

LA PLATA ARCHULETA WATER DISTRICT MASTER PLAN

November 2009

Prepared For:
La Plata Archuleta Water District
Board of Directors

Prepared By:
Harris Water Engineer, Inc.
954 E. 2nd Ave., Ste. 202
Durango, CO 81301
970-259-5322

Funded By:
Water Supply Reserve Account Grant

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Executive Summary

The La Plata Archuleta Water District (District) is a special district organized pursuant to Article 1 of Title 32, C.R.S. The District was formed after an organizational election during August 2008, to finance, construct, operate and maintain a public water system for rural areas in La Plata and Archuleta Counties. The District will provide reliable and safe potable water and fire flow from its facilities. These are essential services in many parts of the District where the quality and quantity of water is a concern. The water distribution system and the facilities required to be constructed are described in this Master Plan which will act as a “road map” for further planning, design, and permitting.

The water system will utilize two water sources and two treatment plants. The water will be treated to Colorado Department of Public Health and Environment Drinking Water Standards and delivered through a pipe distribution system to District water users. The system will be pressurized by multiple water storage reservoirs (tanks) and pressure boosting stations (pumps) or pressure reducing valves as necessary. The pipelines will be sized to deliver 1,000 gallons per minute at most locations to satisfy fire flow requirements or the estimated 2060 peak demand, whichever is greater. Fire hydrants will be installed throughout the system at locations determined in cooperation with the local fire districts. The distribution pipelines will primarily be 8 inch diameter with diameters up to 18 inches for major trunklines from the treatment plants. Water system facilities will include treated water storage tanks, water diversions, transmission and distribution lines, valves, connections and meters for homes and businesses, water loading stations and all necessary and incidental facilities customary in any community water distribution system.

After consideration of eight different water sources and treatment plant locations, the District’s Board of Directors (Board) has determined that obtaining water: (1) from the Animas-La Plata Project (ALP) with a treatment plant downstream of the Ridges Basin Dam is the preferred source of water to serve the western half of the District; and (2) a joint treatment plant with the Town of Bayfield using water from Vallecito Reservoir is the preferred source of water to serve the eastern half of the District. This configuration provides the potential for a redundant supply to both areas. In the event either of these preferred sources cannot be utilized, alternative sources on the Pine River and the Animas River are identified in this Master Plan. The two preferred sources of water both draw water from large reservoirs (120,000 AF each) and are the most secure sources of supply available to the District. The ALP treatment plant will serve the Florida Mesa and the Bayfield treatment plant will serve the area east of the Florida River within the Pine River Irrigation District. The water distribution system will utilize an integrated design so that water from either source can be delivered to all areas within the District, as a backup supply in the case of an emergency.

Two water supply planning horizons are evaluated in the Master Plan, an intermediate horizon of year 2030 when all of the facilities should be substantially constructed and a long term horizon of 2060. The amount of annual water demand for these two planning horizons is shown in the following table. The number of equivalent units (EU) that could be served using the reasonable annual demand estimate for the Board’s priority goal of Conservation Use of 200 gallons per EU per day (g/EU/d) and the La Plata County (LPC) planning amount of 350 g/EU/d is shown for

2030 and for 2060. The conclusion is that the District should secure a minimum raw water supply of at least 2,745 acre feet (AF) per year to meet the 2060 demand from a combination of the two preferred sources. Approximately 1,060 AF per year will be needed by 2030.

	Reasonable Annual Demand (AF)	Resulting EU Served @ 200 g/EU/d (EU)	Resulting EU Served @ 350 g/EU/d (EU)
Year			
2010	0	0	0
2030	1060	4725	2700
2060	2750	12250	7000

The order in which these facilities will be constructed has not been determined by the Board. Annual determinations will be made based upon homes served per mile, cost per mile, availability of right of way, health and safety issues, and fairness in extending service to all areas of the District. Logistically, the homes nearest the two preferred water sources will be served first, but after that, the distribution system should be extended into all areas of the District as quickly and equitably as funding is available. The Board has passed a resolution to mitigate the expense to property owners that are served later by reducing their capital investment fee (e.g. tap fee) by an amount equal to the property taxes paid to the District prior to their connection to the system. Because Board members are elected from five separate board member districts, each geographic area will be represented when the determinations are made concerning the order in which the District’s pipelines are extended.

The estimated cost of the water system facilities, within a range of –30% to +30%, is \$122,050,000. The range of the cost estimate reflects the variables inherent in the significant differences in construction conditions throughout the District. For example, the cost of installing an 8 inch pipeline can vary by 100% from one location to another depending upon soil conditions, utilities in the easement, and space to install pipe. These estimated costs do not reflect economies of scale that may occur due to the many miles of pipeline required to be installed.

Construction of the treatment plants and the water distribution system will be funded through a 5 mill levy that District voters must approve before construction of these facilities may be started. Bonds will be issued by the District and repaid from property taxes collected after the mill levy is approved. Proceeds from the sale of the bonds will be used to construct the treatment plants and the water distribution system. Property tax revenues not required for debt service payments on the bonds will also be used to fund pipeline construction on a “pay as you go basis.” Though a much smaller amount, a portion of the property tax revenues are expected to be used to pay District staff until there is sufficient revenue from sales of water to pay all administrative expenses. The District Board will consider a mill levy reduction after the system is constructed.

The Master Plan demonstrates how the water distribution system will be completed. The Master Plan will be used as a guide for the Board and in the application process for the numerous permits that are required prior to construction, such as the LPC permits and Corps of Engineers

404 Permit. The Master Plan is a “living” document subject to revisions to respond to new information and needs identified as the system is constructed and placed in operation.

I. Introduction and Service Area

The La Plata Archuleta Water District (District) is a special district organized pursuant to Article 1 of Title 32, C.R.S. The District was formed by election in November of 2008 to finance, construct, operate and maintain a public water system for areas in La Plata and Archuleta Counties. The District boundaries are shown on Figure One in Appendix A. The District will operate the water system to provide essential, reliable and safe potable water and fire protection facilities and services. The water system and its facilities are described in this Master Plan which will act as a “foundation and road map” for further planning, design, and permitting.

Generally, the water system will utilize two water sources to divert raw water to two treatment plants. The water will be treated to Colorado Department of Public Health and Environment Drinking Water Standards and delivered via a pipe distribution system to District water users. The system will be pressurized by multiple water storage reservoirs (tanks) and pressure boosting stations (pumps) or pressure reducing valves as necessary. The pipelines will be sized to deliver 1,000 gallons per minute (gpm) at most locations for fire flow requirements or the estimated 2060 peak demand, whichever is greater. Fire hydrants will be placed on the pipeline in locations as determined in cooperation with the local fire districts. The distribution pipe will primarily be 8 inch diameter with diameters up to 18-inches for major trunklines from the treatment plants. Water system facilities will include treatment plants, treated water storage tanks, water diversions, transmission and distribution lines, valves, connections and meters for homes and businesses, water loading stations and all necessary and incidental appurtenances.

The District is situated in the southeastern corner of LPC, to the south, southeast and east of Durango, Colorado. The eastern boundary of the District is the La Plata and Archuleta county line. The District has identified potential service areas in Archuleta County and may eventually extend into Archuleta County to serve properties along the Highway 160 corridor and near Arboles and Navajo Reservoir. The southern boundary is the Colorado state line. The western boundary is generally the Animas River. The northern boundary runs south of Durango’s Potential Urbanizing Zone that includes Grandview, and then generally runs parallel to and north of the Highway 160 to the Archuleta County line. The District has also identified potential service areas north of this boundary and may eventually extend to serve properties along CR 240 or near Vallecito Reservoir. Please see Figure Two in Appendix A.

The current service area within the District encompasses land that has been agricultural ranches and farmland for over a century. The area has been gradually subdivided over the last three or four decades and is now a mixture of residential subdivisions, agricultural ranch and farm land, and some commercial properties which are mostly concentrated around the Durango/LPC Airport and the Gem Village area along Highway 160. Please see Figure Three in Appendix A. Although the area has been subdivided, it is still primarily an agricultural community with the subdivisions serving as bedroom communities for Durango, Bayfield and Ignacio. Durango is the LPC seat. A majority of the residents that work outside of the home drive to Durango to work. Many of the others work in Bayfield or Ignacio. The oil and gas industry has multiple plants within the area that also provide employment and a small fraction of the residents may work in the neighboring towns of Aztec and Farmington, New Mexico. The Ignacio JT School

District covers about half of the District area, with the Durango 9R and Bayfield 10JTR School Districts equally covering the other half.

County records indicate there are approximately 5,570 privately owned lots within the District's boundaries, not including the towns of Bayfield and Ignacio and their service areas and other smaller units of local governments. 1,670 of these properties are classified as agricultural, 3,310 as residential and 55 as commercial. Other miscellaneous classifications include industrial, exempt, vacant, and others. Agricultural properties may or may not have a home situated on the property. 2,150 of the lots are located within platted subdivisions. Some property owners have elected to exclude their property from the District. As of 2008, approximately 860 of these properties were so excluded. This leaves 4,700 privately owned properties classified as agricultural (1,300), residential (2,880) and commercial (45). 1,800 of the lots are located within platted subdivisions. These numbers of lots are sufficient for system operation as the system design and operation is not dependent on new growth.

The District is located within the Animas, Florida, Los Pinos (Pine) and Piedra River watersheds. Lands within the District consist of hills, ridges, mesas and drainages, with elevations ranging from approximately 6,200 feet to 7,900. The greatest portion of the land lies between elevations 6,300 and 6,800, with a slight slope to the south. Many natural laterals and auxiliary irrigation ditches transect the area.

Agricultural uses occur on both private and tribal lands and include irrigated and non-irrigated cropland and rangeland. Much of the non-irrigated lower elevation land is dryland with areas of pinion, sagebrush, other desert shrubs, and grasses used for grazing livestock. The higher elevation lands include Douglas fir, ponderosa pine, aspen and juniper oak woodlands. Non-irrigated crops include winter wheat. Irrigation is used primarily for alfalfa and irrigated pasture, also for wheat, oats, and barley.

The soils in the area consist of various types of loams, clays and rock outcroppings, such as: Falfa clay loam, Herm loam, Mikim loam, Bayfield silty clay loam, Zyme clay loam and Zyme-Rock outcrop, etc...

II. Water Demand

II-A. Demand Scenarios and Projections

The planning of the water system requires estimates and projections of water demands at various times in the future. Various types of water demand estimates are necessary including:

- Planning horizon
- Water accounting units
- Annual water demand
- Monthly distribution of annual demand
- Distribution pipeline sizing criteria
- Treatment plant sizing criteria
- Hydraulic analysis of the water system

The criteria for each of the various types of water demands are described and evaluated in the following sections, including a recommendation for each.

Harris Water Engineering (HWE), the engineering consultant for the District, has performed extensive and detailed water demand evaluations for the Pagosa Area Water and Sanitation District (PAWSD), which is a nearby water system in Archuleta County. The PAWSD evaluations are used extensively in estimating the District water demands. However, PAWSD has greater outdoor irrigation and commercial water use than expected for the District requiring adjustments.

The criteria derived below are for purposes of this Master Plan and are subject to modification and updating as more detailed information is developed for the specific characteristics of the District.

II-B. Planning Horizon

The criteria for each of the water demands is dependent upon how far in the future to plan which is referred to as the planning horizon. Two planning horizons are suggested for consideration.

1. Near term planning horizon of 2030. This date is based on assuming construction of the water system can begin in about 2012, which includes two years for obtaining the numerous permits and agreements necessary to begin construction, the system should be fully constructed no later than 2030. Please see Section VI. During the period from 2012 to 2030, the number of connections each year will be dependent on the speed the pipelines are installed and the connection of homes. Generally, facilities that can be relatively easily increased in size (e.g. treatment plant, pumps and water tanks) would be initially sized to meet the 2030 demand.

2. Long term planning horizon of 2060. The 2060 date was chosen to provide a 50-year planning horizon to size facilities that are not easily increased in size such as pipelines. 50 years is a common planning horizon and is often considered reasonable, such as in a recent Colorado Supreme Court decision indicating 50 years is a reasonable time frame to plan for water rights.

From 2030 to 2060, the number of connections will largely depend on new growth in the area; however, the system design and operation are not dependent on new growth. New pipeline construction will be extensions from the mainlines described in this Master Plan to new developments. The estimated water demand for the 2060 planning horizon will be used to determine how much raw water to secure and to size facilities that are not easily increased, such as trunk and distribution pipelines.

RECOMMENDATION: A near term planning horizon of 2030 and a long term horizon of 2060.

II-C. Equivalent Units to Measure Water Demand

Selection of a water measurement “unit” is necessary to estimate the water demand for each planning horizon. Many systems use “taps” or “connections” to describe the number of units that are served; however, this type of description does not indicate the difference in water usage between “taps”. Another method used by many water systems, is “equivalent units” (EU) with a “unit” being the amount of water used by a typical single family home. Permanent population is not recommended because of the difficulty in determining the population given second homes and commercial developments.

Further, the number of EU can employ the industry standard Uniform Plumbing Code (UPC) to assign a weighted fixture count to residences and businesses. This fixture count will dictate the gpm of water demand, thus indicating the appropriate meter size required. The lower the fixture count, the less the water demand, and thus the smaller the meter size and associated EU. Low-flow and water conserving appurtenances will result in a lower fixture count, meter size and EU allocation. See the water meter sizing explanation as obtained from the PAWSD web site, attached in Appendix C.

This methodology fairly allocates EU based on potential water usage. Large water users, whether commercial or residential, will be appropriately charged for their impact on the water system.

RECOMMENDATION: The use of Equivalent Units to measure water demand.

II-D. Estimated Equivalent Units for Each Planning Horizon

An estimate of the water demand for each planning horizon is necessary to secure an adequate water supply and properly size the facilities. The annual demand is determined based on the estimated number of EU and the water usage per EU. The number of EU will increase over time as the water system is constructed, existing homes connect, and new homes are built.

There is significant variability (multiple demand scenarios) in estimating the number of EU that will be connected to the District water system at each planning horizon. Currently there are no EU on the water system and the major question is how many will connect to the system in 2030 and 2060?

The current LPC land use plans were used to develop a range of potential EU. How many EU will realistically be developed due to growth demand or changes in the land use plans is not known. The pattern of development within the District is also not known. The plans for the

water system attempt to provide the infrastructure to provide water no matter what the amount of growth or the development pattern. The water system is needed even if there is no growth, which is highly unlikely.

The demand scenarios were developed using the ArcMap software and LPC GIS coverages. The coverages used were the parcel coverage, Florida Mesa Planning District and Bayfield Planning District Land Use Classification. These coverages were used to find the number of existing parcels, and the minimum and maximum number of new parcels that could be expected to develop, as allowed by the planning district land use classifications.

The parcel coverage was spatially joined to the Florida Mesa Planning District and Bayfield Planning District Land Use Classification coverages using ArcMap. This provided the land use code from the planning district coverage to appear in the parcel coverage data file, so each parcel was coded with the underlying land use classification. The land use classification governs the residential densities and parcel size restrictions for different areas within each planning district. The minimum and maximum residential allowance for each parcel was then analyzed according to each parcel's acreage and current improvements.

