January 2003	- -	No Data	- -
		January 2004	- -	125	- -
		March 2004	310[10]	- -	- -
		January 2005	- -	128	- -
		January 2006	- -	123	- -
		January 2007	300	124	- -
		January 2008	260	134	- -
		January 2009	- -	144	- -
		January 2010	- -	147	- -
		March 2011	150	148	- -
		January 2012	- -	150.14	- -
		January 2013	- -	151.94	- -
	Long Term Average				**-2.6**
	Current Five -Year Average				**-3.6**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3165 (BW-20) [9]	1976	July 1976	700	50	- -
		April 1999	- -	129	- -
		January 2000	- -	131	- -
		February 2001	- -	135	- -
		January 2002	500[12]	No Access	- -
		October 2002	300[11]	137	- -
		January 2003	- -	No Data	- -
		January 2004	- -	136	- -
		March 2004	260[10]	- -	- -
		January 2005	- -	138	- -
		January 2006	- -	136	- -
		January 2007	250	No Data	- -
		January 2008	220	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	168	- -
		March 2011	- -	158	- -
		January 2012	- -	160.95	- -
		January 2013	45	163.69	- -
	Long Term Average				**-3.1**
	Current Three -Year Average				**+1.4**
P-3165-A (BW-21) [9]	1975	March 1977	800	75	- -
		April 1999	- -	130	- -
		January 2000	- -	134	- -
		January 2001	- -	No Data	- -
		January 2002	600[12]	No Access	- -
		October 2002	400[11]	142	- -
		January 2003	- -	No Data	- -
		January 2004	- -	140	- -
		March 2004	285[10]	- -	- -
		January 2005	- -	142	- -
		January 2006	- -	138	- -
		January 2007	300	133	- -
		January 2008	290	140	- -
		January 2009	- -	140	- -
		January 2010	- -	145	- -
		March 2011	190	148	- -
		January 2012	- -	149.78	- -
		January 2013	42	151.09	- -
	Long Term Average				**-2.1**
	Current Five -Year Average				**-2.2**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3123-A-S (BW-22) [9]	1977	August 1976	800	55	- -
		May 1999	- -	124	- -
		February 2000	- -	127	- -
		January 2001	- -	No Data	- -
		January 2002	400[12]	127	- -
		October 2002	350[11]	126	- -
		January 2003	- -	127	- -
		January 2004	- -	126	- -
		March 2004	300[10]	- -	- -
		January 2005	250	132	- -
		January 2006	250	134	- -
		January 2007	250	133	- -
		January 2008	245	147	- -
		January 2009	- -	158	- -
		January 2010	- -	160	- -
		March 2011	220	165	- -
		January 2012	150	165.81	- -
		January 2013	29	167.01	- -
	Long Term Average				**-3.0**
	Current Five -Year Average				**-4.0**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3123-A-S-4 (BW-23) [9]	1993	May 1993	800	No Data	- -
		May 1999	- -	125	- -
		January 2000	- -	127	- -
		February 2001	- -	132	- -
		January 2002	600[12]	No Access	- -
		October 2002	350[11]	132	- -
		January 2004	- -	130	- -
		March 2004	285[10]	- -	- -
		January 2005	260	138	- -
		January 2006	260	131	- -
		January 2007	250	132	- -
		January 2008	261	116[15]	- -
		January 2009	- -	143	- -
		January 2010	- -	151	- -
		March 2011	- -	155	- -
		January 2012	- -	155.93	- -
		January 2013	31	157.38	- -
	Long Term Average				**-2.3**
	Current Four -Year Average				**-3.6**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3123-A-S-3 (BW-24) [9]	1977	July 1977	900	61	- -
		May 1999	**- -**	132	- -
		February 2000	**- -**	135	- -
		January 2002	750[12]	141	- -
		October 2002	500[4]	140	- -
		January 2003	**- -**	141	- -
		January 2004	- -	139	- -
		January 2005	- -	142	- -
		January 2006	- -	137	**- -**
		January 2007	- -	No Data	**- -**
		January 2008	- -	No Data	**- -**
		January 2009	- -	No Data	**- -**
		January 2010	- -	160	**- -**
		March 2011	190	162	**- -**
		January 2012	- -	166.38	**- -**
		January 2013	- -	167.88	**- -**
	Long Term Average				**-3.0**
	Current Five -Year Average				**-2.6**
P-3123-A (BW-25) [9]	1977	January 1977	800	70	- -
		May 1999	**- -**	140	- -
		February 2000	**- -**	132	- -
		February 2001	**- -**	151	- -
		January 2002	500[2]	No Access	- -
		January 2003	**- -**	151	- -
		January 2004	**- -**	149	- -
		January 2005	**- -**	151	- -
		January 2006	- -	148	**- -**
		January 2007	- -	No Data	**- -**
		January 2008	- -	No Data	**- -**
		January 2009	- -	167	**- -**
		January 2010	- -	170	**- -**
		March 2011	- -	172	**- -**
		January 2012	[18]	175.72	**- -**
		January 2013	Dry	177.95	**- -**
	Long Term Average				**-3.0**
	Current Four -Year Average				**-2.7**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2910-A-S (BW-26)	1996	December 1996	250	155[6]	- -
		January 2002	300[12]	132	- -
		January 2003	- -	132	- -
		January 2004	- -	129	- -
		January 2005	- -	132	- -
		January 2006	- -	128	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	210	152.79	- -
		January 2013	184	154.64	- -
	Long Term Average				**-2.2**
	Most Recent Three-Year Average				**Insufficient Data**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3124 (BW-27)	1972	May 1972	No Data	No Data	- -
		February 2000	- -	107	- -
		January 2002	500[12]	113	- -
		January 2003		112	- -
		January 2004	- -	119	- -
		January 2005	- -	120	- -
		January 2006	- -	124	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	148	- -
		January 2012	210	148.27	- -
		January 2013	155	150.48	- -
	Long Term Average				**-3.4**
	Most Recent Three-Year Average				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3569 (BW-28)	1997	June 1997	450	144[6]	- -
		January 2002	200[12]	121	- -
		January 2003	- -	124	- -
		January 2004	- -	124	- -
		January 2005	- -	128	- -
		January 2006	- -	122	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	111	173.46	- -
		January 2013	112	166.93	- -
	Long Term Average				**-1.4**
	Most Recent Three-Year Average				**Insufficient Data**
P-3569-S-3 (BW-29)	1986	November 1986	1,000	No Data	- -
		April 1999	- -	139	- -
		January 2002	300[2]	135	- -
		January 2003	- -	135	- -
		January 2004	- -	140	- -
		January 2005	- -	139	- -
		January 2006	- -	141	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	148	169.83	- -
		January 2013	- -	172.15	- -
	Long Term Average				**-2.4**
	Most Recent Three-Year Average				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2713-A-A-S (BW-30)	1972	July 1973	900	55	- -
		April 1999	- -	114	- -
		January 2000	- -	115	- -
		January 2002	550[12]	No Access	- -
		May 2002	- -	117	- -
		January 2003	- -	No Access	- -
		January 2004	- -	120	- -
		January 2005	- -	121	- -
		January 2006	- -	122	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	82	146.72	- -
	Long Term Average				**-2.3**
	Most Recent Three-Year Average				**Insufficient Data**
P-3123-A-S-8 (BW-31)	No Data	- -	- -	- -	- -
		January 2002	400[12]	No Access	- -
		January 2003	- -	No Access	- -
		January 2004	- -	134	- -
		January 2005	- -	137	- -
		January 2006	- -	131	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	102	No Data	- -
		January 2013	26	171.22	- -
	Long Term Average				**-4.1**
	Most Recent Three-Year Average				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2801 (BW-32)	1972	July 1972	No Data	No Data	- -
		February 2001	- -	100	- -
		January 2002	700[12]	No Data	- -
		January 2003	- -	100	- -
		January 2004	- -	100	- -
		February 2005	- -	101.5	- -
		January 2006	- -	103	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	275	No Data	- -
		January 2013	205	126.50	- -
	Long Term Average				**-2.2**
	Most Recent Three-Year Average				**Insufficient Data**
P-3136-S (BW-33)	No Data	- -	- -	- -	- -
		January 2002	400[12]	No Data	- -
		January 2003	- -	No Data	- -
		January 2004	- -	No Data	- -
		January 2005	- -	No Data	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	125	No Data	- -
		January 2013	- -	135.00	- -
	Long Term Average				**Insufficient Data**
	Most Recent Three-Year Average				

