

Northwest Douglas County Rural Water Alternatives

Plum Valley Heights and Town of Louviers



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Executive Summary

This study is a preliminary engineering evaluation to identify a plan and the costs required for the Plum Valley Heights community and the Town of Louviers to acquire and deliver renewable water to replace the current source of water supply for these rural communities, i.e., non-tributary ground water. While the cost of acquiring and importing water supply to a rural community is very expensive on a per unit basis, the continued availability of domestic water supply is critical to maintain the value of properties. Currently, there is an extraordinary opportunity for property owners to acquire renewable water supplies that can be delivered to the Roxborough Water Treatment Plant, which provides for a relatively short delivery pipeline to reach Plum Valley Heights, and a moderate delivery distance further on to reach the Town of Louviers. While expensive, it is very unlikely that any other option for renewable water supply acquisition and delivery will ever be less expensive than this opportunity.

The results of this study are summarized in the following:

1. Renewable water supplies may be made available to the Plum Valley Heights community and/or the Town of Louviers through the Roxborough Water and Sanitation District (“Roxborough”) and/or the Dominion Water and Sanitation District (“Dominion”, the water provider for Sterling Ranch), with water delivered to the Roxborough Water Treatment Plant. If the communities desire to pursue these supplies by paying the costs and by constructing the delivery system described in this report, they should immediately approach Roxborough and/or Dominion as appropriate to obtain a specific agreement for water deliveries and/or service.
2. The Louviers Water and Sanitation District (“Louviers”) has indicated that they have other pressing water supply and infrastructure needs that are a priority and may limit their ability to invest substantially in these renewable water supplies in the near term. Louviers, however, remains interested in pursuing a contract for future renewable water, and may be in a position to participate in some components of a water transmission pipeline in the near future. This report provides them with plan and cost information for their financial planning purposes.
3. The best opportunity for Plum Valley Heights to acquire renewable water and gain service deliveries appears to be through inclusion in Roxborough.
4. The cost of inclusion and a ¾ inch residential water tap from Roxborough is \$26,882.
5. The least expensive water delivery system to provide water to the Plum Valley Heights community is shown in Figure 7. This system would provide peak day delivery capacity, but would not be sized to provide for fire flow deliveries. The estimated cost of this

- delivery system is \$561,800. For 29 property owners, this results in a capital facility contribution of \$19,400 per property owner.
6. Total up-front costs for Plum Valley Heights including inclusion and tap fees (4) plus the capital facility contribution (5) amount to \$46,300 per property owner.
 7. Adding fire flow deliveries to Plum Valley Heights would increase costs by \$10,740 per property owner for a moderate fire flow delivery of 600 gpm, or by \$22,730 for a full fire flow delivery of 1,500 gpm.
 8. Additional costs to Plum Valley Heights would include monthly service fees for water deliveries that would be charged per the Roxborough rates shown in Table 8. Costs would also include annual property tax charges by Roxborough for capital facilities that serve the property such as the Water Treatment Plant and their large water tank storage facility. These annual charges are shown in Table 9, and are based upon the assessed value of a property, which is approximately 8% of the property's market value.
 9. If Plum Valley Heights' property owners desire to acquire service from Roxborough, opportunities exist to jointly borrow funds through the formation of governmental financing entities that take advantage of public financing rates. The property owners should investigate how much of the upfront capital can be borrowed in this manner, the financing rate, and the requirements for forming and maintaining these entities. Additional funds could potentially be obtained through a refinancing of home mortgages or through a second mortgage. Plum Valley Heights should also investigate the availability of grants for water supply and water infrastructure that may be available from state and federal sources.
 10. The least expensive cost option for an extension of a water system for deliveries of renewable water to Louviers from the Plum Valley Heights system at N. Moore Road and West Trail North Drive as shown in Figure 10 is \$671,900. This, however, presumes use of the Plum Valley Heights water system that will require a cost share which has been assumed to be at 50% of the value of the main from the Roxborough Water Treatment Plant to N. Moore Road. Therefore, adding this cost share, the total cost to Louviers for renewable water deliveries from the Roxborough Water Treatment plant is estimated at \$827,000.
 11. These costs may drop for Louviers in the future to the extent that Dominion develops water infrastructure closer to Louviers, or in the event that a more direct pipeline route becomes available through the selection of another alignment for the Sterling Ranch secondary access road, or through an easement obtained across property owned by the Dupont Company. This could result in a reduction in costs of \$50,300 (4" pipe lines) from the cost presented in (10) above.
 12. Since Louviers has a community water supply through its Arapahoe Well (currently being replaced), once a water delivery is established, renewable water could potentially

be purchased in small increments over time to slowly replace its ground water – to the extent that renewable water remains available from Dominion for its rural neighbors.

13. The cost of water supply through Dominion for purchase by Louviers has not yet been determined, but such information should be available in the coming months. Louviers should maintain contact and communications with Dominion over time to determine the cost and to assess the ongoing availability of these renewable water supplies.
14. Louviers could benefit from additional water pressure from a direct connection to the Roxborough water system, which if directly connected to the Louviers system, would add about 20 psi in operating pressures.

This study provides detail information on water demands, water systems, and costs that are the basis for the information provided in this Executive Summary. The report also provides information that will be helpful in pursuing grants and financing for this infrastructure.

Introduction

History - Rural development in Douglas County has generally obtained water supply through wells drilled into the non-tributary aquifers of the Denver Basin. Wells are most often individual wells for a property, or community wells shared by a rural neighborhood. The wells can tap into any of the four aquifers of the Denver Basin, and are usually drilled into the shallowest formation that provides the desired flow production and water quality.

Rural development in the Northwest portions of Douglas County (“Highway 85 Corridor”), that is, generally bordering and west of Highway 85 are located along the western fringe of the Denver Basin. A cross section of the Denver Basin Formation is shown in Figure 1. The aquifers within this formation are the Dawson, the Denver, the Arapahoe and the Laramie Fox-Hills from top to bottom. The aquifers are shaped in a bowl that tilts up at its edges as shown in Figure 1, and in much of this area, the Dawson Formation has already surfaced and is not available for water supply. Therefore, properties in this area rely on wells in the Denver, Arapahoe and Laramie Fox-Hills Formations. Due to the upward tilt of the aquifers, wells in these aquifers are shallower than wells in the same aquifers located further to the east. As wells throughout the aquifer pump water, the water level in the aquifers declines over time which impacts water levels and production capability. This decline in water level may dry up wells or substantially impact production on this fringe while wells further to the east can continue to effectively operate, albeit at reduce production.

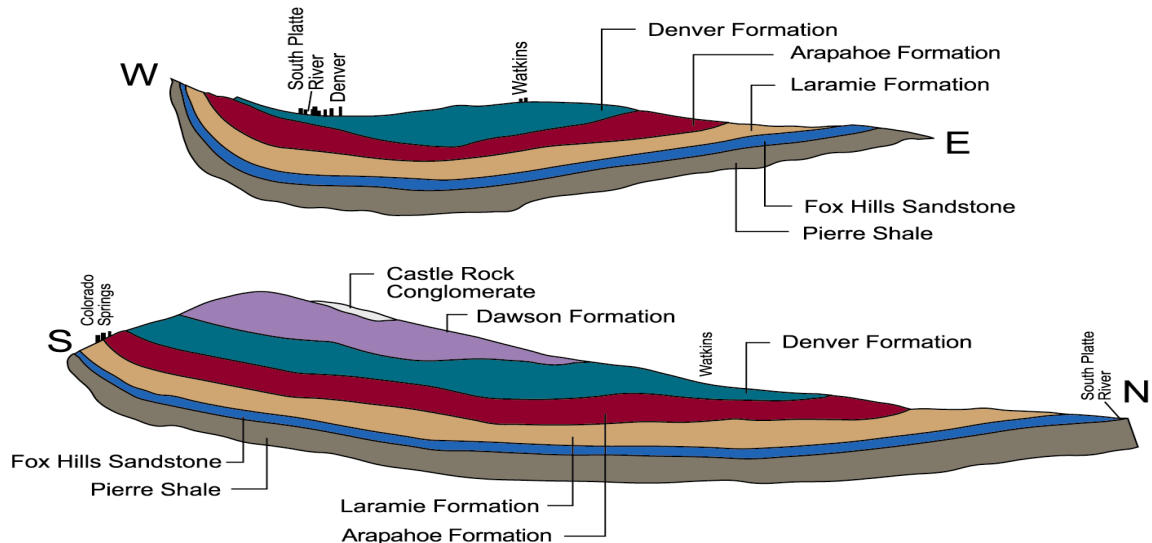


Figure 1

As the urban areas of Douglas County developed over the past 30 years, there has been intensive development of wells in these aquifers which has resulted in large declines in water levels that have been impacting the ability of rural properties in the Highway 85 Corridor to produce water. In 2003, the South Metro Water Supply Study modeled these demands and the effects on wells

and well production and alerted the urban water providers to the fact that these aquifers would not be able to economically support the level of urban development that was in process. Therefore, the study recommended that urban water providers find alternative renewable water supplies to supplement or replace these ground water supplies. The water providers, in general, have made large efforts over the last 10 years to reduce their reliance on the Denver Basin groundwater which has resulted in reduced levels of aquifer decline. However, since these aquifers recharge very slowly, and since some level of pumping does continue in the urban areas, the declines in water levels are likely to continue for properties in the Highway 85 Corridor. Therefore, this area should look for any available opportunities to replace or supplement its Denver Basin ground water supplies.

Many rural property owners in this area have recognized the problems with producing Denver Basin ground water, and have been pursuing water supply solutions. Water solutions are very challenging because other water sources are not readily available, and because the cost of transporting and distributing water into rural areas is very difficult economically. This is because the purchase of water supplies and construction of infrastructure is very expensive and with low densities of rural development, there are few property owners sharing this large expense. However, a reliable and permanent water supply is critical to maintaining property values, and hence even expensive solutions deserve consideration.