If a parcel already had an improvement and did not have enough acreage to be subdivided according to the underlying land use code, the current improvement was counted and no additional units were calculated for that parcel. If a parcel had enough acreage to be subdivided, the density of the new parcels was counted as the minimum and maximum residential densities as allowed by the land use codes. The current improvement was not included in the amount of new units allowed.

If a parcel did not already have an improvement and did not have enough acreage to be subdivided according to the underlying land use code, then one unit was added and counted as residential density allowed because the parcel is already an existing parcel of record. All existing parcels of record will be allowed one tap. If a parcel did not already have an improvement and had enough acreage to be subdivided, the density of the new parcels was counted as the minimum and maximum residential densities allowed.

If a parcel is located in a place in the District that does not have a planning district, then one unit was calculated per parcel, regardless of the acreage. If the parcel was already improved, then no new units were counted. If the parcel was not already improved, then one unit was added and counted as the residential density allowed. In these areas, one unit per parcel will be allowed for existing parcels of records.

The District Service Plan, as approved by the La Plata Board of County Commissioners, states the District "shall not provide water service to property that is not a legal lot of record in accordance with LPC Land Use Regulations. Water service provided by the District shall comply with LPC Land Use regulations, including restricting the water service to the allowed Land Use density." This restriction in the Service Plan means that water cannot be provided to any property owner that does not comply with the County Land Use regulations that exist now or in the future. The density projections in this section are an attempt to quantify the range of potential EU the District may serve. The LPC Planning Department is developing a new

Comprehensive Plan. Once this plan is formulated and adopted by LPC, the District will employ the revised land use maps and planning densities associated with the plan to calculate future water needs.

The tribal, federal and state exempt lands were removed from the parcel coverage to determine the amount of privately owned land. There are approximately 5,565 privately owned parcels, which may include subdivision open space and other tax-exempt lands, as well as individual parcels. The parcel coverage shows that 3,597 of those parcels have some sort of improvement on them. For projection purposes, the improvements are considered to be homes, but they could be barns or sheds, etc... These projections are based on the total number of lots in the District. The excluded parcels were not removed from the estimate because it is likely many will come back into the District in the future once a pipeline is adjacent to the property, from change of landowner who does not want the responsibility for a well, or for various other reasons.

Applying the land use classifications to the 5,565 privately owned parcels, it was determined that a minimum of 3,909 and a maximum of 14,498 additional residential units could be allowed by the current land use classification densities. The Board feels it is unrealistic to expect the maximum possible density of 20,000 parcels (the existing 5,565 plus the maximum additional 14,498 units allowed.) (The LPC Planning Department also feels it is unreasonable to expect the county's current infrastructure, and residents, to support the maximum density allowed by the current land use plans, thus the new LPC Comprehensive Plan with revised land use maps and planning densities are expected to be less than currently.) Therefore, for purposes of estimating demand, a low and high number of EU is estimated for 2030 and 2060. The low estimated in 2030 assumes that half the existing 3,600 developed lots will connect to the water system, for a total of 1,800 EU which assumes little or no growth. The high number in 2030 assumes that the full 3,600 EU will connect to the water system, which will be a combination of existing and newly developed lots which assumes moderate growth.

The low EU in 2060 is estimated to be 4,000. This is about half of the currently improved parcels plus half of the minimum number of new parcels, as allowed by the land use classifications. The high EU estimate in 2060 is 10,000, assuming that half of the lots allowed by the current land use plans will connect to the water system by that date.

RECOMMENDATION: The various water demand criteria will be determined based on a range of EU from 1,800 to 3,600 in 2030 and 4,000 to 10,000 in 2060 and shown on Table 1.

TABLE 1 – Equivalent Units

Year	Equivalent Units (EU)	
	Min	Max
2010	0	0
2030	1800	3600
2060	4000	10000

II-E. Estimated Water Usage Per EU

The water usage per EU is also difficult to estimate because it varies based on the characteristics of each water system. The estimate herein is based largely on information from the PAWSD water system but provides flexibility to adjust as actual data is accumulated for the District.

There are three general locations for measurement of water usage:

- 1) the point the raw water is diverted from a stream or reservoir,
- 2) the amount of water treated at the treatment plant(s), and
- 3) the amount of water delivered at each meter.

There are losses between each of these potential measurement points. The largest usage in gallons per EU per day (g/EU/d) would be determined by measurement at the raw water diversion point, which includes all losses in delivering water to each meter. However, typically the best measurement records are at the treatment plant. There is not a standard criterion for determining losses between each measuring point because every water system has different delivery facilities.

Utilization of the District's two recommended water sources (see the Preferred Water Source section of this report) will result in different losses. There will be essentially no loss of water delivered from Ridges Basin Dam to the treatment plant. Water delivered from Vallecito Reservoir to the Bayfield treatment plant may be lost in the Pine River from the reservoir to Bayfield and the diversion through a ditch or pipeline to the treatment plant. The result of this variability is a range of g/EU/d.

Until the District has 10 to 15 years of actual usage records it is not possible to accurately estimate g/EU/d. Therefore a range of g/EU/d is used to provide a reasonable determination of the total amount of water that should be secured.

LPC (LPC) currently uses 350 gallons per home (assumed to be an EU) per day; further this is assumed to be at the raw water diversion. PAWSD has very accurate records for the past 14 years and when accounting for water conservation and drought reduction since 2002, indicates 260 g/EU/d measured at the treatment plant. PAWSD has a significant amount of lawn irrigation and commercial usage that the District will not have.

The District water system is primarily for domestic usage and not for outside lawns and gardens. As an extensive irrigation system exists in the area, the District expects virtually no outside use. The District will develop an effective water conservation plan to assist its customers in using the least amount of water possible and a rate structure to discourage much, if any, outside usage. This Master Plan includes a District water usage goal of 200 g/EU/d at the raw water diversion point which is believed to be achievable based on:

- PAWSD records and the differences with the District system,
- In-house usage is typically estimated at 175 g/EU/d,
- LPC 350 g/EU/d includes 192 g/EU/d for in-house use and the difference for outside lawn irrigation,

- AWWA recommendation of 175 g/EU/d for in-house use,
- An effective water conservation plan to assist customers in reducing water usage, and
- A rate structure to discourage outside water usage.

RECOMMENDATION: A range of water usage per EU of 200 to 350 g/EU/d measured at the raw water sources, with the conservation goal being 200 g/EU/d.

II-F. Estimated Annual Water Demand

As indicated on the following table, Table 2, when combining the projected EU and usage per EU ranges, the 2030 annual water demand would range between approximately 400 and 1,400 AF. The 2060 annual water demand would range between 900 and 3,900 AF. This is an extremely wide range of potential annual water demand reflecting the difficulty in making estimates for a large, new water system.

TABLE 2 – Demand Scenarios

Year	Equivalent Units (EU)		Conservation Demand 200 gpd/EU (AF/YR)		LPC Planning Demand 350 gpd/EU (AF/YR)	
	Min	Max	Min	Max	Min	Max
2010	0	0	0	0	0	0
2030	1800	3600	403	807	706	1411
2060	4000	10000	896	2240	1568	3921

The District is planning to secure a raw water supply in the early years of system development to meet a reasonable estimate of the 2060 demand at 350 g/EU/d. The reasonable annual demand estimate is recommended to be the middle of the LPC 2060 range of 1,568 to 3,921 or 2,750 AF. The amount needed in 2030 would similarly be 1,060 AF. Table 3 shows the number of EU that could be served using the reasonable annual demand estimate for the Conservation use and the LPC use as compared to the projected minimum and maximum EU. This table indicates that the reasonable annual demand, as estimated herein, is sufficient water to supply the projected number of EU at each usage rate.

TABLE 3 – Reasonable Annual Demand

Year	Reasonable Annual Demand (AF)	Resulting EU Served @ 200 g/EU/d (EU)	Resulting EU Served @ 350 g/EU/d (EU)	Projected Equivalent Units (EU)	
				Min	Max
2010	0	0	0	0	0
2030	1060	4732	2704	1800	3600
2060	2750	12275	7014	4000	10000

RECOMMENDATION: Secure a minimum raw water supply of at least 2,750 AF to meet the 2060 demand, with approximately 1,060 AF needed by 2030.

Generally about half of the water would be secured from each of the two water sources; however, the ALP option is a one time only opportunity to obtain water so more than 1,375 AF, half of the 2060 reasonable demand, might be acquired from ALP due to future limitations.

The water supply from Vallecito Reservoir is likely to be more flexible and can be increased in the future; therefore, an arrangement to secure water gradually over 50 years might be established to meet actual demands. For example, only approximately 530 AF would be requested from Vallecito by 2030, if half of the supply were secured from each source.

Following is an example calculation converting the gallons used per EU per day to the number of AF needed each year.

$$\left(350 \frac{\text{gal}}{\text{day} \cdot \text{EU}}\right) \times (7,000 \text{EU}) \times \left(365 \frac{\text{days}}{\text{year}}\right) \times \left(\frac{1 \text{AF}}{325,851 \text{gal}}\right) \cong 2,745 \text{AF / year}$$

Conversion Notes:

- 1 acre foot (AF) = 325,851 gallons
- 1 cubic foot per second (cfs) = 448.83 gallons per minutes (gpm) = 723.967 AF/Year

II-G. Estimated Monthly, Weekly, and Daily Demand Distribution

An estimate of the peak month, peak week and peak day demands are necessary to size the facilities, primarily the treatment plant and pipe distribution system.

The annual water demand will not be evenly distributed each month but will be highest in the summer months and lowest in the winter months. Though the District will attempt to minimize outside water usage, there will be higher summer demand than winter. Typically the highest summer demand month is June and/or July and is approximately double the winter demand.

The following monthly demand pattern, shown in Table 4, is recommended based largely on PAWSD records.

TABLE 4 – Monthly 2030 Demand Pattern

	% of Demand per Month	AF Used per Month	Average cfs per Month
January	6.5%	69	1.12
February	6.5%	69	1.24
March	6.5%	69	1.12
April	8.0%	85	1.43
May	9.5%	101	1.64
June	12.0%	127	2.14
July	12.0%	127	2.07
August	10.0%	106	1.72
September	8.5%	90	1.51
October	7.5%	80	1.29
November	6.5%	69	1.16
December	6.5%	69	1.12
Total		1,060 AF	

TABLE 5 – Monthly 2060 Demand Pattern

	% of Demand per Month	AF Used per Month	Average cfs per each Month
January	6.5%	179	2.91
February	6.5%	179	3.22
March	6.5%	179	2.91
April	8.0%	220	3.70
May	9.5%	261	4.25
June	12.0%	330	5.55
July	12.0%	330	5.37
August	10.0%	275	4.47
September	8.5%	234	3.93
October	7.5%	206	3.35
November	6.5%	179	3.00
December	6.5%	179	2.91
Total		2,750 AF	

The peak month is 12% of the annual water usage, therefore, in 2030, 127 AF of the annual 1,060 AF (2,700 EUs using County 350 gpd, see Table 3) is delivered in June or July; similarly in 2060, 330 AF of the 2,750 AF (7,000 EUs using County 350 gpd, see Table 3) is delivered in June or July.

Generally the treatment plant is recommended to be sized to deliver the 2030 peak week demand. The peak day and hour demand is met from storage tanks. The information available to estimate the peak week demand includes:

- The average day demand during June is 2.14 cfs.
- PAWSD data indicates the peak week is approximately 25% greater than the average day during the peak month.
- The peak week demand for treatment plant sizing would be 2.14 cfs times 125% which is 2.68 cfs.

For purposes of the Master Plan, 2.68 cfs (1,200 gpm) is recommended as the minimum combined initial capacity for the two treatment plants. The treatment plants may be modular design that allows incremental units to be added rather than installing the full 1200 gpm initially. Again, this criteria is not fixed and will vary from year to year in actual operation, therefore, the estimates herein are for planning purposes and will be evaluated continuously through the design and construction stages.

RECOMMENDATION: The two treatment plants should be sized to meet the 2030 demand estimated to be approximately 1,200 gpm total.

II-H. Fire Flow Requirements

District representatives have contacted local fire protection districts to determine necessary fire flow and to request cooperation with any other joint issues. The Upper Pine River Fire Protection District, the Los Pinos Fire Protection District and the Durango Fire and Rescue Authority all serve within the District boundaries. The District hopes to have the input of the fire districts, not just for fire flow requirements, but also for fire hydrant placement.

Initial conversations with the Los Pinos Fire District indicate that 500 gpm would meet their needs, but they'd prefer 1,000 gpm if the hydrants would be available as "fill points" in support of their water tender operations. The District is designing the distribution system to provide 1,000 gpm at most locations; there are a few high elevation points in the distribution system where this may be difficult.

III. Water Supply

The District holds conditional water rights on the Animas, Pine and Piedra Rivers and can potentially obtain water from Lake Nighthorse of the Animas-La Plata Project (ALP) and from Pine River Irrigation District (PRID) using Vallecito Reservoir. Utilization of these sources are described in more detail in the Water Sources Alternatives section. This section describes the water supply available from each location.

III-A. District Water Rights

The District holds the following conditional water rights:

- 1) Animas River near Weasilskin Bridge, up to 15 cfs
- 2) Animas River and/or Florida River at Bondad, up to 15 cfs
- 3) Pine River near Pine River Canal, up to 7.5 cfs
- 4) Pine River 2 miles north of Ignacio, up to 7.5 cfs
- 5) Piedra River near Arboles, up to 5 cfs
- 6) The combined diversion at all locations cannot exceed 15 cfs

Individually, or in combinations, these water rights can serve portions of the District or the entire District. The water rights may be used simultaneously, but cannot exceed a combined diversion of 15 cfs. The quantity of water available for diversion at each location is an important factor in determining the best water source for the District and is evaluated later in this section.

The District also has the possibility of obtaining a water supply from ALP and Vallecito Reservoir which are also described in this section.

III-B. General Criteria for Evaluation of District Water Rights

To assess the actual water supply of each of these sources, daily stream flow data was obtained for the following United States Geology Survey (USGS) gauges: 1) Animas River near Durango, 2) Animas River near Cedar Hill, 3) Piedra River near Arboles, and 4) Los Pinos River near Ignacio.

The recommended annual and monthly demand scenarios described in Tables 4 and 5 above were used to compare stream flow gauge records with monthly demand to determine each water right location's potential to meet the District's demand.

III-C. Animas River Water Supply

The District holds a conditional water right on the Animas River of 15 cfs. There are three alternative diversion sites located along the Animas and Florida Rivers for this right, so two different gauge readings were used to determine if the Animas River flows were adequate at each diversion site to meet the right and provide the water supply to meet the District's demand. The USGS Animas River near Cedar Hill gage has daily stream flow records from 1933 until the present day. Animas River near Durango has daily stream flow records from 1897 until the present day.

To ensure the Animas River would satisfy the District’s water right for the system the minimum, maximum, and average stream flow were determined for each month at the different gauges. The following tables display the results. It is shown that the minimum water flow for the Animas River is always significantly greater than the District’s monthly water demand. The records shown in Tables 6 and 7 below indicate that even in drought years the Animas River always meets the water right flow amount, as well as the projected monthly demands.