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3136 (BW-34)	1972	August 1972	No Data	70[6]	- -
		February 2001	- -	112	- -
		January 2002	400[12]	No Data	- -
		January 2003	- -	110.5	- -
		January 2004	- -	111	- -
		January 2005	- -	111	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	125	No Data	- -
		January 2013	- -	130.48	- -
	Long Term Average				**-1.5**
	Most Recent Three-Year Average				**Insufficient Data**
P-2801-S (BW-35)	1976	April 1976	2100	70[6]	- -
		February 2001	- -	110	- -
		January 2002	800[12]	No Data	- -
		January 2003	- -	109.5	- -
		January 2004	- -	110	- -
		February 2005	- -	111	- -
		January 2006	- -	111	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	250	No Data	- -
		January 2013	- -	116.67	- -
	Long Term Average				**-1.3**
	Most Recent Three-Year Average				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2801-S-3 (BW-36)	1998	February 1998	No Data	No Data	- -
		January 2002	400[12]	No Data	- -
		January 2003	- -	No Data	- -
		January 2004	- -	No Data	- -
		February 2005	- -	No Data	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	125	No Data	- -
		January 2013	- -	113.94	- -
	Long Term Average **Most Recent Three-Year Average**				**Insufficient Data**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2801-S-2 (BW-37)	1998	January 1998	No Data	No Data	- -
		January 2002	400[12]	No Data	- -
		January 2003	- -	No Data	- -
		January 2004	- -	No Data	- -
		February 2005	- -	No Data	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	175	No Data	- -
		January 2013	- -	117.46	- -
	Long Term Average **Most Recent Three-Year Average**				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2801-S-4 (BW-38)	No Data	- -	- -	- -	- -
		January 2002	400[12]	No Data	- -
		January 2003	- -	No Data	- -
		January 2004	- -	No Data	- -
		February 2005	- -	No Data	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	400	No Data	- -
		January 2013	- -	123.82	- -
	Long Term Average Most Recent Three-Year Average				**Insufficient Data**
P-3137 (BW-39)	1972	September 1972	No Data	70[6]	- -
		February 2001	- -	100	- -
		January 2002	- -	No Data	- -
		January 2003	- -	100	- -
		January 2004	- -	100	- -
		January 2005	- -	100	- -
		January 2006	- -	99	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	375	No Data	- -
		January 2013	- -	130.74	- -
	Long Term Average Most Recent Three-Year Average				**-1.5 Insufficient Data**
Unknown 8 (BW-40)	No Data	- -	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	- -	127.48	- -
	Long Term Average Most Recent Three-Year Average				**Insufficient Data**