Existing Opportunities - Two events of substantial significance have occurred recently which present an opportunity for some optimally situated rural property owners to acquire and deliver renewable water supplies to this area. These are:

1. The Roxborough Water and Sanitation District (“Roxborough”) recently completed a water supply and delivery agreement with the City of Aurora which provides a permanent renewable water supply. Prior to this time, Roxborough had a lease for water supply from Aurora that had a termination date in 2022. Roxborough, in assessing the permanent water supply now available from Aurora has determined that it has about 50 taps available beyond full development projections within its boundaries. This means that these taps could potentially be made available to nearby property owners who desire to include into Roxborough for water service. Decisions regarding inclusions for service or the availability of these taps are totally at the discretion of Roxborough acting through its Board of Directors. However, management has indicated that the District is willing to hear inclusion requests that are in the best interests of Roxborough.

The water supply from Aurora is delivered to the Roxborough Water Treatment Plant (“RWTP”) which is located east of the Roxborough development as shown on Figure 2. This plant is located in close proximity to the community of Plum Valley Heights and the Town of Louviers which results in the need for very limited infrastructure to deliver the water to either of these communities.

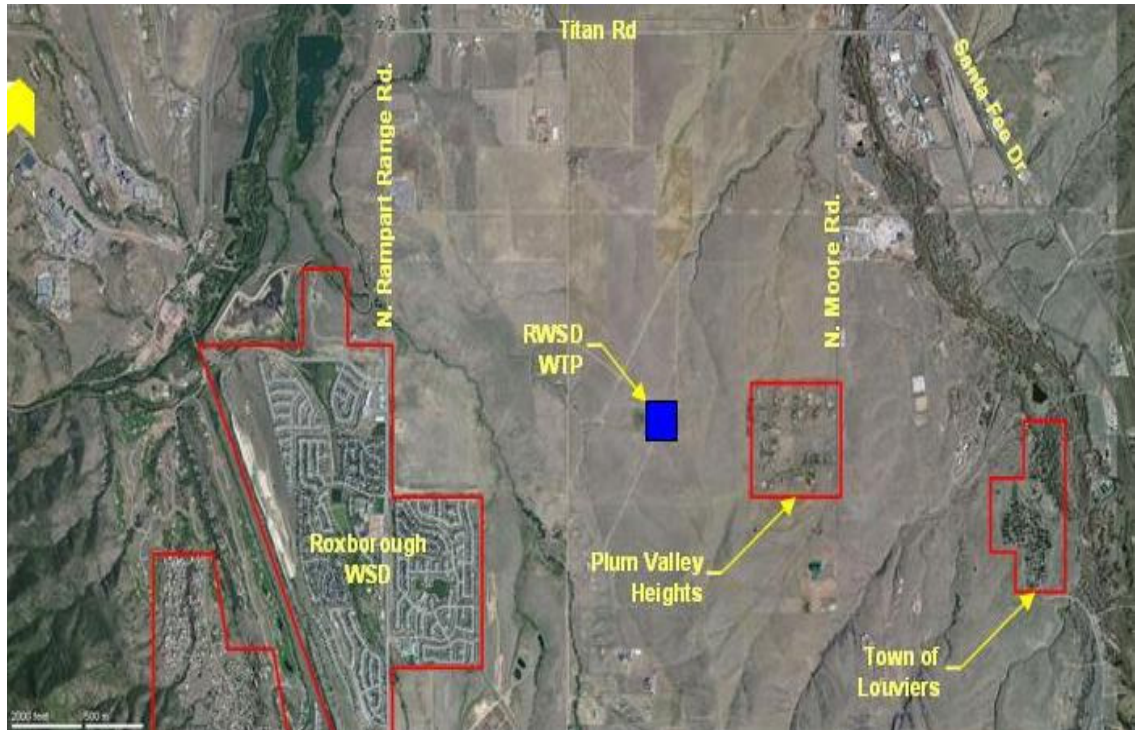


Figure 2

2. The Sterling Ranch Development is a new planned community whose zoning was recently approved by Douglas County. The development is planned to include some 12,500 residential properties when complete and water services are to be provided for this development. The Dominion Water and Sanitation District has been pursuing water supply for this development, and has offered to make a certain amount of water supply available to rural neighbors.

Recently, Dominion acquired its initial water supply and has arranged for delivery, and has offered to negotiate an agreement to make a portion of that water supply available to rural neighbors in Plum Valley Heights and/or the Town of Louviers when Dominion begins delivering within its District and when these communities have installed a water delivery system. Dominion has also arranged for this water supply to be delivered to the RWTP, and hence the water is available for delivery from the same location as the Roxborough water. Dominion has indicated that water for rural neighbors will be offered under terms similar to those for property owners in the Sterling Ranch.

The cost of renewable water supply delivered to this location is very expensive whether acquired through Roxborough or Dominion. This is the case for new development throughout much of the Denver Metropolitan area as water supplies become more and more scarce. At the same time, it seems unlikely that less expensive water supplies will ever be available in this area, and the location of delivery in close proximity to Plum Valley Heights and the Town of Louviers is very fortunate and cost effective for the additional costs of treatment and delivery.

Town of Louviers, Water System Priorities – The Louviers Water and Sanitation District (“Louviers”), in recent times, has been pursuing major water improvements for the Town.

Specifically, Louviers has been planning to install a new non-tributary ground water well as their primary source of water supply and is in need of replacing portions of its distribution piping where ongoing failures have raised considerable concern. Their proposed investment in these improvements will be substantial, but with significant grant money, Louviers may be in a position to also participate in some initial investments in renewable water and/or delivery infrastructure. Therefore, Louviers should be in the planning to understand the opportunities for renewable water and deliveries, and the costs involved. Therefore, this study has included an evaluation of the infrastructure required to connect to the RWTP for delivery of renewable water.

Study Plan and Purpose - This report is being prepared to provide information for Plum Valley Heights and Louviers to evaluate the plan and the cost for delivery of renewable water supplies from these sources to these communities. The plan is a preliminary engineering study that identifies the infrastructure and preliminary costs which are intended to provide these communities with information so that the property owners can effectively assess their ability to participate in a plan to replace their non-tributary ground water supplies with a renewable water resource.

Since Louviers has indicated its inability to fully participate in renewable water improvements in the near future, this study shows the development of a phased program. The Plum Valley Heights Improvements (“PVH Improvements”) could be the initial phase that includes a water supply system to serve the Plum Valley Heights community. The Louviers Improvements could then be an extension of that system in the future for additional water deliveries to the Town of Louviers, and there is a potential for some participation by Louviers in the initial phase as well.

Both Plum Valley Heights and Louviers will need financial assistance to participate in renewable water improvements. The opportunity for these entities to team on a joint project may well be attractive to agencies offering grants or low cost loans, and should be explored.

Water Demands

Plum Valley Heights –

The Plum Valley Heights community consists of 29 properties located a short distance directly east of the Roxborough Water Treatment Plant (“RWTP”) as shown on Figure 3. Each property has an individual ground water well, and hence there are no existing water distribution facilities. Some properties deliver water to a cistern with limited storage. Most, however, deliver water from the well through a pressure tank which maintains water pressure in the home and draws well deliveries as use depletes pressure in the tank.

These homes have a variety of outside irrigation demands that relate directly to the area that is irrigated. In general, the area irrigated is relatively small for each property. There is also no fire delivery system and the fire department would use tender trucks to carry water in to fight a fire. In home use is estimated to be typical of small lot residential homes in the Denver Metropolitan area, and is estimated at 5,000 gallons per month as an average. Outdoor irrigation use is estimated at 2.5 feet of water per irrigated area. Based upon these assumptions and rough estimates of irrigated areas, the average annual use of a property is estimated to be 0.4 acre-feet

per unit, or about 11.6 acre-feet for the 29 homes in the neighborhood. There are 5 other properties located nearby that could potentially participate in a delivery system for this area. These properties would add an additional 2.0 acre-feet of demands so that the total delivery considered is 13.6 acre-feet. These water demands are estimates since no records exist.

The Plum Valley Heights community also desires to consider the opportunity to install a water delivery and distribution system that would deliver fire flow demands. The South Metro Fire Rescue Authority (“SMFRA”) provides fire protection services in this area. The SMFRA has indicated that the desired flow through a hydrant for a residential fire is 1,500 gallons per minute (“gpm”). However, flows of 600 gpm would provide sufficient delivery to greatly improve the capability to fight a fire in this location, and would improve the area classification for insurance ratings. Therefore, in evaluating a water transmission system for this area, design flows of 1,500 gpm and 600 gpm were evaluated in addition to designing the system for the peak day rates shown in Table 1.



Figure 3

Louviers –

The Town of Louviers is located a short distance south and east of Plum Valley Heights as shown on Figure 4. The Town consists of 108 properties that are currently served by the Louviers Water and Sanitation District (“Louviers”). The properties are served from a community well in the Arapahoe Aquifer of the Denver Basin Formation. The well pumps to two water storage tanks located immediately west of the Town (Figure 4), and deliveries are made by gravity from the tanks through a distribution system located generally in the streets. The Town serves these 108 properties plus a number of public properties including the Louviers

Clubhouse, Triangle Park and the Dupont Park. The properties typically have irrigated lawns that are relatively small in size. Annual water demands range from 20 to 48 acre-feet per year. Annual historical demands for individual residential properties average 0.3 acre-feet per year. The water system does include fire hydrants with fire flow delivery from the water tanks which contain 90,000 gallons when full. Fire flow delivery is assumed to come from the water tank and therefore this analysis considers only the peak demands for domestic flows when sizing water transmission facilities to deliver renewable water.



