# Placer County Regional Pipeline
# Applegate Wastewater Connection to SMD-1 Collection System:
# Pipeline Routing Study

**FINAL REPORT**

**July 2007**

**Hatch Mott MacDonald**
**7311 Greenhaven Drive, Suite 250**
**Sacramento, CA 95831**

**Placer County Regional Pipeline**
**Applegate Wastewater Connection to SMD-1 Collection System:**
**Pipeline Routing Study**

## Introduction and Background

The Regional Pipeline Project will comprise a major trunk gravity sewer and a series of force mains to convey wastewater generated in Placer County foothill communities to the regional wastewater treatment plant (WWTP) in Lincoln. The main trunk sewer will collect flows from Placer County's Sewer Maintenance District SMD-1 WWTP in North Auburn and the City of Auburn's WWTP and will convey their raw, untreated wastewater to the Lincoln WWTP. Force main connections will connect the wastewater from the Applegate WWTP and Newcastle Sanitary District's WWTP to the main gravity sewer. In addition, wastewater from Placer County's existing SMD-3 WWTP will be diverted via force main to the basin for wastewater flowing to Roseville's Dry Creek WWTP. Once connections are made to the pipeline, wastewater treatment facilities will be abandoned: although their sites will be utilized for flow equalization and / or pumping facilities where necessary.

The Regional Pipeline Project is to be phased to suit priority needs, availability and release of funding, and to match constructability and construction schedules for various pipeline sections.

Key drivers for the project are:

- ***Removing Environmental Impacts:*** the project will remove treated wastewater effluent discharge from local creeks. However, the potential impact on riparian environments from the loss of flow must be assessed and satisfactorily mitigated;
- ***Removing Local Cities and Districts from Responsibility for Wastewater Treatment:*** The costs are too high for local cities and special districts to continue to have to invest capital to operate and maintain treatment facilities as part of the increasingly-stringent 5 year NPDES discharge permitting process;
- ***Recycled Water is a Valuable Resource:*** recycled water is becoming a valuable resource at lower elevations and centralizing Title 22 treated water production at the Lincoln WWTP will match an area where recycled water will be in demand.

As part of the Regional Pipeline Project, raw wastewater generated in the Applegate community will be re-directed from the existing Applegate WWTP and pumped to a connection with the existing SMD-1 sewer network. The existing Applegate WWTP will be decommissioned. Once connected to the SMD-1 network, flows will drain to the SMD-1 WWTP site on Joeger Road in North Auburn for ultimate connection to the Regional Pipeline.

Engineering and environmental evaluation of alternative pipeline routes from Applegate to the SMD-1 sewer network has been accelerated ahead of the remaining sections of the Regional Pipeline due to continuing non-compliance of the Applegate WWTP with its inability to meet Waste Discharge Requirements (WDR) and the imposition of administrative civil liability on Placer County as the WWTP operator by the Central Valley Regional Water Quality Control Board (CVRWQCB) in 2006.

This routing study is tasked with identifying and evaluating at least five alternative route alignments, including three potential I-80 freeway crossings. It also examines whether the existing pumping tank location on Applegate Road is the best location for a pump station to intercept raw wastewater flows to the Applegate WWTP, and whether a crossing of the Union Pacific Railroad (UPRR) right-of-way can

be avoided. A preferred pipeline alignment is recommended following this evaluation of the alternative routes, together with definition of future design services, a timeline and preliminary construction schedule, a 15% level cost estimate, and a draft project description for CEQA analysis purposes.

## Applegate WWTP

The Applegate WWTP is located approximately eight miles northeast of Auburn, on the south side of I-80 about one mile south of the Applegate freeway exit, and is shown on Figure 1. The plant is located on a 6.8 acre parcel (APN 073-120-013) immediately east of the UPRR right-of-way. Constructed in 1974, it comprises three evaporation and percolation ponds, each approximately 1 acre in size and about 6 feet deep. The ponds were designed to operate in series.

The CVRWQCB Staff Report of June 23, 2006 provides detailed information on the design and operational history of the Applegate wastewater conveyance and treatment systems. The treatment and conveyance system was designed for a population of 100 generating a maximum daily flow capacity of 10,000 gallons per day (gpd). In 2006, it was estimated that about 11,000 gpd was discharged into the wastewater collection system. The collection system consists of approximately 8,000 linear feet of 6-inch diameter sewer and a wastewater pump station that conveys domestic wastewater from approximately 26 land parcels with 34 equivalent dwelling units (EDUs). Of these EDUs, 24 are single-family homes, together with a motel with 10 units, three commercial connections, a church, a firehouse and a community center. Wastewater is pumped under the UPRR to the WWTP.

Disinfection using a chlorination system was added to the WWTP to disinfect partially-treated effluent from Pond No. 2 to Pond No.3 in anticipation of annual surface water discharges from Pond No. 3. These discharges violated the WWTP's WDR, but were caused by high hydraulic loading and a lack of wet weather capacity at the plant.

While the pond system's design capacity is now hydraulically inadequate for wastewater flows, the WWTP was also subjected to seasonal groundwater inflow into Pond No.3 under artesian conditions. The CVRWQCB Report of June 23, 2006 reported that the groundwater inflow during the winter months is sufficient to fill and overtop Pond No.3 even if no wastewater had been discharged into it.

In view of continuing surface water overflows from the WWTP, the CVRWQCB issued a Cleanup and Abatement Order in May 2001 that required Placer County to operate the WWTP in compliance with its WDR, provide greater disinfection of flows into Pond No. 3, and to develop and implement short and long term improvements to prevent discharges. In response to the Order, the County proposed construction of a community leachfield and began to divert excess flows to temporary storage tanks for subsequent hauling to the SMD-1 WWTP. However, following further surface water discharges caused by heavy rainfall and sewage spills in 2005 and 2006, the CVRWQCB imposed administrative civil liability for non-compliance with the Cleanup and Abatement Order on Placer County in June 2006. Following negotiations, a Settlement Agreement between Placer County and the CVRWQCB to resolve the administrative civil liability was reached in December 2006. Under the Agreement, Placer County is required (in addition to other requirements) to:

- Show that monies from the suspended liability have been used in the design of a pipeline to transfer wastewater from Applegate to SMD-1 (by September 1, 2007);
- Show that construction of the pipeline has begun by September 1, 2008;
- Show that by October 15 of each year, wastewater from all sewer connections has been diverted from the WWTP to temporary storage tanks;

- Collect and haul away all wastewater from the Applegate service connections between October 15 and May 15 of each year. This is to ensure that any wastewater remaining in the ponds at the end of the summer season can percolate and evaporate away prior to the onset of winter rains, and that any winter season overflows from the ponds are comprised solely of infiltrated groundwater and rainfall.

## Connection Points and Freeway Crossing Locations

### *Connection Points to the SMD-1 Sewer Network*

The following connection points to the SMD-1 sewer network have been identified by Placer County and have been used in this routing study. Several of these connection points are within the Winchester Country Club STEP system, which is discussed in a later section.

**Table 1: SMD-1 Sewer Network Connection Points**

| Connection No. | Location |
|---|---|
| 1 | Dry Creek Road at Windsong Place / Blue Grass Drive |
| 2 | Winchester Club Drive to west of Pinnacle View Drive (Winchester Country Club) |
| 3 | Winchester Club Drive at Sugar Pine Road (Winchester Country Club) |
| 4 | Ridgemore Drive at Meadow Vista Road |
| 5 | Christian Valley Road at Williams Drive / Williams Court |

### *Upstream Applegate Connection Point*

The Applegate wastewater collection system will be diverted prior to crossing the UPRR right-of-way and a pump station constructed in the vicinity of Bonvue Drive and Applegate Road.