TABLE 6 – Animas @ Cedar Hill Flow Summary

Month	Minimum cfs	Maximum cfs	Average cfs	2060 Demand cfs
January	90	991	250	2.91
February	130	1430	265	3.22
March	118	3800	439	2.91
April	129	4190	1088	3.70
May	258	10400	2526	4.25
June	182	11800	2922	5.55
July	107	9580	1224	5.37
August	89	4200	633	4.47
September	92	8220	540	3.93
October	136	7390	485	3.35
November	150	1730	348	3.00
December	130	842	274	2.91

TABLE 7 – Animas @ Durango Flow Summary

Month	Minimum	Maximum	Average	2060 Demand cfs
January	103	431	204	2.91
February	104	489	207	3.22
March	94	1700	304	2.91
April	141	3510	846	3.70
May	285	9500	2308	4.25
June	172	10700	2808	5.55
July	130	7300	1178	5.37
August	116	3570	585	4.47
September	121	7740	465	3.93
October	134	7000	423	3.35
November	134	1340	288	3.00
December	100	539	224	2.91

The Animas River has not had a call, which could potentially restrict the District water rights. Therefore, there is more than adequate flow in the Animas River from a physical and legal perspective to meet the District water demands.

III-D. Los Pinos River Water Supply

The District holds a conditional water right on the Pine River of 7.5 cfs. There are two alternative diversion sites for this right. The Los Pinos River near Ignacio gauge was used to determine the adequacy of Pine River flows at each diversion site to meet the water right and provide an adequate water supply to meet the District's demand. Los Pinos River near Ignacio daily stream flow record is from October of 1999 until the present. Table 8 shows the flow in the dry months are not adequate to meet the 2060 demand.

TABLE 8 – Pine River Flow Summary

Month	Minimum (cfs)	Maximum (cfs)	Average (cfs)	2060 Demand cfs
January	6.5	291	67	2.91
February	8	682	121	3.22
March	10	1050	222	2.91
April	4.3	2370	295	3.70
May	2.1	2140	273	4.25
June	0.87	1360	140	5.55
July	0.92	237	15	5.37
August	0.33	119	13	4.47
September	1.1	133	14	3.93
October	0.96	763	136	3.35
November	5	716	108	3.00
December	6.6	491	83	2.91

The Pine River was further evaluated due to the fact it was not satisfying the projected demands. If the river cannot supply the District's full demand, then supplemental water is needed. Vallecito Reservoir water from PRID is the most likely supplemental source. The evaluation indicates approximately 600 to 700 AF of supplemental water may be needed to meet the 2060 demand in a dry year assuming approximately half of the annual District demand is provided from the Pine River. The evaluation is similar for both water right locations on the Pine River.

III-E. Piedra River Water Supply

The District holds a conditional water right on the Piedra River of 5 cfs. There is one diversion site on the Piedra River for this right just upstream from Navajo Reservoir. The Piedra River near Arboles gauge was used to determine if the Piedra flows enough at the diversion site to meet the water right and provide an adequate water supply to meet the District's 2060 demand. Piedra River near Arboles daily stream flow record is from September of 1962 until the present.

Table 9 shows that the minimum water flow for the Piedra River is adequate to provide the 2060 monthly flow, though the entire river would be diverted in dry years.

TABLE 9 – Piedra River Flow Summary

Month	Minimum cfs	Maximum cfs	Average cfs	2060 Demand cfs
January	16	310	76	2.91
February	15	600	94	3.22
March	26	2250	332	2.91
April	55	4420	875	3.70
May	50	4630	1278	4.25
June	11	3610	997	5.55
July	5.2	2130	321	5.37
August	3.9	2430	219	4.47
September	4.4	5360	207	3.93
October	34	4140	185	3.35
November	19	900	125	3.00
December	20	1030	91	2.91

III-F. Water Rights Summary

The analysis determined whether the water rights and flow available at each river could satisfy the 2060 demand.

In summary, the Animas River water right can meet the District’s demand up to and beyond the 2060 50-year planning horizon. The minimum Animas River flow is greater than the largest projected monthly 2060 cfs demand.

The Pine River cannot meet the District’s projected 2060 demand. The District’s water right would have to be supplemented for at least a portion of each year. The minimum Pine River flow is less than the 7.5 cfs water right often, for consecutive days throughout the summer months and even some winter days, as well.

The Piedra River water right can meet the District’s demand up to the 2060 planning horizon. Although the minimum Piedra River flow fell below the 5 cfs water right for a few days during the drought of 2002, the minimum flow is usually greater than the 2060 demand.

III-G. ALP Water Supply

ALP water might be purchased from the State of Colorado through the Colorado Water Conservation Board (CWCB). The State has an option to purchase up to approximately 10,000 AF of supply, the option is available until about 2012 or 2013 when the final ALP cost allocation is prepared. The purchase price is expected to be between \$2,500 and \$3,500 per AF which is a very reasonable cost for storage water available on demand. The District has sent a letter to the CWCB expressing interest in purchasing 1,000 AF of the available supply. Obtaining this water supply is a one time only opportunity; therefore, the District may be interested in as much as 1,600 AF in order to have a comfortable supply and that amount would provide a seat on the ALP Managing Committee (please see Section IV-C). Using the 2060 planning horizon annual

water demand of 2,750AF and assuming about half would be needed from ALP indicates at least 1,375 AF should be acquired, further indicating the initial request of 1,000 AF should be increased.

The water will be stored in Lake Nighthorse and accessed through a pressurized outlet pipe through the Dam. The available pressure through the dam will be adequate to operate the treatment plant.

III-H. PRID Water Supply

PRID has water available from Vallecito Reservoir on demand. The water is presently priced at \$250 per AF per year for water used and \$50 per AF for water held in reserve until actually needed. PRID has implemented agreements (e.g. Town of Bayfield) with other entities for water provided in a similar manner. When the District is ready and knows the amount of water to be secured, PRID has established the process to obtain the water. Based on Table 3 approximately a maximum of 530 AF may be requested from PRID to meet the 2030 planning horizon and up to 1,375 AF to meet the 2060 demand.

III-I. Water Quality Information

The Animas and Pine Rivers serve as current drinking water sources and the City of Durango (Durango), the Town of Bayfield (Bayfield) and the Southern Ute Indian Tribe (SUIT) treat surface water from these sources. The water quality of the rivers is relatively good and the stream segments where the District diversions could occur meet the Colorado Water Quality Control Commission's (WQCC) Water Quality Standards for drinking water; however many contaminants do exist that require treatment to meet the State's Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs) for drinking water.

The Colorado Division of Wildlife and other agencies and volunteers collect data through the Riverwatch Program. This data is available through the Colorado Data Sharing Network. The data indicates that there are samples collected in the Animas, Florida and Pine Rivers that exceed the MCLs and SMCLs for various contaminants. The Animas has been found to have elevated levels of hardness as CaCO₃, arsenic, iron, manganese and sulfate. The Florida has been found to have elevated levels of CaCO₃, iron, and manganese. The Pine has been found to have elevated levels of CaCO₃, aluminum, arsenic, iron and manganese.

Durango utilizes the Florida River as its primary source, with the Animas providing supplemental water during the irrigation season. Durango publishes a Consumer Confidence Report (CCR) as required by the WQCC Department of Public Health and Environment. The CCR lists the following contaminants found in the raw water, most of which were found in levels far below the MCLs and SMCLs and do not require treatment: coliform, radium, barium, fluoride, nitrate, turbidity, alkalinity, calcium hardness and TOC. As the levels of these contaminants are below the MCLs and SMCLs, the only water quality parameter that Durango must address through treatment is the fluctuating sediment load and microscopic particulates that are found in all surface water sources. The Durango treatment plant filters the water and provides disinfection.

A study conducted in 1988-1989 by the U.S. Department of the Interior, National Irrigation Water Quality Program, found elevated levels of harmful constituents in local area groundwater and surface water. The Pine River and its tributaries were sampled and concentrations of selenium (1 sample), manganese (25 samples) and mercury (1 sample) were found in excess of EPA drinking water regulations and 12 surface water samples contained levels of selenium in excess of EPA aquatic life regulations.

Seasonal fluctuations of sediment loads can provide challenges to surface water treatment plants. The Animas and Florida Rivers have uncontrolled seasonal sediment fluctuations. The Pine River has less seasonal variability due to Vallecito Reservoir, but some tributaries to the Pine, below Vallecito Reservoir, do contribute seasonal sediment loads. Surface water from Lake Nighthorse will have reduced sediment loads because the sediment load from the Animas River is minimized in the pumping operations and also because the sediment will settle in the reservoir prior to release to the District's treatment plant.

IV. Alternative Sources of Water

The District has evaluated alternative methods to provide water to meet the 2060 demand through a set of design parameters that includes: water supply/water availability; partnering opportunities; site locations and layouts; water quality and treatment issues; pumping heads; water costs; permitting; etc... The eight water source alternatives are described in this section followed by the reasons for selection of two alternatives as the preferred sources. Please see Figure Four in Appendix A for water source locations.

IV-A. Partnering Opportunities

There are other water providers in the proximity of the District's service area. Durango, Bayfield and Ignacio all have municipal water treatment and distribution systems to serve the residents within their respective city limits. Durango holds water rights on the Florida and Animas River. Durango diverts water from the Florida River for treatment and distribution and has diversion facilities from the Animas River to supplement the Florida supply during low flows. Bayfield holds water rights in the Pine River and leases supplemental water out of Vallecito Reservoir from PRID. Both of these sources are diverted out of the Pine River for treatment and distribution within the Bayfield service area. Ignacio purchases treated water from the Southern Ute Indian Tribe (SUIT) who holds water rights on the Pine River and in Vallecito Reservoir. The SUIT treatment plant is north of Ignacio.

Durango has an allocation of water in Lake Nighthorse that is currently held by the Colorado Water Resources and Power Development Authority. Durango owns land near Ridges Basin Dam and plans to eventually construct a treatment plant there to distribute water within Durango's service area. The District Board has approached Durango to discuss the viability of partnering opportunities to construct a joint treatment plant at the dam and share the costs of a main distribution line through Durango's service area, to the District's service area. This proposal was verbally communicated in a meeting in the spring of 2008. At that time, Durango did not believe it would be interested in entertaining such a proposal.

The District has also written to the SUIT to update them of the District's development and to invite the SUIT to pertinent discussions. The latest letter was dated February 5, 2009. No response has been received to date. Ultimately, the District would be interested in some type of partnership with SUIT to provide water service to Tribal members that live outside of the Tribe's distribution system area and are currently served by water hauling which might be served by the District water system.

The District has approached the Bayfield Town Manager to present possible partnering opportunities with Bayfield. Bayfield's treatment plant is nearing 80% capacity and Bayfield will soon begin planning and design activities to enlarge its treatment capacity. The Bayfield Town Manager was very receptive to the idea of constructing a joint treatment plant to treat water diverted from the Pine River, as well as joint mainlines to deliver water to areas in Bayfield proposed service area that Bayfield has not yet been able to serve and on into the District's service area.

There are also a number of small metro districts and homeowners' associations that treat and distribute groundwater to small individual residential subdivisions. As these areas are included in the District's potential service area, the District has the ability to install master connections to the subdivisions' infrastructure to provide emergency service for these existing systems. Depending on the quantity and quality of the groundwater sources, these smaller systems could also eventually purchase water from the District to be delivered to the master meter and distributed with the existing infrastructure, by the individual metro districts. These existing systems could also eventually petition into the District through the inclusion process, at which time the District would accept ownership and operational control of the individual distribution systems and integrate completely into the District's distribution system.

IV-B. Alternative Water Sources

The District has the following potential water sources. The advantages and disadvantages of each water source are described in this section. Please see Figure Five in Appendix A for the initial service area of each source.

Animas River Sources

1. Animas-La Plata Project (ALP) – a new District treatment plant below Ridges Basin Dam using releases from Lake Nighthorse.
2. Animas River Downstream of Weaselskin Bridge - a new District treatment plant using the District's direct diversion water rights from the Animas River.
3. Animas River at Bondad - a new District treatment plant using the District's direct diversion water rights from the Animas River and/or Florida River.

Pine River Sources

1. Joint Treatment Plant With Town of Bayfield using Pine River Irrigation District (PRID) water from Vallecito Reservoir.
2. Pine River near Highway 160 – a new District treatment plant using PRID water from Vallecito Reservoir.
3. Pine River South of Bayfield - a new District treatment plant using a combination of District water rights supplemented by PRID water during times the Pine River is on call.
4. Pine River near Ignacio - a new District treatment plant using a combination of the District's water rights and PRID water.
5. Purchase treated water from the Southern Ute Tribe – The Tribe has not indicated interest in providing treated water to the District so this was not considered in the evaluations.

Piedra River Source

1. Piedra River near Arboles - a new District treatment plant using the District's water rights from the Piedra River.

IV-C. Water Source Alternative A – Animas-La Plata Project

Water Source Alternative A (Alternative A) consists of utilizing water from Lake Nighthorse and building a treatment plant and storage tank on Bureau of Reclamation property near Ridges Basin Dam (Dam). Due to the location of the treatment plant the Florida Mesa would be served initially as the pipeline extends to the east.

The water will be purchased from the State of Colorado through the Colorado Water Conservation Board (CWCB). The water will be stored in Lake Nighthorse and accessed through a pressurized outlet pipe through the Dam. There will be annual operation and maintenance (O&M) charges. It is expected that the purchase price will be between \$2,500 and \$3,500 AF. The O&M charges have not been estimated. A Managing Committee will operate Lake Nighthorse. Any entity purchasing 1,600 AF or more has an opportunity to have a seat on the Managing Committee, therefore, the District may choose to secure 1,600 AF individually or in combination with other potential users of the “State water”.

The treatment plant will be constructed and operated solely by the District. The City of Durango (Durango) owns a portion of the Lake’s storage and is expected to eventually build a treatment plant at or near the Dam, however, discussions between the District and Durango, to date, have generated no interest from Durango for a shared treatment plant.

A storage tank will be constructed near the Dam on Animas La Plata Project land owned by the United States Bureau of Reclamation. The storage tank can be placed at an elevation to provide adequate pressure to most of the Florida Mesa. A trunkline will be constructed along Ridges Basin Creek and the road that accesses the downstream side of the Dam, across the Animas River and along N. Rainbow Road and Bardin Drive to Highway 550. The distribution lines will branch out south and east from the trunkline. Generally, the pipelines will follow existing county roads, which will provide pipeline loops. Where the pipelines are not on existing public right of way (ROW) agreements will be developed with property owners.

The area that Alternative A can most easily serve first is a portion of Florida Mesa starting in the northwest corner at the intersection of Highway 550 and CR 220, Initial Service Area A on Figure Five in Appendix A. The distribution lines will be built along the county roads branching out from that intersection south along U.S. Highway 550 and extending east and south across the Mesa. In consecutive years of construction, the distribution lines will extend further south on the Mesa and east into the Oxford tract. There are approximately 22 miles of county roads in the area that would be served first and the existing parcels result in a density of 26 parcels per mile, which could be translated to EU per mile. 67% of the existing lots are currently developed resulting in 17 parcels (or EU) per mile.

PROS:

- Purchase water instead of lease.
- Minimize pumping compared to other Animas River options.
- One storage tank near the treatment plant that serves as supply tank and chlorine contact tank.
- Remote possibility of joint treatment plant operation with Durango.
- Pipeline begins at one of the densest areas of EU per mile.
- The configuration of the county roads in this area allows pipeline loops to improve capacity and water quality.
- Environmental permitting for the water diversion structure, treatment plant and storage tank location, may be reduced due to the ALP existing permits.
- Reservoir water quality is consistent.