Figure 4

Average water deliveries are determined as the total annual demand delivered at a constant rate throughout the year. The peak day demand is conservatively estimated from residential water demands at 4.0 times the average annual demand for purposes of pipe sizing. The peak day demand is commonly used to determine delivery rates with hourly peaks met through storage. Table 1 shows the average and estimated peak day demands for Plum Valley Heights and the Town of Louviers.

**TABLE 1
ESTIMATED DEMANDS**

Community	Average Demand (gpm)	Peak Day Demand (gpm)
Plum Valley Heights	11.5	46
Town of Louviers	30	120
Plum Valley Heights and Town of Louviers	42	166

Water System Alignment

Project Phasing – As discussed in the “Introduction”, a water delivery system for Plum Valley Heights and the Town of Louviers is proposed to be installed in 2 phases. The initial phase would include deliveries from the RWTP to Plum Valley Heights (“PVH Improvements”), and the later phase would extend the system from Plum Valley Heights to the water tank serving the Town of Louviers (the “Louviers Improvements”).

PVH Improvements - This water main would connect to the existing treated water line exiting the RWTP on the west side of the plant, and would then loop east across the RWTP property toward Plum Valley Heights as shown in Figure 5.

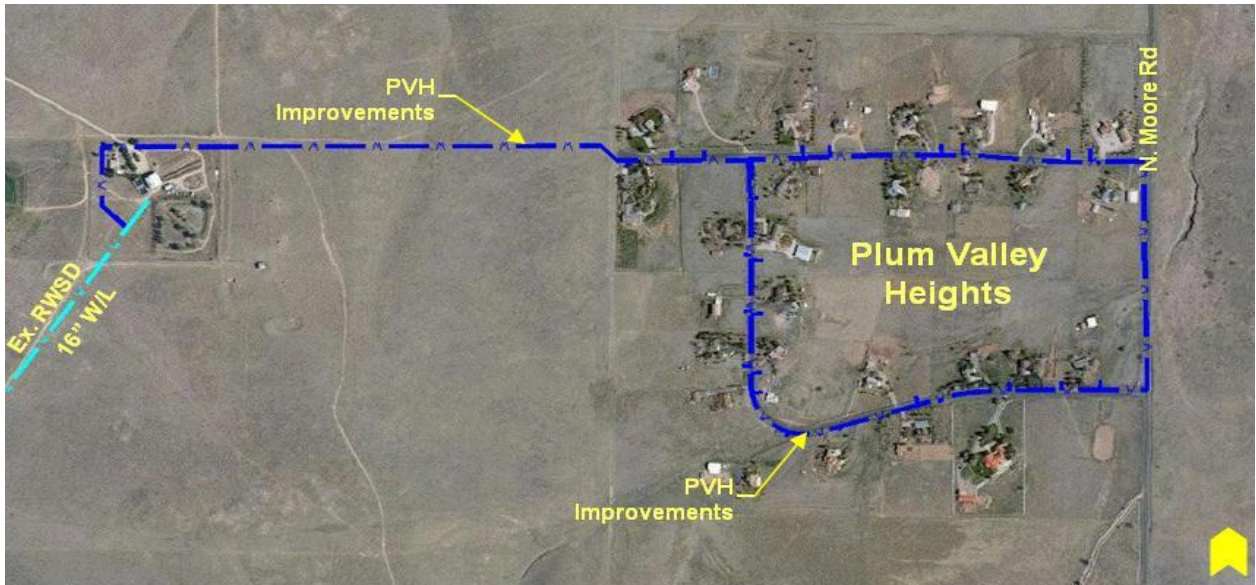


Figure 5

Leaving the RWTP property, the water line will require an easement from the Sterling Ranch. The Sterling Ranch has indicated its intent to cooperate in providing such an easement to the extent that it corresponds with their site development. On Figure 5, the alignment shown is a direct alignment across the property which is a best case condition, and has not been confirmed

as acceptable to the Sterling Ranch. While this alignment is shown, cost estimates provided in this report add 20% to the length of the alignment shown to account for some revision in the alignment. Since development will not occur for some time in this portion of Sterling Ranch, the easement provided may require that portions of the line be relocated in the future, if necessary, to accommodate development. While the cost of an easement is expected to be reasonable, the risk of a future relocation of a portion of the line, either horizontally or vertically will exist. The Sterling Ranch has indicated its willingness to cooperate to the extent practical to minimize any such relocation in the future. The extent of risk for the cost of relocations will need to be worked through with Sterling Ranch in the process of acquiring an easement.

The water line will then traverse through the Plum Valley Heights community as shown in Figure 5. The primary water main will traverse along the northern half of the community adjacent to W. Trail North Drive, and a distribution main will traverse the southern half of the community adjacent to W. Trail South Drive as shown. Services will be provided off of this loop to all properties. The loop will allow redundancy for flow delivery in the event of a line failure within the loop, and will provide for better water quality as water circulates with home demands. The pipeline will include a limited number of valves so that services can be reasonably isolated.

The pipeline alignment is intended to be constructed in the right-of-way adjacent to the street to avoid the costs of asphalt removal and replacement. The actual location will be determined during final design after utilities are located. In some areas, utilities, and in other areas topography, will certainly conflict with the proposed pipeline location. In these areas, this study assumes that the pipeline would be moved to within the pavement. For this preliminary investigation, the study assumes that this would occur in locations that would amount to 15 percent of the pipeline length through the community.

This is the extent of the PVH Improvements which will be sufficient to provide flow deliveries to the Plum Valley Heights community. This pipeline would be installed as an independent system that could be extended in the future to the Town of Louviers through a connection adjacent to N. Moore Road.

There are 5 property owners (“PVH Neighbors”) located south of Plum Valley Heights that may have an interest in connecting to the Plum Valley Heights system for service. While these properties are located relatively close to Plum Valley Heights, the cost of extending water lines to these properties with so few owners sharing in the costs will be very expensive. In addition, because water pressures will be the minimum for properties located on higher ground and at greater distances from the RWTP, a booster pump station may be required to reach some or all of the properties. Furthermore, in order to minimize these service line costs, alignments through the private properties should also be investigated. Therefore, service line extensions are not shown to these properties, nor are costs developed for these extensions in the following paragraphs, nor are these properties assumed to participate in the Plum Valley Heights delivery system. However, to the extent these property owners desire an estimate of costs for these extensions, after reviewing the costs for service described in this report for Plum Valley Heights water deliveries, they can be provided through further study as an addendum to this report.

Louviers Improvements – For service to Louviers in the future, a connection is proposed to occur near the intersection of N. Moore Road and W. Trail North Drive as shown in Figure 6. The water line then would continue east across property that is currently owned by the Dupont Company. It is likely that a secondary access road for the Sterling Ranch will be constructed across this property in the future to provide a second connection to Highway 85. Sterling Ranch has been working with Douglas County on alignment options for this roadway which are still being evaluated, some of which are shown on Figure 6. For planning purposes, this study has selected one of those alignments as shown and assumes that the pipeline crossing the Dupont property would be installed within the right-of-way that will be acquired for the roadway. The alignment shown requires that the pipeline from Plum Valley Heights be extended north along N. Moore Road to a point where it connects with this potential alignment. This alignment was chosen as one of the more likely proposals, and choice of another alignment may well result in a reduction in the length of pipeline, and hence a reduction in the costs presented herein. Therefore, this selected alignment is thought to provide a conservative estimate of costs required for an extension to the Town of Louviers. If an easement could be acquired from the Dupont Company, an alternative alignment is also shown in Figure 6, and costs are provided for this alignment as well.

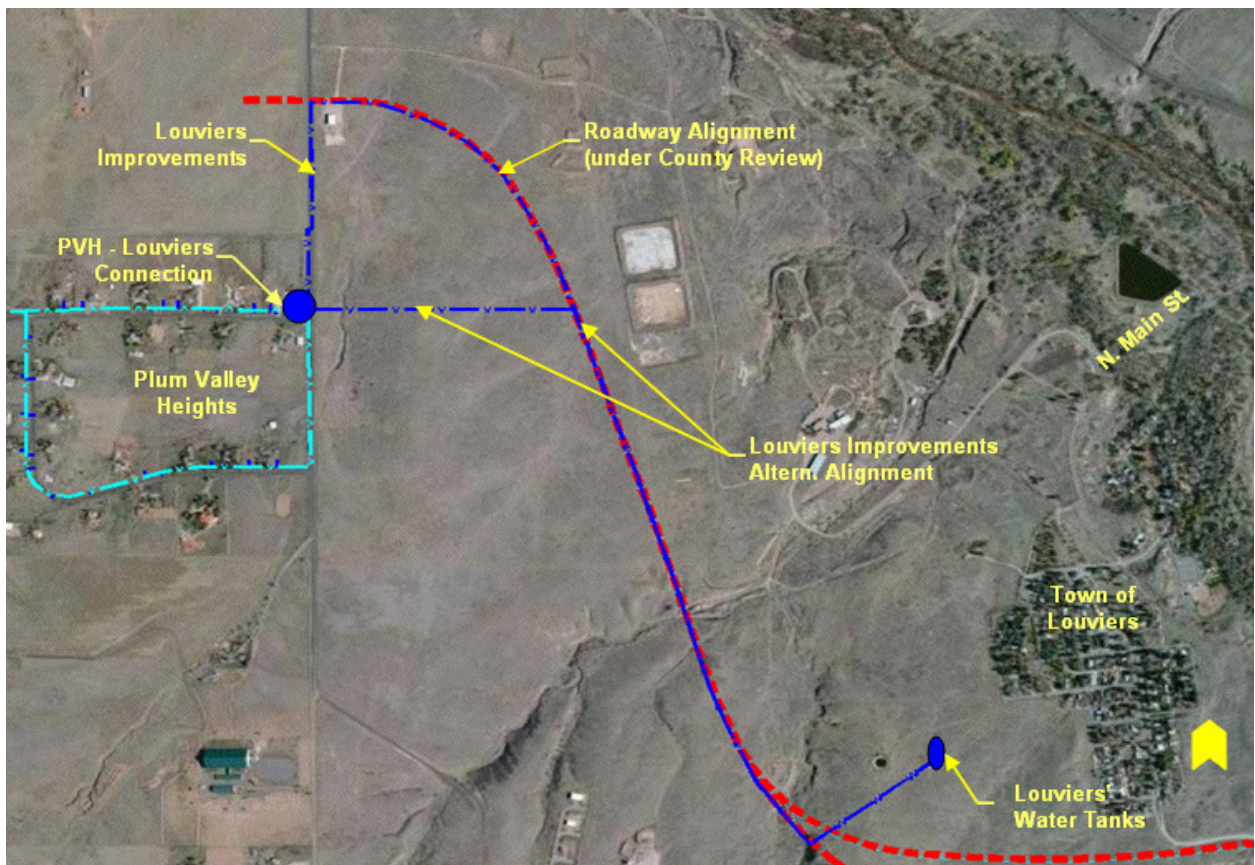


Figure 6

The water main will then traverse open space within the Town of Louviers to the existing Louviers' Water Storage Tank. Figure 6 shows a direct connection of the water main into the storage tank. The Town of Louviers would then receive flow delivery from these tanks under