### *I-80 Freeway Crossings*

Three potential crossing locations have been considered as part of this routing study:

**Table 2: I-80 Freeway Crossings**

| Crossing | Location |
|---|---|
| A | Existing culvert at the Applegate Road frontage road south of Fairidge Drive (if feasible), or a jack-and-bore crossing in casing south of this location across the freeway between Applegate Road and Lake Arthur Road |
| B | Clipper Gap overpass. |
| C | Applegate Exit overpass. |

For Crossing A, there are a number of potentially suitable locations to cross I-80 in a 3000 feet section north of the Clipper Gap Exit, as both Applegate Road (on the east) and Lake Arthur Road (on the west) are parallel frontage roads adjacent to the freeway. Jack-and-bore crossings will be subject to the

requirements of a Caltrans Encroachment Permit that are likely to include a perpendicular crossing of the freeway, jacking and receiving pits outside of the right-of-way, and a casing for pipeline installation.

Crossings B and C make use of the existing overpasses at the Clipper Gap and Applegate Exits. Use of these bridges will again be subject to Caltrans approval and the bridge type and cross-section. Approval may be more forthcoming if the pipe can be installed within the roadway cross-section: Caltrans is reticent to approve liquid-filled pipelines hung from bridge edge beams. In the event that use of the overpasses is not allowed, there are suitable adjacent locations for jack-and-bore crossings at both crossings. For Crossing B at Clipper Gap, a jack-and bore crossing could be located immediately north of the exit between Applegate Road and Lake Arthur Road. For Crossing C, a crossing adjacent to Bonvue Drive on Applegate Road to Lake Arthur Road would be a feasible alternative. It is anticipated that an overpass crossing would be a cheaper alternative to a jack-and-bore crossing.

## Previous Routing Study

A new sub division development named Sugar Pine Ridge has been proposed between the Winchester Country Club Subdivision to the west, and the I-80 Freeway to the east. A Tentative Map package has been submitted for the Sugar Pine Ridge development and, as part of that package, an updated report was prepared in March 2007 that addressed pumping domestic wastewater from the new development to connect with the existing Winchester sewer system (and eventually onto the SMD-1 sewer network). In addition to looking at the feasibility of connecting 51 proposed Sugar Pine Ridge services into the Winchester system, the report also looked at the hydraulic impact of also adding in the flows from 40 Applegate services.

The Winchester Country Club Subdivision is served by a pressurized collection system with each residential and commercial service connection having its own septic tank and effluent pump. Effluent from each septic tank is pumped into the central pressurized main. This system, known as a STEP system, was constructed in 1999 and will eventually serve 1692 service connections in the Winchester subdivision and Christian Valley. The central pressurized main varies between 2 and 10-inch in diameter and connects approximately 4 ½ miles downstream to the SMD-1 gravity sewer network west of Winchester.

Five alternative routes were considered and detailed hydraulic studies made examining the impact of adding the Applegate flows alone and the combined Sugar Pine Ridge / Applegate flows on the Winchester STEP system. Connection points were defined within the Winchester Subdivision that include Connections 2 and 3 for this study detailed in Table 1 above. One of the five routes, Route A, includes a routing along future roads within the Sugar Pine Ridge development. This provides a more direct route from Freeway Crossing A with potentially-significant savings in pipeline costs due to a shorter pipeline length from Applegate. However, given the time constraints for design and construction of the Applegate to SMD-1 pipeline imposed by the Settlement Agreement between Placer County and the CVRWQCB, and the unknown timeline for the Sugar Pine Ridge development, no reliance has been placed upon the availability of Route A in this routing study. This decision should, however, be reviewed again immediately prior to detailed design of the preferred Applegate to SMD-1 pipeline route in case timing or other circumstances have changed.

The March 2007 report concluded that:

- The addition of Applegate flows under all Winchester connection alternatives significantly raises the hydraulic grade line by 26 feet from 8 feet to 34 feet for a section of the existing central pressurized main between Stanley Drive and Dry Creek Road. The report recommends upsizing

1,115 linear feet of the 6-inch diameter main in this vicinity to 8 or 10-inch diameter to reduce this increase in head.

- Routing 1a (which is adopted below as a potential route in this study as Alignments 2A and 2B) similarly increases the head in the Winchester system by up to 29 feet with the addition of the Applegate flows. If the Sugar Pine Ridge flows are also included, the head increases by a significant 43 feet. The report indicates that effluent pumps for the STEP system on 280 lots could be affected by an increase of up to 26 feet of additional pumping head, with a further 19 lots by up to 29 feet, with the addition of the Applegate flows alone.
- A route including segment E in the report (which is adopted in this routing study as Alignments 5C and 5D) is highlighted as being significantly longer than alternatives that connect to the Winchester sewer system. It is noted, however, that this longer route avoids the high head problems associated with connecting to the Winchester system.
- A route including segment F in the report (which is adopted in this routing study as Alignments 3A and 3B) connects to the Winchester system at a higher elevation and would require the Applegate flows to be pumped through approximately 285 feet of head. The report notes that a second pump station (in addition to the Applegate Pump Station (PS)) would be required adjacent to Placer Hills Road in the Sugar Pine Ridge development to lift the low flows from Applegate through this high head. In addition, STEP system effluent pumps would be subject to additional pumping heads of up to 26 feet – this will potentially impact 280 lots.

## Alternative Alignments

Five alignments to be evaluated in this routing study, together with several alternative sub-alignments, are detailed below in this section.

The alignments are described below and are shown in detail on Figure 2.

All alignments start at the Applegate PS adjacent to Applegate Road and Bonvue Drive. Approximate route lengths and elevation differences between the Applegate PS and the relevant SMD-1 sewer network connection point are also included.

### ***Alignment 1 – Applegate PS to Dry Creek Road***

The connection point is the existing SMD-1 sewer at the intersection of Dry Creek Road and Blue Grass Drive, west of Windsong Place.

***Alignment 1A***

**Table 3: Alignment 1A Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to I-80 crossing point on Applegate Road south of Fairidge Drive | 6,900 | 1747 | - 251 |
| Cross I-80 through an existing culvert crossing / new jack-and-bore crossing to Lake Arthur Road. | 250 | 1742 | - 5 |
| Southwest on Lake Arthur Road to the intersection of Christian Valley Road and Bowman Road at Dry Creek Road. | 10,700 | 1512 | - 230 |
| West on Dry Creek Road to the SMD-1 connection point. | 15,000 | 1347 | - 165 |
| | | | |
| **Total length** | 32,850 LF | | |
| **Total change in elevation** | | | - 651 ft |

***Alignment 1B***

**Table 4: Alignment 1B Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to Applegate Road. | 400 | 1999 | + 1 |
| Southwest on the Applegate Road frontage road to the Clipper Gap overpass. | 10,700 | 1676 | - 323 |
| Cross I-80 over the Clipper Gap bridge to Placer Hills Road. | 700 | 1712 | + 36 |
| Southwest on Lake Arthur Road to the intersection of Christian Valley Road and Bowman Road at Dry Creek Road. | 6,900 | 1512 | - 200 |
| West on Dry Creek Road to the SMD-1 connection point. | 15,000 | 1347 | - 165 |
| | | | |
| **Total length** | 33,700 LF | | |
| **Total change in elevation** | | | - 651 ft |

A possible variation for Alignment 1 is the use of future roads in the proposed Sugar Pine Ridge Subdivision.

