Table I-6. Water Demand Projections for City of Longmont, 2004 through Buildout.

	AF			
2004	14,900	16,800	4,600	21,400
2005	18,300	20,600	5,300	25,900
2006	18,600	20,900	5,300	26,200
2007	18,800	21,300	5,400	26,700
2008	19,100	21,600	5,400	27,000
2009	19,400	21,900	5,400	27,300
2010	19,700	22,200	5,900	**28,100**
2011	20,000	22,600	5,900	28,500
2012	20,300	22,900	5,900	28,800
2013	20,600	23,200	6,000	29,200
2014	20,800	23,500	6,000	29,500
2015	21,100	23,900	6,400	30,300
2016	21,500	24,200	6,500	30,700
2017	21,800	24,600	6,500	31,100
2018	22,100	25,000	6,500	31,500
2019	22,500	25,400	6,500	31,900
2020	22,800	25,700	6,800	32,500
2025	25,800	29,100	6,800	35,900
2030	27,700	31,300	6,800	38,100
2048	31,400	35,500	6,800	42,300

[1] Including system losses.

Water Conservation

The City of Longmont has implemented a range of conservation measures in the past and more conservation measures are contemplated in the future to reduce demand. In 1989, the City enacted an increasing block rate structure with a 30 percent overall rate increase. Normalizing for weather variations, residential gpcd has been relatively stable for the past ten years.

In 1996, Longmont developed a water conservation master plan to "promote water conservation by example, education, incentive, and innovation, as a responsible approach to present and future management of a valuable resource." The Plan includes best management practices (BMPs) including:

- Implementing block pricing for residential water customers
- Increasing rates for unmetered use
- Basing commercial/industrial rates on the cost of service

- Converting residential services to meters
- Showing comparative usage on monthly utility bills
- Retrofitting City buildings with low water use plumbing fixtures
- Selecting appropriate plant materials using xeriscape principles
- Retro-fitting irrigation systems to central control
- Monitoring the irrigation systems for leakage
- Acting as a resource for disseminating water conservation information
- Conducting an annual water festival
- Providing a xeriscape demonstration garden, xeriscape information and seminars
- Requiring low water use fixtures in new construction
- Creating the Drought Response Plan and enacting water waste ordinances
- Acting as a resource to commercial/industrial water users for water conservation information

Additional conservation measures are being developed and implemented by the City of Longmont. The city will require a soil amendment on all new lawns to conserve water. Landscaping standards are also moving away from blue grass for arterial landscaping. Longmont has also recently implemented a washer and toilet rebate program for frontloaded, efficient washers and low-flow toilets. Longmont is also revising its landscaping standards to encourage xeriscaping.

Overall water savings of 18 to 20 percent might be achieved through implementation of the above BMPs. Longmont utility officials estimate that past conservation measures have already saved about 10 percent and these savings are factored into the water demand projections. Hence, a savings of an additional 10 percent is envisioned with new conservation measures (City of Longmont 2004a). This additional 10 percent savings is not reflected in the demand projections, since it represents an additional future resource. The City will continue to monitor water conservation savings and demand requirements in the future.

Anticipated Water Need

Assumptions

The evaluation of potential water needs is based on projections of the future water demands for each of the Participants and the existing or anticipated firm supply of water available. Estimates of the firm water supply often referred to as the dry year yield, indicate the amount of water that is available during a defined period or condition. Often this encompasses a 50-year historical record that includes several dry years. For planning purposes water providers must consider the firm yields available to serve customers during periods of regularly occurring drought. In addition, because water yield from the various water supply sources can fluctuate substantially from year to year, water providers seek to secure water supplies or adequate storage to capture flows during wet years so as to meet their dry year water needs.

Despite the utility of the using firm yield for long-range planning, firm yield is difficult to estimate for several sources of water including C-BT Project water and water reuse. As previously described, C-BT water is a supplemental water supply, with quotas established annually depending on available supplies. Typically C-BT water deliveries are greater during dry years and are lower during wet years, under the assumption that C-BT unit holders need the supplemental water supplies more during dry years. For purposes of this analysis we have assumed a long-term dry year yield for the C-BT Project of 0.6 AF per year. However, except in exceptionally dry years, C-BT may deliver yields of up to 1.0 AF per unit. Thus in many dry years, Participants that own C-BT units may have available C-BT Project water greater than indicated by the assumed 0.6 AF per unit yield.

In addition, firm yield supplies also do not reflect the reuse component for some sources of supply. Transbasin diversions other than C-BT water and some other water sources can typically be captured and reused repeatedly until extinction. For most Participants reuse water is used to meet non-potable irrigation requirements or downstream obligations. Water for reuse depends on the availability of water for the first use. While Windy Gap water can be reused, if the supply is not firm, then neither is the reuse.

For some Participants, firm supply and demand projections indicate a near-term shortage. However, this shortage is based on dry year conditions and average yields may be adequate to meet current demands, particularly in consideration of available C-BT supplies and reuse water.

The existing firm supply (including the long-term yield for C-BT) and projected future demand described in this analysis provide the best available estimate of anticipated shortages in firm yield. To the extent that there are shortages, Participants will need to acquire or develop other sources of water. Firming the yield of the Windy Gap Project would contribute to meeting projected water needs. The remaining water shortage could be met by developing additional water sources along with implementing additional water conservation measures.