gravity flow as it does now. The tanks could also be bypassed with the pipeline connecting directly into the distribution system. Louviers could use this to boost flow pressures in the community as described in the following section. In this case, the flow deliveries would be controlled by water pressures Zone 1 (low zone) of the Roxborough water system. Even if the tanks were bypassed for domestic delivery, water would be delivered to the storage tanks for fire protection, with fire deliveries operating off of Louviers' tanks pressures.

Water Delivery System Hydraulics and Sizing

A single alignment is proposed for deliveries to Plum Valley Heights as described in the previous paragraphs. The size of the pipelines, and hence the cost of improvements, would vary for three potential options. Option 1 sizes these pipelines to deliver peak day demands only. Option 2 increases pipeline diameters to deliver a "moderate" fire flow demand of 600 gpm. Option 3 increases the pipe sizing further to deliver 1,500 gpm, the common fire flow delivery for typical urban residential development. These options are described in the following.

PVH Improvements, Option 1 (Peak Day Deliveries)

This alternative provides water delivery to Plum Valley Heights for domestic use only. This alternative results in the smallest diameter piping and costs. Water delivered from the RWSD WTP has a static head of approximately 100 feet at the high point of the connection. For a peak day demand for Plum Valley Heights, the pipe sizing would be as shown on Figure 7. The main line piping would be 4 inch diameter PVC pipe, with 4 inch diameter piping completing the loop in W. Trail South Drive and N. Moore Road as shown. Flow deliveries would be at pressures ranging from about 40 psi for properties at the higher elevations to 80 psi on the low end. This assumes pressure losses for service lines, valves and meters to be approximately 5 psi. This is a minimum pressure at the highest properties in the community but is close to the maximum available pressure that can be attained without incorporating a booster system.

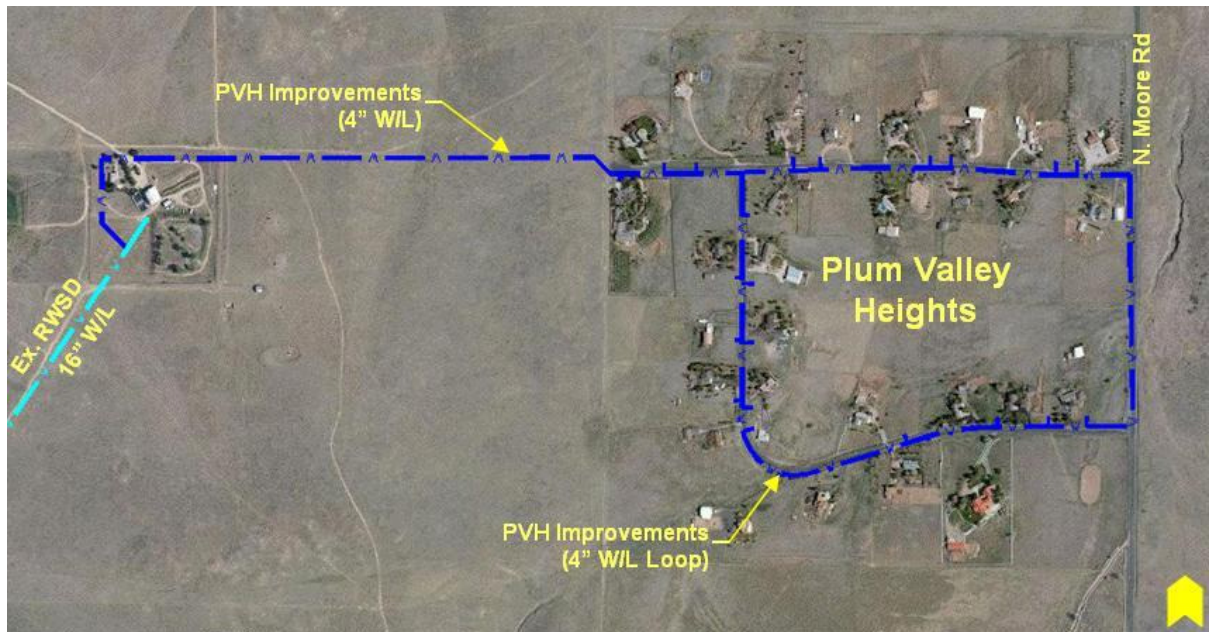


Figure 7

PVH Improvements, Option 2 (Moderate Fire Flow Deliveries)

This alternative would be sized for a fire flow demand of 600 gpm. The main line pipe would be an 8 inch diameter pipe, with 6 inch diameter piping in W. Trail South Drive and N. Moore Road as shown in Figure 8. This would provide a substantial fire flow from a hydrant, albeit well below the 1,500 gpm which is the desired flow for fire control in a residential area. Flow deliveries would be about 2.5 psi greater than Option 1, ranging from about 42.5 psi to 82.5 psi, again allowing for 5 psi for service system losses.

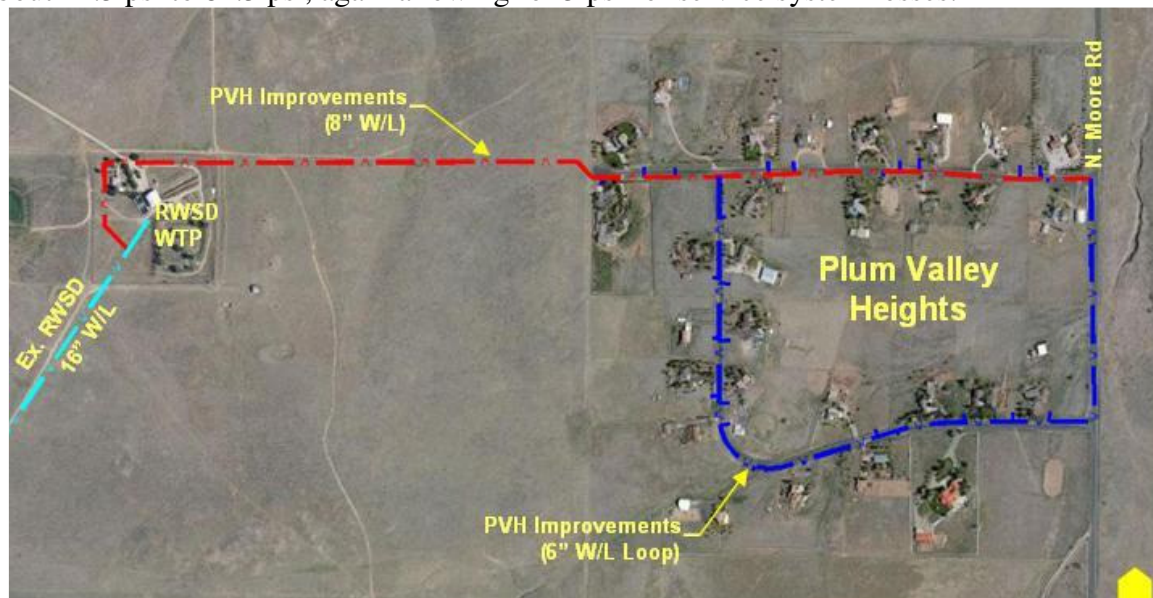


Figure 8

PVH Improvements – Option 3 (Full Residential Fire Flow)

Figure 9 shows a 12 inch main line from the RWTP through Plum Valley Heights on W. Trail North Drive with an 8 inch water loop located in W. Trail South Drive and N. Moore Road. This is the same alignment as Options 1 and 2, but with a larger diameter main. Pressures at Plum Valley Heights remain in the range of 42.5 psi to 82.5 psi. This pipeline can deliver the typical full residential fire flow of 1,500 gpm at pressures exceeding 20 psi.