- Treatment plant and tank on existing public land, not requiring acquisition of private land.

CONS:

- The State has not officially exercised its option to purchase water from the project. The process to purchase water not fully determined.
- Independent treatment plant construction and operation.
- Long distance to first tap.
- Only a small portion of the initial pipeline area served is affected by groundwater contaminants.
- Metals in the Animas River may require more advanced and expensive treatment options.
- US Corp of Engineers Nationwide 404 Permit required for pipeline crossings.

IV-D. Water Source Alternative B – Property on Animas near Weaselskin Bridge

Water Source Alternative B (Alternative B) consists of utilizing the District’s water rights to obtain water from the Animas River from a direct river diversion, building a treatment plant and storage tank on private land, and initially serving the Florida Mesa, Initial Service Area B or C on Figure Five in Appendix A.

The District holds water rights on the Animas River for 15 cfs. This is more than enough water to supply the District’s needs past the projected 50-year planning horizon. No water shortage is expected, as flows much in excess of 15 cfs have been available in the Animas River, throughout the period of record.

A river diversion will be constructed in the Animas River about 3 miles south of Weaselskin Bridge. The river diversion, treatment plant and storage tank will be constructed on privately owned property and operated solely by the District. This construction requires negotiations and ROW purchase from the landowner. The river diversion, in addition to the pipeline crossings, will require a US Corp of Engineers 404 Permit which will include endangered species.

A storage tank will be constructed near the treatment plant, but multiple additional storage tanks will be required to pressurize the system. The pressure zones for this alternative are much more complicated. A tank would be required to serve the properties closest to the source as described below, however, additional tanks would be required to serve the various areas.

The area in the closest physical proximity to Alternative B is the Highway 550 corridor from Bondad Hill north to about CR 302 and the area between Highway 550 and the Animas River. Also the areas near the CR 300 and CR 301 intersection. Because of the multiple pressure zones, this source may not be best used to serve the properties within the closest physical vicinity. It would be more efficient to boost the pressure to a higher pressure zone and then gravity flow back to these properties.

Due to the topography of the area, many of the pipelines would not be looped and would dead end at the end of the county roads, unless they traversed private land. There are approximately

25 miles of county roads in this area and the existing parcels result in a density of 16 parcels per mile, which could be translated to EU per mile. 63% of the existing lots are currently developed resulting in 10 parcels per mile.

PROS:

- No annual cost for water.
- Short distance to serve first homes.

CONS:

- One of the least dense areas of parcels per mile.
- Independent treatment plant construction and operation.
- More complicated pressure zones.
- Two initial storage tanks – one supply tank and one chlorine contact tank.
- Few options for the supply tank location to serve only this pressure zone.
- Multiple pressure zones and tanks required to extend into the rest of the District.
- Negotiations with private landowners for river diversion, treatment plant and storage tank locations and ROW.
- The configuration of the county roads in this area does not support pipeline loops.
- The source is fairly far removed from the areas affected by groundwater contaminants.
- Metals in the Animas River may require more advanced and expensive treatment options.
- Sediment loads in the rivers fluctuate seasonally.
- US Corp of Engineers Nationwide 404 Permit required for pipeline crossings.

IV-E. Water Source Alternative C – Bondad on Animas and Florida Rivers

Water Source Alternative C (Alternative C) consists of utilizing the District’s water rights to obtain water from the Animas River, and/or the Florida River, from a direct river diversion, building a treatment plant and storage tank on private land, and initially serving the Florida Mesa, Initial Service Area B or C on Figure Five in Appendix A.

The District holds water rights on the Animas River, in conjunction with the Florida River, for 15 cfs. This is more than enough water to supply the District’s needs past the projected 50-year planning horizon. No water shortage is expected, as flows much in excess of 15 cfs have been available in these rivers, throughout the period of record.

A river diversion will be constructed in either the Animas River near Bondad at the Highway 160 river crossing or in the Florida River at the CR 310 river crossing. The river diversion, treatment plant and storage tank will be constructed on privately owned property and operated solely by the District. This construction requires negotiations and ROW purchase from the landowner. The river diversion, in addition to the pipeline crossings, will require a US Corp of Engineers 404 Permit.

This source is very similar to Alternative B. A storage tank will be constructed near the treatment plant, but multiple additional storage tanks will be required to pressurize the system. The pressure zones for this alternative are much more complicated. A tank would be required to

serve the properties closest to the source as described below, however, additional tanks would be required to serve the northern portion of Florida Mesa, the Highway 160 corridor, or the Oxford track.

The area in the closest physical proximity to Alternative C is the Highway 550 corridor from Bondad Hill north to about CR 302 and the area between Highway 550 and the Animas River. Also the areas near the CR 300 and CR 301 intersection. Alternative C could also serve properties on the eastern side of the Florida River, north of the CR 310 intersection with CR 318. Because of the multiple pressure zones, this source may not be best used to serve the properties within the closest physical vicinity. It would be more efficient to boost the pressure to a higher pressure zone and then gravity flow back to these properties.

Due to the topology of the area, many of the pipelines would not be looped and would dead end at the end of the county roads, unless they traversed private land. There are approximately 32 miles of county roads in this area and the existing parcels result in a density of 15 parcels per mile, which could be translated to EUs per mile. 64% of the existing lots are currently developed resulting in 10 parcels per mile.

PROS:

- No annual cost for water.
- May be able to utilize Colorado Department of Transportation (CDOT) or County road ROW for river diversion.
- Short distance to serve first homes.

CONS:

- One of the least dense areas of parcels per mile.
- Independent treatment plant construction and operation.
- Complicated pressure zones.
- Two initial storage tanks – one supply tank and one chlorine contact tank.
- Few options for the supply tank location to serve only this pressure zone.
- Multiple pressure zones and tanks required to extend into the rest of the District.
- Negotiations with private landowners for treatment plant and storage tank locations and ROW.
- The configuration of the county roads in this area does not support pipeline loops.
- The source is fairly far removed from the areas affected by groundwater contaminants.
- Metals in the Animas River may require more advanced and expensive treatment options.
- Sediment loads in the rivers fluctuate seasonally.
- US Corp of Engineers Nationwide 404 Permit required for pipeline crossings.

IV-F. Water Source Alternative D – Joint Treatment Plant With Bayfield

Water Source Alternative D (Alternative D) consists of utilizing water from Vallecito Reservoir, initially purchasing treated water and water storage from the Town of Bayfield, eventually building a joint treatment plant with the Town of Bayfield and extending pipelines from Gem

Village, as depicted on Figure Five in Appendix A, south and west and/or south of Bayfield to Allison.

The water will be leased from the Pine River Irrigation District. As the District would be utilizing the existing Bayfield treatment plant, Bayfield will likely charge the District O&M costs or a similar Use fee. It is expected that PRID's annual lease price will be \$250 per AF with a standby fee of \$50 per AF. Negotiations with Bayfield are in their infancy. O&M or use charges have not been discussed, however, initial discussions with Bayfield indicate that the treatment plant and new storage tank have capacity for up to 120 to 500 additional EUs, depending on water conservation measures in place.

With the ability to immediately purchase treated water, the District could concentrate its initial construction efforts on pipeline and service. Eventually, as the treatment capacity of the existing Bayfield treatment plant is utilized, the District and Bayfield would jointly construct a new treatment plant or add capacity to the existing plant.

Currently Bayfield serves property on the east side of the Pine River. Bayfield ultimately plans to extend its service into the Gem Village area, depicted on Figure Five in Appendix A. The District can not serve within this area, however, instead of independently extending a trunkline to the outside of Bayfield's service area, the District and Bayfield can construct a joint line across the Pine River and along Highway 160 to the west side of Gem Village. The District will then extend lines into its service areas.

The District may be able to temporarily utilize Bayfield's recently constructed tank, which sits at an elevation of 7,168. This elevation is sufficient to serve the area around Highway 160 and CR 510 (and south), shown on Figure Five, in Appendix A, as Service Area D or E & F w/Tank. If the District desires to construct a new tank, there is a tank site available near CR 222 at an elevation of 7,220. This tank site would provide enough pressure to initially serve that same area. The tank site in Bayfield would also allow the District to provide service to the CR 510/Highway 172 area first, if the District so chose. This area is shown on Figure Five, in Appendix A, as Initial Service Area D or E.

The existing county road layout will allow multiple loops within either of the two initial areas that can be served by Alternative D. The distribution lines will be built along the county roads branching out from Bayfield's service area either along Hwy 160 or CR 510, then extending southwest towards the Oxford tract. In consecutive years of construction, the distribution lines could extend further south across the Oxford tract and into the area with the worst groundwater contamination.

Initial Service Area D or E & F w/Tank has approximately 17 miles of county roads and the existing parcels result in a density of 27 parcels per mile, which could be translated to EU per mile. 70% of the existing lots are currently developed resulting in 19 parcels per mile. Service Area "D or E" has approximately 28 miles of county roads and the existing parcels result in a density of 25 parcels per mile, which could be translated to EU per mile. 65% of the existing lots are currently developed resulting in 16 parcels per mile.

PROS:

- Immediate availability of treated water.
- Joint treatment plant.
- Large Vallecito Reservoir provides firm supply.
- PRID water used within Pine and Piedra River basins.
- Potential for joint supply lines through Bayfield's service area (Gem Village).
- Minimize pumping.
- Can utilize Bayfield's existing storage tank.
- No dedicated pipeline (with no service connections) to storage tank or upper pressure zone.
- One of the densest areas of parcels per mile.
- The configuration of the county roads in this area allows multiple pipeline loops.
- Environmental permitting for the water diversion structure, treatment plant and storage tank locations will be reduced due to the existing project.
- Although the pipelines initially serve an area that is minimally affected by groundwater contaminants, the Oxford area with the worst groundwater contaminant concentration can be immediately served as the pipeline extends to the south.
- Sediment fluctuation less than Animas River due to Vallecito Reservoir.

CONS:

- May be PRID issues with water lease.
- Annual lease with no purchase possible. Increased cost over the life of the project.
- Only a small portion of the initial area served is affected by groundwater contaminants.
- US Corp of Engineers Nationwide 404 Permit required for pipeline crossings.
- Negotiations with private landowners for storage tank location and ROW.

IV-G. Water Source Alternative E – Highway 160 on Pine River

Water Source Alternative E (Alternative E) consists of utilizing water from Vallecito Reservoir, building collection galleries near the Pine River, a treatment plant and storage tank and initially serving the Highway 160 corridor. The water will be leased from the Pine River Irrigation District.

Collection galleries will be constructed near the Pine River less than a quarter of a mile southeast of the Highway 160 Bridge. The collection galleries and treatment plant will be constructed on privately owned property and operated solely by the District. This construction requires negotiations and ROW purchase from the landowner. The collection galleries and treatment plant location may require environmental permitting in addition to the US Corp of Engineers 404 Permit required for the pipeline crossings.

The District can not serve within the Bayfield service area, and would need to independently extend a trunkline to the outside of Bayfield's service area along Highway 160 to the west side of Gem Village to start distribution.

The District would construct a new tank near CR 222 at an elevation of 7,150 to 7,220. This tank site would provide enough head to initially serve most of the area encompassing Initial

Service Area D or E & F w/Tank. The existing county road layout will allow multiple loops within this area. The distribution lines will be built along the county roads branching out from Bayfield's service area along Hwy 160, then extending southwest towards the Oxford tract. In consecutive years of construction, the distribution lines could extend further south across the Oxford tract and into the area with the worst groundwater contamination. Alternative E could serve this area, Initial Service Area D or E initially, with no tank.

The initial service area has approximately 17 miles of county roads and the existing parcels result in a density of 27 parcels per mile, which could be translated to EU per mile. 70% of the existing lots are currently developed resulting in 19 parcels per mile.

PROS:

- No annual cost for water.
- One of the densest areas of parcels per mile.
- Large Vallecito Reservoir provides firm supply.
- PRID water used within Pine and Piedra River basins.
- The configuration of the county roads in this area allows multiple pipeline loops.
- Sediment fluctuation less than Animas River due to Vallecito Reservoir.
- Gallery filters some of the sediment before the water enters the collection galleries.

CONS:

- May be PRID issues with water lease.
- Greater pumping than Alternative D.
- Independent treatment plant construction and operation.
- Two initial storage tanks – one supply tank and one chlorine contact tank.
- Independent, dedicated supply line through Bayfield's service area to serve east of Pine River.
- Negotiations with private landowners for collection galleries, treatment plant and storage tank locations and ROW.
- The area initially served is fairly far removed from the areas affected by groundwater contaminants though the pipelines are needed to serve the Oxford area that has the poorest groundwater quality.
- Environmental permitting required for collection galleries and treatment plant.
- US Corp of Engineers Nationwide 404 Permit required pipeline crossings.

IV-H. Water Source Alternative F –Pine River South of Bayfield

Water Source Alternative F (Alternative F) consists of utilizing the District's water rights to obtain water from the Pine River, building a river diversion, a treatment plant and storage tank, and initially serving the Highway 160 corridor. This option is generally the exact same as Alternative E, just a different water source and location.

The District holds water rights on the Pine River for 7.5 cfs. The water right is for an amount that is more than enough water to supply the District's needs past the projected 50-year planning horizon. However, there are periods of record that indicate the Pine River could not physically supply the demand during the irrigation season. Supplemental water would need to be purchased from PRID. It is expected that PRID's annual lease price will be \$250 per AF with a standby fee of \$50 per AF.

The river diversion will be constructed in the Pine River about 3.5 miles south of the Highway 160 Bridge in Bayfield. The river diversion and treatment plant will be constructed on privately owned property and operated solely by the District. This construction requires negotiations and ROW purchase from the landowner. The river diversion, in addition to the pipeline crossings, will require a US Corp of Engineers 404 Permit.

The District can not serve within the Bayfield service area, and would need to independently extend a trunkline through a portion of Bayfield's service area and along Highway 160 to the east side of the Town in order to extend a pipeline to Allison.

The District would construct a new tank on privately owned land near CR 222 at an elevation of 7,150 to 7,220. This tank site would provide enough head to initially serve most of the area encompassing Initial Service Area D or E & F w/Tank. The existing county road layout will allow multiple loops within this area. The distribution lines will be built along the county roads branching out from Bayfield's service area along Hwy 160, then extending southwest towards the Oxford tract. In consecutive years of construction, the distribution lines could extend further south across the Oxford tract and into the area with the worst groundwater contamination.

The initial service area has approximately 17 miles of county roads and the existing parcels result in a density of 27 parcels per mile, which could be translated to EUs per mile. 70% of the existing lots are currently developed resulting in 19 parcels per mile.

PROS:

- Large Vallecito Reservoir provides firm supply.
- PRID water used within Pine and Piedra River basins.
- Reduced annual cost for water, as only the supplemental water will be purchased.
- One of the densest areas of parcels per mile.
- The configuration of the county roads in this area allows multiple pipeline loops.
- Sediment fluctuation less than Animas River due to Vallecito Reservoir.

CONS:

- May be PRID issues with water lease.
- Independent treatment plant construction and operation.
- Complicated pressure zones.
- Difficult to serve east of Pine River to Allison area.
- Two initial storage tanks – one supply tank and one chlorine contact tank.
- Greater pumping than Alternatives D or E.
- Independent, dedicated supply line into the adequate pressure zone and through Bayfield's service area to serve east of Pine River.
- Negotiations with private landowners for collection galleries, treatment plant and storage tank locations and ROW.
- The area initially served is fairly far removed from the areas affected by groundwater contaminants though the pipelines are needed to serve the Oxford area that has the poorest groundwater quality.