Water Need

Longmont's current water needs are met by C-BT, direct flow rights, and reservoir storage. Water demand is expected to exceed available firm water supplies by about 2017, which would affect the ability of the City to meet dry year water needs depending on C-BT deliveries (Figure I-1). A firm water supply shortage of about 7,100 AF is projected by 2030 and about 11,300 AF by 2050. Firming Longmont's Windy Gap water supply would provide about 5,125 AF of water based on the City's storage request and preliminary modeling, or about 12 percent of the City's 2050 firm water supply (Figure I-2). Current reuse supplies may provide about 1,000 AF on average and reuse of about 62 percent of Windy Gap water would also contribute to meeting future non-potable water demand. Water conservation and other sources of water supply also will be needed to meet all of the estimated future water demands.

Figure I-1. Longmont's 2005 Annual Firm Yield vs. Total Projected Water Requirements.

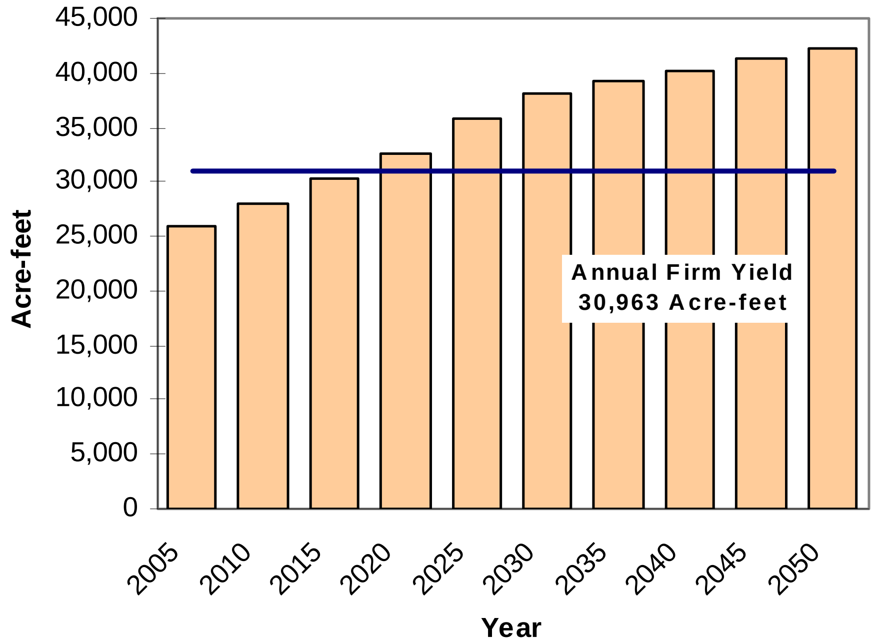
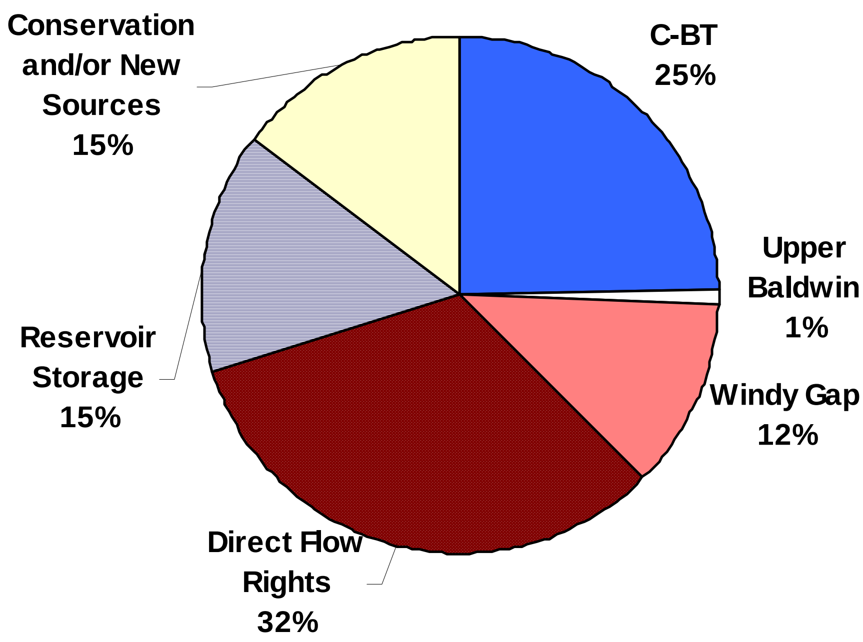


Figure I-2. Longmont's 2050 Projected Firm Water Supply Sources.



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WATER SUPPLY AND DEMAND

CITY OF LOUISVILLE

Introduction

The City of Louisville is located in Boulder County about 6 miles east of the City of Boulder and 25 miles northwest of Denver. The City was founded in 1878 in response to the emerging coal mine industry in the area. Today Louisville supports a residential community and associated commercial and industrial businesses. Louisville city limits cover an area of about 8.6 square miles including 1,700 acres of designated open space owned by the City or owned in conjunction with other bordering municipalities (ERO 2004a). The following discussion provides a summary of Louisville's water supply and demand.