Historic Depletion Rates in the City of Portales Blackwater Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-2910-S (BW-41)	1998	April 1998	No Data	No Data	- -
		January 2002	400[12]	100	- -
		January 2003	- -	100	- -
		January 2004	- -	106	- -
		January 2005	- -	108	- -
		January 2006	- -	112	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	150	No Data	- -
		January 2013	153	139.37	- -
	Long Term Average				**-3.6**
	Most Recent Three-Year Average				**Insufficient Data**
P-2910 (BW-42)	1975	February 1975	No Data	No Data	- -
		February 2001	- -	101	- -
		January 2002	300[12]	118	- -
		January 2003	- -	118	- -
		January 2004	- -	120	- -
		January 2005	- -	123	- -
		January 2006	- -	126	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		January 2011	- -	No Data	- -
		January 2012	400	No Data	- -
		January 2013	320	158.51	- -
	Long Term Average				**-4.8**
	Most Recent Three-Year Average				**Insufficient Data**

Long Term Combined Average for all City Blackwater Wells with 2013 Data	**-2.7**
Short Term Combined Average for all City Blackwater Wells with 2013 Data	**-2.8**

Notes:

1. The 1998 depth to water in BW-3 is probably in error.
2. Wells BW-8 and BW-9 were not pumped in 1999.
3. Not used.
4. Depth to static water could not be measured in Well BW-1 because access was blocked by the submersible pump electric lines. Well BW-1 was taken out of service in February 2004 due to insufficient depth of water.
5. The casing of the original Well BW-2 partially collapsed in 1997, rendering the well unusable. In September 2001 the original well was plugged and a replacement well was drilled about 40 ft south of the original well. The replacement BW-2 was placed in service in May 2002.
6. Depth to water upon completion of drilling; may not accurately represent static water level.
7. This is a private well not owned by the City of Portales but is included for purposes of comparison.