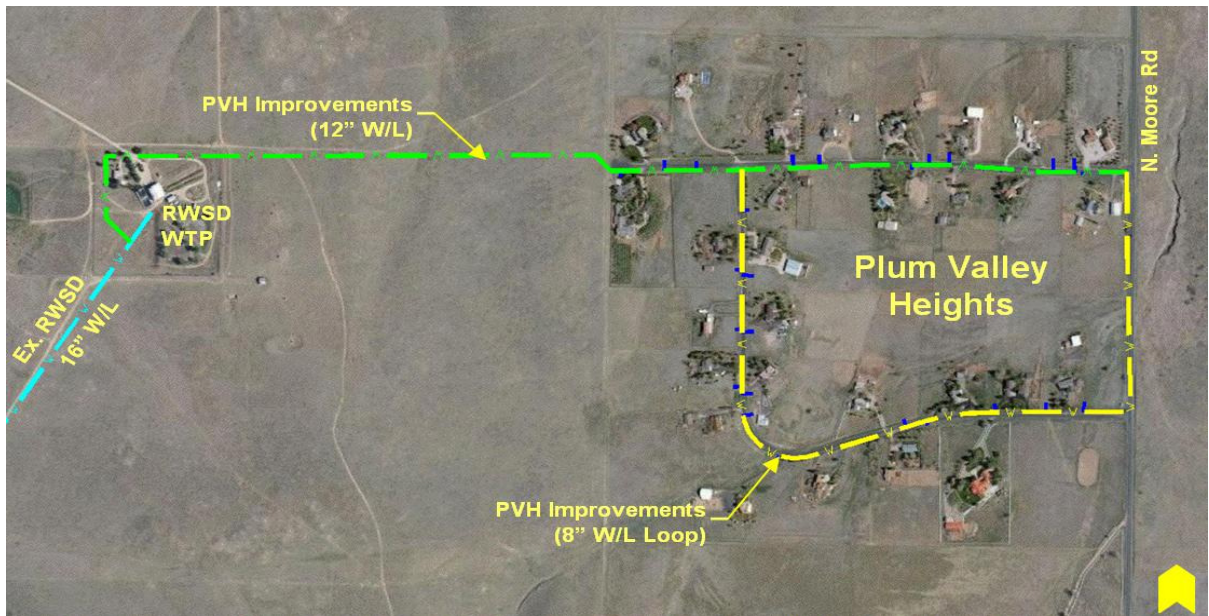


Figure 9

For any of these options, it is assumed that the Plum Valley Heights residents could continue to use their well water for irrigation purposes as long as the wells will allow. This would require that the in-door system and outdoor irrigation be completely separate, and would be subject to the approval of Roxborough.

As described previously, this study anticipates that if the Plum Valley Heights community decides to pursue renewable water supplies under this plan, the PVH Improvements will be constructed initially with an extension to Louviers a possibility for the future. For this extension, the Louviers' Improvements would be sized to meet peak day demands. This "peak day" system would provide deliveries as necessary to provide domestic water service to the community and the ability to fill the existing Louviers' Water Storage Tank for fire deliveries. Therefore, no upsizing of the delivery pipeline is proposed to provide fire deliveries to Louviers.

There are two options proposed for the Louviers Improvements. Option 1 would be to construct a small booster station on the extension from the PVH Improvements, located near the intersection of W. Trail North Drive and N. Moore Road, and keep pipeline diameters small; or Option 2 would be to provide larger size piping that would substantially reduce the pressure losses and will allow for deliveries to the Town of Louviers without a booster pump station. If the PVH Improvements, Option 1 is constructed by Plum Valley Heights, the only option available to Louviers is the booster pump station option because the head loss in the 4 inch

pipeline to Plum Valley Heights will be large enough that boosting of pressure to Louviers will be required. Therefore, the options for Louviers are as follows.

Louviers Improvements – Option 1 (Booster Pumping)

A small booster pump station would be constructed near the connection to the PVH Improvements at W. Trail North Drive and N. Moore Road as shown in Figure 10. There is latitude in the location of this booster station to be constructed anywhere along the pipe alignment next to N. Moore Road. The pipeline to Louviers would then be a 4 inch main from the booster pump station to the Louviers' Water Storage Tanks. The pipeline would connect directly into the Louviers' distribution system to boost pressures. The pump and pipeline sizing shown assumes that delivery pressures into the Louviers' system would be at about 30 psi, a 20 to 25 psi increase over existing delivery pressures from the water storage tanks. The pipeline would also be connected to the water storage tanks for purposes of filling the tanks.

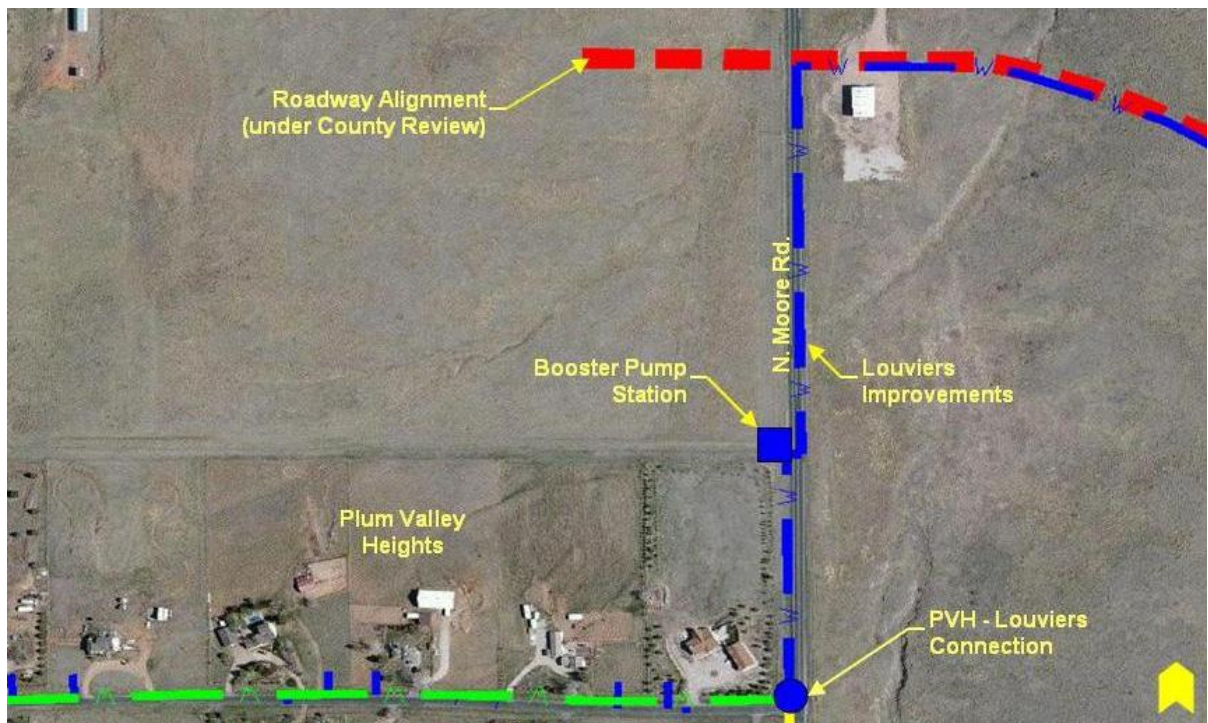


Figure 10

Louviers Improvements – Option 2 (Large Main Delivery)

An 8 inch diameter pipeline would be constructed from the connection to the PVH Improvements at W. Trail North Drive and N. Moore Road to the Louviers' Water Storage Tanks. This requires that Plum Valley Heights has selected and implemented PVH Improvements – Options 2 or 3, with at least an 8 inch diameter pipeline through Plum Valley Heights. Under these conditions, deliveries to Louviers will be at about 30 psi, the same pressure delivery proposed in Option 1, but without the need to include a booster pump station. This option is shown in Figure 11.

Rural Water Systems – Water systems in rural areas necessarily vary in sizing, redundancy, and water system looping that benefits urban areas. In this case, much of the length of the water system is a single line that could result in delivery interruption to all customers in the event of a line break, depending on location. In addition, with long pipeline deliveries to a small number of properties with limited demands, water quality can be a concern where water is in a pipeline for an extended period of time. While these conditions are not desirable, they are conditions that are common in rural areas, and can be addressed with proper operations and planning.

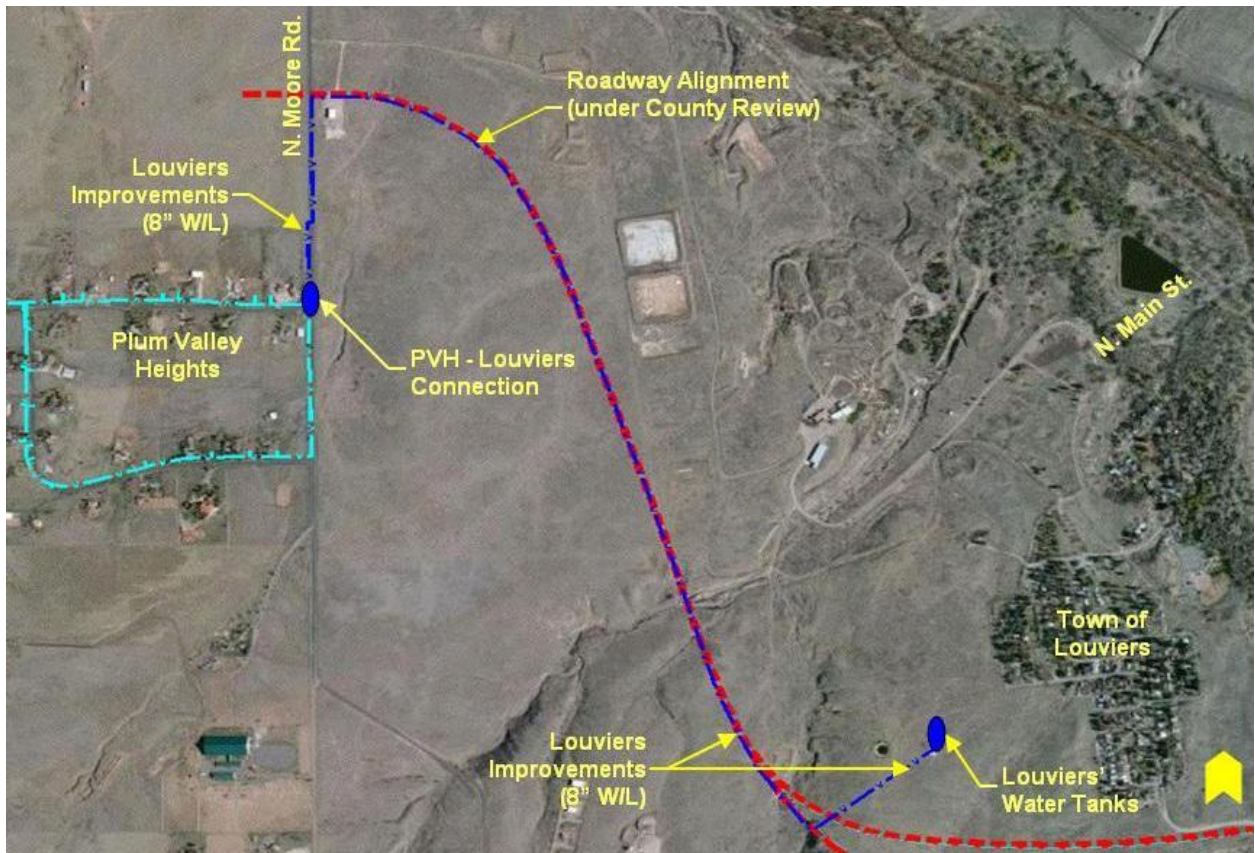


Figure 11

Water System Costs – Plum Valley Heights Options

PVH Improvements

Tables 2, 3, and 4 present the cost estimates for PVH Improvements, Options 1, 2, and 3 respectively. These are the water system improvements only and do not include the costs for water supply which are presented in the following section.