Water Supply

Louisville's main sources of water supply include direct flow rights from South Boulder Creek and C-BT water (Table J-1). Louisville has two water treatment plants (north and south) as well as a wastewater treatment plant just east of town. South Boulder Creek and Marshall Lake water are delivered by a combination of the Community Ditch, Louisville Lateral and pipelines from South Boulder Creek to both water treatment plants. Windy Gap and C-BT water are transported via the Southern Water Supply Pipeline (SWSP) to the North Water Treatment Plant. Currently the only physical limitation in Louisville's system is its capacity in the SWSP pipeline, which is 7.2 cfs (Boyle Engineers 2003).

Transbasin Supplies

Colorado-Big Thompson

Annual deliveries of C-BT Project water vary from year to year depending on available water supplies, the needs of shareholders, and the annual quota established by the NCWCD Board of Directors. Historically, C-BT quotas have ranged between 0.5 and 1.0 AF per unit. However, quotas are adjusted to actually deliver more water in dry years. This is the opposite situation from most water rights in Colorado, because the C-BT Project was designed to provide supplemental water in dry years when native water supplies yield less water. Historically, the C-BT Project has delivered 1 AF in dry years and as little as 0.5 AF in wet years or in extremely dry years, such as the drought of 2002 when the C-BT Project was limited by the physical supply of water that it could actually deliver. Louisville, like most municipalities, has not assembled a water portfolio that would deliver a full supply of water in extreme drought years for economic reasons. Based on analysis of hydrology and C-BT operations through historical drought periods from 1950 to present, NCWCD has determined that the firm yield of the C-BT project is 0.6 AF per unit.

Table J-1. Inventory of Louisville Water Supply.

		Firm Annual Yield (AF)
Transbasin Sources		
C-BT Project	1,937 units	1,162[1]
Windy Gap Project	9 units	0
Direct Flow Rights		
Direct transfers via Community Ditch and Louisville Pipeline from South Boulder Creek	N.A.	3,201
Reservoir Storage		
Louisville Reservoir	210 AF	0
Harper Reservoir	610 AF	0
Marshall Reservoir (FRICO)	350 shares	700
Marshall Reservoir (SBCC)	26 shares	0
Total		5,063[2]

[1] C-BT yield is variable from year to year. C-BT's long-term firm yield is assumed to be 0.6 AF/unit for purposes of this analysis.

The City of Louisville's owns 1,937 units in the C-BT Project, which provides a firm yield of about 1,162 AF using a C-BT quota of 0.6 AF/unit. C-BT water represents about 22 percent of Louisville's existing raw water supply. C-BT water is delivered from Carter Lake to Louisville via the Southern Water Supply Pipeline (SWSP).

Windy Gap

Windy Gap Project water provides an additional source of transbasin water. The City of Louisville currently owns 9 units of Windy Gap water, which is delivered through the SWSP—the same as C-BT water. Windy Gap has not provided a firm supply of water on which Louisville can rely on to meet its water requirements.

Direct Flow Rights

Louisville's raw water supply system is built on a foundation of direct diversion and storage rights on South Boulder Creek. Direct flow rights are diverted primarily from South Boulder Creek at the Louisville Pipeline and/or Community Ditch headgates near Eldorado Springs and conveyed through the City's system for treatment at its two water treatment plants (Boyle Engineers 2003).

Reservoir Storage

Louisville has water storage in several reservoirs including about 600 AF in Harper Lake and 210 AF in Louisville Reservoir. The City owns 25 percent of the shares in Farmers Reservoir and Irrigation Company (FRICO) Marshall Division, which provides firm annual yield of 700 AF of water. The City also owns 70 percent of the storage capacity in Marshall Lake belonging to the South Boulder & Coal Creek Irrigating Ditch Company (390 AF out of a total 600 AF of available storage). The City has a secondary use agreement with the FRICO. This agreement allows Louisville's use of any remaining water storage space after the needs of other shareholders are met. Overall, there is limited water storage capacity in the Louisville system (ERO 2004a).

Reuse

Reuse water is used by Louisville to reduce demand on the potable water system's raw water supply during the summer months when water demand is highest. Overall, about 25 percent of Louisville's native supply can be reused. Louisville recently installed a water reuse pipeline that can supply about 500,000 gallons/day from the wastewater treatment plant to the Coal Creek Golf Course. Reuse water is also used at the Louisville Sports Complex and Miners Field and will be used at numerous parks located along the pipeline route (City of Louisville 2004a). Currently about 300 AF of water is available for non-potable reuse (Louisville 2005). In the future, up to about 900 af/year of native water primarily from South Boulder Creek could be available for reuse incrementally over time (ERO 2004a). Louisville estimates about 45 percent of Windy Gap water could be reused for irrigation (Louisville 2005).

Water Demand

The City of Louisville is responsible for providing water to residential, commercial, industrial, and irrigation users within the City's boundaries. The City also provides water to several residential and one commercial customer just outside the city limits. Louisville's largest water user is StorageTek, which used 340 AF of water in 1997. StorageTek has recently reduced water demands due to operational changes; the company required 67 AF of water in 2003.

Historical Water Demands

The City of Louisville's 2003 population was estimated at 18,387 persons. Table J-2 provides historical population estimates and numbers of water taps by customer type with annual growth rates for population and total water taps.