***Alignment 2 – Applegate PS to Bancroft Road (Winchester area)***

The connection point is the existing SMD-1 sewer at the intersection of Pinnacle View Drive (W) and Winchester Club Drive in the Winchester Country Club subdivision.

***Alignment 2A***

**Table 5: Alignment 2A Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to I-80 crossing point on Applegate Road south of Fairidge Drive. | 6,900 | 1747 | - 251 |
| Cross I-80 through an existing culvert crossing / new jack-and-bore crossing to Lake Arthur Road. | 250 | 1742 | - 5 |
| Southwest on Lake Arthur Road to the intersection with Pinewood Way. | 4,300 | 1663 | - 79 |
| North on Pinewood Way to Bancroft Road. | 2,600 | 1784 | + 121 |
| West on Bancroft Road to Conifer Lane. | 2,600 | 1919 | + 135 |
| Short cross-country reach to Granite Park Lane. | 250 | 1897 | - 22 |
| Granite Park Lane to Pinnacle View Drive. | 700 | 1900 | + 3 |
| North on Pinnacle View Drive to the SMD-1 connection point. | 1,400 | 1944 | +44 |
| | | | |
| **Total length** | 19,000 LF | | |
| **Total change in elevation** | | | - 54 ft |

***Alignment 2B***

**Table 6: Alignment 2B Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to Applegate Road. | 400 | 1999 | + 1 |
| Southwest on the Applegate Road frontage road to the Clipper Gap overpass. | 10,700 | 1676 | - 323 |
| Cross I-80 over the Clipper Gap bridge to Placer Hills Road. | 700 | 1712 | + 36 |
| Southwest on Lake Arthur Road to the intersection with Pinewood Way. | 950 | 1663 | - 49 |
| North on Pinewood Way to Bancroft Road. | 2,600 | 1784 | + 121 |
| West on Bancroft Road to Conifer Lane. | 2,600 | 1919 | + 135 |
| Short cross-country reach to Granite Park Lane. | 250 | 1897 | - 22 |
| Granite Park Lane to Pinnacle View Drive. | 700 | 1900 | + 3 |
| North on Pinnacle View Drive to the SMD-1 connection point. | 1,400 | 1944 | +44 |
| | | | |
| **Total length** | 20,300 LF | | |
| **Total change in elevation** | | | - 54 ft |

An alternative alignment would use Placer Hills Road instead of part of Pinewood Way: this may be preferable given the wider roadway of Placer Hills Road, although it is more heavily trafficked. Use of future roads in the proposed Sugar Pine Ridge Subdivision is also possible depending upon development timing.

***Alignment 3 – Applegate PS to Winchester Club Drive (near Sugar Pine Road)***

The connection point is the existing SMD-1 sewer at Winchester Club Drive west of Sugar Pine Drive.

***Alignment 3A***

**Table 7: Alignment 3A Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to I-80 crossing point on Applegate Road south of Fairidge Drive. | 6,900 | 1747 | - 251 |
| Cross I-80 through an existing culvert crossing / new jack-and-bore crossing to Lake Arthur Road. | 250 | 1742 | - 5 |
| Southwest on Lake Arthur Road to the intersection with Placer Hills Road. | 3,600 | 1712 | - 30 |
| North on Placer Hills Road to Sugar Pine Road. | 4,300 | 1870 | + 158 |
| West on Sugar Pine Road to Winchester Club Drive. | 950 | 1912 | + 42 |
| West on Winchester Club Drive to the SMD-1 connection point. | 950 | 1998 | + 86 |
| | | | |
| **Total length** | 16,950 LF | | |
| **Total change in elevation** | | | 0 ft |

***Alignment 3B***

**Table 8: Alignment 3B Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to Applegate Road. | 400 | 1999 | + 1 |
| Southwest on the Applegate Road frontage road to the Clipper Gap overpass. | 10,700 | 1676 | - 323 |
| Cross I-80 over the Clipper Gap bridge to Placer Hills Road. | 700 | 1712 | + 36 |
| North on Placer Hills Road to Sugar Pine Road. | 4,300 | 1870 | + 158 |
| West on Sugar Pine Road to Winchester Club Drive. | 950 | 1912 | + 42 |
| West on Winchester Club Drive to the SMD-1 connection point. | 950 | 1998 | + 86 |
| | | | |
| **Total length** | 18,000 LF | | |
| **Total change in elevation** | | | 0 ft |

***Alignment 4 – Applegate PS to Ridgemore Drive (near Meadow Vista Road)***

The connection point is the existing SMD-1 sewer at Ridgemore Drive near Meadow Vista Drive.

***Alignment 4A***

**Table 9: Alignment 4A Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to I-80 crossing point on Applegate Road south of Fairidge Drive | 6,900 | 1747 | - 251 |
| Cross I-80 through an existing culvert crossing / new jack-and-bore crossing to Lake Arthur Road. | 250 | 1742 | - 5 |
| Southwest on Lake Arthur Road to the intersection with Placer Hills Road. | 3,600 | 1712 | - 30 |
| North on Placer Hills Road to Meadow Vista Road. | 8,800 | 1714 (high point 1920) | + 2 (+ 208) |
| West on Meadow Vista Road to SMD-1 connection point at Ridgemore Drive. | 6,450 | 1789 | + 75 |
| | | | |
| **Total length** | 26,000 LF | | |
| **Total change in elevation** | | | - 209 ft |

***Alignment 4B***

**Table 10: Alignment 4B Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to Applegate Road. | 400 | 1999 | + 1 |
| Southwest on the Applegate Road frontage road to the Clipper Gap overpass. | 10,700 | 1676 | - 323 |
| Cross I-80 over the Clipper Gap bridge to Placer Hills Road. | 700 | 1712 | + 36 |
| North on Placer Hills Road to Meadow Vista Road. | 8,800 | 1714 (high point 1920) | + 2 (+ 208) |
| West on Meadow Vista Road to SMD-1 connection point at Ridgemore Drive. | 6,450 | 1789 | + 75 |
| | | | |
| **Total length** | 27,050 LF | | |
| **Total change in elevation** | | | - 209 ft |

***Alignment 4C***

**Table 11: Alignment 4C Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to Applegate Road. | 400 | 1999 | + 1 |
| Applegate Road / Orchard Road & Applegate Exit overpass. | 7,000 | 2042 | + 43 |
| Cross I-80 over the Applegate Exist bridge to Lake Arthur Road. | 700 | 2035 | - 7 |
| Southwest on Lake Arthur Road to Meadow Gate Road. | 1,900 | 2058 | + 23 |
| West on Meadow Gate Road to Placer Hills Road. | 9,000 | 1708 | - 350 |
| South on Placer Hills Road to Meadow Lane. | 500 | 1696 | - 12 |
| West on Meadow Lane to Meadow Vista Road. | 3,100 | 1698 | +2 |
| West on Meadow Vista Road to SMD-1 connection point at Ridgemore Drive. | 3,100 | 1789 | + 91 |
| | | | |
| **Total length** | 25,700 LF | | |
| **Total change in elevation** | | | - 209 ft |

***Alignment 5 – Applegate Road to Christian Valley Road at Williams Drive / Williams Court***

The connection point is the existing SMD-1 sewer on Christian Valley Road at Williams Drive / Williams Court.