- US Corp of Engineers Nationwide 404 Permit required pipeline crossings, river diversion and treatment plant.

IV-I. Water Source Alternative G – North of Ignacio on Pine River

Water Source Alternative G (Alternative G) consists of utilizing water from the Pine River, building a river diversion, a treatment plant and storage tank, and initially serving areas east of the Pine River. Please see Initial Service Areas G and G or H on Figure Five in Appendix A.

The District holds water rights on the Pine River for 7.5 cfs. The water right is for an amount that is more than enough water to supply the District's needs past the projected 50-year planning horizon. Although there are periods of record that indicate the Pine River could not physically supply the demand of the whole system, it can supply the demand of the service areas to the east of the Pine. Supplemental water would need to be purchased to supply the entire District's service area or this source needs to be used in conjunction with another District water source alternative. The supplemental water could be leased from the Pine River Irrigation District. It is expected that PRID's annual lease price will be \$250 per AF with a standby fee of \$50 per AF.

The river diversion will be constructed in the Pine River about 2 miles north of the Highway 151 Bridge in Ignacio. The river diversion and treatment plant will be constructed on privately owned property and operated solely by the District. This construction requires negotiations and ROW purchase from the landowner. The river diversion, in addition to the pipeline crossings, will require a US Corp of Engineers 404 Permit.

Alternative G could serve two different initial areas: (1) south along Highway 151 to Allison, branching out on the county roads in that area; and (2) north along CR 334 and CR 523, branching out on the county roads in that area.

A storage tank will be constructed near the treatment plant, but an additional storage tank will be required to pressurize the system for either area. The pressure zones for this alternative are also very complicated. A tank would be required to pressurize these areas, however; there are no appropriate tank sites near the treatment plant, which would require many miles of dedicated line to reach the upper pressure zones.

The South area offers opportunity for pipeline looping. There are approximately 42 miles of county roads in this area and the existing parcels result in a density of 10 parcels per mile, which could be translated to EUs per mile. 47% of the existing lots are currently developed resulting in 5 parcels per mile.

Due to the topology of the north area many of the pipelines would not be looped and would dead end at the end of the county roads, unless they traversed private land. There are approximately 17 miles of county roads in this area and the existing parcels result in a density of 8 parcels per mile, which could be translated to EUs per mile. 58% of the existing lots are currently developed resulting in 4 parcels per mile.

PROS:

- Vallecito Reservoir provides firm supply.
- PRID water used within Pine and Piedra River basins.
- Reduced annual cost for water, as only the supplemental water will be purchased.
- The configuration of the county roads in this area allows multiple pipeline loops.
- About a third of this area is affected by groundwater contaminants.
- Sediment fluctuation less than Animas River due to Vallecito Reservoir.

CONS:

- One of the least dense areas of parcels per mile.
- Independent treatment plant construction and operation.
- Greater pumping than Alternatives D, E or F.
- Complicated pressure zones.
- Two initial storage tanks – one supply tank and one chlorine contact tank.
- Approximately 3.5 to 8 miles to reach a suitable tank site.
- Negotiations with private landowners for river diversion, treatment plant and storage tank locations and ROW.
- Removed from the rest of the District by tribal land and Bayfield's service area.
- US Corp of Engineers Nationwide 404 Permit required pipeline crossings, river diversion and treatment plant.

IV-J. Water Source Alternative H – Piedra River at Arboles

Water Source Alternative H (Alternative H) consists of utilizing water from the Piedra River, building a river diversion, a treatment plant and storage tank, and initially serving areas east of the Pine River. Please see Initial Service Area G or H on Figure Five in Appendix A.

The District holds water rights on the Piedra River for 5 cfs. The water right is for an amount that is adequate to supply the District's needs past the projected 50-year planning horizon. No water shortage is expected, as flows in excess of 5 cfs have been available in the Piedra River, throughout the period of record.

The river diversion will be constructed in the Piedra River at the Highway 151 Bridge at the north end of Navajo Reservoir near Arboles, in Archuleta County. The river diversion and treatment plant will be constructed on privately owned property and operated solely by the District. This construction requires negotiations and ROW purchase from the landowner. The river diversion, in addition to the pipeline crossings, will require a US Corp of Engineers 404 Permit.

Alternative H would serve the same area as the south service area in Alternative G. The area is along Highway 151 between Ignacio and Allison, branching out on the county roads.

A storage tank will be constructed near the treatment plant, but an additional storage tank will be required to pressurize the system. The pressure zones for this alternative are also very complicated. A tank would be required to pressurize the area, however; there are no appropriate tank sites near the treatment plant, which would require many miles of dedicated line to reach the upper pressure zones, approximately 8 miles.

The area offers opportunity for pipeline looping. There are approximately 42 miles of county roads in this area and the existing parcels result in a density of 10 parcels per mile, which could be translated to EUs per mile. 47% of the existing lots are currently developed resulting in 5 parcels per mile.

PROS:

- No annual cost for water.
- The configuration of the county roads in this area allows multiple pipeline loops.
- About a third of this initial area is affected by groundwater contaminants.

CONS:

- One of the least dense areas of parcels per mile.
- Independent treatment plant construction and operation.
- Maximum pumping of any Alternative.
- Complicated pressure zones.
- Two initial storage tanks – one supply tank and one chlorine contact tank.
- Approximately 10 miles to reach a suitable tank site.
- Negotiations with private landowners for river diversion, treatment plant and storage tank locations and ROW.
- Very removed from the rest of the District by tribal land and Bayfield’s service area.
- Sediment fluctuation with no reservoir control.
- US Corp of Engineers Nationwide 404 Permit required pipeline crossings, river diversion and treatment plant.

IV-K. Comparison of EU Density per Mile

An attempt was made to evaluate the density of parcels/EU that could potentially be served in the first year of pipeline construction to provide an indication of which source could initially serve the most parcels. Parcel density per mile was estimated based on parcels within a half-mile of either side of the County roads, even if the parcel does not border the road. The densities for each alternative are summarized in the following table.

TABLE 10 – EU Density per Mile

Alternative	EU Density (EU/mile)	EU Density w/ Existing Development (EU/mile)
A	26	17
B	16	10
C	15	10
D	27	19
E	27	19
F	27	19
G	8	4
H	10	5

Alternatives A (ALP), D (Bayfield), E (Highway 160), and F (Pine River south of Bayfield) provide the greatest density of EU per mile.

IV-L. Preferred Water Sources

Project planning has indicated that obtaining water from the Animas and Pine River Basins would provide the best long-term secure supply. The Piedra River source will be considered when the water system is extended into Archuleta County. Approximately half of the water supply for the District would be provided from the Animas Basin and half from the Pine River Basin. The distribution system will be integrated so that either source can serve the entire system if necessary.

Although the District holds water rights on both the Animas and the Pine, the best sources of water are ALP, Alternative A, and Bayfield, Alternative D, using water from Vallecito Reservoir. The District would construct and operate a treatment plant at Ridges Basin Dam to treat water released through the dam, and the District would construct and operate a joint treatment plant with Bayfield to treat water released from Vallecito. Factors contributing to the selection of these two alternatives as the preferred water sources are summarized below.

The best source of water in the Animas Basin is Lake Nighthorse by purchase from the Animas – La Plata Project (Alternative A). Contributing factors include:

- a) Water is provided from a large reservoir,
- b) The water quality is consistent from the reservoir,
- c) The cost is not finalized but appears to be a one time purchase cost in the range of \$2,500 to \$3,500 per acre-foot of diversion, plus annual OMR costs,
- d) Releases from the reservoir are through a pipeline that should provide adequate pressure to operate the treatment plant,
- e) The land for the treatment plant and water tank are owned by the U.S. Bureau of Reclamation (USBR) not requiring private land,
- f) The water is at the highest elevation of any Animas River option, requiring the least pumping,
- g) Source is near the Florida Mesa which will have a large water demand,
- h) The endangered fish species clearances have already been obtained,
- i) The least amount of environmental permitting of any Animas River source,
- j) Potential to have joint treatment plant with City of Durango even though initial discussions with the City indicate the City is not currently interested.

The best source of water in the Pine River Basin is Vallecito Reservoir and a joint treatment plant with Bayfield (Alternative D). Contributing factors include:

- a) Water is provided from a large reservoir,
- b) Bayfield will need to enlarge their treatment plant at about the same time the District needs a new plant,
- c) A joint plant saves money in both construction and operation for both entities,

- d) The District and Bayfield can share trunk pipelines from the treatment plant to service areas east and west of the Town (e.g. Gem Village),
- e) The District and Bayfield can share diversion facilities from the Pine River to the treatment plant, whether existing diversion facilities are adequate or new facilities are needed,
- f) PRID water is available for use within the Pine and Piedra River basins,
- g) The water is at the highest elevation of any Pine River option, requiring the least pumping,
- h) The location is ideal for serving within the Pine River basin and the PRID district whether to the airport or Allison,
- i) Bayfield may have a small amount of treatment capacity to lease water prior to the new treatment plant in order for the District to begin to serve taps as soon as pipelines can be installed,
- j) Least environmental permitting of any Pine River source.

Please see Figures Six and Seven in Appendix A.

IV-M. ALP Water Source Description

The District is pursuing a water treatment plant at the base of Ridge's Basin Dam. An outlet works has already been constructed within the dam's structure. The outlet structure is a steel and stainless steel pipe 36 inch diameter. City of Durango, Southern Ute Tribe and the Ute Mountain Ute Tribe paid the cost of construction for the outlet works. The District will purchase a portion of the outlet works for their use.

Interest has been expressed in utilizing lands owned by the Bureau of Reclamation (USBR) for the ALP. The District has made a request to the CWCB to purchase a portion of the approximately 10,500 AF the Board has an option to obtain. Please see Water Source Alternative A- Animas-La Plata Project for further description of the purchasing option. The option is available until the final ALP cost allocation in 2012 to 2013. To utilize the water, a treatment plant would be constructed near the base of the dam. Water would be pumped from the treatment plant to a water storage tank also located on United States Bureau of Reclamation (USBR) lands. "Application for Transportation and Utility Systems and Facilities on Federal Land" form No. 1004-0189 was completed and submitted to Reclamation for approval, in order for the District to construct the treatment plant, water tank, and pipelines.

After the application is approved, the following layout for the facilities on USBR lands is recommended. An 18 inch ductile iron pipeline will connect to the outlet works, delivering raw water to a treatment plant located southeast of the dam. The treatment plant will be approximately 40 by 100 feet and designed to treat 0.086 million gallons (MG) of raw water each day. A dedicated 18 inch pipeline will deliver treated water to a 1 MG storage tank. The storage tank will need to be built at an elevation of approximately 7,165. There are two possible locations on USBR land, either directly north of the treatment plant or southwest of the treatment plant. An 18 inch ductile steel pipe will connect the storage tank to the distribution system. The pipeline will travel across USBR land and exit on the southeast corner through Animas Air Park. From there, the pipeline will be constructed on Air Park Drive before heading south on CR 213. The pipeline will need to cross the Animas River requiring a Corp of Engineers 404 Permit.

After crossing the Animas River, the pipeline will travel along Lake Lane then N. Rainbow Road before connecting to the Central Zone at CR 219.

TABLE 11 – Animas La Plata Treatment Plant Cost Estimate

Animas La Plata Treatment Plant Cost Estimate						
Construction Item Description	Size/Diameter	Unit	Quantity	Unit	Unit Cost	Total Cost
18" DIP Pressure Class 350	18	inch	34,411	l.f	\$52.50	\$1,810,000
Installation including finish site work			34,411	l.f	\$60.00	\$2,060,000
Remediation			76,468	s.y.	\$6.33	\$480,000
Valves, Bends, PRVs, etc...			10%	%		\$440,000
Storage Tank	1000000	gallons	1000000	gallon	\$0.73	\$730,000
SolarBee Mixer			1	each	\$25,000	\$25,000
River Diversion, crossing the Animas River			1	each	\$50,000	\$50,000
Treatment Plant - Building and Site					\$3,670,000	\$3,670,000
Treatment Plant - Water Treatment			0.86	MGD	\$990,000	\$990,000
					=====	
Total Improvements						\$10,255,000
Contingencies			25%	%		\$2,560,000
Engin., Admin., Environ., Legal			10%	%		\$1,030,000
					Grand Total	\$13,845,000
					Class 4 Cost Estimate Range:	-30% \$9,691,500
						+30% \$17,998,500

IV-N. Bayfield Water Source Description

The District is pursuing a joint water treatment plant with the Town of Bayfield. Together, water will be utilized from Vallecito Reservoir being delivered by PRID through the Los Pinos Ditch Company.

Water from the Los Pinos Ditch flows into an existing settling reservoir having an estimated capacity of 30 AF. Water for District uses would be leased from PRID and diverted from the Pine through the Los Pinos Ditch into the settling reservoir. The water then gravity flows into treatment plant where it undergoes treatment before being pressurized and delivered to the existing four storage tanks. The total capacity of the existing Bayfield storage is approximately 1.5 MG, the District would share in additional tanks. The existing treatment plant has a capacity of 1.3 MGD or about 1,050 gpm. During the summer months, the maximum demand is about 1 MGD. Bayfield is at 70 to 75% of their maximum capacity. District would like to lease water from Bayfield allowing for distribution construction and service to begin as soon as monies are available. District would have 0.2 MGD, or service for about 200 EUs, available until the existing treatment plant is enlarged.

Currently, the treatment plant has a capacity of 1.3 MGD. The District will need 0.86 MGD to provide service to the District. The existing Bayfield treatment plant should be enlarged to a 2 MGD treatment plant. This would require a larger settling reservoir, additional treatment packages and additional storage tanks. Bayfield plans to serve Gem Village and surrounding areas. The District proposes to share the distribution line to these service areas, since the District's service area begins at these boundaries. By sharing the line, the District has a means to deliver water outside of Bayfield's service area. The shared pipeline will have a minimum diameter of 12 inches and constructed of poly vinyl chloride (PVC).

TABLE 12 – Bayfield Treatment Plant Cost Estimate

Bayfield Treatment Plant Cost Estimate						
Construction Item Description	Size/Diameter	Unit	Quantity	Unit	Unit Cost	Total Cost
18" PVC C-900 DR25	18	inch	7,575	l.f	\$26.01	\$200,000
Installation including finish site work			7,575	l.f	\$60.00	\$450,000
Remediation			16,834	s.y.	\$6.33	\$110,000
Valves, Bends, PRVs, etc...			10%	%		\$80,000
Storage Tank	1000000	gallons	1000000	gallon	\$0.73	\$730,000
SolarBee Mixer			1	each	\$25,000	\$25,000
						=====
Treatment Plant - Building and Site					\$5,310,000	\$5,310,000
Treatment Plant - Water Treatment			0.86	MGD	\$1,440,000	\$1,440,000
						=====
Total Improvements						\$8,345,000
Contingencies			25%	%		\$2,090,000
Engin., Admin., Environ., Legal			10%	%		\$830,000
					Grand Total	\$11,265,000
					Class 4 Cost Estimate Range:	
					-30%	\$7,885,500
					+30%	\$14,644,500

IV-O. Treatment Plant Facility Description and Cost Estimates

The District's water sources' water quality is discussed in the Water Supply – Water Quality section above. This section lists the water quality issues that will be remedied by the treatment technology. Prior to final treatment plant design, the District will conduct extensive water quality sampling, in addition to water quality results available from other sources. The District's water treatment plants will use whatever means necessary to treat the sources to the State's MCLs and SMCLs.