Population grew 49 percent, or at an average annual rate of 3.1 percent, from 1990 through 2003. The average annual growth rate for the total number of residential water taps was just 0.2 percent from 1998 through 2003, and commercial water taps increased at an average annual rate of 7.1 percent in the same period. Annual growth rates for both population and water taps have fluctuated. Population grew most significantly in the early and mid-1990s, while residential water taps have remained almost stagnant since 1998. Commercial growth has been considerable since 1998.

Residential growth in Louisville has slowed dramatically since the mid-1990s as the city approaches residential buildout. Currently, the City of Louisville is fully annexed, and any future growth would be more or less limited to residential/commercial infill development. The commercial sector will generate the majority of future growth in water taps and usage in the City of Louisville (City of Louisville 2004c).

Table J-2. City of Louisville Population and Water Taps, 1990 to 2003.

							Total In-City Taps
1990	12,361	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1991	13,575	9.8%	N.A.	N.A.	N.A.	N.A.	N.A.
1992	14,732	8.5%	N.A.	N.A.	N.A.	N.A.	N.A.
1993	15,887	7.8%	N.A.	N.A.	N.A.	N.A.	N.A.
1994	16,943	6.6%	N.A.	N.A.	N.A.	N.A.	N.A.
1995	17,538	3.5%	N.A.	N.A.	N.A.	N.A.	N.A.
1996	17,947	2.3%	N.A.	N.A.	N.A.	N.A.	N.A.
1997	18,147	1.1%	N.A.	N.A.	N.A.	N.A.	N.A.
1998	18,177	0.2%	5,979	219	74	62	6,334
1999	18,062	-0.6%	6,044	297	91	94	6,526
2000	18,937	4.8%	6,044	297	91	94	6,526
2001	18,950	0.1%	6,044	297	91	94	6,526
2002	18,681	-1.4%	6,044	297	91	94	6,526
2003	18,387	-1.6%	6,039	309	93	88	6,529

[1] Residential Taps include single-family and multi-family units.

[2] Other Taps include irrigation taps and other misc. taps.

Source: U.S. Census Bureau 2004; City of Louisville 2004b.

Potable Water Demands

Table J-3 provides a breakdown of historical potable water use by consumer type for the City of Louisville from 1998 through 2003.

Table J-3. Potable Water Use by Customer Type for the City of Louisville, 1998 to 2003.

						Annual Percent Growth
1998	798	277	70	72	1,217	N.A.
1999	763	275	64	73	1,175	-3.4%
2000	855	310	74	93	1,332	13.3%
2001	814	278	64	101	1,257	-5.6%
2002	643	190	23	49	906	-27.9%
2003	692	235	41	85	1,053	16.2%

Source: City of Louisville 2004c.

These figures reflect potable water deliveries to the end user for the customers the City serves. Annual fluctuations are largely attributable to weather. Total potable water deliveries decreased by 14 percent between 1998 and 2003, due primarily to drought-related water restrictions in response to a severe shortage in the last two years. Deliveries decreased by 28 percent between 2001 and 2002, indicating the City's ability to reduce demands during drought. Total potable deliveries reached a peak of 1,330 MG in year 2000. Residential users have historically accounted for the majority of total deliveries at 66 percent; commercial users accounted for an average of 23 percent of total potable water use. Single-family residential use accounts for an average of about 90 percent of residential use and 60 percent of overall, in-city use. The proportions of use accounted for by each customer type remained relatively constant from 1998 through 2003.

Table J-4 provides total and residential gallons per capita and per tap per day for 1998 through 2003, as measured at the tap.

Table J-4. Potable Water Use per Capita and per Tap for the City of Louisville.

					Total Use per Total Tap
			Gallons per Tap per Day		
1998	120	183	336	3,467	526
1999	116	178	317	2,538	493
2000	124	193	358	2,856	559
2001	118	182	339	2,568	528
2002	94	133	266	1,756	380
2003	103	157	287	2,086	442

Source: Figures are based on the data presented in Tables J-2 and J-3.

From 1998 through 2003, residential water use averaged 112 gpcd. Total water use per capita per day averaged 171 gallons. Single family residential water use per single family residential tap averaged 317 gallons per tap per day from 1998 through 2003, whereas commercial water use per commercial tap averaged 2,545 gallons per tap per day. Total water use per tap for all taps averaged 488 gallons per tap per day. Although water usage patterns were lower in 2002 and 2003 in the City of Louisville, average water use measurements appear to more accurately reflect historical and future water usage patterns.

Non-potable Water Demands

In 2004, the City of Louisville supplied approximately 216 AF of non-potable or wastewater treatment effluent reuse to meet irrigation needs at various city locations. The City's Golf Course used 182 AF, or 58 MG, including 135 AF of non-potable and 48 AF of wastewater treatment effluent reuse. An additional 34 AF of wastewater treatment effluent reuse water was used to irrigate the city's ball fields. These supplies are delivered via pipeline and incur only negligible delivery losses. The City supplied the golf course with non-potable irrigation water from 1998 through 2003. Louisville anticipates providing non-potable reuse water to irrigate additional parks and ball fields starting in 2005, bringing the total deliveries of effluent reuse water to 300 AF (ERO 2004).

