# IV
# WATER SERVICE

**Existing Water System**

The North Albuquerque Acres area slopes up from the Louisiana Boulevard area to Tennyson Street at a slope of about four percent representing approximately 750 feet of elevation rise over 3.8 miles of distance. Because of this elevation differential, the area is split into several water pressure zones. The water pressure zones for this area were established by the City of Albuquerque several years ago and are used in the City of Albuquerque's Water Master Plan that was developed by Leedshill-Herkenhoff, Inc. in 1982. The water pressure zones range from 3E in the Louisiana Boulevard area to 9ER in the Tennyson Street area. A map of the water pressure zones can be seen in Exhibit IV-1 in the Appendix. A water pressure zone defines, in general, the area that can be served by one level of input pressure with the upper portions of the zone providing the minimum 50 psi and the lower portions of the zone providing the maximum 100 psi. The "R" shown with a water pressure zone shows that this zone is fed by "reducing" the water pressure from a tank located more than one zone above the fed zone.

Exhibit IV-1 shows that the water pressure zone boundaries in the North Albuquerque Acres area follow a north-south path. It also shows that these boundaries, in some cases, closely follow the north-south roads such as Eubank Boulevard, Browning Street, and Lowell Street. However, it shows further that the water pressure zone boundaries do not always follow the roadway path as is the case of the zone boundary between Holbrook Street and Ventura Street. Here, the boundary is between the two roadways.

Presently, just about all of the North Albuquerque Acres area (NAA) is served by individual groundwater wells with no public water system infrastructure and does not rely on Albuquerque-Bernalillo Water Utility Authority (ABWUA) water even though the area has defined water pressure zones. Each of these existing wells either serves one home or a group of homes.

The exceptions to this are the Primrose Point area including Double Eagle Elementary School, a small portion of the homes in the southeast part of the study area, and the existing Walker Tank located on Paseo del Norte just west of Eubank Boulevard. The Primrose Point area, the more densely populated area bounded by Oakland Avenue, Anaheim Avenue, Tennyson Street, and Lowell Street, currently has water service with fire protection provided by the Sandia Peak Utilities company (SPU). It does not rely on individual property wells. This development lies in the highest pressure zone for the study area, 9ER. SPU also provides water service to Double Eagle Elementary School. SPU is the best available option for providing water service to these homes because the other tanks owned by the ABWUA that are high enough to provide service are located several miles to the south. Additional construction is currently underway to expand the Primrose Point area to the north of the currently existing development. This area will likewise have water service including fire protection provided by SPU; the fire hydrants are already visible at the construction site.

SPU is presently unable to significantly expand its service area due to system limitations. However, it is the understanding of the study team that SPU is not opposed to the opportunities to expand and would be willing to discuss expansion opportunities.

The southeast fringe of the study area has some water service provided by the ABWUA system. Currently, there are water lines with fire protection on San Francisco Avenue between Holbrook Street and Eubank Boulevard. The water line on San Francisco Avenue from Eubank Boulevard provides water service to the Temple of the Church of Jesus Christ of Latter-day Saints. Furthermore, there are water lines with limited fire protection on Coronado Avenue that also provide service to the homes on the south side of the road that are part of the Quintesance development. It appears that the homes on the north side of the road are also provided with water service even though these homes are outside the City of Albuquerque. Additional transmission only water lines without visible fire protection are found on Santa Monica Avenue between Eubank Boulevard and Browning Street and intermittently on San Antonio Drive between Eubank Boulevard and Tennyson Street.

Finally, the Walker tank of the ABWUA system has supply lines and transmission lines along Paseo del Norte. The Walker tank provides service to water pressure zones 5E and 4ER. The ABWUA also has a tank located on Paseo del Norte just east of Wyoming Boulevard. This tank, located outside the study area, serves water pressure zone 3E.

**Water System Feasibility**

The requirements of the water feasibility portion of this study were to verify the water system study portion of the Schiavo Report. During this verification process, key elements of the Schiavo Report related to the water system could not be verified.

Due to this verification difficulty, the study team halted the verification process and worked with Bernalillo County personnel to develop alternatives for the water feasibility portion of the study. Three alternatives were developed. These were:

1. Develop a water model of the entire the entire North Albuquerque Acres area using three different scenarios for providing water service.