***Alignment 5A***

**Table 12: Alignment 5A Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to I-80 crossing point on Applegate Road south of Fairidge Drive | 6,900 | 1747 | - 251 |
| Cross I-80 through an existing culvert crossing / new jack-and-bore crossing to Lake Arthur Road. | 250 | 1742 | - 5 |
| Southwest on Lake Arthur Road to the intersection of Christian Valley Road and Bowman Road. | 10,700 | 1512 | - 230 |
| North and northwest on Christian Valley Road to the SMD-1 connection point. | 12,850 | 1584 (high point 1840) | + 72 (+ 328) |
| | | | |
| **Total length** | 30,700 LF | | |
| **Total change in elevation** | | | - 414 ft |

***Alignment 5B***

**Table 13: Alignment 5B Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to Applegate Road. | 400 | 1999 | + 1 |
| Southwest on the Applegate Road frontage road to the Clipper Gap overpass. | 10,700 | 1676 | - 323 |
| Cross I-80 over the Clipper Gap bridge to Placer Hills Road. | 700 | 1712 | + 36 |
| Southwest on Lake Arthur Road to the intersection of Christian Valley Road and Bowman Road. | 7,150 | 1512 | - 200 |
| North and northwest on Christian Valley Road to the SMD-1 connection point. | 12,850 | 1584 (high point 1840) | + 72 (+ 328) |
| | | | |
| **Total length** | 31,800 LF | | |
| **Total change in elevation** | | | - 414 ft |

***Alignment 5C***

**Table 14: Alignment 5C Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to I-80 crossing point on Applegate Road south of Fairidge Drive | 6,900 | 1747 | - 251 |
| Cross I-80 through an existing culvert crossing / new jack-and-bore crossing to Lake Arthur Road. | 250 | 1742 | - 5 |
| Southwest on Lake Arthur Road to the intersection with Pinewood Way. | 4,300 | 1663 | - 79 |
| North on Pinewood Way to Bancroft Road. | 2,600 | 1784 | + 121 |
| West on Bancroft Road to Christian Valley Road. | 7,400 | 1796 (high point 1921) | + 12 (+ 137) |
| West on Christian Valley Road to the SMD-1 connection point. | 8,300 | 1584 (high point 1840) | - 212 (+ 44) |
| | | | |
| **Total length** | 29,750 LF | | |
| **Total change in elevation** | | | - 414 ft |

***Alignment 5D***

**Table 15: Alignment 5D Route Segments**

| Route Segment Description | Linear Feet (LF) | Elevation, ft | Elevation Change, ft |
|---|---|---|---|
| Applegate PS | | 1998 | |
| Applegate PS to Applegate Road. | 400 | 1999 | + 1 |
| Southwest on the Applegate Road frontage road to the Clipper Gap overpass. | 10,700 | 1676 | - 323 |
| Cross I-80 over the Clipper Gap bridge to Placer Hills Road. | 700 | 1712 | + 36 |
| Southwest on Lake Arthur Road to the intersection with Pinewood Way. | 950 | 1663 | - 49 |
| North on Pinewood Way to Bancroft Road. | 2,600 | 1784 | + 121 |
| West on Bancroft Road to Christian Valley Road. | 7,400 | 1796 (high point 1921) | + 12 (+ 137) |
| West on Christian Valley Road to the SMD-1 connection point. | 8,300 | 1584 (high point 1840) | - 212 (+ 44) |
| | | | |
| **Total length** | 31,050 LF | | |
| **Total change in elevation** | | | - 414 ft |

There are possible variations that could reduce route segment length by utilizing Upper Lake Road, Westlake Road and Fallen Leaf Lane, and a cross-country connection to Christian Valley Road.

## Evaluation of Alignments

***Methodology***

The evaluation of the alignments detailed above is made in this section. The evaluation is made for each alignment using the following engineering and non-engineering criteria. Detailed environmental criteria have not been directly included in this routing study evaluation, though any major potential environmental impacts have been identified as far as possible at this routing study scale.

- Engineering criteria:
  - Pipeline diameter range and route length;
  - Design pumping head, power demand and number (if any) of additional pump stations beyond a single pump station at Applegate;
  - Capacity of the SMD #1 / Winchester STEP collection system downstream of the connection point, and the need for modifications to those systems and their facilities;
  - Additional appurtenant structures and facilities;
  - Ease of the I-80 Freeway crossing;
  - Crossings of creeks and canals;
  - Relative capital and operational costs;
  - Relative ease of construction (access, space);
  - Anticipated construction duration and ability to meet project milestones and overall schedule.

- Non-engineering criteria:
    - Right-of way requirements, particularly the ease of permanent and temporary construction easement acquisition;
    - Impact on residential areas and potential for public opposition;
    - Public and elected official / agency opinion;
    - Permitting requirements (and time to acquire);
    - Potential disruption to traffic during construction, and ease of traffic mitigation during construction;
    - Conflicts with major existing infrastructure.

***Qualitative Evaluation***

Table 16 below highlights in qualitative terms the advantages and disadvantages of each alignment

**Table 16: Qualitative Evaluation of Alignments**

| | Advantages | Disadvantages |
|---|---|---|
| 1A | • Avoids connection to, and need for, expensive modifications to the Winchester STEP system and centralized pressure main.<br>• Avoids additional pumping through a high static lift to higher elevations in Winchester Country Club, with associated higher operation and maintenance costs and operational complexity.<br>• Consistent fall in grade along route (total of 651 feet) simplifies hydraulics, leading to easier operation and maintenance.<br>• Route is in public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential benefit is the connection of properties to the main along Dry Creek Road.<br>• Lake Arthur Road is a wider, less winding route than Applegate Road (1B), leading to easier construction.<br>• Most downstream connection to the SMD-1 sewer network avoids upstream system modifications. | • Long pipeline route at 32,850 LF (6.2 miles) and thus higher pipeline capital cost than other alignments.<br>• Dry Creek Road is main traffic route with higher traffic volumes compared to other routes.<br>• Potential for commuter objection / complaint. |
| 1B | • Avoids connection to, and need for, expensive modifications to Winchester STEP system and pressure main.<br>• Avoids additional pumping through a high static lift to higher elevations in Winchester Country Club, with associated higher operation and maintenance costs and operational complexity.<br>• Consistent fall in grade along route (total of 651 feet) simplifies hydraulics, leading to easier operation and maintenance.<br>• Route is in public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential benefit is the connection of properties to the main along Dry Creek Road.<br>• Use of Clipper Gap I-80 Freeway crossing overpass will save costs over jack-and-bore (1A), but | • Longest pipeline route at 33,700 LF (6.4 miles) and thus higher pipeline capital cost than other alignments.<br>• Dry Creek Road is main traffic route with higher traffic volumes compared to other routes.<br>• Potential for commuter objection / complaint. |