Total Water Requirements

Table J-5 indicates the City of Louisville's total potable and non-potable water deliveries from 1998 through 2003.

Table J-5. Total Water Requirements for the City of Louisville, 1998 to 2003.

					Total Water Requirements[1]
				AF	
1998	1,217	68	1,285	3,944	5,360
1999	1,175	68	1,244	3,816	5,248
2000	1,332	68	1,400	4,296	6,030
2001	1,257	68	1,326	4,068	5,672
2002	906	53	959	2,943	4,235
2003	1,053	62	1,115	3,421	4,560

[1] Including system losses.

Source: City of Louisville 2004c.

Total requirements reflect water treatment plant production data adjusted to account for 15 percent losses from points of diversion to the treatment plant (City of Louisville 2005). Losses from treatment plant to tap for potable deliveries averaged 14 percent. Total water requirements reached their peak in 2000 when more than 6,000 AF of water was diverted for Louisville customers. From 1998 through 2003, total water requirements decreased by 15 percent, due primarily to drought-related water restrictions.

Projected Water Requirements

City of Louisville's Projected Water Requirements

Prepared by the City's water resource engineer, the City of Louisville provided the study team with projected potable and non-potable water demands at buildout. These buildout projections are found in the City of Louisville Raw Water Master Plan Update and were based on previously anticipated land use and water use patterns within the City's planning area. In 2004 the City initiated a city wide Comprehensive Planning review (Id). The review is incorporating important assumptions about residential and commercial growth into the buildout projection for the City. This projection assumes 1,650 new housing units at buildout in addition to the City's current 7,400. The projection also assumes 6.24 million more square feet of commercial and industrial space at buildout in addition to the City's current 8.6 million square feet. Finally, the projection assumes 187 acres of additional parks and open space (City of Louisville 2004d). Assumptions about future development and water use on Storage-Tek lands have been incorporated into potable and non-potable projections. The study team adopted these same assumptions about growth at buildout. The City will update the buildout total raw water demand at the completion of the review.

Study Team Demand Projections

To arrive at projections of the City of Louisville's future water use, the study team first estimated population and commercial square footage from 2005 through 2050. Based on discussions with the City, the study team assumed a one percent growth rate in population and a 1.5 percent growth rate in commercial square footage through buildout (City of Louisville 2004e; Leland Consultants 2004). The City anticipates that commercial square footage will remain stable for the next two years before ensuing with the 1.5 percent growth rate. Projections of population and commercial square footage are provided in Table J-6.

Table J-6. Population and Commercial Space Projections for the City of Louisville, 2005 through 2050.

		Nonresidential Square Footage (millions)
2005	18,700	9
2010	19,600	9
2015	20,600	10
2020	21,700	11
2025	23,000	12
2030	23,000	12
2035	23,000	13
2040	23,000	14
2045	23,000	15
2050	23,000	15

Source: City of Louisville 2004e; Harvey Economics 2004.

Based on the assumed rate of growth, the City of Louisville will reach residential buildout by 2025 and commercial buildout by 2045. To project water use between 2003 and 2050, the study team began by applying the average residential water use per capita per day of 110 gallons to projected population to forecast residential water demands. The team then applied the average water use per commercial square foot per day of 0.08 gallons to projected commercial square footage to forecast commercial water demands (City of Louisville 2004c, 2004e). Finally, the study team assumed that city and irrigation demands would increase with population at one percent annually, while non-potable demands for the golf course, parks and ball fields would increase with commercial development at 1.5 percent annually. Table J-7 provides projected potable and non-potable demands for the City of Louisville through 2050.

Table J-7. Water Demand Projections for the City of Louisville, 2005 to 2050.

	-						-	Annual Percent Change
2005	2,300	720	390	3,400	300	3,700	5,000	N.A.
2010	2,400	780	410	3,600	320	3,900	5,300	1.2%
2015	2,500	840	440	3,800	350	4,100	5,600	1.1%
2020	2,700	900	460	4,100	380	4,400	6,000	1.4%
2025	2,800	970	480	4,300	400	4,700	**6,300**	1.0%
2030	2,800	1,050	510	4,400	440	4,800	6,500	0.6%
2035	2,800	1,130	530	4,500	470	4,900	6,700	0.6%
2040	2,800	1,220	560	4,600	500	5,100	6,900	0.6%
2045	2,800	1,250	560	4,600	500	5,100	6,900	0.0%
2050	2,800	1,250	560	4,600	500	5,100	6,900	0.0%

[1] Including system losses.

Source: Harvey Economics 2004.

An additional 14 percent was added to potable demands to account for distribution system and treatment plant losses, and an additional 15 percent was added to all potable and non-potable demands to account for losses from point of diversion to treatment plant. Total water requirements are anticipated to increase by 38 percent from 2003 through 2050, or at an average annual rate of 0.7 percent.

Conservation

The City of Louisville has implemented a number of measures to encourage conservation throughout its system (ERO 2004a). These measures include:

- Leak detection and testing and replacement of faulty meters;
- Rebates for low-flow toilets, drip irrigation systems, water efficient clothes washers and controlled sprinkler systems;
- An inclining block water rate structure with a charge for excess water use;
- Totally metered water usage;
- A reuse system for non-potable treated wastewater; and
- Educational materials in water bills and on the City's website.