8. Excepting BW-10 for which the January 2002 depth to static water is suspect.
9. Wells BW-19 through BW-42 are converted Baker Farm wells.
10. Well yield conservatively estimated by West Texas Water Well Service based on pump test.
11. Well yield estimated by L&J Well Service Inc. based on pump test.
12. Well yield estimated by Mr. Wayne Baker, former land owner.
13. Flow meter is improperly sized for declining yield and is not accurate; pumping rate estimated by City of Portales
14. Pump turned off; pumping rate estimated by City of Portales
15. The 16 foot rise in water level in BW-23 from the previous year is unlikely but may have resulted from a significant reduction in pumping during 2007.
16. Well BW-9 was not pumped during 2009 or 2010.
17. New Wells BW-24 and BW-25 were placed in service in 2010.
18. Well BW-25 had insufficient water to pump in January 2012.

Appendix B

Historic Depletion Rates in the City of Portales Sandhill Wells

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-1110-S-16 (SH-1)	1953	1953	- -	50	- -
		1998	475	102	- -
		January 2000	300	107	- -
		January 2002	350	106	- -
		January 2003	200	(3)	- -
		January 2004	110	(3)	- -
		January 2005	100	(3)	- -
		January 2006	100	(3)	- -
		January 2007	100	(3)	- -
		January 2008	60[5]	(3)	- -
		January 2009	- -	(3)	- -
		January 2010	- -	No Data	- -
		March 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	54	112.69	- -
	Long Term Average **Current Five-Year Average**				**Insufficient Data**
P-1110-S-2 (SH-2)	1956	1956	- -	60	- -
		1998	425	97	- -
		January 2000	300	105	- -
		January 2001	- -	104	- -
		January 2002	200[2]	104	- -
		January 2003	Out of Service	No Data	- -
		March 2011	Out of Service	115	- -
		January 2012	- -	No Data	- -
		January 2013	- -	Dry	- -
	Long Term Average				**-1.0** **Out of Service**

Historic Depletion Rates in the City of Portales Sandhill Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
In Licensing (SH-3)	1962	1962	- -	100	- -
		1998	250	- -	- -
		January 2000	280	110	- -
		February 2001	- -	108	- -
		January 2002	140	108	- -
		January 2003	75	111	- -
		January 2004	75	111	- -
		January 2005	45[2]	110	- -
		January 2006	45[2]	111	- -
		January 2007	40[2]	111	- -
		January 2008	40[5]	95[6]	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		March 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	150	116.77	- -
	Long Term Average **Current Five-Year Average**				**Insufficient Data**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
In Licensing (SH-4)	1958	1958	- -	70	- -
		1998	250	95	- -
		January 2000	300	106	- -
		February 2001	- -	104	- -
		January 2002	100	105	- -
		January 2003	100	107	- -
		January 2004	90	108	- -
		January 2005	90	107	- -
		January 2006	100	107	- -
		January 2007	100	108	- -
		January 2008	90[5]	86[6]	- -
		January 2009	- -	No Data	- -
		January 2010	- -	115	- -
		March 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	70	119.91	- -
	Long Term Average **Current Five-Year Average**				**Insufficient Data**

Historic Depletion Rates in the City of Portales Sandhill Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-1110-S-4 (SH-5)	1963	1963	- -	88	- -
		1998	400	94	- -
		January 2000	325	102	- -
		February 2001	- -	101	- -
		January 2002	260	103	- -
		January 2003	200	104	- -
		January 2004	210	104	- -
		January 2005	215	104	- -
		January 2006	215	106	- -
		January 2007	210	106	- -
		January 2008	160[5]	96[6]	- -
		January 2009	- -	No Data	- -
		January 2010	- -	No Data	- -
		March 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	- -	109.32	- -
	Long Term Average **Current Five-Year Average**				**Insufficient Data**