2. Develop a water model of a portion of the North Albuquerque Acres area using three different scenarios and then extrapolate the finding of that sample area to the remainder of North Albuquerque Acres.

3. Discontinue the water system feasibility verification and present only the sewer system findings.

Alternative 1, a water model of the entire area, would provide the best information for cost analysis, pressure analysis, and source analysis. However, the alternative would be the most costly effort of the three alternatives as it would be closer to a design level effort. Additionally, the study team felt that this modeling effort would more than likely need to be substantially

repeated during a design effort if that design effort was too far into the future, which is what is currently anticipated.

Alternative 2, the extrapolated sample model, would provide the adequate information for development of general costs of providing water service to most of the North Albuquerque Acres area. This alternative would also provide some insight into the problems that might be encountered in design of a full system. The sample water model would not be able to account for all of the variations in supply, transmission, and distribution that would be accounted for in Alternative 1. However, this alternative would be substantially cheaper than Alternative 1.

Alternative 3, discontinue the water system feasibility verification process, would avoid the expenditure of any additional funds. However, it would not satisfy the requirements from the Sector Development Plan that were driving this study.

Alternative 2 was chosen by Bernalillo County personnel as enough information to meet the requirements of the Sector Development Plan with the minimum expenditure of funds. The limitations of this choice are:

- The model will assume a constant supply of water. Therefore, assessment of the areas that may not be able to be served due to elevation from new or existing storage tanks cannot be made. Nick Schiavo's report showed that an area of North Albuquerque Acres to the far northeast would be limited in its service availability. Use of the limited area model cannot deny or verify this possibility.
- The costs for the extrapolated water model will not include storage tank costs, transmission costs, well costs, or well collector line costs. Therefore, the model will provide costs for the distribution system and not the supply system.
- The limited area model will approximate the amount of commercial development in the zone chosen. The costs for the system will need to be assessed for the entire feasibility area and cannot be assessed on a more block by block level. Therefore, the costs for the system may be high for zones that have little or no commercial development or low for zones that may have a concentration of commercial development.
- The limited area model will provide differential costs between the levels of service and should provide a reasonable estimate of overall distribution system cost without the supply costs. An estimate has been made of the PRV's that would be required on the overall distribution system between pressure zones. This was done to provide a more accurate cost for the overall system even though these same PRV's are not included in the limited area model cost (8E).
- Even though the limited area model can provide for a general cost and a general cost comparison between system scenarios, there is no guarantee that the ABWUA will accept the limited area model because it is for a limited area only, was not modeled within the ABWUA water system model, and provides for scenarios that are more rural in nature.
- The limited area model reduces the line sizes and locations found in the 1982 Water Master Plan due to the reduced planned development in the North Albuquerque Acres

area. These reductions would need to be approved by the ABWUA prior to actual design efforts.

- The limited area model cannot provide information as to the engineering feasibility of providing service to the area.

Three scenarios were part of the water modeling for Alternative 2 in order to determine the incremental cost of providing increased levels of fire flows. These scenarios are:

1. Rural/Domestic
2. Sub-urban
3. Intermediate

**Rural/Domestic Scenario-**The Rural/Domestic scenario is considered the bare minimum level of service that would provide just domestic water use with no fire flows in non-commercial areas except on the major north-south roadways such as Lowell Street. The north-south roadways would have fire hydrants spaced at a maximum of 475-foot intervals and would provide 1500 gallons per minute (gpm) for two hours. The lines running on the east-west roadways, such as Carmel Avenue, would be two-inch or four-inch water lines and would not provide any fire flows; a minimum of a six-inch water line is needed to provide for fire flows. For cost purposes, the 2-inch lines are priced at the 4-inch line cost. The commercial areas of the sector development plan would receive fire flows of only 1500 gpm for two hours with hydrants spaced at a maximum of 475-foot intervals. The institutional areas of the sector development plan would receive fire flows of 1500 gpm for two hours with hydrants spaced at a maximum of 300-foot intervals.