In response to the 2002/2003 drought, the City imposed watering restrictions from April 2002 through April 2003, which have since been lifted. The City has adopted a Drought Management Plan, which guides the implementation of measures when conditions point towards a shortage in supply, including; watering restrictions, tiered surcharges, and public education. Drought restrictions are distinguished from on-going conservation measures which are the emphasis in this analysis. The City is not actively pursuing any additional permanent conservation measures at this time.

Anticipated Water Need

Assumptions

The evaluation of potential water needs is based on projections of the future water demands for each of the Participants and the existing or anticipated firm supply of water available. Estimates of the firm water supply, often referred to as the dry year yield, indicate the amount of water that is available during a defined period or condition. Often this encompasses a 50-year historical record that includes several dry years. For planning purposes water providers must consider the firm yields available to serve customers during periods of regularly occurring drought. In addition, because water yield from the various water supply sources can fluctuate substantially from year to year, water providers seek to secure water supplies or adequate storage to capture flows during wet years so as to meet their dry year water needs.

Despite the utility of the using firm yield for long-range planning, firm yield is difficult to estimate for several sources of water including C-BT Project water and water reuse. As previously described, C-BT water is a supplemental water supply, with quotas established annually depending on available supplies. Typically C-BT water deliveries are greater during dry years and are lower during wet years, under the assumption that C-BT unit holders need the supplemental water supplies more during dry years. For purposes of this analysis we have assumed a long-term dry year yield for the C-BT Project of 0.6 AF per year. However, except in exceptionally dry years, C-BT may deliver yields of up to 1.0 AF per unit. Thus in many dry years, Participants that own C-BT units may have available C-BT Project water greater than indicated by the assumed 0.6 AF per unit yield.

In addition, firm yield supplies also do not reflect the reuse component for some sources of supply. Transbasin diversions other than C-BT water and some other water sources can typically be captured and reused repeatedly until extinction. For most Participants reuse water is used to meet non-potable irrigation requirements or downstream obligations. Water for reuse depends on the availability of water for the first use. While Windy Gap water can be reused, if the supply is not firm, then neither is the reuse.

For some Participants, firm supply and demand projections indicate a near-term shortage. However, this shortage is based on dry year conditions and average yields may be adequate to meet current demands, particularly in consideration of available C-BT supplies and reuse water.

The existing firm supply (including the long-term yield for C-BT) and projected future demand as described in this analysis provide the best available estimate of anticipated shortages in firm yield. To the extent that there are shortages, Participants will need to acquire or develop other sources of water. Firming the yield of the Windy Gap Project may contribute to meeting projected water needs. The remaining water shortage could be met by developing additional water sources along with additional water conservation measures.

Water Need

The City of Louisville water needs are currently met by direct flow rights, C-BT Project water, and reservoir storage. Water demand is expected to exceed available firm water supplies by about 2006, which would affect the ability of the City to meet dry year water needs depending on C-BT deliveries (Figure J-1). The City of Louisville is estimated to reach residential buildout by 2025 and commercial buildout by 2045. In 2050 a firm water supply shortage of about 1,800 AF is anticipated. Firming the Windy Gap water supply would provide Louisville up to 900 AF of water or about 13 percent of the City's 2050 water supply (Figure J-2). In addition, reuse of about 45 percent of Windy Gap effluent would contribute to meeting future non-potable water demand, as would the potential to reuse increasing amounts of native water up to 900 AF. Although Louisville's future non-potable water supply appears to be adequate to meet those needs, the City will need to develop additional firm water supplies to meet potable demand. Water conservation and other sources of water supply in addition to firming Windy Gap water also will be needed to meet future water demands.

Figure J-1. Louisville's 2005 Annual Firm Yield vs. Total Projected Water Requirements.