TABLE 2
PVH Improvements,
Option 1

<i>Item No.</i>	<i>Description</i>	<i>Quantity</i>	<i>Unit</i>	<i>Unit Price</i>	<i>Total Price</i>
1	Pothole Existing Utilities to identify all potential conflicts with	40	EA	\$319	\$12,760
2	Furnish and install 4-inch potable PVC C900 Class 150, DR 18 with standard bedding, backfill, and all associated items including joint restraint, complete in place.	11,047	LF	20	220,940
3	Furnish and install 4-inch valve with epoxy coating, including bedding, and all related appurtenances, complete in place	20	EA	750	15,000
4	Tie-into existing 16-inch water line at RWSD-WTP (16" w/l)	1	EA	8,000	8,000
5	Furnish and install- 3/4" service taps (assumes PVC service line - up to 100')	29	EA	750	21,750
6	2-inch air relief valve including all related appurtenances, complete in	1	EA	2,293	2,293
7	2-inch blowoff assembly including all related appurtenances, complete in	1	EA	2,293	2,293
8	Furnish and install 4-inch tee with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	2	EA	300	600
9	Furnish and install 4-inch 45 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	17	EA	225	3,825
10	Furnish and install 4-inch 11.25 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	9	EA	225	2,025
11	Street cut & repair (15% of PVH roads)	330	TON	85	28,050
12	Furnish, Install and Maintain Vehicle Construction Entrance	2	EA	2,488	4,976
13	Furnish, Install and Maintain Stabilized Staging Area	2,500	SY	2.5	6,250
14	Furnish, Install and Maintain Silt Fence	10,417	LF	1.5	15,626
15	Furnish, Install and Maintain Reinforced Rock Berm	250	LF	20	5,000
16	Furnish, Install and Maintain Concrete Washout Area	2	EA	550	1,100
17	Seeding and Mulching	6.5	AC	1,500	9,750
18	Street Maintenance	1.5	LM	4,000	6,000
19	Furnish and install marker posts, complete in place.	17	EA	200	3,400
20	Mobilization - 5%	1	LS	18,482	18,482
21	Contingency, including easements - 25%	1	LS	92,409	92,409
22	Engineering - 12%	1	LS	44,357	44,357
23	Administrative - 10%	1	LS	36,964	36,964

Total = \$561,849

TABLE 3
PVH Improvements,
Option 2

<i>Item No.</i>	<i>Description</i>	<i>Quantity</i>	<i>Unit</i>	<i>Unit Price</i>	<i>Total Price</i>
1	Pothole Existing Utilities to identify all potential conflicts with construction	40	EA	\$319	\$12,760
2	Furnish and install 8-inch PVC pipe C900 Class 150, DR 18 with standard bedding, backfill, and all associated items including joint restraint, complete in place.	6,423	LF	40	256,920
3	Furnish and install 6-inch PVC pipe C900 Class 150, DR 18 with standard bedding, backfill, and all associated items including joint restraint, complete in place.	4,624	LF	28	129,472
4	Furnish and install 8-inch valve with epoxy coating, including bedding, and all related appurtenances, complete in place	10	EA	1,800	18,000
5	Furnish and install 6-inch valve with epoxy coating, including bedding, and all related appurtenances, complete in place (PCVH South Trail Rd)	10	EA	800	8,000
6	Tie-into existing 16-inch water line at RWSD-WTP (16" w/l)	1	EA	8,000	8,000
7	Furnish and install- 3/4" service taps (assumes PVC service line - up to 100')	29	EA	750	21,750
8	2-inch air relief valve including all related appurtenances, complete in place	1	EA	2,293	2,293
9	2-inch blowoff assembly including all related appurtenances, complete in place	1	EA	2,293	2,293
10	Furnish and install 8x6-inch tee with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	2	EA	410	820
11	Furnish and install 8-inch 45 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	7	EA	400	2,800
12	Furnish and install 6-inch 45 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	10	EA	350	3,500
13	Furnish and install 6-inch 11.25 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	9	EA	350	3,150
14	Furnish and install Fire Hydrants	10	EA	4,500	45,000
15	Street cut & repair (15% of PVH roads)	330	TON	85	28,050
16	Furnish, Install and Maintain Vehicle Construction Entrance	2	EA	2,488	4,976
17	Furnish, Install and Maintain Stabilized Staging Area	2,500	SY	2.5	6,250
18	Furnish, Install and Maintain Silt Fence	10,417	LF	1.5	15,626
19	Furnish, Install and Maintain Reinforced Rock Berm	250	LF	20	5,000
20	Furnish, Install and Maintain Concrete Washout Area	2	EA	550	1,100
21	Seeding and Mulching	6.5	AC	1,500	9,750
22	Street Maintenance	1.5	LM	4,000	6,000
23	Furnish and install marker posts, complete in place.	17	EA	200	3,400
24	Mobilization 5%	1	LS	29,745	29,745
25	Contingency, including easements - 20%	1	LS	118,982	118,982
26	Engineering - 12%	1	LS	71,389	71,389
27	Administrative - 10%	1	LS	59,491	59,491
<i>Total =</i>					<u><u>\$874,517</u></u>

TABLE 4
PVH Improvements,
Option 3

<i>Item No.</i>	<i>Description</i>	<i>Quantity</i>	<i>Unit</i>	<i>Unit Price</i>	<i>Total Price</i>
1	Pothole Existing Utilities to identify all potential conflicts with	40	EA	\$319	\$12,760
2	Furnish and install 12-inch PVC pipe C900 Class 150, DR 18 with standard bedding, backfill, and all associated items including joint restraint, complete in place.	6,423	LF	65	417,495
3	Furnish and install 8-inch PVC pipe C900 Class 150, DR 18 with standard bedding, backfill, and all associated items including joint restraint, complete in place.	4,624	LF	40	184,960
4	Furnish and install 12-inch valve with epoxy coating, including bedding, and all related appurtenances, complete in place	10	EA	2,500	25,000
5	Furnish and install 8-inch valve with epoxy coating, including bedding, and all related appurtenances, complete in place (PCVH South Trail Rd)	10	EA	1,800	18,000
6	Tie-into existing 16-inch water line at RWSD-WTP (16" w/l)	1	EA	8,000	8,000
7	Furnish and install- 3/4" service taps (assumes PVC service line - up to 100')	29	EA	750	21,750
8	2-inch air relief valve including all related appurtenances, complete in	1	EA	2,293	2,293
9	2-inch blowoff assembly including all related appurtenances, complete in place	1	EA	2,293	2,293
10	Furnish and install 12x8-inch tee with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	2	EA	720	1,440
11	Furnish and install 12-inch 45 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	7	EA	550	3,850
12	Furnish and install 8-inch 45 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	10	EA	400	4,000
13	Furnish and install 8-inch 11.25 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	9	EA	400	3,600
14	Furnish and install Fire Hydrants	10	EA	4,500	45,000
15	Street cut & repair (20% of PVH roads)	330	TON	85	28,050
16	Furnish, Install and Maintain Vehicle Construction Entrance	2	EA	2,488	4,976
17	Furnish, Install and Maintain Stabilized Staging Area	2,500	SY	2.5	6,250
18	Furnish, Install and Maintain Silt Fence	10,417	LF	1.5	15,626
19	Furnish, Install and Maintain Reinforced Rock Berm	250	LF	20	5,000
20	Furnish, Install and Maintain Concrete Washout Area	2	EA	550	1,100
21	Seeding and Mulching	6.5	AC	1,500	9,750
22	Street Maintenance	1.5	LM	4,000	6,000
23	Furnish and install marker posts, complete in place.	17	EA	200	3,400
24	Mobilization 5%	1	LS	41,530	41,530
25	Contingency, including easements - 20%	1	LS	166,119	166,119
26	Engineering - 12%	1	LS	99,671	99,671
27	Administrative - 10%	1	LS	83,059	83,059

Total = \$1,220,971

Louviers Improvements

Tables 5 and 6 present the cost estimates for Louviers Improvements, Options 1 and 2, respectively. These are the water system improvements only and do not include the costs for water supply which are presented in the following section.