Common water contaminants can be treated by various methods, as shown on the following table. Where one method can be used to treat multiple contaminants, that method will be employed.

TABLE 13 – Common Treatment

Treatment per Contaminants	
Contaminant	Treatment Technique
Selenium	Activated Alumina, Coagulation/Filtration, Lime Softening, Reverse Osmosis, Electrodialysis
Arsenic	Iron Based, or other, Adsorption Media, Reverse Osmosis
Mercury	Granular Activated Carbon, Coagulation/Filtration, Lime Softening, Reverse Osmosis
Fluoride	Activated Alumina, Distillation, Reverse Osmosis, Anion Exchange
Nitrate	Reverse Osmosis, Electrodialysis, Ion Exchange
Iron &/or Manganese	Aeration, Lime Softening, Coagulation, Settling, Filtration, Ion Exchange
Calcium Hardness	Precipitation Softening (Lime-Ash, Soda Ash), Coagulation/Sedimentation, Rapid Sand Filtration
TSS	Coagulation/Sedimentation, Rapid Sand Filtration
Turbidity	Ultrafiltration
Coliform	Prechlorination, Coagulation/Sedimentation, Rapid Sand Filtration, Post Chlorination
Algae	Copper Sulfate

Although studies have indicated elevated levels of some contaminants at some times, the Animas and Pine Rivers have fairly pristine water quality and require very basic treatment. Both Durango and Bayfield use coagulation, filtration and disinfection.

Water supplied by Ridges Basin Reservoir will have less sediment than Pine River water treated at the Bayfield treatment plant. The Bayfield plant will employ additional settling for pretreatment and additional solids handling for filter backwash. Otherwise, both treatment plants are expected to utilize coagulation/flocculation filters, microfiltration filters and disinfection. The District will purchase specially designed package filters and will not build the filters on site. The treatment buildings will be designed and sized to install treatment modules as demand increases. The treatment train is relatively simple as indicated on Figure Eight in Appendix A.

The treatment plants will be equipped with the following general amenities:

- Office
- Laboratory
- Conference Room
- Electrical/MCC Room
- Bathroom
- Garage/Maintenance Room
- Storage Room

V. Distribution System

The water distribution system is described in this section. The distribution system is essentially the same for any of the water source alternatives, with the location of water into the distribution system being the only change.

V-A. Hydraulic Modeling Criteria

The pipe delivery system will be sized to deliver the 2060 peak day demand or the fire flow, whichever is greater. The fire flow is 1,000 gpm delivered nearly everywhere within the pipe system. The peak day demand needs to be in the form of gpm per EU for modeling in order to distribute demand around the pipe system. The number of EU are 7,000 in 2060 using the County 350 g/EU/d. Available information includes:

- The average day 2060 flow is 3.75 cfs (0.24 gpm/EU).
- The daily demand during June is an average flow of 5.55 cfs (0.35 gpm/EU).
- American Water Works Association (AWWA) recommends a range of 1.5 to 3.5 for maximum day to average day. These factors indicate the peak day would be between 5.63 (0.36 gpm/EU) to 13.13 cfs (0.85 gpm/EU).
- PAWSD modeling uses peak day demand of 2.36 times the average day or 0.57 gpm per EU.

For purposes of the Master Plan, the pipe distribution system is recommended to deliver 2.5 times the average day demand of 0.60 gpm/EU or 1,000 gpm for fire flow. Modeling may indicate that the EU demand is too large for the small number of EU connected to the water system in the early decades and may cause water quality problems within the pipeline, in which case further adjustments may be necessary.

RECOMMENDATION: The pipe distribution system should be modeled using 1,000 gpm fire flow or the peak flow of 0.60 gpm/EU to determine delivery capacity and pipeline sizing.

The peak flow of 0.60 gpm/EU for 7,000 units is 4,200 gpm. The 2030 flow for 2,700 units would be 1,620 gpm.

The pipe distribution system will be modeled as 8 inch pipe throughout. The pipelines are located along every state and county road. Water sources used to supply the system are Alternative A – Animas-La Plata Project and Alternative D – Joint Treatment Plant with Bayfield. The iterations of the hydraulic model were conducted using various pipe diameters, tanks elevations and locations, pump locations, pressure reducing valves in order to determine the best combination of facilities. The following description is a result of those iterations.

V-B. Pipeline Routes and Lengths

The hydraulic modeling is based on constructing nearly all of the pipelines along state and county roads. Many subdivisions exist in the service area with over 200 miles of private or county roads. The distribution system modeling does not include the private roads within the subdivisions.

Modeling indicates the looped distribution system of 8 inch pipe with 12 inch pipe in some locations, will provide the fire flow and the peak demand to all delivery points on the system. The mainlines from the storage tanks at Ridges Basin Dam and in Bayfield must be larger diameter to deliver the supply to the distribution system. The line from Ridges Basin Dam to the Florida Mesa will be 18 inch diameter ductile iron pipe due to very high pressure at the Animas River crossing. The mainline in the Bayfield area will also carry Bayfield's supply to the Gem Village area. This mainline will be 12 inch diameter.

Generally, the pipeline routes were selected to follow county roads and state highways, to serve as many water users as possible, provide looping to the system to minimize pipeline diameter and maximize water freshness. Looping is possible generally throughout the District; however, looping is maximized on the Florida Mesa and in the Oxford area, simply due to the layout of the county roads. The county roads between Ignacio and Allison also provide looping options. Few looping options exist north of Highway 160 due to the more mountainous terrain. From a pipeline standpoint, either the Florida Mesa or the Oxford area should be considered for the first construction phases. The density per mile is greatest in these areas and looping is maximized.

A majority of the land area of the District can be served by gravity flow from the tanks located at Ridges Basin Dam and in Bayfield. Multiple pressure zones, requiring individual pumps and storage tanks, exist north of Highway 160 and east of Bayfield along Highway 160. Serving the areas that are pressurized by gravity initially provides for more economic construction (no pumps, tanks, etc...) allowing for more pipelines to be built in each construction phase. Please see attached Figure Nine in Appendix A for proposed preliminary pipeline routing. As preliminary pipeline is completed in certain areas, then secondary routing will be constructed.

V-C. Tank Pressure Zones

Water storage tanks are utilized in the distribution system for a variety of reasons. Storage tanks provide chlorine contact time for the removal of viral contaminants, they provide peak flows in excess of treatment plant production, they provide water availability if treatment or supply is interrupted and they provide system pressure.

Storage tanks will be located at each treatment plant. The storage tank at Ridges Basin Dam (ALP) is proposed to be located on USBR land, at an elevation of approximately 7,165. The tank is planned to have a capacity of 1 MG with dimensions of 36 feet in height with a 70 foot diameter. The storage tank in Bayfield will also be at the same elevation of approximately 7,165. The tank will have the same capacity and dimensions as the tank at Ridges Basin Dam. As discussed in the Detailed Description and Evaluation of Alternative Water Sources Section and the Pipeline Diameters Section, these two tanks provide system pressure to the majority of the distribution system, creating the main pressure zone for the system known as the Central Zone. The Central Zone consists of Florida Mesa, Oxford, areas south of HWY 160, first part of CR 234 north of HWY 160, east of the Florida River and Allison. Please see the attached Figure Ten in Appendix A. The ALP tank pressurizes the Florida Mesa, starting at the highest mesa elevation of 6,960, along CR 220. Prior to water reaching the top of the mesa, the pipeline must cross the Animas River. The pressure at this point is in excess of 375 psi, requiring ductile iron pipe. The pressure at the top of the mesa, along CR 220, will be approximately 100 psi. As water flows down the mesa, pressure reducing valves will be required to maintain the

distribution system pressure between 30 and 80 psi. The ALP tank will also pressurize north of Highway 160 along CR 234 until reaching the intersection of CR 225.

The Bayfield tank will provide pressure to the system in the areas generally south of Highway 160 and east of the Florida River. South of CR 514, pressure reducing valves will be required to keep the distribution system pressure between 30 and 80 psi. To the east of Bayfield, pressure will have to be boosted to serve the Highway 160 corridor and north, but the Bayfield tank will provide system pressure in the areas southeast of Bayfield or generally south of Saul’s Creek. A pipeline distribution system cost estimate was created for the Central Zone. Please see Distribution Cost Estimate for further description of the construction item descriptions.

TABLE 14 – Central Zone Cost Estimate

Central Zone Cost Estimate						
Construction Item Description	Size/Diameter	Unit	Quantity	Unit	Unit Cost	Total Cost
12" PVC C-900 DR 18	12	inch	120,660	l.f	\$31.46	\$3,800,000
Installation including finish site work			120,660	l.f	\$30.00	\$3,620,000
8" PVC C-900 DR 14	8	inch	1,060,217	l.f	\$9.19	9,740,000
Installation including finish site work			1,060,217	l.f	\$19.75	\$20,940,000
Remediation			2,624,172	s.y.	\$6.33	\$16,620,000
Fire Hydrants			224	each	\$3,000	\$670,000
Valves, Bends, PRVs, etc...			10%	%		\$5,540,000
						=====
Total Improvements						\$60,930,000
Contingencies			25%	%		\$15,230,000
Engin., Admin., Environ., Legal			10%	%		\$6,090,000
					Grand Total	\$82,250,000
					Class 4 Cost Estimate Range:	
					-30%	\$57,575,000
					+30%	\$106,925,000

The entire service area east of Bayfield on Highway 160 is known as the East Highway 160 Zone. This zone will require the pressure to be boosted to a storage tank. The storage tank is located at an elevation of approximately 7,485. The tank is planned to have a capacity of 150,000 gallons with dimensions of 25 feet in height with a 32 foot diameter. Please see the attached Figure Ten in Appendix A.

TABLE 15 – East Highway 160 Zone Cost Estimate

East Highway 160 Zone Cost Estimate						
Construction Item Description	Size/Diameter	Unit	Quantity	Unit	Unit Cost	Total Cost
8" PVC C-900 DR 14	8	inch	71,551	l.f	\$9.19	\$660,000
Installation including finish site work			71,551	l.f	\$19.75	\$1,410,000
Remediation			159,001	s.y.	\$6.33	\$1,010,000
Fire Hydrants			14	each	\$3,000	\$40,000
Valves, Bends, PRVs, etc...			10%	%		\$310,000
Booster Station E. HWY 160 (150 cfs at 600 TH)			1	each	\$58,712	\$60,000
Storage Tank	150000	gallons	150000	gallon	\$0.73	\$110,000
Solar Bee Mixer			1	each	\$25,000	\$25,000
						=====
Total Improvements						\$3,625,000
Contingencies			25%	%		\$910,000
Engin., Admin., Environ., Legal			10%	%		\$360,000
					Grand Total	\$4,895,000
					Class 4 Cost Estimate Range:	-30% \$3,426,500
						+30% \$6,363,500

The majority of the service area north of Highway 160 is much more mountainous and has many areas with ground elevations higher than either the ALP or Bayfield tank. Multiple pressure zones will be required. An individual tank to maintain the pipe pressure at a minimum of 30 psi will serve each pressure zone. Initial pipeline modeling indicates that there will be at least two pressure zones to serve the areas north of Highway 160, between Grandview and Bayfield. One zone consists of serving along CR 228, known as the CR 228 Zone. The second zone will serve elevations higher than 7,320, known as the CR 502 Zone. Please see the attached Figure Ten in Appendix A.

TABLE 16 – CR 228 Zone Cost Estimate

County Road 228 Zone Cost Estimate						
<i>Construction Item Description</i>	<i>Size/Diameter</i>	<i>Unit</i>	<i>Quantity</i>	<i>Unit</i>	<i>Unit Cost</i>	<i>Total Cost</i>
10" PVC C-900 DR 14	10	inch	11,711	l.f	\$13.90	\$160,000
8" PVC C-900 DR 14	8	inch	20,203	l.f	\$9.19	\$190,000
Installation including finish site work			31,914	l.f	\$19.75	\$630,000
Remediation			70,919	s.y.	\$6.33	\$450,000
Fire Hydrants			6	each	\$3,000	\$20,000
Valves, Bends, PRVs, etc...			10%	%		\$150,000
Booster Station CR 228 (150 gpm, delivering to 1st Tank)			1	each	\$58,712	\$60,000
Storage Tank	500000	gallons	500000	gallon	\$0.73	\$370,000
Solar Bee Mixer			1	each	\$25,000	\$25,000
						=====
Total Improvements						\$2,055,000
Contingencies			25%	%		\$510,000
Engin., Admin., Environ., Legal			10%	%		\$210,000
					Grand Total	\$2,775,000
					Class 4 Cost Estimate Range:	-30% \$1,942,500
						+30% \$3,607,500

TABLE 17 – CR 502 Zone Cost Estimate

County Road 502 Zone Cost Estimate						
<i>Construction Item Description</i>	<i>Size/Diameter</i>	<i>Unit</i>	<i>Quantity</i>	<i>Unit</i>	<i>Unit Cost</i>	<i>Total Cost</i>
10" PVC C-900 DR 14	10	inch	6,120	l.f	\$13.90	\$90,000
8" PVC C-900 DR 14	8	inch	111,365	l.f	\$9.19	\$820,000
Installation including finish site work			117,485	l.f	\$19.75	\$1,870,000
Remediation			261,077	s.y.	\$6.33	\$1,340,000
Fire Hydrants			22	each	\$3,000	\$50,000
Valves, Bends, PRVs, etc...			10%	%		\$420,000
Booster Station CR 502 (150 gpm, delivering from 1st Tank to 2nd Tank)			1	each	\$58,712	\$60,000
Storage Tank	500000	gallons	500000	gallon	\$0.73	\$370,000
Solar Bee Mixer			1	each	\$25,000	\$25,000
						=====
Total Improvements						\$5,045,000
Contingencies			25%	%		\$1,260,000
Engin., Admin., Environ., Legal			10%	%		\$500,000
					Grand Total	\$6,805,000
					Class 4 Cost Estimate Range:	-30% \$4,763,500
						+30% \$8,846,500

These zones are depicted on the attached Figure Ten in Appendix A, but the areas with individual pressure zones are generally:

- Central Zone – Florida Mesa, Oxford, areas south of HWY 160, first part of CR 234 north of HWY 160, east of the Florida River, and Allison
- East Highway 160 – east of Highway 160 including CR 527 and CR 528
- CR 228 – CR 233, CR 226, CR 225, north of CR 230, along CR 228 until an elevation of 7,320
- CR 502 – elevations greater than 7,320 including CR 502, CR 503, CR 502, and CR 505

The specific locations for these tank locations have not yet been identified. The necessary elevations are known for the tank to serve each of the pressure zones. They are as follows:

TABLE 18 – Pressure Zone Tank Elevations

Pressure Zone	Required Tank Elevation, feet
Central	7,165
East Highway 160	7,485
CR 228	7,420
CR 502	7,960

The storage tank sites will require necessary elevations, accessibility and suitable soils. The sites will be identified using topographical and land use/land ownership maps. The general locations of the storage tank sites are represented on the District maps. The elevations have been determined by the pipeline modeling software, WaterCad, and distribution system analysis; however, accessibility and soil studies have not been conducted. Since specific locations have not been identified, conversations and negotiations with landowners have not been initiated and will transpire after the specific sites have been identified.