The primary benefit of the Rural/Domestic scenario is that it provides water service to the residents of the area at the lowest cost compared to the other two scenarios. Specific costs for each of the scenarios are discussed later in this document. The scenario also provides for some fire flows especially for the commercial and institutional areas. However, it has three primary drawbacks:

1. Inequality of fire flows
2. Little reduction, if any, in fire insurance premiums for a vast majority of the area
3. Does not meet the guidelines set forth by the Bernalillo County Fire Marshall

The inequality of fire flows means that fire flows would be provided for only some of the residents of the area with those nearest the north-south streets receiving the greatest benefit. Significant planned inequalities in a public system should be avoided where possible and prudent. Additionally, because significant portions of the study area would not receive fire flows, very few property owners would receive reduced fire insurance rates. The Bernalillo County Fire Marshall personnel have stated that the Rural/Domestic scenarios would not meet the Fire Marshall guidelines for water systems in Bernalillo County. However, it is the understanding of the study team that there are water systems in Bernalillo County that have been allowed that do not meet the Fire Marshall guidelines.

**Sub-urban Scenario-**The Sub-urban scenario would be the level of service that would be considered more "normal" for a suburban area. This includes fire flows of 1500 gpm for three hours with hydrants spaced at a maximum of 475-foot on all residential streets. The commercial areas would have fire flows of 3000 gpm for three hours with fire hydrants at 315-foot maximum spacing. The institutional areas would have fire flows of 3000 gpm for three hours with fire hydrants at 300-foot maximum spacing. The minimum water line size would be six inches in all areas.

The primary benefit of the Sub-urban scenario is that it provides water service to the residents of the area with fire flows that meet the guidelines of the Bernalillo County Fire Marshall and should result in a reduction in fire insurance rates. A letter with some basic information regarding the ISO fire rating in the area is located in the Appendix. The primary drawback of this scenario is its cost. Later in this document, the costs of the various scenarios are discussed and compared.

**Intermediate Scenario-**The Intermediate scenario provides a service level between the Rural/Domestic and the Sub-urban. The idea of the Intermediate scenario is to provide fire flows for all of the study area but at a reduced level. The north-south roadways and the commercial/institutional areas would have the same hydrant spacing and fire flows as the Rural/Domestic scenario. The difference between the Intermediate and the Rural/Domestic would be on the residential east-west streets. Fire flows on each of the east-west residential streets would be 750 gpm for 3 hours with hydrants at 950-foot maximum spacing. Because of the hydrants on the east-west residential streets, the minimum water line size would be six inches except in the middle of the street between the two fire hydrants where the minimum line size would be two inches. For the cost estimate the two-inch water lines are priced at the four-inch line price.

The primary benefit of the Intermediate scenario is that it provides water service to the residents of the area coupled with some kind of fire flows for all of the residents with a lower cost than the Sub-urban system. This scenario, however, still has the same drawbacks as the Rural/Domestic scenario but to a lesser degree.

More detailed information regarding the requirements and differences between the scenarios is provided in Exhibit IV-2. Included in that table are the pros and cons of the different scenarios.

**Representative Sample Water Model**

Molzen-Corbin & Associates received the notice to proceed with the extrapolated sample model alternative in November 2003. The extrapolated model was to be run for each of the three scenarios discussed previously. Team members from Molzen-Corbin & Associates and Bernalillo County chose to model the area bounded by Browning Street to the west, Lowell Street to the east, the Sandia Pueblo to the north, and San Antonio Drive to the south. This area follows approximately the 8E water pressure zone.

The above area was chosen because the team members felt that it provided the best possibility of serving as a representative sample that could be extrapolated to the remainder of the area. Certain elements within the sample model area were adjusted to provide a more representational model.

Although the water model analysis was to model the distribution system only, the model used the future tank at Paseo del Norte and Tramway Boulevard as its water and pressure source due to the realism this would provide. It should be noted that this future tank is not yet on the 10-year plan for the ABWUA system.

From the mapping for this model area it can be seen that the tank is at an elevation of 6035 while the ground is at an approximate elevation of 6041. This means that the tank would be dropped down into the hill slightly.

Water distribution modeling software (WaterCAD) from Haestad Methods was used to model the 8E area according to the flows and other requirements outlined in Exhibit IV-2. The model was created assuming each lot was inhabited.

In order to provide a more representative sample that could be applied to the east and to the west some adjustments were made to the area modeled. These modifications were:

- Commercial zones were assumed along both sides of Paseo del Norte. This is in keeping with the sector development plan for this area. The zoning areas from the sector development plan are shown in Exhibit I-1.