TABLE 5
Louviers Improvements,
Option 1

<i>Item No.</i>	<i>Description</i>	<i>Quantity</i>	<i>Unit</i>	<i>Unit Price</i>	<i>Total Price</i>
1	Pothole Existing Utilities to identify all potential conflicts with	10	EA	\$319	\$3,190
2	Furnish and install 4-inch potable PVC C900 Class 150, DR 18 with standard bedding, backfill, and all associated items including joint restraint, complete in place.	10,363	LF	20	207,260
3	Furnish and install 4-inch valve with epoxy coating, including bedding, and all related appurtenances, complete in place	18	EA	750	13,500
4	Tie-into 4-inch water line at W. Trail N. Dr. & N. More Rd.	1	EA	800	800
5	Tie-into dual 8" lines at Louviers water tanks, including bypass	1	LS	10,000	10,000
6	2-inch air relief valve including all related appurtenances, complete in	2	EA	2,293	4,586
7	2-inch blowoff assembly including all related appurtenances, complete in	2	EA	2,293	4,586
8	Furnish and install 4-inch 45 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	14	EA	225	3,150
9	Furnish and install 4-inch 11.25 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	8	EA	210	1,680
10	Booster Station, including enclosure	1	LS	125,000	125,000
11	Street cut & repair (N. Moore Rd)	68	TON	85	5,780
12	Furnish, Install and Maintain Vehicle Construction Entrance	2	EA	2,488	4,976
13	Furnish, Install and Maintain Stabilized Staging Area	2,500	SY	2.5	6,250
14	Furnish, Install and Maintain Silt Fence	19,136	LF	1.5	28,704
15	Furnish, Install and Maintain Reinforced Rock Berm	150	LF	20	3,000
16	Furnish, Install and Maintain Concrete Washout Area	2	EA	550	1,100
17	Seeding and Mulching	9	AC	1,500	13,500
18	Street Maintenance	0.4	LM	4,000	1,600
19	Furnish and install marker posts, complete in place.	17	EA	200	3,400
20	Mobilization - 5%	1	LS	22,103	22,103
21	Contingency, including easements - 25%	1	LS	110,516	110,516
22	Engineering - 12%	1	LS	53,047	53,047
23	Administrative - 10%	1	LS	44,206	44,206
<i>Total =</i>					<u><u>\$671,934</u></u>

Note: If the alternative alignment shown in Figure 6 is possible through acquisition of an easement, the estimated cost reduction is \$50,300.

TABLE 6
Louviers Improvements,
Option 2

<i>Item No.</i>	<i>Description</i>	<i>Quantity</i>	<i>Unit</i>	<i>Unit Price</i>	<i>Total Price</i>
1	Pothole Existing Utilities to identify all potential conflicts with	10	EA	\$319	\$3,190
2	Furnish and install 8-inch potable PVC C900 Class 150, DR 18 with standard bedding, backfill, and all associated items including joint restraint, complete in place.	10,363	LF	40	414,520
3	Furnish and install 8-inch valve with epoxy coating, including bedding, and all related appurtenances, complete in place	18	EA	1,200	21,600
4	Tie-into 12 or 8-inch water line at W. Trail N. Dr. & N. More Rd.	1	EA	1,400	1,400
5	Tie-into dual 8" lines at Louviers water tanks, including bypass	1	LS	10,000	10,000
6	2-inch air relief valve including all related appurtenances, complete in	2	EA	2,293	4,586
7	2-inch blowoff assembly including all related appurtenances, complete in	2	EA	2,293	4,586
8	Furnish and install 8-inch 45 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	14	EA	400	5,600
9	Furnish and install 8-inch 11.25 degree bend with epoxy coating, including bedding, thrust block and all related appurtenances, complete in place	8	EA	400	3,200
10	Street cut & repair (N. Moore Rd)	68	TON	85	5,780
11	Furnish, Install and Maintain Vehicle Construction Entrance	2	EA	2,488	4,976
12	Furnish, Install and Maintain Stabilized Staging Area	2,500	SY	2.5	6,250
13	Furnish, Install and Maintain Silt Fence	19,136	LF	1.5	28,704
14	Furnish, Install and Maintain Reinforced Rock Berm	150	LF	20	3,000
15	Furnish, Install and Maintain Concrete Washout Area	2	EA	550	1,100
16	Seeding and Mulching	9	AC	1,500	13,500
17	Street Maintenance	0.4	LM	4,000	1,600
18	Furnish and install marker posts, complete in place.	17	EA	200	3,400
19	Mobilization - 5%	1	LS	26,850	26,850
20	Contingency, including easements - 25%	1	LS	134,248	134,248
21	Engineering - 12%	1	LS	64,439	64,439
22	Administrative - 10%	1	LS	53,699	53,699
<i>Total =</i>					<u><u>\$816,228</u></u>

Note: If the alternative alignment shown in Figure 6 is possible through acquisition of an easement, the estimated cost reduction is \$158,000.

The following are assumptions that pertain to the cost estimates presented above for all options.

1. Service Connections - Service connections include the connection to the water main and a 3/4 inch PVC delivery line to the home's residential plumbing (not applicable to Louviers cost estimates). The costs are based upon an average distance (100 feet) from the street to the home and are intended to estimate an average cost per home.
2. Easements – Easements are assumed to be 20 feet in width unless otherwise noted. No cost is assumed for easements in road right-of-ways.
3. Contingency – Estimated as 25 percent in the preliminary design stage.
4. Engineering – Includes final design, construction observation and materials testing.
5. Administrative – Includes costs for Owner's representative, easement acquisition, accounting, and general administration.

Water Supply Options and Costs

As discussed in the "Introduction", there are two potential water supply options available for renewable water flow deliveries. These are described separately in the following paragraphs.

Roxborough Water and Sanitation District – The Roxborough Water and Sanitation District ("Roxborough") has an estimated 50 water taps available in its District by virtue of the water purchased from the City of Aurora. Roxborough will make these taps available to properties in Plum Valley Heights and/or the Town of Louviers. Should these taps be made available to Plum Valley Heights, the properties served are required to be included in the District, and water service would be under the same terms as any other water customer in the District pursuant to the District agreement with Aurora. Average annual water use for Roxborough for a residential tap is 0.33 acre-feet per unit. This is reasonably consistent with expected water use in Plum Valley Heights. For Louviers, the terms of service would likely be through an intergovernmental service agreement for a specific volume of water. Since this would not be an inclusion, this is subject to negotiation of additional terms and/or charges by Roxborough if a request for service is made by Louviers.

The current fees for service in Roxborough are shown on Table 7 & 8, and include Inclusion Fees, System Development Fees and Service Fees. For properties to gain service, the properties would need to 1) pay the inclusion fee, 2) invest in and install the water delivery system, and 3) pay the system development fee for service.

For Plum Valley Heights, this will need to be done for the community as a whole, as it is not feasible for Roxborough to offer these services to individual properties. For Louviers, this would be done through the Louviers Water and Sanitation District for the benefit of the properties within their service area.

Once service is established, the properties included would pay the service fees for delivery of water which include costs for water treatment, storage and delivery. In the case of Plum Valley Heights, the properties, assuming inclusion in Roxborough, would also be subject to property taxes which pay the annual debt service associated with the funds that have been borrowed by the District to construct its capital infrastructure. For Louviers, while property taxes would not be charged as such, the cost for participation in this infrastructure would need to be paid through other fees, which are assumed to be the equivalent of the property taxes.

A summary of the current fees in Roxborough is provided in the following Tables 7, 8 and 9. Table 7 shows the current fee which is paid for each property as a part of the process of including within the boundaries of the Roxborough. Table 7 also shows the current water system development charge and permit fee for a single family residential home with a ¾ inch tap. These fees combined are the “up-front” fees that would need to be paid to gain water services consistent with other residential customers of the District.

TABLE 7
Up-Front Fees
Inclusion Fees and Tap Fees
Typical Single Family Residence

Inclusion Fee	\$3,200
Water System Development Fee	\$22,032
Permit Fee	\$1,650
Total Up-Front Fees	\$26,882

Table 8 shows the current service fees paid by Roxborough customers for water service. The charges include a “base fee” which is a fixed monthly fee established as a minimum charge by the District to cover their fixed costs such as personnel, equipment and facility costs. The District charges for each thousand gallons of water used at the rates shown in the table. These costs increase with increased usage as shown to promote water conservation.

TABLE 8
Service Fees

Base Rate	0 – 20,000 gal	20,001 – 40,000 gal	40,000 gal & above
\$43.14	\$5.06/1,000	\$6.54/1,000	\$11.85/1,000

A typical residential in-door use during the winter is 5,000 gallons. In summer, typical usage would range from 10,000 to 20,000 gallons. Therefore, the monthly water bill during the winter would be expected to be around \$80, and in the summer is estimated to be between \$100 and \$160. These costs relate directly to the cost of obtaining and delivering renewable water supplies. While somewhat high, these are not substantially above entities in the south and east metro areas that are not served by Denver Water.

Roxborough currently has a mill levy of 13.266 mills which is part of the overall annual property tax bill. Table 9 presents an estimate of the property taxes that would be paid based upon the property value of an individual residential property. Plum Valley Heights customers would be required to pay the full Roxborough property tax even though only water services would be provided. Again, this level of mill levy is not unusual for districts in the south and east metro area.

TABLE 9
Property Taxes

Market Value	Assessed Value (8% of Market Value)	Annual Taxes (13.266 mills)
\$200,000	\$16,000	\$212
\$500,000	\$40,000	\$530
\$800,000	\$64,000	\$849
\$1,200,000	\$96,000	\$1,274

These costs represent all of the charges associated with service from Roxborough. However, in any new development, water delivery infrastructure is constructed and funded by the developer. Therefore, the water pipelines shown previously in Figures 5 and 6 must also be designed, constructed and funded by Plum Valley Heights or the Town of Louviers as appropriate. Once the system is constructed for properties included within Roxborough, Roxborough will be responsible for operations and maintenance. Therefore, in addition to the charges presented in this section, a property owner will be responsible for a share of the capital costs of these water delivery pipelines.