V-D. Water Loading Stations

Water loading stations will be installed during construction to provide a source of water while the system is being developed and after construction. The location of the stations will be determined based on demand. The property owners who are in the District will not be charged for water but others will be.

V-E. ROW for Distribution System Facilities

ROW for the distribution system facilities will be constructed on existing public ROW (e.g. LPC and CDOT) to the maximum extent possible. ROW purchase (e.g. fee title or easement) will be required for all above ground facilities which are primarily water tanks; the locations of the tanks have not been determined. Where ROW is required across private property for pipelines, the property owner will generally be expected to donate the ROW; however, the flexibility will be included to pay for ROW where appropriate.

The District plans to construct its mainlines and distribution lines parallel and adjacent to most state highways and county roads within the District via the permitting process listed below. If alternate pipeline routes along private or subdivision roads provide a benefit to homeowners and the District, those routes will be considered rather than public roads.

The CDOT allows utilization of highway ROW through the Special Use Permit Process. According to LPC Code Section 42-145, the county has established a priority favoring the use of county ROW by public utilities, rather than private utilities. The District will be subject to the permitting requirements in association with utilizing the ROW, as delineated by LPC Code Section 42. In addition to LPC Code Section 42-145, the LPC Public Works Department requires the following for construction projects within LPC's ROW:

1. All utility work within or crossing a county right-of-way needs to be permitted with the County Engineering Department.
2. Many of the County rights-of-way may be prescriptive use, even on the Southern Ute Indian Reservation, but they still need to be permitted.
3. Utility work within the exterior boundaries of the Southern Ute Indian Reservation needs to be permitted with the Tribe.
4. The county rights-of-way may be defined by existing fence lines but that is not always the case.
5. Research may be required to establish the actual county rights-of-way. This is the responsibility of the utility or applicant.
6. Traffic control is required for all work in the county rights-of way.
7. If a county road is damaged or excavated during construction, it shall be repaired according to county standards.
8. Any disturbed land in the rights-of-way will have to be re-graded and re-vegetated with an approved native seed mix.
9. Water mains shall be located outside the structural section of the county road so damage to the road will be minimized in the event of a water main leak.
10. Water mains crossing a country road or located within the structural section of a county road shall be placed inside a carrier pipe or casing and shall be installed with casing spacers, like <http://www.cascademfg.com/casingspacer.aspx> or equivalent.
11. Fire hydrants or any facilities that may present a roadside hazard shall be placed outside the clear zone, typically ten (10) feet from the edge of the travel lane.

Some areas within the District's service area have a majority of federal or state owned lands. These areas have very little privately owned land and therefore very little need for service. It may be difficult to gain ROW across some of the federally owned land. Areas with landownership issues that impede pipeline construction or make it difficult to gain ROW, will be avoided or will be of low priority. As evidenced on Figure Nine in Appendix A, the District does not plan to extend lines into some of the federal and state owned lands.

Some noncontiguous portions of SUIT lands are distributed throughout the District's service area. As previously mentioned in Section Water Supply – Partnering Opportunities – by agreement with the SUIT, the District could deliver water to these noncontiguous lands that

currently require water hauling. The District will negotiate ROW issues with the SUIT at that time, or as required for mainline distribution system construction. Two and a half percent of the District's pipeline length has SUIT ownership on both sides and 5.25% of the pipeline length has SUIT ownership on one side.

V-F. Distribution System Cost Estimate

The cost estimates for the distribution pipeline system include price of pipe, installation of pipe, fire hydrants, required valves, bends, pressure reducing valves (PRVs), necessary booster stations, storage tanks, etc... The length of pipeline required for each zone was determined from the pipeline modeling software WaterCAD. GIS data consisting of roads, parcels, water courses and section lines was imported into WaterCAD. Pipeline routes were superimposed on state and county roads. Installation for the pipeline includes trench installation, trench excavation, imported bedding and backfill. Remediation for the pipeline includes seeding, mulching and fertilizer for the newly covered dirt work. Mobilization, demobilization and bonding are required for all pipeline work.

A fire hydrant will be installed for every one mile of pipeline. The pipeline is about 269 miles thus requiring 263 hydrants. These hydrants will be located in coordination with the fire districts.

Three different booster stations are required to pressurize East Highway 160 Zone, CR 228 Zone and CR 502 Zone. Each pump was sized to supply a flow of 150 gpm. Each pump has a different elevation gain to overcome. The exact location of the pumps has not been determined. This location is dependent on the existing pressure in the pipeline and availability of land.

Storage tanks were sized to supply each pressure zone. Each tank will be equipped with a SolarBee Mixer. When water becomes stagnant inside tanks the water quality can diminish. The mixer is used to maintain constant water temperature and water quality in the storage tank by continually mixing the incoming water with the water being stored.

The complete Water Treatment and Distribution Pipeline System cost estimate is presented below. The cost estimate was created using the American Association of Cost Estimators (AACE) International "Cost Estimate Classification System – As Applied in Engineering Procurement, and Construction for the Process Industries." This cost estimate classifies as a Class 4. The end use of this estimate is for study and feasibility. The maximum expected accuracy range is from -30% to +50%. The minimum expected range is from -15% to +20%. For purposes of the Master Plan, a range of -30% to +30% was used.

TABLE 19 – Water Treatment and Distribution System Cost Estimate

WATER TREATMENT AND DISTRIBUTION PIPELINE SYSTEM						
Construction Item Description	Size/Diameter	Unit	Quantity	Unit	Unit Cost	Total Cost
18" DIP Pressure Class 350	18	inch	34,411	l.f	\$112.50	\$3,870,000
18" PVC C-900 DR25	18	inch	7,575	l.f	\$86.01	\$650,000
12" PVC C-900 DR 18	12	inch	120,660	l.f	\$61.46	\$7,420,000
10" PVC C-900 DR 14	10	inch	17,831	l.f	\$33.65	\$600,000
8" PVC C-900 DR 14	8	inch	1,240,722	l.f	\$28.94	\$35,900,000
Remediation			3,158,220	s.y.	\$6.33	\$20,000,000
Fire Hydrants			263	each	\$3,000	\$790,000
Valves, Bends, PRVs, etc...			10%	%		\$6,923,000
Mob., Demob., and Bonding				each	\$180,000	\$180,000
River Diversion, crossing the Animas River			1	each	\$50,000	\$50,000
Booster Station CR 228 (150 gpm, delivering to 1st Tank)			40	hp	\$58,712	\$60,000
Booster Station CR 502 (150 gpm, delivering from 1st Tank to 2nd Tank)			40	hp	\$58,712	\$60,000
Booster Station E. HWY 160 (150 gpm, delivering to 1st Tank)			40	hp	\$58,712	\$60,000
CR 228 Storage Tank	500,000	gallons	500,000	gallon	\$0.73	\$370,000
CR 502 Storage Tank	500,000	gallons	500,000	gallon	\$0.73	\$370,000
E. HWY 160 Storage Tank	150,000	gallons	150,000	gallon	\$0.73	\$110,000
ALP Treatment Plant Storage Tank	1,000,000	gallons	1,000,000	gallon	\$0.73	\$730,000
Bayfield Treatment Plant Storage Tank	1,000,000	gallons	1,000,000	gallon	\$0.73	\$730,000
SolarBee Mixer			5	each	\$25,000	\$125,000
ALP Treatment Plant - Building and Site				each	\$3,670,000	\$3,670,000
ALP Treatment Plant - Water Treatment			0.86	MGD	\$990,000	\$990,000
Bayfield Treatment Plant - Building and Site				each	\$5,310,000	\$5,310,000
Bayfield Treatment Plant - Water Treatment			0.86	MGD	\$1,770,000	\$1,770,000
Total Improvements						\$90,740,000
Contingencies			25%	%		\$22,690,000
Engin., Admin., Environ., Legal			10%	%		\$9,070,000
Raw Water Cost - ALP			1,600	AF	\$3,315	\$5,304,000
Grand Total						\$127,804,000
Class 4 Cost Estimate Range:						
-30%						\$89,462,800
+30%						\$166,145,200

V-G. Pipeline Construction Phasing Options

The question most asked by residents of the District is when will they get water. This question is not easily answered because there are so many variables to definitively say beforehand when pipes will be installed in certain areas. This portion of the Master Plan addresses the variables, the actions taken to make the construction as fair as possible and the attempt by the Board to somewhat mitigate the wait.

In the formation of the District, it was recognized that the order of service would be a major issue and Board of Director districts were created so that not all Board members could come from one area. The Directors are from five geographic areas within the District in order that each area would have representation in determining the order that pipelines will be constructed. For this reason pipeline extension will not be solely based on cost considerations but will also involve fairness to serve all areas in an approximately equal manner.

The process for determining pipeline construction phasing will usually involve annual winter reviews of the pipelines to be constructed the following year. The factors to be considered each year by the Board will include, in no particular order:

- Funds available for construction (see Financing section for more detail)
- ROW obtained for routes or more importantly problems with obtaining ROW
- EU served per mile of pipe
- Health and safety needs for water service
- Fairness that pipelines are extending into all areas
- Permits have been obtained
- Construction cost per mile of pipe
- Other factors

A major logistical fact is that pipelines closest to the treatment plants must be constructed first in order to convey water into the more remote parts of the service area. Therefore, property nearest the two water sources would receive service first. After pipes are constructed near the water sources, the most likely scenario is to construct pipelines in somewhat equal proportions into all areas of the District.

The largest area, generally south of Highway 160, can be served directly from the water tanks at each treatment plant. There are three other areas that require additional pumping and additional tanks, as discussed above. The process of locating water tank sites and negotiating with landowners may cause pipe installation in these areas to fall behind the Central Zone.

To partially mitigate the time to extend the pipelines into all areas, the Board has adopted a resolution (see Appendix B) discounting the capital investment fee (aka tap fee) by the amount of taxes paid up to the time water service is available to a property. In this manner, property owners in areas that receive water service later, can receive a credit to their capital investment fee.

The Board also plans to install water loading stations as the pipelines are extended so that people hauling water (there is a significant number) can obtain water closer to their home. Property owners in the District will receive water at the loading stations for free.

The pipelines are planned to be constructed along public roads; however, many of the properties exist within subdivisions. The Board of Directors has established a pipeline extension policy to address the private roads within subdivisions to serve as many users as possible with each phase of construction. There are likely to be situations where installation of the pipelines along private roads rather than public roads would benefit both the District and property owners. Please see the policy in Appendix B.

In summary, the most likely pattern to install pipelines is to construct pipelines along public roads near the water sources first, then pipelines would be extended into all areas of the District somewhat equally.

VI. Financing the Water System

VI-A. Overall Cost Estimate

Table 19 shows the estimated cost for the entire water treatment and distribution system to be \$122 million, with an expected deviation of $\pm 30\%$ as recommended by the AACE International Cost Estimate Classification System, Class 4. This means the low end of this range is \$85,000,000 and the high end of the range is \$159,000,000. However, this Estimate indicates over 1,421,199 lineal feet of pipe will be required to be installed and the conditions will vary significantly across the District. Thus there is a significant range of variability that cannot be quantitatively assessed at this time.

VI-B. Financing Options

The costs of construction are expected to be financed from the proceeds of a bond issue and from a portion of a 5 mill levy not required to service the bond issue. The mill levy must be approved by the voters within the District before construction may proceed. A project of this magnitude requires a bond issue and property tax revenues to finance the early stages of construction, including the water treatment facilities and to continue construction to completion as portions of the water distribution system become operational. In addition to the proceeds of a bond issue and mill levy, the District will continue to investigate other funding sources.

If passed, a 5 mill levy, based on the District's assessed valuation for 2009, would generate approximately \$5 million per year starting as early as 2011. A significant amount of this property tax revenue is from the property tax levied on natural gas production and facilities located within the District. Although natural gas production has historically trended upwards with time, the price at which the natural gas produced is sold can vary significantly from year to year. For this reason, the Board expects that the District's property tax revenue may vary significantly from year to year and that this will require that the construction of new facilities be conservatively financed to anticipate these variables. This is done by not committing the entire mill levy to debt service. Instead, property tax revenues will be used in two ways. First, to pay the annual debt service on the bonds and second to pay the costs of continued construction of facilities after the bond proceeds have been fully utilized. The size of the bond issue has not yet been determined but is expected to be in the \$15 to \$25 million range. In its Service Plan, the District has estimated that approximately \$885,000 would be required each year during the first 15 years to service a \$15 million bond issue, less than 20% of the projected property tax revenues. The annual property tax revenues not required for debt service will be available to pay for construction costs incurred in the year of receipt on a cash and carry basis. This provides the opportunity for the Board to set its annual construction budget based on the projected property tax revenues for that year after the District's assessed valuation has been determined. This conservative approach to debt service and construction expenditures will permit the Board to make adjustments for expected variations in the District's property tax revenues. Initially the Board will also utilize a portion of the property tax revenues to pay the costs of operations, maintenance, administrative expenses and to create reserves until the District's operating revenues from sales of water are sufficient to pay these expenses each year. In summary, the purpose of the bond issue is to "jump start" the construction process in order to complete the

treatment facilities and as much of the distribution system as possible in order to begin delivering water to the residents of the District. Once that process is started, continued construction will be sustained by the property tax revenues received by the District from the mill levy approved by the voters.

Capital investment fees (CIF) collected as users connect to the water system will also be used to pay the costs of construction as the system is expanded. Homeowners connected to the water system will pay a monthly charge for metered water that will be adequate to pay the costs of operation and maintenance; however, the revenues from these charges will not be adequate to fully pay these expenses until a substantial number of customers are receiving water.

The water treatment and distribution system will be constructed as quickly as the proceeds of the bond issue, property tax revenues and capital investment fees allow. Once the mill levy is approved, the Board will determine the pace of construction and expansion of the water distribution system based on annual assessments of the District's financial condition.

The District has only one purpose: to construct a water treatment and distribution system as quickly and efficiently as possible so that all of the residents within the District who desire water service will receive an adequate supply of quality water from a financially sound District that has positioned itself to expand and grow as funds are available. Some District residents have expressed concern about the timing of construction. Like any local government, the District will construct its facilities through a conservative budgeting and appropriation process. As the saying goes, "a long journey begins with the first step". In this case, that first step is approval of a 5 mill levy at the earliest possible time.

VI-C. Substantial Construction Completion

The backbone, or preliminary pipeline routing, of the water system described in this master plan is estimated to be substantially completed in 2030. The current mill levy plus capital investment fee collections will provide in excess of \$100 million by 2030 which is approximately the amount needed to construct the facilities. During the 20 year period, the income from the mill levy will vary, maybe substantially, due to the value of gas production. Attempting to predict the value of gas from year to year is not possible; however, when looking 20 years in the future the value is likely to increase more than the construction cost because natural gas does not contribute carbon to the atmosphere and drilling is continually more regulated, thus increasing demand and restricting production. Though not essential to the 2030 substantial completion, the mill levy income is likely to increase at a greater rate than construction costs.

After 2030, the extension of pipelines will continue indefinitely to serve individual homes and subdivisions. The continual extension of new pipelines will provide service to existing homes as their wells no longer provide adequate water and new homes.

