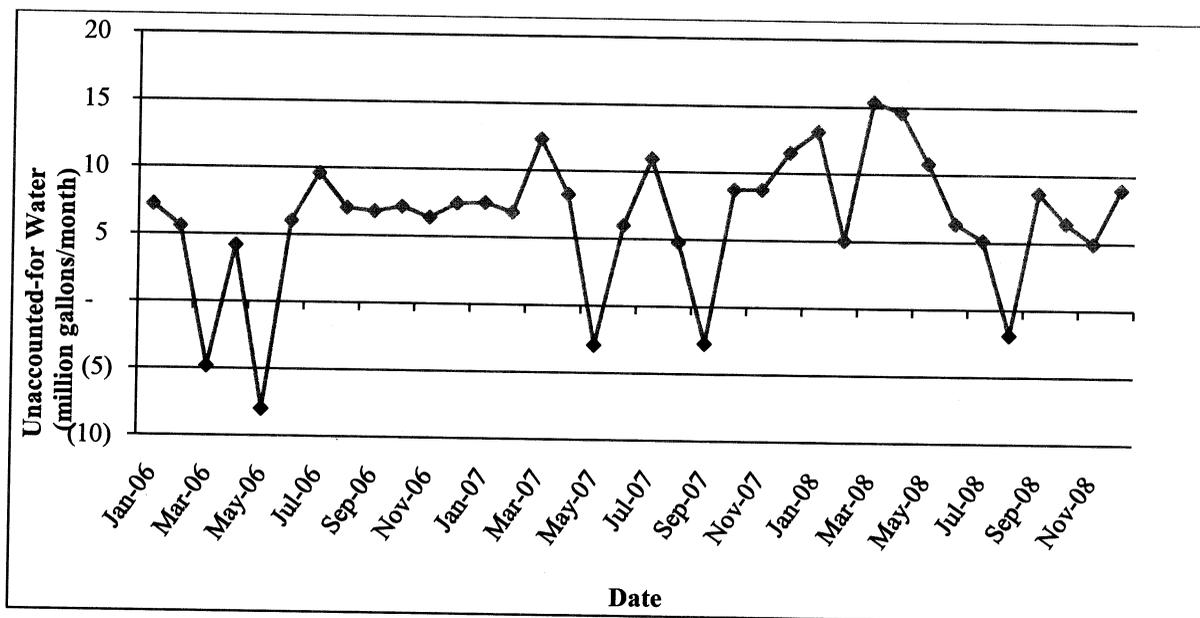


EXECUTIVE SUMMARY

The Village of Angel Fire in Colfax County, N.M. is fortunate to be situated in the idyllic Moreno Valley surrounded by the Sangre de Cristo Mountains. The Village's location has made it a major destination point for skiers, snowboarders, mountain bikers, hikers and sportsmen, and the local economy thrives as a result. But that same geographic diversity and mountain climate have combined to present significant challenges to the operation of the municipal water system, primarily in the forms of keeping the water lines from freezing in the frigid winter temperatures and maintaining a reasonable water pressure throughout the steep terrain of the Village.

One of the ways these conditions manifest themselves is the need to use "bleeder" lines that allow water to run through water lines in freezing weather conditions. Although this practice prevents the lines from freezing, it results in tremendous water loss from the system with high levels of unaccounted-for water. The graph below shows the volume of water that is believed to be lost throughout the course of a year. Leaks in the system and other "traditional" water system loss venues certainly can be considered to be contributors to the water losses, but the conclusion may be drawn that water loss increases in the winter months can be attributed to the practice of bleeding lines to prevent freezing. To put this issue in perspective, **about half of the water pumped in Angel Fire is never sold or otherwise put to beneficial use.**



Another way the geographic setting of Angel Fire poses water system operational challenges is the large operational pressure range from 35 to 125 psi. This is in marked contrast to a more typical range of 35 to 80 psi. Such high pressure may also be contributing to the high percentage of unaccounted-for water by allowing exponentially more water to escape from even a small leak in a distribution pipe.

A critically important issue for any community is the ability to supply sufficient water to knock down a structure fire. The Uniform Fire Code recommends that a flow of 1,000 gpm be provided for the types of structures found at Angel Fire. Only 6 of the 34 fire flow nodes in the Angel Fire water system are able to deliver that amount of fire flow, and many are less than half that recommend flow rate. **The weakest zone in the system delivers only 97 gpm.** The primary cause of this fire flow shortfall is the use of water lines that are less than 6 inches in diameter.

Recommendations

The Engineer evaluated a variety of alternatives for the disparate set of challenges facing the Village of Angel Fire water system.

The issue of freezing lines and related practice of using bleeder lines was considered by the Engineer, who recommended that **all lines be buried to a depth of at least 6 feet below the surface.** By putting all lines below this freeze line, the water lines would be protected from freezing and the unaccounted-for water losses would be dramatically reduced.

To rectify the problem of undersized lines, the Engineer considered the alternatives replacing all 4-inch lines with 6-inch lines, and replacing all 2-, 3-, and 4-inch lines with 6-inch lines. The recommendation was made to **replace all 2-, 3-, and 4-inch lines with 6-inch lines.** A major driver in the recommendation for consistent use of 6-inch pipe throughout the water system was that all lines would then be able to be fitted with fire hydrants.

The Engineer recommended the **replacement and reburial of bleeder lines to reduce the considerable volume of unaccounted-for water.**

The Village's operators believe that several of the existing water storage tanks are in need of relining. In addition, four of the existing tanks fail to meet the minimum volume required to provide two hours of fire flow. The recommendations, therefore, are that the Village should **replace its smaller tanks with tanks that would provide sufficient capacity for fire flow, as well as hire a contractor to reline those tanks that are found to have deteriorated linings.**

The northwest quadrant of the Village is seen as the only viable location for significant residential and commercial development. As was recommended for the established portions of the community, the Engineer recommends that **all new water lines emplaced in the northwest quadrant be at least 6 inches in diameter.**

The estimated overall project costs, not including the expansion of the service area to the northwest quadrant, is summarized in the Table ES-1.

**TABLE ES-1
PROJECT COSTS**

Component	Cost
Water Distribution System Improvements	
Priority 1 – Lines Subject to Freezing, Have Been Used as Bleeders, and Are Undersized	\$26,220
Priority 2 – Lines Subject to Freezing and Are Undersized	\$845,860
Priority 3 – Reburial of Bleeder Lines	\$1,573,090
Priority 4 – Lines Subject to Freezing	\$1,329,640
Priority 5 – Undersized Lines (2", 3", and 4")	\$7,835,520
Leak Detection	\$55,200
Undersized Tanks	\$960,000
Tank Relining	\$750,000
Subtotal	\$13,375,530
NMGRT @ 7.4375% for Construction	\$994,810
Subtotal Construction Costs	\$14,370,340
Basic design services and allowance for special services including; observation, specialty inspection and construction phase support, soils investigation, surveying, and grant administration	\$1,437,000
NMGRT @ 7.0% for engineering services	\$100,560
Subtotal Engineering Services	\$1,537,560
TOTAL ESTIMATED PROJECT COSTS	\$15,907,900