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| | dependent upon Caltrans approval.<br>• Most downstream connection to the SMD-1 sewer network avoids upstream system modifications. | |
| | | |
| 2A | • Relatively short pipeline route at 19,000 LF (3.6 miles) and thus lower pipeline capital costs.<br>• Alternative road alignments are available to address public concerns: Pinewood Way has narrow, winding ROW vs. Placer Hills Road which is wider, more direct but more heavily-trafficked.<br>• Potential to incorporate flows from new Sugar Pine Ridge development but dependent on timing.<br>• Lake Arthur Road is a wider, less winding route than Applegate Road (2B), leading to easier construction. | • Uncertainty over the viability and cost of connection into the Winchester STEP system given likely number of effluent pump upgrades (280+ lots identified in previous routing study) and significant head increases in the STEP central pressure main.<br>• Higher static elevation leads to higher pumping costs and the cost of a possible second pump station.<br>• Construction in a recently-developed, affluent sub-division may generate considerable public objection, particularly if there are large numbers of STEP pump modifications on private property.<br>• Narrow street construction may increase costs.<br>• Private ROW (ROW acquisition costs). |
| 2B | • Relatively short pipeline route at 20,300 LF (3.8 miles) and thus lower pipeline capital costs (but longer than 2A).<br>• Alternative road alignments are available to address public concerns: Pinewood Way has narrow, winding ROW vs. Placer Hills Road which is wider, more direct but more heavily-trafficked.<br>• Potential to incorporate flows from new Sugar Pine Ridge development but dependent on timing.<br>• Use of Clipper Gap I-80 Freeway crossing overpass will save costs over jack-and-bore (2A), but dependent upon Caltrans approval. | • Uncertainty over the viability and cost of connection into the Winchester STEP system given likely number of effluent pump upgrades (280+ lots identified in previous routing study) and significant head increases in STEP central pressure main.<br>• Higher static elevation leads to higher pumping costs and the cost of a possible second pump station.<br>• Construction in recently-developed, affluent sub-division may generate considerable public objection, particularly if there are large numbers of STEP pump modifications on private property.<br>• Narrow, winding street construction may increase costs.<br>• Part private ROW (ROW acquisition costs). |
| 3A | • Short pipeline route at 16,950 LF (3.2 miles) and thus lower pipeline capital costs.<br>• Placer Hills Road is a wide, direct route but more heavily-trafficked.<br>• Potential to incorporate flows from new Sugar Pine Ridge development but dependent on timing.<br>• Lake Arthur Road is a wider, less winding route than Applegate Road (3B), leading to easier construction. | • Uncertainty over the viability and cost of connection into the Winchester STEP system given likely number of effluent pump upgrades (280+ lots identified in previous routing study) and significant head increases in the STEP central pressure main.<br>• Higher static elevation leads to higher pumping costs and the cost of a possible second pump station.<br>• Construction in a recently-developed, affluent sub-division may generate considerable public objection, particularly if there are large numbers of STEP pump modifications on private property.<br>• Narrow street construction may increase costs.<br>• Part private ROW (ROW acquisition costs). |
| 3B | • Short pipeline route at 18,000 LF (3.4 miles) and thus lower pipeline capital costs.<br>• Placer Hills Road is a wide, direct route but more heavily-trafficked.<br>• Potential to incorporate flows from new Sugar Pine Ridge development but dependent on timing.<br>• Use of Clipper Gap I-80 Freeway crossing overpass will save costs over jack-and-bore (3A), but dependent upon Caltrans approval. | • Uncertainty over the viability and the cost of connection into the Winchester STEP system given likely number of effluent pump upgrades (280+ lots identified in previous routing study) and significant head increases in STEP central pressure main.<br>• Highest static elevation leads to highest pumping costs. A second pump station was identified in the previous routing study, adding more capital cost.<br>• Construction in recently-developed, affluent sub-division may generate considerable public objection, particularly if there are large numbers of STEP pump modifications on private property.<br>• Narrow, winding street construction may increase costs. |

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| | | • Part private ROW (ROW acquisition costs). |
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| 4A | • Route is in Public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential to connect properties in Meadow Vista.<br>• Lake Arthur Road is a wider, less winding route than Applegate Road (4B). | • Relatively long pipeline route at 26,000 LF (4.9 miles).<br>• Uncertainty over the viability and the cost of connection into the Winchester STEP system given likely number of effluent pump upgrades (280+ lots identified in previous routing study) and significant head increases in STEP central pressure main. An additional pump station will be needed to pump Applegate flows into the Winchester system.<br>• Potential for traffic disruption in Meadow Vista and along Placer Hills Road and Meadow Vista Road. |
| 4B | • Route is in Public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential to connect properties in Meadow Vista.<br>• Use of Clipper Gap I-80 Freeway crossing overpass will save costs over jack-and-bore (4A), but dependent upon Caltrans approval. | • Relatively long pipeline route at 27,050 LF (5.1 miles).<br>• Uncertainty over the viability and the cost of connection into the Winchester STEP system given likely number of effluent pump upgrades (280+ lots identified in previous routing study) and significant head increases in STEP central pressure main. An additional pump station will be needed to pump Applegate flows into the Winchester system.<br>• High static lift to higher elevations will require additional pump station(s) with associated higher capital and operation and maintenance costs.<br>• Potential for traffic disruption in Meadow Vista and along Placer Hills Road and Meadow Vista Road. |
| 4C | • Shortest of Alignment 4 alternatives at 25,700 LF (4.9 miles).<br>• Route is in Public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential to connect properties in Meadow Vista. | • Still relatively long route when compared to other main alternatives, leading to higher capital costs.<br>• Route is dependent upon use of Applegate Road bridge over the UPRR and upon Caltrans for use of the Applegate Road Exit overpass crossing of the I-80 Freeway. Alternative jack-and bore crossing of I-80 from Applegate Road at Bonvue Drive to Lake Arthur Drive may be cheaper than overpass crossing due to shorter pipeline route.<br>• Uncertainty over the viability and the cost of connection into the Winchester STEP system given likely number of effluent pump upgrades (280+ lots identified in previous routing study) and significant head increases in STEP central pressure main. An additional pump station will be needed to pump Applegate flows into the Winchester system.<br>• Potential for traffic disruption in Meadow Vista and along Placer Hills Road and Meadow Vista Road. |
| | | |
| 5A | • Avoids connection to, and need for, expensive modifications to the Winchester STEP system and centralized pressure main.<br>• Avoids additional pumping through a high static lift to higher elevations in Winchester Country Club, with associated higher operation and maintenance costs and operational complexity.<br>• Route is in public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential to connect properties from along Christian Valley Road.<br>• Lake Arthur Road is a wider, less winding route than | • Long pipeline route at 30,700 LF (5.8 miles) and thus higher pipeline capital cost than some other alignments.<br>• Christian Valley Road is a traffic route with relatively high traffic volumes compared to most other routes.<br>• Potential for commuter objection / complaint. |