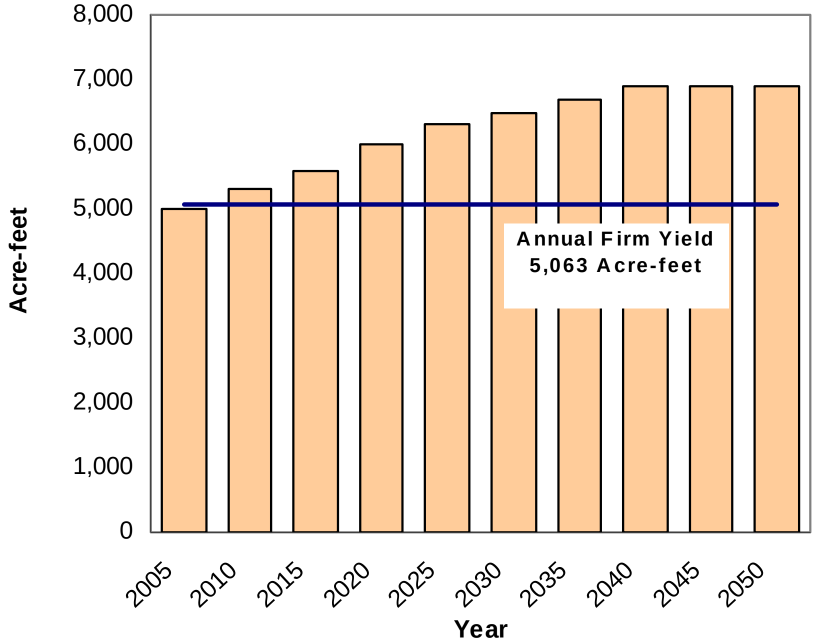
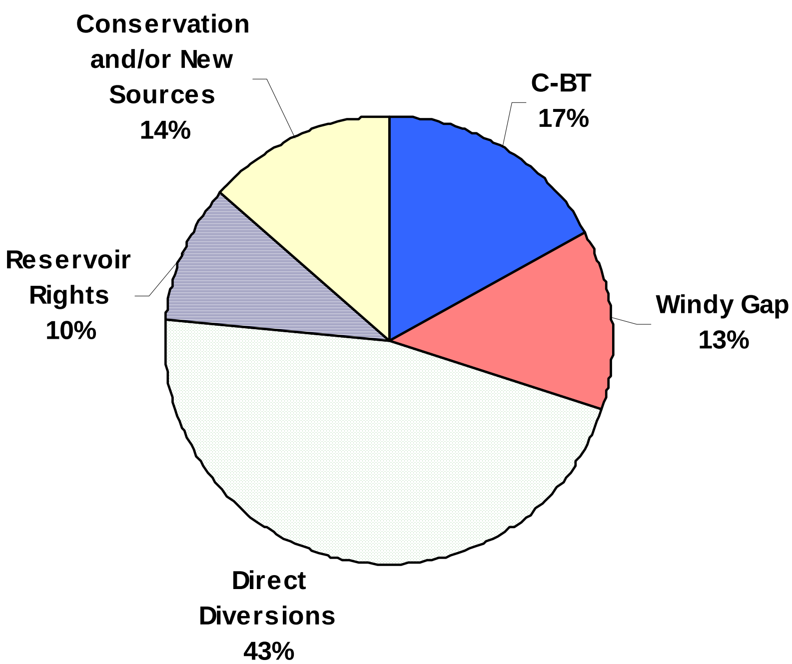


Figure F-2. Louisville's 2050 Projected Firm Water Supply Sources.



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WATER SUPPLY AND DEMAND

CITY OF LOVELAND

Introduction

The City of Loveland is located 50 miles north of Denver in southeastern Larimer County. Loveland's city limits encompass about 23.5 square miles. The City has experienced rapid population growth between 1990 and 2003, with a population increase of over 50 percent during this period. The following discussion provides a summary of Longmont's water supply and demand.

Water Supply

The City of Loveland has two categories of water supply — transbasin supplies and transferred native ditch water rights (Table K-1). Transbasin supplies consist of C-BT and Windy Gap water. Transferred native ditch rights are diverted directly from the Big Thompson River and consist of Early Transfers, 82CW202A ("202A") Transfers, Rist & Goss Transfers, and Pending Transfers (2002CW392). Some of the water attributable to Loveland's C-BT, 202A Transfers, and Pending Transfers are used for non-potable irrigation of many City-owned parks and golf courses if not diverted at Loveland's water treatment plant.

Transbasin Water

Colorado-Big Thompson Project

Annual deliveries of C-BT Project water vary from year to year depending on available water supplies, the needs of shareholders, and the annual quota established by the NCWCD Board of Directors. Historically, C-BT quotas have ranged between 0.5 and 1.0 AF per unit. However, quotas are adjusted to actually deliver more water in dry years. This is the opposite situation from most water rights in Colorado, because the C-BT Project was designed to provide supplemental water in dry years when native water supplies yield less water. Historically, the C-BT Project has delivered 1 AF in dry years and as little as 0.5 AF in wet years or in extremely dry years, such as the drought of 2002-2004 when the C-BT Project was limited by the physical supply of water that it could actually deliver. Longmont, like most municipalities, has not assembled a water portfolio that would deliver a full supply of water in extreme drought years for economic reasons. Based on analysis of hydrology and C-BT operations through historical drought periods from 1950 to present, NCWCD has determined that the firm yield of the C-BT project is 0.6 AF per unit.

Loveland's 10,538 units of C-BT water account for the largest portion of its water supply. Loveland's C-BT water yields about 6,232 AF of firm annual yield based a yield of 0.6 AF/unit.

Table K-1. Inventory of Loveland Water Supplies.

		Firm Annual Yield (AF)
Transbasin Sources		
C-BT Project	10,538 units	6,232[1]
Windy Gap Project	40 units	0
Eureka Ditch	100%	180
Early Transfers		
Portion of No. 1 Priority on Big Thompson River	3.44 cfs	3,060
Big Thompson Ditch & Mfg. Co.	2.0 shares	
202A Transfers and Rist & Goss Transfers [2]		
Barnes Ditch	1,306.8 in.	2,450
Big Thompson Ditch & Mfg. Co.	2.6 shares	
Buckingham (George Rist)	6.1 shares	
Chubbuck Ditch	596.6 inches	
Louden Ditch Company	191.5 shares	
South Side Ditch	57.5 shares	
Rist & Goss Ditch	6.41 cfs	
Reservoir Storage		
Green Ridge Glade Reservoir	6,836 AF storage capacity	4,900
Total raw water available for delivery to WTP		16,822
Pending Transfers / Non-potable Water Supply		
Barnes Ditch	22.12 shares	970
Big Thompson D&M	0.888 shares	
Buckingham (George Rist)	87.25 shares	
Chubbuck Ditch	432.02 in.	
Louden Ditch Company	27.722 shares	
South Side Ditch	8.5 shares	
Total		**17,792**

[1] C-BT yield is variable from year to year. C-BT's long-term firm yield is assumed to be 0.6 AF/unit for purposes of this analysis.