- Double Eagle Elementary School included in zone 8E model because it would be realistic for zone 8E and provide a worst case scenario for this area even though Sandia Peak Utilities currently provides water service for this school. For the extrapolated areas, the water line that corresponded to the elementary school was extended to run the full length of the road.

- Water lines were extended through the dam/basin area that lies just to the south of Paseo del Norte. This was done so that the zone 8E model could be used to represent the areas to the east and west of the modeled zone where there is no dam/basin.

- Two commercial/institutional zones were added in order for the model to apply to the other areas where institutional and commercial zones may be used. One of these additions is in the area between Paseo del Norte and Palomas Avenue (east-west direction) and between Browing Street and Lowell (north-south direction) The other area was added south off of Browing Street between Pino Avenue and San Francisco Avenue.

**Findings of the Modeling**

Based on a tank at Tramway Boulevard and Paseo del Norte the zone 8E modeled area would need a configuration for each scenario as shown on the model maps provided in the appendix. The line sizes for the Rural/Domestic scenario range from two-inch to 10-inch lines with pressure reducing valves located in the southwest portion of the 8E area. The line sizes for the Intermediate scenario are similar to the Rural/Domestic scenario ranging from two-inch to 10-inch lines with pressure reducing valves located in the southwest portion of the 8E area. The lines sizes for the Sub-urban scenario ranged from six-inch lines to 14-inch lines with pressure reducing valves located in the southwest portion of the 8E area. Because the City of Albuquerque system does not use 14-inch lines, the cost for the 14-lines in the cost estimate is actually the 16-inch line cost. Maps of the three models are shown in Exhibits IV-3, IV-4, and IV-5 in the Appendix

The modeling found that three portions of the modeled area under all three scenarios fell outside of the 8E water pressure zone:

- The northeast corner of the area near Elena Drive and Lowell Street
- The southwest corner of the area near San Antonio Avenue and Browing Street
- A central southern area near the corner of Signal Avenue and Browing Street

The northeast corner area near Elena Drive and Lowell Street was not able to obtain a static pressure between 50 psi and 100 psi which is the working range for the City of Albuquerque system. The static pressure for this northeast corner area at its lowest point was 39 psi. However, the same area was able to maintain, under each scenario, the minimum 20 psi residual pressure with a fire flow. This area of lower pressure effects approximately eight lots. This lower pressure area is due to its higher elevation with regard to its surroundings.

The southwest corner of the area near San Antonio Avenue and Browing Street had the opposite problem of the northeast area. This southwest area, because of its lower elevation, modeled static pressures that were higher than 100 psi. Higher pressures are an issue because household water fixtures are designed for a maximum pressure, often 125 psi. Pressures too high can result in the failure of household fixtures.

During the modeling process attempts were made to increase the pressures in the northeast corner of the model area by raising the base tank elevation within the range of reasonable elevation expectations. However, the maximum pressure that was obtained with this raising was 44 psi static pressure (from 39 psi). This still did not meet the 50 psi static pressure minimum and did result in a significant increase in the number of locations that had static pressures above 100 psi.

Attempts were also made to eliminate the high pressure areas discussed above in the southwest and south-central areas without the use of pressure reducing valves. This was done by lowering

the tank. However, this lowering resulted in a drop in the northeast static pressures to levels below the 20 psi residual pressure needed for the fire flows.

Therefore, the approximate middle range was found with the tank at 6035, minimum static pressures in the northeast corner of 39 psi, and higher pressures in the southwest corners. The higher pressures in the southwest corner were eliminated through the use of pressure reducing valves.

During a design process these out of range areas could be designed in more detail to fine tune the balance between the high and low pressure areas.

**Costs for 8E Zone**

Costs were developed for each of the three scenarios modeled. These costs are shown in Exhibits IV-6, IV-7, and IV-8. These costs were developed to show the cost differential between the minimum system to provide just domestic water and the full fire flow system provided in the sub-urban system.

As can be seen from the figures developed, the rural/domestic system is $5.422 million with little fire flow capabilities. The full sub-urban system is $6.757 million. This represents only a 24.6% increase to provide full fire protection for the residents of North Albuquerque Acres.