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| | Applegate Road (5B & 5D). | |
| 5B | • Avoids connection to, and need for, expensive modifications to the Winchester STEP system and centralized pressure main.<br>• Avoids additional pumping through a high static lift to higher elevations in Winchester Country Club, with associated higher operation and maintenance costs and operational complexity.<br>• Route is in public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential to connect properties from along Christian Valley Road.<br>• Use of Clipper Gap I-80 Freeway crossing overpass will save costs over jack-and-bore (5A &5C), but dependent upon Caltrans approval. | • Longer pipeline route at 31,800 LF (6.0 miles) and thus higher pipeline capital cost than some other alignments.<br>• Christian Valley Road is a traffic route with relatively high traffic volumes compared to most other routes.<br>• Potential for commuter objection / complaint. |
| 5C | • Avoids connection to, and need for, expensive modifications to the Winchester STEP system and centralized pressure main.<br>• Avoids additional pumping through a high static lift to higher elevations in Winchester Country Club, with associated higher operation and maintenance costs and operational complexity.<br>• Route is in public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential to connect properties from along Christian Valley Road.<br>• Lake Arthur Road is a wider, less winding route than Applegate Road (5B & 5D).<br>• Shortest of the Alignment 5 alternatives. | • Long pipeline route at 29,750 LF (5.6 miles) and thus higher pipeline capital cost than some other alignments.<br>• Christian Valley Road is a traffic route with relatively high traffic volumes compared to most other routes.<br>• Pinewood Way may be an alternative to Placer Hills Road to overcome potential for commuter objection / complaint.<br>• Bancroft Road is relatively narrow with school access constraints.<br>• Trenching would be required at the base of the Halsey Forebay Dam, possibly requiring additional permits and more expensive construction techniques. |
| 5D | • Avoids connection to, and need for, expensive modifications to the Winchester STEP system and centralized pressure main.<br>• Avoids additional pumping through a high static lift to higher elevations in Winchester Country Club, with associated higher operation and maintenance costs and operational complexity.<br>• Route is in public ROW, so there is limited residential disruption and reduced potential for residential objection / complaint.<br>• Public ROW used – avoids private ROW acquisition costs.<br>• Potential to connect properties from along Christian Valley Road.<br>• Use of Clipper Gap I-80 Freeway crossing overpass will save costs over jack-and-bore (5A & 5C), but dependent upon Caltrans approval. | • Longer pipeline route at 31,050 LF (5.9 miles) and thus higher pipeline capital cost than some other alignments.<br>• Christian Valley Road is a traffic route with relatively high traffic volumes compared to most other routes.<br>• Pinewood Way may be an alternative to Placer Hills Road to overcome potential for commuter objection / complaint.<br>• Bancroft Road is relatively narrow with school access constraints.<br>• Trenching would be required at the base of the Halsey Forebay Dam, possibly requiring additional permits and more expensive construction techniques. |

## ***Routing Study-Scale Hydraulic Evaluation of Alignments***

### Wastewater Flows

It is reported that the maximum daily flow to the Applegate WWTP was about 11,000 gpd in 2006. This is equivalent to an average daily flow rate of about 450 gallons per hour, or 8 gpm. As the Applegate basin is so small, peaking factors will be high. The previous routing study assumed an average flow pumping rate of about 60 gpm, and a maximum flow rate of 100 gpm. This rate is compatible with a small wastewater pump station with a standard 4 – 6 starts per hour. For the purposes of an outline assessment of alignment hydraulics and in the absence of an extended period of flow records from the existing pump station, these flows have been adopted.

### General Hydraulics Issues

The general hydraulics issues impacting all of the alignments are:

- Low wastewater flows from a very small basin;
- The need to convey these low flows significant distances of at least 3.2 miles, possibly up to 6.4 miles;
- Maintaining adequate sediment transport capacity in the pipeline (all sediment must be transported once a day under peak daily flow velocities of at least 2.5 feet per second (fps), preferably 3 fps). During engineering design, consideration needs to be given to installing a STEP system for all Applegate connections so that the volume of raw wastewater solids discharged to the local sewer network is significantly reduced, and potential impacts on the downstream conveyance system to the SMD-1 network are minimized.
- Pump station wet well or other tank storage sizing should provide for an ability to send a sustained self-cleansing ‘slug’ of flow down the pipeline.
- High static lifts and significant ground elevation changes within alignments leading to a need for additional pump stations;
- High detention periods and a threat of wastewater septicity and odor generation.

### Pipe Diameter Range and Head Losses due to Friction

Based upon an average flow of 60 gpm, a peak flow of 100 gpm and a need to achieve a self cleansing velocity of about 2.5 fps at peak flow, the pipeline diameter should be in the range of 4 to 6 inches. In order to prevent blockage or clogging, a minimum force main diameter of 6-inches is typically used. Even at a 6-inch diameter size, peak velocities will be low. This gives weight to the argument for installation of a STEP system at Applegate so that settled, screened wastewater is conveyed to the new Applegate PS for onward conveyance to the SMD-1 sewer network.

Frictional Head Losses are estimated as follows:

**Table 17: Estimated Frictional Head Losses for Varying Pipe Diameters and Flows**

| Pipe Diameter, inches | Flow, gpm | *Frictional head loss, ft per 1000ft of pipeline | Flow velocity, fps |
|---|---|---|---|
| 4 | 60 | 3.2 | 1.5 |
| 4 | 100 | 8.5 | 2.5 |
| 6 | 60 | 0.4 | 0.7 |
| 6 | 100 | 1.1 | 1.2 |

*Head losses calculated using the Colebrook-White Equation

At a peak flow of 100 gpm in a 6-inch diameter pipe, total frictional head losses by alignment are as follows:

**Table 18: Total Estimated Frictional Head Loss by Alignment at Peak Flow (6-inch pipe)**

| **Alignment** | **Total length, LF** | **Total Frictional Head Loss, ft** |
|---|---|---|
| 1A | 32,850 | 36 |
| 1B | 33,700 | 37 |
| | | |
| 2A | 19,000 | 21 |
| 2B | 20,300 | 22 |
| | | |
| 3A | 16,950 | 19 |
| 3B | 18,000 | 20 |
| | | |
| 4A | 26,000 | 29 |
| 4B | 27,050 | 30 |
| 4C | 25,700 | 28 |
| | | |
| 5A | 30,700 | 34 |
| 5B | 31,800 | 35 |
| 5C | 29,750 | 33 |
| 5D | 31,050 | 34 |

## Hydraulic Assessment of Alignments

Table 19 summarizes the critical hydraulics parameters for the alignments:

**Table 19: Alignment Critical Hydraulics Parameters**

| Alignment | *Maximum Lift Station lift within alignment, ft | Maximum fall within alignment, ft | # No. of additional Lift Stations and possible location |
|---|---|---|---|
| 1A | 40 | - 600 | **One** (possible) additional PS on Dry Creek Road |
| 1B | 40 | - 600 | **One** (possible) additional PS on Dry Creek Road |
| | | | |
| 2A | 262 | - 335 | **Three.** One at Pinewood Way / Lake Arthur Drive, one at Bancroft Road / Conifer Lane, and one to convey flows through the Winchester STEP system |
| 2B | 262 | - 323 | **Three.** One at Pinewood Way / Lake Arthur Drive, one at Bancroft Road / Conifer Lane, and one to convey flows through the Winchester STEP system. |
| | | | |
| 3A | 292 | - 286 | **Three.** One at Pinewood Way / Lake Arthur Drive, one at Placer Hills Road / Sugar Pine Road and one to convey flows through the Winchester STEP system. |
| 3B | 322 | - 335 | **Three.** One at Clipper Gap / Lake Arthur Drive, one at Placer Hills Road / Sugar Pine Road and one to convey flows through the Winchester STEP system. |
| | | | |
| 4A | 218 | - 292 | **Three.** One at Placer Hills Road / Lake Arthur Drive, one at Meadow Vista Road, and one to convey flows from Ridgemore Drive within the SMD-1 sewer network. |
| 4B | 258 | -323 | **Three.** One at Clipper Gap / Lake Arthur Drive, one at Meadow Vista Road, and one to convey flows from Ridgemore Drive within the SMD-1 sewer network. |
| 4C | 105 | - 362 | **Two.** One at Meadow Vista Road, and one to convey flows from Ridgemore Drive within the SMD-1 sewer network. |
| | | | |
| 5A | 328 | - 486 | **Three.** One at Christian Valley Road / Bowman Road, one at Bancroft Road / Christian Valley Road, and one to convey flows from William Drive within the SMD-1 sewer network. |
| 5B | 415 | -323 | **Three.** One at Christian Valley Road / Bowman Road, one at Bancroft Road / Christian Valley Road, and one to convey flows from William Drive within the SMD-1 sewer network. |
| 5C | 258 | -335 | **Three.** One at Christian Valley Road / Bowman Road, one at Bancroft Road / Christian Valley Road, and one to convey flows from William Drive within the SMD-1 sewer network |
| 5D | 262 | -323 | **Three.** One at Pinewood Way / Lake Arthur Drive, one at Bancroft Road / Pinewood Way, and possibly one to convey flows from William Drive within the SMD-1 sewer network |