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-1110-S (SH-6)	1981	1981	- -	70	- -
		1998	200	80	- -
		January 2000	175	86	- -
		January 2001	- -	87	- -
		January 2002	60	89	- -
		January 2003	60	90	- -
		January 2004	50	92	- -
		January 2005	40	92	- -
		January 2006	40[2]	92	- -
		January 2007	40[2]	93	- -
		January 2008	40[5]	110	- -
		January 2009	- -	No Data	- -
		January 2010	- -	112	- -
		March 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	- -	Not in Service	- -
	Long Term Average **Current Five-Year Average**				**Insufficient Data**

Historic Depletion Rates in the City of Portales Sandhill Wells (Continued)

Well Number	Date Completed	Date of Measurement	Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-1110-S-3 (SH-7)	1981	1981	- -	65	- -
		1998	375	75	- -
		January 2000	300	81	- -
		January 2001	- -	83	- -
		January 2002	110[2]	84	- -
		January 2003	100	85	- -
		January 2004	110	87	- -
		January 2005	110	88	- -
		January 2006	110	87	- -
		January 2007	100	89	- -
		January 2008	80[5]	84	- -
		January 2009	- -	No Data	- -
		January 2010	- -	96	- -
		March 2011	- -	No Data	- -
		January 2012	- -	No Data	- -
		January 2013	- -	Not in Service	- -
	Long Term Average **Current Five-Year Average**				**Insufficient Data**

Long Term Average for all City Sandhill Wells with 2013 Data	**-0.8**
Short Term Average for all City Sandhill Wells with 2013 Data	**Insufficient Data**

Notes:
1. Wells SH-2, -3, and -6 were not pumped during 1998 or 1999.
2. The pumping rate was estimated by the City of Portales.
3. Depth to static water could not be measured because access was blocked by the submersible pump electric lines.
4. Well SH-2 was mistakenly reported dry at a depth of 106 ft. in January 2003 and was taken out of service. However, the total well depth as reported on the driller's log is 132 ft. and a depth to static water of 115 ft was measured in March 2011.
5. Pump turned off; pumping rate estimated by City of Portales
6. The reported rise in water level of 10 feet or more is unlikely and may be in error.
7. Well SH-3 was not pumped in 2009.

Appendix C

Historic Depletion Rates in the City of Portales Baker Farm Wells

Well Number	Date Completed	Date of Measurement	Reported Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
Unknown 5 Not Used	No Data	- -	- -	- -	- -
		January 2002	500[2]	No Data	- -
		January 2003	- -	No Data	- -
		January 2004	- -	No Data	- -
		January 2005	- -	No Data	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average **Current Five-Year Average**				**No Current Data**

Well Number	Date Completed	Date of Measurement	Reported Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3123-A-S-5 Served CSE10: #2 - at pivot	1993	May 1993	400	No Data	- -
		January 2002	200[2]	133	- -
		January 2003	- -	133	- -
		January 2004	- -	134	- -
		January 2005	- -	137	- -
		January 2006	- -	133	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average **Most Recent Three-Year Average**				**No data from 2007 to date**

Well Number	Date Completed	Date of Measurement	Reported Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3123-A-S-6 Served CSE10: #3 - north-east of pivot	1993	October 1993	400	No Data	- -
		January 2002	300[2]	153	- -
		January 2003	- -	153	- -
		January 2004	- -	154	- -
		January 2005	- -	157	- -
		January 2006	- -	153	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average **Most Recent Three-Year Average**				**No data from 2007 to date**

Historic Depletion Rates in the City of Portales Baker Farm Wells (Continued)