Dominion –Dominion, the water provider for Sterling Ranch, has secured their initial water supply which may be delivered to the Roxborough Water Treatment Plant. As discussed previously, Dominion is willing to make available a portion of the water supply that it has acquired for neighboring rural development. Dominion has also indicated their willingness to allow for deliveries of water through their water distribution system once developed. However, for deliveries in the near term, rural communities should look to develop their own water supply delivery system from the Roxborough Water Treatment Plant.

Dominion has also indicated that it will make water supplies available to rural neighbors on the same basis as customers within its development. That is, the volume and delivery of flow will be on the same basis as Sterling Ranch customers. Annual water volume for a tap in Sterling Ranch will be limited to 0.25 acre-feet which is substantially less than is estimated for Plum Valley Heights. In that case, the volume of use will need to be limited to that volume, although additional needs could potentially be met by maintaining the existing well supply for outside irrigation uses. The cost for water delivery to the RWTP will include the cost of acquiring and developing water supply including the infrastructure necessary to deliver the water, and a rate of return as Dominion may determine appropriate. Since Dominion is acquiring water from a number of sources with different purchase, system development and operational costs, they will be determining their water supply investment costs as the weighted average costs for delivery of all sources. Currently, they continue to work on their water development plan and are in the process of estimating their capital and operation costs that will be assessed through system

development and service fees. Dominion is expected to have an estimate of these initial costs in the near future, and has agreed to make these costs available to Plum Valley Heights and Louviers for consideration when available.

For both Plum Valley Heights and Louviers, the cost information associated with deliveries from Dominion may be meaningful to their near term decisions. However, since Roxborough has sufficient taps available to provide service to all Plum Valley Heights properties, and since Roxborough has confirmed its willingness to serve Plum Valley Heights, a unique opportunity with Roxborough is currently available for Plum Valley Heights. Therefore, the primary recommendation of this study is for Plum Valley Heights to immediately consider service from Roxborough.

If Plum Valley Heights were to commit to service from Roxborough at this time, water availability from Roxborough for Louviers would be limited. Dominion, though, has committed a substantial amount of water supply for rural development near to their boundaries. This should remain a viable source of water supply for Louviers for some time. Louviers should, in the interim, continue contacts with Roxborough and Dominion regarding the availability and cost of this water supply. Louviers may also further benefit in the future from water systems developed within the Sterling Ranch, or through extensions to other rural communities.

Cost Evaluation and Summary

Plum Valley Heights - Acquiring renewable water supplies and service for a rural community is an expensive undertaking for property owners. In this case, a Plum Valley Heights inclusion into Roxborough for water service results in an up front fee of \$26,882. This does not include the cost of water system improvements that must be constructed before any water deliveries can occur. Assuming that all property owners in Plum Valley Heights participated, the up front water system costs would be about \$19,400 per unit for Option 1, \$30,200 per unit for Option 2, and \$42,100 per unit for Option 3. Therefore, total up front payments would amount to \$46,300, \$57,100, or \$69,000 for Options 1, 2 and 3, respectively.

Service fee payments would be based upon use as shown in Table 8 previously, but for most customers would range from about \$100 to \$130 per month as an average with higher payments in the summer months and lower payments during the winter. Property taxes would also be incurred for contributions to debt service for the infrastructure of the Roxborough. These costs are directly proportional to property value as shown in Table 9. For most properties in Plum Valley Heights, these costs are estimated to range from \$500 to \$800 annually, and are paid as part of property tax payments made directly to the County, or made through a mortgage payment.

Presumably, for costs of this magnitude, most property owners will desire to finance the up front costs. This could be done individually, or through a governmental financing entity such as a Special District formed by the community, a Public Improvement District or a Local Improvement District formed through Douglas County, or a sub-district formed through Roxborough. The scope of this study did not include an evaluation of these options, but the Plum Valley Heights community should determine the best financing option available from

formation of these institutional entities by evaluating the amount that can be financed, the finance rate available through each type of district, and the annual cost of administration. For any of these options, a vote of the property owners in the district will be required to authorize the borrowing of funds. In most cases, it requires a majority vote to form the district and authorize the amount of funds to be borrowed. To the extent a vote is successful, all properties in the district are required to participate. Timing of a public election on formation and voted authorization varies by the type of district.

It is likely that only a portion of these up front costs is financeable through one of these entities. In that case, individual property owners may be able to finance the remaining costs through a refinancing of their individual mortgages or through a second mortgage on the property.

Since the cost of renewable water supply and delivery is very substantial, the Plum Valley Heights community should investigate the possibility of grants that may be available from State or Federal sources to lessen the burden. These types of grants do exist and are worth pursuing. Obtaining a grant will often require an intensive effort, and some investment in preparing applications and studies to support the requests are typical.

Louviers – For Louviers, the primary option for acquisition of a renewable water supply in the future appears to be a purchase through Dominion. The cost for this water supply is currently being developed by Dominion. While it is expected that these costs will be comparable to the cost of acquisition through Roxborough both for up front costs and ongoing service fees and capital contributions, cost information should be available from Dominion in the relatively near future. These costs will be in addition to the water delivery system costs estimated in this study to extend the water main from Plum Valley Heights to Louviers. This cost is estimated at \$671,900 or \$816,200 (Tables 5 & 6), plus a capital contribution to Plum Valley Heights for use of their system. While a “buy-in” to the Plum Valley Heights water system, if constructed, would be negotiated at the time of connection, it seems reasonable to assume that Louviers would be expected to contribute substantially for its use of the Plum Valley Heights water main from the RWTP to Moore Road. Given that without the use of the Plum Valley water system, a parallel system of approximately the same size would be required, it would seem that a 50/50 cost share of the depreciated value of the system is an appropriate assumption for the purposes of estimating future costs for Louviers. This cost today would be either \$155,100 or \$259,300 depending on the Plum Valley Heights option selected. The cost would depend on the system Louviers selects as well, and would bring the total estimated cost for infrastructure for Louviers to either \$827,000 or \$1,075,500. As discussed previously, other options may be available to Louviers in the future through on-going development of the Dominion water infrastructure.

Since Louviers may have an interest in participating in the Plum Valley Heights system, and some initial ability to participate in renewable water improvements, Plum Valley Heights should coordinate with Louviers in planning of this delivery system. The opportunity to serve multiple communities through the project could open up additional funding opportunities for both through joint grants or low cost loans.

Future renewable water for Louviers will be a substantial investment. Since Louviers is currently proceeding to install a new Arapahoe Aquifer well, the District will want to maximize

use of that asset into the future. To the extent that this well continues to produce water effectively going forward, Louviers may be able to acquire renewable water supply gradually over time once the opportunity exists to invest in a water supply delivery system.

Recommendations

This study has been prepared to identify existing opportunities for the Plum Valley Heights community and the Town of Louviers to invest in renewable water acquisition and delivery. These opportunities currently include potential water deliveries from Roxborough and/or Dominion. This study identifies the water system and costs required to connect to Roxborough for service, and the various costs to include in the District and purchase water taps. This study also identifies the infrastructure necessary for Louviers to connect to this same water system now or at a later time, and discusses the opportunity for Louviers to acquire renewable water from either Roxborough or Dominion.

The cost of acquiring and delivering water to these entities is a very expensive endeavor. However, should production of ground water supplies in this area continue to decline to where normal domestic demands can no longer be maintained, there will be a severe negative impact on property values. It is very unlikely that there will be a future option more cost effective than the current opportunity to acquire renewable water supplies from the nearby system of Roxborough.

The acquisition of renewable water supply and the funding and construction of water delivery infrastructure promises to be a challenging effort requiring significant time, study and investment to gather support, investigate financial opportunities and grants, vote to form entities and authorize debt, obtain easements, complete designs, construct facilities and establish operations. The process will take time and will require perseverance. However, today there are means of acquiring renewable water for rural homeowners in this area that may not exist in the future and homeowners should consider taking advantage of support by Douglas County, Roxborough and Dominion to work through this process and acquire these supplies. Specifically, the following actions should be considered by each entity:

Plum Valley Heights:

1. The Plum Valley Heights (“PVH”) community should begin immediately to meet and discuss the opportunity, the proposed water delivery system and the cost of service.
2. The PVH community should assess homeowner interest and capability to fund improvements.
3. Once interest by a majority of the community is determined, PVH should approach the Board of Directors of Roxborough to confirm the willingness of the District to serve the property and document the terms of service.
4. The PVH community should investigate and identify opportunities for grants for rural water supply from State and Federal sources. PVH should also investigate

opportunities for joint participation and funding of facilities with Louviers, and joint opportunities for grants or low cost loans.

5. The PVH community should investigate the institutional financing entities available to them through Douglas County, Roxborough or through the formation of a Title 32 Special District. A study should be completed to identify the amount of funding available, the terms available for public financing and the administrative costs that the community would incur through creation of one of these entities.
6. Once the plan to establish service and fund infrastructure has been clearly determined and vetted with the community, the PVH community should establish the institutional funding entity as required by law by petitioning for an election to form the entity and authorize debt financing.
7. Following establishment of the entity, petitions should be filed with Roxborough for service, and the new entity should proceed with financing as needed.
8. Once financing is completed, the entity should contract for the final design of water infrastructure.
9. Once final design is complete, the entity should contract for construction of facilities.

Town of Louviers:

1. Following completion of priority improvements, Louviers should:
 - a) Establish contact with both Roxborough and Dominion to express interest in acquiring a portion of their renewable water supply now or in the future. Investigate the possibility of a water supply contract with Roxborough or Dominion that would allow for a “phased” buy-in over time.
 - b) Establish contact with Plum Valley Heights to discuss and participate in the planning of the water delivery system from the Roxborough Water Treatment Plant.
 - c) Participate with Plum Valley Heights in pursuing grants or low cost loans since applications may well be stronger and more effective with multiple community involvement.
 - d) Stay informed of water system development within Dominion that could provide for connections in the future.
 - e) Investigate the potential for a pipeline easement across the Dupont Property from Plum Valley Heights to help reduce the cost of future infrastructure.