* includes estimated static and frictional head # in addition to Applegate PS

## Preferred Alignment

A review of the qualitative and hydraulics evaluations presented in the previous two sections suggests that all Alignments under Alternatives 2, 3, 4 and 5 can be discounted due to:

- **Viability, high risk and significant costs of connection into the Winchester STEP system.** The hydraulics carried out for the previous routing study showed that there were significant head increases (greater than 25 feet) in the STEP system central pressure main once the Applegate flows were added. This increase (by a factor of three in places) may be accommodated if the pressure rating of the central main is high enough, and sufficient restraint against increased pipe thrusts was provided when the main was built. If not (as is likely), the main would have to be replaced or paralleled at significant capital cost. In addition, each residence's STEP system effluent pump may have to be replaced so that it can pump against the significantly-increased pressure in the central main. Significant capital cost would be involved as over 280+ lots could be affected.
- **Higher elevations for SMD-1 Connection Points 2, 3, 4 and 5.** Higher elevations lead to higher pumping costs. Up to three additional lift stations are also required for these Alternatives, with associated extra capital costs.
- **Operational complexity and higher operation and maintenance costs.** High heads and significant variation in ground elevations along the pipeline routes will require at least two and three additional lift stations. This will lead to unacceptable operational complexity and increased operation and maintenance costs. High head, low flow wastewater lift stations are typically very inefficient with pumps operating at low efficiency points on their curves / envelopes. There are also a limited number of standard pumps available to handle these duties. Significant lift station control integration will be required.
- **Public disruption and complaints.** Construction in a recently-developed, affluent sub-division may generate considerable public objection, particularly if there are large numbers of STEP pump modifications on private property. An extended schedule of upgrades would be required, lengthening disruption to the residents.
- **Private Right-of Way.** For these Alternatives, some private ROW would be required. Acquisition of this ROW will incur cost and will probably extend the critical path for design and construction.

Two alignments remain for consideration: Alignments 1A and 1B. These alternatives are the longest routes, but are hydraulically the simplest. There is a consistent fall from the Applegate PS location to the SMD-1 connection point at the intersection of Dry Creek Road and Blue Grass Drive. The route avoids the higher and varying elevation problems associated with the other alignments to the north. The SMD-1 connection point is the closest to the SMD-1 gravity sewer system, thus reducing problems of connecting to pressure pipes. It may also be possible to avoid constructing a lift station at Applegate if gravity flow is possible as far as a new lift station at the intersection of Lake Arthur Drive and Dry Creek Road under Alignment 1A. Removal of solids and screenings from the flow due to the use of a STEP system in Applegate may make this feasible. The primary disadvantage for Alignments 1A and 1B is disruption to a main traffic thoroughfare during construction. Alignment 1A is shorter than 1B.

Based upon information currently available, **Alignment 1A is the preferred alternative.** Alternative 1B should be included in environmental evaluation subsequent to this study since it has several common segments with 1A and provides an alternative method of crossing I-80 should the 1A crossing be found to be too expensive, cannot be permitted, or is impractical.

## Cost Estimates

### ***Relative Cost Estimates for Technically and Operationally-Viable Alternatives***

The previous section demonstrated that two alternatives (Alignments 1A and 1B) are technically and operationally viable. Based upon its shorter length, Alignment 1A is the preferred alternative.

Relative capital cost estimates for the pipeline elements of the two alternatives are given below in Table 20. Costs that are common, or that would not vary significantly between the alternatives (e.g. design, permitting, construction of lift stations, contractor mobilization and demobilization), have been excluded. A detailed cost estimate to a 15% conceptual design level is given later in this section for the preferred alternative, Alignment 1A.

**Table 20: Relative Costs for Viable Alternatives**

| Alignment | Pipeline Length, LF | Pipeline Cost, $ | Cost Differential, $ |
|---|---|---|---|
| 1A | 32,850 | $3,153,600 | 0 |
| 1B | 33,700 | $3,235,200 | +$81,600 (2.5%) |

Note: Cost of $96 / LF used for assumed 6-inch diameter pipeline installed (based upon $16 per LF per inch diameter).

### ***Relative Cost Estimates for Discounted Alternatives***

Alignments under Alternatives 2, 3, 4 and 5 have been found not to be technically and operationally viable. For comparison purposes with Alignments 1A and 1B, relative cost estimates have been prepared for these discounted alternatives and these are presented in Table 21. The following assumptions have been made:

- Cost of $96 / LF used for 6-inch diameter pipeline installed and $128 / LF for 8-inch diameter pipeline installed (based upon $16 per LF per inch diameter).
- Costs of $75,000 per lift station have been included for all Alignments (including 1A and 1B). The lift station at Applegate is assumed to be included in all alternatives and is not included in these relative cost calculations.
- For each of Alternatives 2, 3, 4 and 5, the shortest alignment (A, B, C, or D as appropriate) has been used.
- For Alternatives 2, 3, 4 and 5, Winchester STEP Upgrade costs are included for the cheaper of two possible scenarios:
    1. Assumes no connection can be made to the Winchester STEP central main as it does not have an adequate pressure rating and thrust restraint, and a parallel main is constructed instead. The Stanley Drive section of the existing main has to be upgraded as recommended in the previous routing study. This scenario avoids STEP effluent pump replacement at 280 lots.
    2. Assumes no modifications are needed to the Winchester STEP central main as it has an adequate pressure rating and adequate thrust restraint to handle the additional hydraulic head. The Stanley Drive section of the existing main has to be upgraded as recommended in the previous routing study. STEP effluent pumps are replaced at 280 lots.
- All other costs are assumed to be common between the Alternatives.

- No contingency has been included. A higher contingency would be required for Alternatives 2, 3, 4 and 5 given the level of uncertainty, higher risk and unknowns in the Winchester STEP system.
- ROW costs have been excluded, although there may be acquisition costs for ROW in private land for Alternatives 2, 3, 4 and 5.