**Model Extrapolation**

After the development of the model as described above, those same layouts were then copied to the north and to the south to fill the entire North Albuquerque Acres area. Those areas that are already in the city of Albuquerque were not included in this extrapolation.

The extrapolation for the study areas south of Paseo del Norte was a very smooth process because the areas are basically the same shape as the representative sample area. The areas north of Paseo del Norte, however, were extrapolated by centering the representative model on Paseo del Norte and moving the entire model to the east or to the west depending on whether it was the 9ER or 7E zone, for example. The north end smaller lines were adjusted to fit the northern boundary of the extrapolated area and then the larger lines were extended (or cut) to connect to those particular lines.

Due to the relief for the entire study area and because of the half-mile separation of the main north-south roads, the north-south roads were assigned two water lines with limited connections between them except at Paseo del Norte. One of these north-south lines is at the top of the pressure zone on the west (7E for example) and at the bottom of the pressure zone on the east (8E for example). If these north-south lines were connected at each of the east-west streets, a pressure reducing valve would be required at each of these locations. Rather than this expense, it was felt that dual water lines were a better approach with limited PRV connections.

The fire hydrants for the north-south lines were then placed along water line associated with the bottom of a zone to maximize the pressure that would result at this hydrant. The exceptions to this were the hydrants placed at the top of zone 9ER.

The areas that are served or are planned to be served by the City of Albuquerque were removed from the extrapolated model. The overall configuration is shown on the attached mapping for each of the three scenarios.

In areas where the pressure zone boundary exists between the north-south roads, such as zones 6E and 5E, there are various approaches to dealing with this issue. Some of these are:

1. **Provide north-south water lines on either side of the pressure zone boundary with limited connections that have PRVs.** This would require that the water lines pass through the private properties of the area and would require easements.
2. **Continue the higher pressure zone (6E, for example) through the lower zone (5E, for example) to the next street to the west.** This approach would mean that the homes in the lower zone would have pressures well above the 100 psi maximum pressure for the system. Therefore, this would require PRVs at each individual home with an approximate cost of $25 to $300 per home depending on whether or not the PRV is installed at the time of the meter installation.
3. **Continue the lower pressure zone through the higher zone to the next street to the east.** This approach would mean that the homes in the higher zone would have pressures less than the 50 psi minimum pressure for the system.
4. **Use PRVs at the major north-south streets to adjust the pressure zone boundary.** This would mean that the pressure zone boundary for this area is not consistent with the pressure zone boundaries around it. This can lead to confusion for property owners and maintenance personnel.
5. **Use dead-end lines along the pressure zone boundary.** The east-west lines would not be connected at the pressure zone boundary.
6. **Use PRVs on each east-west line at the pressure zone boundary.**

Approach 1 is not seen as viable due to the need for the easements and the issues involved with construction and maintenance through private property even with easements. Approach 5 is also not seen as viable due to the desire to reduce dead-end lines. Approach 6 is seen as very costly with regard to initial cost and continued maintenance costs associated with PRV stations. Approaches 2, 3, and 4 are all viable and the final decisions on the approach to use would need to be made during the design process where the actual pressures in the system would be analyzed. However, for cost estimate purposes, approach 4 was used as it would be the more costly for the public agency of the remaining approaches. The extrapolated models are shown in Exhibits IV-1, IV-9, and IV-10 in the Appendix.

**Water System Supply and Transmission**

Determination of the water system supply and transmission was not within the scope of this study and is not included in the costs for the different scenarios. However, the City of

Albuquerque Water Master Plan does address some supply and transmission issues even though these plans could be adjusted by the ABWUA in the future. The present schematic plan is for the North Albuquerque Acres area to be supplied by several water tanks located along Paseo del Norte that are yet to be built. There are already two existing tanks located along Paseo del Norte at Wyoming Boulevard and Eubank Boulevard. The number and location of the tanks could be adjusted and, therefore, will not be discussed further. The 9ER water pressure zone, located roughly between Tennyson Street and Lowell Street, would require a tank further east of Tramway Boulevard which might be difficult to accomplish. However, there is also the possibility that the 9ER area south of the Primrose Point development could be served by a tank further to the south. It is believed that the area north of the Primrose Point development could not be served from this same tank. Other sources would probably need to be found for this area including possibly extending the Sandia Peak Utilities service area to cover the far north part of zone 9ER.