VII. Steps For Construction

The District is presently working on pre-construction activities which are significant and time consuming, expected to require approximately two years so that construction might begin in 2012 if funding is available. The major tasks can be categorized into:

- a) Passage of the 5 Mill Levy Election to provide funds to finalize pre-construction tasks and for construction.
- b) Obtain Environmental Permits (e.g. Corps of Engineers 404 Permit).
- c) Complete Agreements with Involved Entities (e.g. Town of Bayfield, CDOT).
- d) LPC Permits – 1041 Permit (if LPC adopts 1041 Powers), Conceptual Development Permit, Class II Construction Permits (likely to be a permit for each portion of the water system), Road Permits (Determine if global permit or permit for each portion of the system similar to Class II).
- e) Colorado Department of Public Health and Environment treatment plant design approval.
- f) Bureau of Reclamation license to construct treatment plant, water tank, and pipelines on their property.
- g) Hire District manager and other staff as necessary.
- h) Prepare distribution system construction drawings.

Tasks b through f will be continued in 2010 through a grant as described below. Task a is the major effort to prepare for and obtain a successful mill levy election which is critical to progress on the water system. Since the District has been formed, mill levy elections can be continued until successful but early success will greatly speed providing water to residents. Tasks g and h will begin after the successful mill levy election.

VII-A. Water Supply Reservoir Account Grant

The Water Supply Reserve Account (WSRA) grant from the Southwest Basin Roundtable and CWCB will provide \$400,000 to complete many of the tasks and make significant progress on others. The following is a listing of the tasks that WSRA funds will be used.

- a) Colorado Department of Public Health and Environment (CDPHE): Public Drinking Water System – The District water system is a new system requiring the development and approval of a complete Technical, Managerial and Financial Capacity (TMF) report which includes such major items as: treatment plant design; distribution system layout and design; rules and regulations for operating the water system; financial plan and rate structure; operating plan and staffing; and other information for the water system. This is a major undertaking which may require additional expertise in water treatment plant design depending on the source of water and the plant capacity identified in the Master Plan; for example, if high turbidity is expected during certain periods a more sophisticated pre-treatment system design may be required. The major deliverables will be the TMF and Design submittal to CDPHE. The initial submittal will be subject to review and modification prior to issuance of the final permit which will be the final product. The WSRA funds are only adequate to start, not complete, this work.

- b) US Army Corp of Engineers 404 Permit – This permit is necessary to allow pipelines to be constructed across waters (e.g. wetlands) of the US. The pipeline routes and treatment plant location identified in the Master Plan will be the basis for the Permit application with criteria to be developed if the pipeline routes change. Section 7 consultation for endangered species, particularly the endangered fish in the San Juan River, will be addressed in the permit. Cultural resources will also be addressed as part of this work. Environmental and cultural resource consultants knowledgeable of 404 Permits and other related requirements will be necessary to perform much of this work, who will be selected near the completion of the Master Plan. The major deliverables will be the 404 Permit submittal to Corp of Engineers.
- c) LPC Conceptual Development Plan (CDP)– LPC requires the submission of a CDP to provide overall conceptual approval for the entire construction project. The Master Plan will provide most of the information for this submittal but format revision and negotiations with LPC Staff and Commissioners will be necessary. The major deliverables will be the CDP Permit submittal to the County.
- d) LPC Class II Permit for Phase I Construction – After approval of the CDP, LPC requires a Class II permit for each construction phase which specifically describes the work to be accomplished. A Class II permit application is generally expected to be submitted to LPC for the construction to be completed in the next time period. The major deliverables will be the Class II Permit submittal to the County.
- e) LPC Road Easement Permit – The majority of the pipelines are planned to be constructed within County ROW which requires a permit. An application for the pipeline construction identified in the Class II permit will be submitted to LPC Road and Bridge Department. A global permit with conditions may also be considered. Issuance of the ROW permits will be the major deliverable.
- f) Negotiations and Contracting for Pipeline, Treatment Plant and Storage Tank ROW's – The contracts and other legal instruments necessary to utilize land for facilities will be negotiated with draft contracts to be implemented when construction funds are available. This work involves the legal and technical work needed to identify the land required and the negotiations with landowners for use of the land. The work may include surveying as needed. The deliverables will be ROW agreements.
- g) Miscellaneous Intergovernmental Agreements or Permitting Requirements – The Master Plan is likely to identify permits/agreements with parties in addition to the above entities that will be required prior to construction. For example, agreements may be required with other water providers for the purchase of treated water, the construction and operation of a joint water treatment plant or the joint use of water supply pipelines. The deliverables will be permits and agreements.
- h) Coordination of Activities – The above permits and agreements will require overall coordination to assure consistency and compatibility.

VIII. Agency Involvement

The District is interested in working with other local, state and federal agencies to ensure comprehensive and efficient service to the District residents. Much of the collaboration process will occur during the design and permitting stage of the distribution system development. However, the District has open and continued dialogue with many governmental agencies, such as the Board of County Commissioners and Bayfield, and plans to continue dialogue with local residents, property owners' associations, irrigation ditch companies, etc... in an effort to understand and, thus, meet resident water needs.

VIII-A. LPC BOCC Meetings

The Board Chairman, Dick Lunceford, has attended LPC Board of County Commissioner (BOCC) meetings to keep the BOCC apprised of the progress of the District. Mr. Lunceford attended in January and September of 2009. He presented the District's Water Demand Analysis and Water Supply Recommendation. The District has also given the BOCC copies of the District's public opinion survey and newsletter.

The BOCC has expressed its support of the District at these meetings and also by providing written support for various grant applications, including the CWCB Water Supply Reserve Account. The BOCC signed an Election Services Intergovernmental Agreement with the District and the LPC Clerk and Record. Also, the BOCC and staff have offered the following suggestions for Master Plan development and District progress:

- Commissioner White recommended the District meet with the SUIT concerning ROW issues.
- Commissioner Riddle recommended the District meet with the LPV Planning Department concerning District development and the County's Comprehensive Plan.
- County Attorney Rogers suggested the District present the Master Plan to the Commissioners prior to finalization.
- County Attorney Rogers has mentioned that the County is negotiating for the ROW associated with county roads on the SUIT reservation.

The District will submit the draft version of the Master Plan to the BOCC prior to finalization, utilizing Ms. Rogers as the point of contact. The BOCC comments will be incorporated into the draft version where appropriate or will be cataloged for use in the permitting processes.

VIII-B. LPC Staff and Comprehensive Plan

District staff has also had continued dialogue with the LPC Planning Department. Preliminary discussions with Erick Aune, LPC Planning Department Director, have been ongoing for a number of years concerning the relationship between the District and LPC planning and land use. The District staff met with LPC Manager Sean Nau, and planning staff, in January 2009 to discuss the District's demand projections in relation to LPC's existing land use plans. The District and LPC agree that the District should not use the maximum potential densities as allowed under current land use plans for the District's build out projections. The District used half of the maximum number allowed for the maximum 2060 build out.

District staff met with Erick Aune and the LPC Planning Department Engineer Victoria Schmitt in May 2009 to discuss water supply per EU. The District will use LPC's required 350 gallons per day per EU for planning and design purposes, but the District Board will encourage conservation with the water rate structure and other appropriate means.

The District submitted the draft version of the Master Plan to the LPC Planning Department and will continue to meet with Planning staff to further define the relationship between the District and LPC's new Comprehensive Plan. The Planning Department comments were incorporated into the draft version where appropriate and cataloged for use in the permitting processes. The LPC Planning Department's comments are attached in Appendix D.

Although the Planning Department is developing a new Comprehensive Plan that may redirect growth toward existing towns with existing water systems, the District's distribution system, although designed to meet future growth, is also designed to provide water to the many existing residents that need water. The service area is large and widespread. The supply lines from the treatment plants may be affected, but the distribution system as a whole will not be because customers are already spread throughout that area of the county. As previously stated, the Planning Department's comments were incorporated into the Master Plan where appropriate and will be used for further design of the water system.

VIII-C. Bayfield

The District approached the Town of Bayfield to determine if Bayfield would be interested in pursuing partnering options, primarily constructing a joint treatment plant to provide for Bayfield's growth, as Bayfield is reaching 80% capacity in the existing treatment plant, and to provide savings to both Bayfield and the District by the economy of scale of building one treatment plant instead of two. Justin Clifton, the Bayfield Town Manager, agreed that the joint treatment plant option was a worthwhile concept and supported the District's further investigations into the plan. Since then, the District has presented the proposal to the Bayfield Town Board and Ron Saba, Director of Public Works. Bayfield has continued to support the District's efforts in developing the plan to jointly construct and operate a treatment plant for use by both entities. This plan is described in more detail in the proceeding pages of this report.

Prior to the construction of the joint plant, the District could purchase a portion of Bayfield remaining capacity to supply a very limited number of the District's water users as soon as a portion of the distribution system was installed. This concept is also described in more detail in the proceeding pages of this report.

VIII-D. Southern Ute Indian Tribe

As discussed in the Partnering Opportunities section, the District has approached the SUI in various written and verbally communicated ways. The District is interested in discussing the following issues with the SUI:

- Purchase of treated water from the SUI water treatment plant (located north of Ignacio on CR 518, along the Pine River) for delivery to District water users,
- Water delivery to SUI members on noncontiguous tribal land distributed throughout the District utilizing the District's infrastructure,

- ROW across SUIIT lands, along county roads.

As the District plans progress and develop, the District will continue to update the Tribe as to the District's progress and status. The District submitted the draft version of the Master Plan to the SUIIT prior to finalization and received SUIIT review. The SUIIT comments are cataloged for use in the permitting processes and are attached in Appendix D.

IX. Public Involvement

The District is also interested in working with local landowners and residents to ensure comprehensive, efficient and affordable service. As discussed below the District holds regular Board meetings that are open to the public, has held multiple public meetings, operates a website, participates in public informational mailings and publishes press releases in the local papers to inform the District residents of the progress and status of the District. The District welcomes public input concerning water use and demands, financing options, construction phases, water loading station locations, rates, etc...

IX-A. District Board Meetings

Board Meetings are held on the second Thursday of each month at the Pine River Soil Conservation District office in Ignacio, located at 255 Ute Street. The Board publishes notice of the regularly scheduled meetings at this meeting location. Prior to September 2009, notice was published at the Oxford Grange. At times, the Board will hold special Board Meetings, at which time notice of such meetings are posted 3 days in advance at the regular posting place, which is 255 Ute Ste in Ignacio, the LPC Clerk and Recorder's Office and one other location within the District. The Board Meetings are also noticed on the District web site at <http://www.laplawd.org>.

The Board regularly publishes the minutes from each meeting on the District website.

Public attendance and participation is welcomed at the Board meetings and the regular agenda contains an agenda item for public input.

IX-B. Public Meetings

In the process of developing this Master Plan, updating the District residents and interested parties and garnering public opinion, a series of public meetings were held in the spring and summer of 2009. The dates and locations were March 27th at the Ignacio Elementary School, June 8th at the Oxford Grange and July 8th at the Lavenia McCoy Public Library in Bayfield.

Presentations were made by Ann McCoy and HWE. Presentations introduced the District and its mission in developing a drinking water distribution system to provide a reliable potable water supply to District residents. Also described were the alternative water sources, projected demand and water use per EU. Water conservation was presented as a goal of the District and the Board will set a rate structure to encourage water conservation. Handout material and displays were provided as information pieces in support of the presentations. This material is available on the Districts website for viewing or download.

Approximately 30 to 50 people attended these meetings. Comment forms were provided at the meetings to record public comment and verbal comments were recorded. Very few comment forms were collected. These public written and verbal comments were used to formulate the Frequently Asked Questions on the District's website. The Board also used these comments to formulate the District policies that can also be found on the website.

As the District progresses into the design stage, the Board will hold more public meetings to again garner the comments and concerns of the water users and to present detailed plans, designs and construction phases.

IX-C. District Website and Public Materials

The District has developed a website in continuing efforts to provide information regarding the District's development to the general public. The website consists of nine web pages concerning different aspects of the District. All documents are provided in portable document format (.pdf), allowing visitors to download the documents. A calendar is located on the Home page providing dates of Board meetings, public meetings and any other special meetings concerning the District.

Three web pages present general information about the project including introductions to the board members and frequently asked questions. A user-friendly contact form is found on the "Contact Us" page. This form allows for web users to contact the District through email, while allowing them to provide minimal information about themselves for privacy purposes.

The remaining five web pages pertain to the ongoing development of the District. A "Master Plan" page presents all information about the Master Plan and its ongoing development. This web page is updated as items are completed for the Master Plan. The District's adopted policies are also available on this page. After the Board officially adopts the Master Plan, the final version will be placed on this web page.

The "News" page provides links to articles published about the District in the local newspapers. District press releases are also available on this page.

The "Public Relations" page presents other related topics and attachments. Any water related topics, such as the Division of Water Resources Statement on existing wells within the District, is available here for viewing and download. Public meeting material is also available on this page.

The "Records" page presents all documentation relating to the District's board meetings. Board meeting minutes and policies are provided on this page.

The "Service Plan" page provides documents approved by the County when the District was newly formed. These documents provide good background information concerning the development of the District for the public and the District engineers use these documents as reference tools developing the Master Plan.

IX-D. Mail Survey

A public opinion questionnaire was mailed to 2,578 households within the district in June 2009. The questionnaire served as an invitation for public reaction to a District proposal for a mill levy to construct, finance, operate and maintain a water treatment and distribution system.

A total of 209 surveys, or 8.1 percent, were returned to the District and processed for responses. Although this particular questionnaire functions as an opportunity to disseminate information and as an information gathering tool and in no way represents a scientific survey, it did provide

valuable information to the District Board. While more than 60 percent of those responding to the survey indicated that the project should be a high or medium priority, and a similar percentage were concerned about the reliability and quality of their existing well water, the percentage of respondents who indicated that they would support the mill levy proposal dropped to 54 percent. The open-ended survey question responses indicate that pocketbook concerns are the driving force behind resistance to support a mill levy election at this time. These concerns are undoubtedly exacerbated by the current economy.

The District Board used these results in the decision to postpone the mill levy election to a later date, but will progress with the design and permitting stages of the distribution system and will continue to disseminate information to the public.

IX-E. District Residents, Property Owner Associations, Special Interest Groups

The District has progressed through the BOCC process of Service Plan approval and District Court authorization to hold an election, conducted the election, held public meetings and conducted a mail survey to garner the comments and opinions of the District residents. Many news articles have been published, meetings held and mailings conducted. The District also provides a comment form on the website to allow residents to email their questions, concerns and/or opinions to District representatives. These avenues have returned some responses, but a surprising number of people seem to have no former knowledge of the District. In the ongoing effort to educate residents of the benefits of the District and the services the District will provide, the District plans to contact property owners' associations and other special interest groups like irrigation ditch and canal companies. The District Board is willing to make presentations to these groups, provide printed material, etc... in the effort to disseminate District information and develop working relationships with these community groups.

APPENDIX A
Figures

APPENDIX B
District Policies

All District Board Policies are included herein.

They include:

Policy on Responding to Open Records Requests

Policy Granting Credit against the Capital Investment Fee...

Policy Concerning Main Extensions Into Subdivisions

Temporary Amendments to Exclusion Policy

Exclusion Policy

Inclusion Policy

APPENDIX C
Supporting Material

APPENDIX D
Agency Comments