**Table 21: Relative Cost Comparison of Viable and Non-viable Alternatives**

| Alignment | Pipe Length, LF | Pipe Cost, $ | No. of Lift Station | Lift Station Cost, $ | *Winchester STEP system upgrade cost, $ | Total Relative Cost, $ | Cost Differential, $ |
|---|---|---|---|---|---|---|---|
| Viable Alignments | | | | | | | |
| 1A | 32,850 | $3,153,600 | 1 | $75,000 | $0 | $3,228,600 | 0 |
| 1B | 33,700 | $3,235,200 | 1 | $75,000 | $0 | $3,310,200 | +$81,600 |
| | | | | | | | |
| Discounted Alignments | | | | | | | |
| 2A | 19,000 | $1,824,000 | 3 | $225,000 | $1,542,700 | $3,591,700 | +$363,100 |
| 3A | 16,950 | $1,627,200 | 3 | $225,000 | $1,542,700 | $3,394,900 | +$166,300 |
| 4C | 25,700 | $2,467,200 | 2 | $150,000 | $1,525,100 | $4,142,300 | +$913,700 |
| 5C | 29,750 | $2,856,000 | 3 | $225,000 | $502,700 | $3,583,700 | +$355,100 |

* For the Winchester STEP system upgrades, the cheapest solution for Alternatives 2A and 3A included above assumes that the Winchester STEP centralized pressure main can be retained (there is considerable doubt that this could be achieved), but that 280 lots require new effluent pumps at $5,000 per installation (pump and miscellaneous works) to overcome the increased hydraulic head. The Stanley Drive upgrade is for 1,115 LF of 8-inch diameter force main and applies to Alternatives 2, 3, 4 and 5. Using $16 per LF per inch diameter, the Stanley Drive upgrade cost is $142,720. There may also be a need to upgrade the main along the remainder of Stanley Drive and Virginia Drive given a 9 feet hydraulic head increase noted in the previous routing study, but this has not been included in this cost comparison. For Alternatives 4C and 5A, the cheapest solution is an upgraded main without STEP upgrades. For 4C, a 6-inch diameter main is assumed for a length of 14,400 LF from the Alternative 4 Connection Point at Woodmont Lane to the start of the Stanley Drive upgrade to 8-inch diameter. Cost for 4C is thus $1,382,400 for new 6-inch main and $142,720 for the Stanley Drive upgrade. For 5C, a 6-inch diameter main is assumed for a length of 3,750 LF from the Alternative 5 Connection Point on Christian Valley Road to the start of the Stanley Drive upgrade to 8-inch diameter. Cost for 5C is thus $360,000 for new 6-inch main and $142,720 for the Stanley Drive upgrade.

This Report does <u>not</u> recommend Alternatives 2, 3, 4 or 5.

## ***<u>Preferred Alternative (Alignment 1A) 15% Conceptual Level Cost Estimate and Project Schedule</u>***

### <u>Cost Estimate Basis and Assumptions</u>

A 15% conceptual level cost estimate for the preferred alternative, Alignment 1A, has been prepared on the following basis and is detailed below in Table 21:

- **Project Schedule.** The schedule is assumed as follows:
    - Routing study completion: July 2007
    - Environmental study completion: September 2007
    - Detailed design and permitting of preferred alternative: August 2007- February 2008
    - Bid and construction contract award: March 2008 – May 2008
    - Construction contract period: June 2008 to July 2009.

- **Cost Estimate Type and Level of Contingency.** Costs are conceptual level estimates only and could change depending on permitting requirements and further project development during detailed design. At this conceptual level, the detailed design plans and specifications needed for detailed estimating purposes have yet to be prepared, so a 20% contingency has been applied to the total construction cost estimate. This level of contingency is in line with the recommendations of AACE (American Association of Cost Engineers) for Class 3 documents (10 to 40% design level completion).

- **Cost Baseline.** Costs are based on first quarter 2007 dollars.

- **Cost Escalation Allowance.** No cost escalation is included in the conceptual cost estimate.

- **Cost Estimate Sources.** City of Roseville Infrastructure Rehabilitation Plan pipe cost tables for sewers, and RS Means estimating data 2007 Q1.

- **Construction Assumptions:** Contractor's mobilization and demobilization is assumed to be at 4% of construction contract cost (typical range is 3-5%). Local control and lift station alarms only, without SCADA systems.

- **Exclusions.** The conceptual cost estimates do not include detailed design engineering, County administrative and legal costs, permitting costs, and construction management. Costs associated with decommissioning of the existing Applegate PS, WWTP, conveyance piping taken out of use, and associated site restoration costs are not included.

**Table 21: 15% Conceptual Level Cost Estimate for Alignment 1A**

| Task Description | Unit | Quantity | Unit Price, $ | Total Cost, $ |
|---|---|---|---|---|
| | | | | |
| **General** | | | | |
| Mobilization and demobilization (4%) | LS | 1 | $160,000 | $160,000 |
| Lift stations site clearance | LS | 1 | $10,000 | $10,000 |
| Applegate connection STEP systems (if required) | EA | 40 | $5,000 | $200,000 |
| Traffic control | LS | 1 | $50,000 | $50,000 |
| Sites restoration and landscaping (including lift station site fencing and drainage) | LS | 1 | $10,000 | $10,000 |
| Connection to existing Applegate sewer system, and dealing with wastewater flows | LS | 1 | $10,000 | $10,000 |
| Connection to existing SMD-1 sewer system, and dealing with wastewater flows | LS | 1 | $10,000 | $10,000 |
| | | | | |
| **Pipeline** | | | | |
| Trench excavation, pipe supply and pipe placement, backfill (trench typ. 3 ft wide x 5 ft deep) for 6-inch dia. AWWA C-900 or HDPE pipe | LF | 32,850 | $96 | $3,153,600 |
| Pavement restoration (trench only- based upon $2.50 / $ft^2$) | LS | 1 | $250,000 | $250,000 |
| Jack-and-bore crossing of I-80 freeway (6-inch pipe in casing) | LS | 1 | $90,000 | $90,000 |

| | | | | |
|---|---|---|---|---|
| Valves (air release, isolation and non-return) | EA | 8 | 500 | $4,000 |
| Valve chambers | EA | 8 | $1500 | $12,000 |
| | | | | |
| **Lift Stations** | | | | |
| Applegate Lift Station | | | | |
| Excavation, foundation, concrete, backfill for wet well | LS | 1 | $25,000 | $25,000 |
| Submersible pumps, piping, valves, flow meter and chambers | LS | 1 | $30,000 | $30,000 |
| Power supply, panel, enclosure and local alarm / control facilities | LS | 1 | $20,000 | $20,000 |
| | | | | |
| Dry Creek Road Lift Station (if required) | | | | |
| Excavation, foundation, concrete, backfill for wet well | LS | 1 | $25,000 | $25,000 |
| Submersible pumps, piping, valves, flow meter and chambers | LS | 1 | $30,000 | $30,000 |
| Power supply, panel, enclosure and local alarm / control facilities | LS | 1 | $20,000 | $20,000 |
| | | | | |
| Sub-total | | | | $4,109,600 |
| | | | | |
| 20% contingency for 15% conceptual design stage | | | | $821,920 |
| | | | | |
| Total | | | | $4,931,520 |
| | | | **Budget** | **$4,950,000** |

The estimated budget of $4,950,000 is equivalent to approximately $150 / LF of pipeline. If the lift station and STEP system costs are excluded, the cost rate is $144 / LF. This is comparable with the City of Roseville's Infrastructure Rehabilitation Plan pipe costs tables, which give a range of $137-$144 per LF for 6-inch diameter water and sewer pipe in trench. The Applegate project includes a jack and bore crossing in addition to the pipe installation.

**Lift Station Power Requirements**

The following is an indicative estimate of the power requirement associated with the anticipated additional Alignment 1A lift station at Dry Creek Road. As indicated previously in the report, it may be possible to eliminate the Applegate PS under this option. From data presented in this report:

- Peak flow, Q: 100 gpm (0.223 cfs)
- Static plus frictional hydraulic head, H: 40 feet

Thus power requirements in horsepower (hp) are given from (Q*H*62.4) /(550* efficiency (assumed 0.75)) = 1.5 hp