Well Number	Date Completed	Date of Measurement	Reported Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3123-A-S-7 Served C8: #1 - at pivot	1996	December 1996	200	150[1]	- -
		February 2001	- -	130	- -
		January 2002	300[2]	132	- -
		January 2003	- -	132	- -
		January 2004	- -	135	- -
		January 2005	- -	136	- -
		January 2006	- -	134	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average Most Recent Three-Year Average				**No data from 2007 to date**
P-3124-S Served C8: #3 - south-west of pivot	1972	May 1972	No Data	No Data	- -
		January 2002	300[2]	126	- -
		January 2003	- -	130	- -
		January 2004	- -	127	- -
		January 2005	- -	130	- -
		January 2006	- -	125	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average Most Recent Three-Year Average				**No data from 2007 to date**
P-3355 Stockyard Well	1975	May 1975	No Data	62	- -
		January 2002	- -	No Data	- -
		January 2003	- -	No Data	- -
		January 2004	- -	No Data	- -
		January 2005	- -	No Data	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average Current Five-Year Average				**No Current Data**

Historic Depletion Rates in the City of Portales Baker Farm Wells (Continued)

Well Number	Date Completed	Date of Measurement	Reported Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3569-S Served CNE10-2: southeast of pivot	1994	May 1994	800	120[1]	- -
		January 2002	300[2]	No Access	- -
		January 2003	- -	No Access	- -
		January 2004	- -	140	- -
		January 2005	- -	140	- -
		January 2006	- -	142	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average				**No data from 2007 to date**

Well Number	Date Completed	Date of Measurement	Reported Pumping Capacity (gpm)	Depth to Static Water (ft)	Average Rate of Water Level Change (ft/year)
P-3900 Unused Stock Well	1993	October 1993	10	85	- -
		January 2002	- -	No Data	- -
		January 2003	- -	No Data	- -
		January 2004	- -	No Data	- -
		January 2005	- -	No Data	- -
		January 2006	- -	No Data	- -
		January 2007	- -	No Data	- -
		January 2008	- -	No Data	- -
		January 2009	- -	No Data	- -
	Long Term Average **Current Five-Year Average**				**No Current Data**
Long Term Average for all Wells with Data					**No data from 2007 to date**
Recent Three to Four-Year Average for all Wells with Data					

Notes:
1. Depth to water was measured upon completion of drilling and may not accurately represent static water level.
2. Well yield estimated by Mr. Wayne Baker, former land owner.

Appendix D

Baker Farm Wells Converted to Municipal Wells

OSE Permit Number	Agricultural Function	City Well Number	Year Renumbered
P-2713-A-A	Served Circle C6 located at pivot	BW-19	2003
P-2713-A-A-S	Served Circle C5 located at pivot	BW-30	2011
P-2801	Served Circle R1 located at pivot	BW-32	2011
P-2801-S	Served Circles R3 and R5 located at R3 pivot	BW-35	2011
P-2801-S-2	Served Circles R3 and R5 located west of R3 pivot	BW-37	2011
P-2801-S-3	Served Circles R3 and R5 located west of R3 pivot	BW-36	2011
P-2801-S-4	Served Circles R3 and R5 located west of R3 pivot	BW-38	2011
P-2910	Served Circle C9 #1 located at pivot	BW-42	2011
P-2910-S	Served Circle C9 #2 located west of pivot	BW-41	2011
P-2910-A-S	Served Circle C27 located northeast of pivot	BW-26	2011
P-3123-A	Served Circle C25E located at pivot	BW-25	2008
P-3123-A-S	Served Circle C16E located at pivot	BW-22	2003
P-3123-A-S-3	Served Circle C25W located at pivot	BW-24	2008
P-3123-A-S-4	Served Circle CSE9 located at pivot	BW-23	2003
P-3123-A-S-8	Served Circle CSE10 #1 located southwest of pivot	BW-31	2011
P-3124	Served Circle C7 located at pivot	BW-27	2011
P-3136	Served Circle R2 located at pivot	BW-34	2011
P-3136-S	Served Circle R2 located southwest of pivot	BW-33	2011
P-3137	Served Circle R4 located at pivot	BW-39	2011
P-3165	Served Circle C16W located at pivot	BW-20	2003
P-3165-A	Served Circle C18 located at pivot	BW-21	2003
P-3569	Served Circle C8 #2 located south of pivot	BW-28	2011
P-3569-S-3	Served Circle CNE10-1 located at pivot	BW-29	2011
Unknown 8	Served Circle R2 located southwest of pivot	BW-40	2011