Our analysis assumed that all needed water would be provided. Our analysis also assumed the implementation of the tank location portion of City of Albuquerque Water Master Plan developed in 1982.

**Water System Costs**

As can be seen from the data on the costs the cost to provide the entire area with water are:

| | |
|---|---|
| Rural/Domestic | $23.951 million |
| Intermediate | $25.336 million |
| Sub-urban | $30.076 million |

These costs show a differential of only 25.6% to provide full fire protection compared to the base rural and domestic almost no fire protection. These costs are shown in Exhibits IV-11, IV-12, and IV-13.

Since the locations, number, and size of storage tanks could vary in the future, including these costs in the system cost was outside the scope of the report. . It is assumed that the same storage tanks and transmission lines would need to be built for each of the three scenarios. The largest difference in the supply and transmission system between the scenarios would result from the increased storage tank sizes needed due to the increased fire flows. The supply/transmission lines to the tanks may or may not need to be increased in size. This would be determined during design and therefore, for this study and costs, the supply/transmission systems are assumed to be the same for each of the three scenarios.

Below are shown some sample storage tank costs from Means Cost data for 2002 with an inflation adjustment of 4% annually to the year 2004:

Concrete Ground Tank (excluding pipe or pumps)

| | |
|---|---|
| 250,000 gallon tank | $280,000 |
| 500,000 gallon tank | $380,000 |
| 1,000,000 gallon tank | $540,000 |
| 2,000,000 gallon tank | $816,000 |
| 4,000,000 gallon tank | $1,290,000 |

The peak day demand is the same for each of the three scenarios. Therefore, the storage for equalization and control would be the same. The biggest difference would be in the fire flow storage requirement. Therefore, if the difference in the size of the tank will be dependent upon the fire protection, the Rural/Domestic and the Intermediate scenarios have the same size of tanks. The Sub-urban scenario would need 360,000 gallons of storage capacity more than the other two scenarios due to the increase in fire protection. For example this would mean that a 1,000,000 gallon storage tank for the Rural/Domestic scenario would need to enlarge to a 1,500,000 gallon storage tank or a 2,000,000 gallon storage tank resulting in an additional cost of approximately $276,000. This cost is not reflected in the cost estimates provided in this study.

**Effect of Installed Water System on Area Wells**

It is the understanding of the study team that the existing private wells in the area could continue to be used for outdoor irrigation and other uses not related to the domestic uses. There would need to be a physical separation between the domestic water provided by the installed water system and the well system.

It is also the understanding of the study team that, at present, there is no requirement that property owners would need to connect to the new water system if installed. However, new development may be required to connect to the system. The study team believes that providing a water system to this area simply to provide fire flows without obtaining normal water user fees to offset the continued operations and maintenance expense for the system may not be a reasonable expectation.

Currently the water connection fee for the City of Albuquerque is $1,419 for a ¾" service. Additionally, the property owners would need to route the house water lines to the property line adjacent to the street. This effort would be made more expensive for routing from the back of the house.

**Water System Phasing**

The water system could be phased with the primary phase requirement that the sewer system be installed prior to or concurrently with the water system. Current City of Albuquerque policy does not allow water service without sewer service when sewer service is available. Therefore,

any water installations would be dependent upon the installed sewers in the area. This somewhat complicates the phasing of the water system because the water would need to follow the sewer and the easiest locations to provide sewer service are not necessarily the easiest locations to provide water service.

The most logical places to begin water system installation are the places that already have water tanks installed. This would mean that areas within water pressure zone 3E, 4ER, and 5E are the logical initial phases of the water system. However, this area is not the most logical place to begin sewer service because of the grades in the far northwest corner of the study area. Therefore, the water phasing could only be determined once the sewer phasing and water tank installation is determined.

**Water System Permitting**

The only known permitting that would need to occur would be the development of a joint powers agreement between the City of Albuquerque and Bernalillo County to provide water services and to tie-in to the City of Albuquerque system. Part of this issue would be the determination by the City of Albuquerque of adequate water supply to provide the area with water.

The initial system layout assumes that all of the system will be built within the street right-of-way and will therefore not require any easements.

**Water System Funding**

There is currently no identified funding for the installation of a water system for the study area.