Appendix E

Reference Point Heights for Depth to Water Measurements

Well Number	Reference Point Height Above Ground Surface (ft)	Well Number	Reference Point Height Above Ground Surface (ft)
Blackwater Wells			
BW-1	2.17	BW-26	2.28
BW-2	2.00	BW-27	2.72
BW-3	2.41	BW-28	3.67
BW-4	2.44	BW-29	1.59
BW-5	2.32	BW-30	1.89
BW-6	1.26	BW-31	2.21
BW-7	1.77	BW-32	2.19
BW-8	1.65	BW-33	2.39
BW-9	1.33	BW-34	2.05
BW-10	1.34	BW-35	1.86
BW-11	2.32	BW-36	2.70
BW-12	2.12	BW-37	2.90
BW-13	2.45	BW-38	2.44
BW-14	3.35	BW-39	2.43
BW-15	2.13	BW-40	2.24
BW-16	3.26	BW-41	2.36
BW-17	2.83	BW-42	1.47
BW-18	2.67		
BW-19	1.63		
BW-20	1.80		
BW-21	1.12		
BW-22	1.90		
BW-23	1.75		
BW-24	2.49		
BW-25	3.00		
Sandhill Wells			
SH-1	0.91	SH-5	1.77
SH-2	0.92	SH-6	1.04
SH-3	2.27	SH-7	0.85
SH-4	1.66		

Appendix F

Correlation of Old and New OSE Permit Numbers

City Well Number	Original OSE Designation	New OSE Point-of-Diversion (POD) Number	City Well Number	Original OSE Designation	New OSE Point-of-Diversion (POD) Number
Blackwater Wells					
BW-1	P-2201	P02201 POD1	BW-26	P-2910-A	P02910A
BW-2	P-2201-S	P02201 POD2	BW-27	P-3124	P03134
BW-3	P-2202	P02202 POD1	BW-28	P-3569	P03569
BW-4	P-2201-S-2	P02201 POD3	BW-29	P-3569-S-3	P03569S3
BW-5	P-2201-S-3	P02201 POD4	BW-30	P-2713-A-A-S	P02713POD2
BW-6	P-2403	P02403 POD1	BW-31	P-3123-A-S-8	P03123AS8
BW-7	P-3475-S	P03475 POD2	BW-32	P-2801	P02801
BW-8	P-2402	P02402 POD1	BW-33	P-3136-A	P03136A
BW-9	P-3475	P03475 POD1	BW-34	P-3136	P03136
BW-10	P-2403-S	P02403 POD2	BW-35	P-2801-S	P02801S
BW-11	P-2203-S	P02203 POD2	BW-36	P-2801-S-3	P02801S3
BW-12	P-2203	P02203	BW-37	P-2801-S-2	P02801S2
BW-13	P-2560	P02560 POD1	BW-38	P-2801-S-4	P02801S4
BW-14	P-2560-S	P02560 POD2	BW-39	P-3137	Unchanged
BW-15	P-2565	P02565	BW-40	In Licensing	In Licensing
BW-16	P-2565-S	P02565 POD2	BW-41	P-2910-S	P02910S
BW-17	P-2565-S-2	P02565 POD3	BW-42	P-2910	P02910
BW-18	P-2565-S-3	P02565 POD4			
BW-19	P-2713-A-A	P02713AA			
BW-20	P-3165	P03165			
BW-21	P-3165-A	P03165 POD3			
BW-22	P-3123-A-S	P03123AS			
BW-23	P-3123-A-S-4	P03123AS4			
BW-24	P-3123-A-S-3	P03123AS3			
BW-25	P-3123-A	P03123A			
Sandhill Wells					
SH-1	P-1110-S-16	Unchanged	SH-5	P-1110-S-4	Unchanged
SH-2	P-1110-S-2	Unchanged	SH-6	P-1110-S	Unchanged
SH-3	In Licensing	Unchanged	SH-7	P-1110-S-3	Unchanged
SH-4	In Licensing	Unchanged			
Unconverted Farm Wells					
	P-3123-A-S-6	P03123AS6		P-3355	P03355
	P-3123-A-S-5	P03123AS5		P-3569-S	P03569S
	P-3123-A-S-7	P03123AS7		P-3900	P03900
	P-3124-S	P03124S			