[2] Historical diversions adjusted for contract/private rights.

Windy Gap

Loveland owns 40 units of Windy Gap water. Windy Gap water does not currently provide a firm water supply to the City (1988 and 2003 were the only years that Loveland received significant supplies of Windy Gap water). When available, Loveland uses Windy Gap water to supplement water supplies needed to meet its overall water demand. In the future, Loveland will need Windy Gap water to meet increased water demand and to develop year-round reusable effluent at the Wastewater Treatment Plant (City of Loveland 2004a).

Eureka Ditch

In 1941, the City of Loveland acquired ownership of the Eureka Ditch, a high mountain ditch that had been used to deliver water from the western slope to the Big Thompson River through Rocky Mountain National Park. The City, the National Park Service, the United States Bureau of Reclamation, and the Northern Colorado Water Conservancy District negotiated a deal under which the City abandoned the ditch in 1995 and the NCWCD provided the City with 180 AF of firm yield from the C-BT Project. This water was made available to Loveland starting in November 1996.

Early Transfers

In the course of its development, Loveland has acquired shares in various irrigation companies that supply irrigation water in and around the Loveland area. These shares typically were associated with land parcels that were developed for residential, commercial or other uses. Loveland's early transfers of irrigation water rights included 3.44 cfs of the No. 1 Big Thompson River priority in the 1880s and two shares (6.00 cfs) of the Big Thompson Ditch and Manufacturing Company in the late 1920s. Loveland uses its early transfers first to meet potable demand. This water consists of direct flow diversions from the Big Thompson River and is not decreed to allow storage. This water provides 3,060 AF of firm yield annually and is available throughout the year (City of Loveland 2004a).

"202A" Transfers and Rist & Goss Transfer

Following the early transfers, the City continued to acquire ditch shares as it grew. Portions of these shares were used informally for a number of years until an application was filed in Case No. 82CW202(A) ("202A") in 1982 to transfer a large block of shares in several different companies to municipal use by the City. The 202A decree was entered by the Water Court in 1986. Since that time the City has made several additional irrigation water rights transfers under the terms and conditions of the 202A decree. These are collectively referred to as the 202A Transfers and include Loveland's share ownership in the Barnes Ditch, Big Thompson Ditch and Manufacturing Company Buckingham (George Rist) Ditch, Chubbuck Ditch, Louden Ditch, and South Side Ditch. Loveland also transferred the water rights associated with the Rist and Goss Ditch in two separate proceedings. Collectively the 202A Ditch Rights (and the Rist & Goss Ditch) account for about 2,450 AF of firm yield. This water is available for delivery to the water treatment plant and meeting potable water demands.

Reservoir Storage

The expansion of Green Ridge Glade Reservoir was completed in 2004. This reservoir has a storage capacity of 6,836 AF and will be used primarily to firm native ditch water rights to provide water on a year-round basis. The reservoir may have limited reserve capacity for storing Windy Gap or C-BT water. The yield of this reservoir has been simulated as part of an outside modeling effort; the firm annual yield of the reservoir was estimated as 4,900 AF per year (Spronk Engineering 2005).

Pending Transfers

Loveland also owns additional native ditch shares that are pending transfer in Water Court. This water is currently used to meet non-potable demands including irrigation of City parks and golf courses. Transfer of this water for treatment and potable use may occur in the future following approval in Water Court. The firm annual yield following transfer for potable use is unknown at this time, but based on yields from previous water transfers it is estimated that 970 AF would be available to meet potable demands.

Other Water Sources

In addition to its native Big Thompson River water rights and transmountain supplies, Loveland can divert additional water by exchange or during free river conditions. These sources are not considered reliable, especially in a firm yield scenario, for purposes of this analysis.

Water Reuse

The City of Loveland does not have a reuse plant and does not have plans to construct a reuse plant in the near future. However the City has recently been able to reuse native water on a limited basis via exchanges from its waste water treatment plant outfall to various points of diversion along the Big Thompson River (Loveland 2005). Effluent releases to the Big Thompson River are used for replacement of evaporative depletions from off-channel ponds at City parks and golf courses. The City also leases some of its reusable effluent to outside-City interests.

If firmed, Windy Gap water would provide an additional reliable source of water for reuse following initial potable use in the municipal system. The City is currently evaluating how Windy Gap reuse would be used, but anticipates some level of use for augmentation, irrigation, and leasing (Loveland 2005). Increased demand for reusable effluent could potentially accelerate Loveland's need for Windy Gap water.

Water Demand

In 2003, the City of Loveland had a population inside its city limits of 58,170 (City of Loveland 2004b). The City of Loveland Water Utility serves most of the population within the City of Loveland plus additional customers within its Growth Management Area (GMA). Other water providers deliver water to some areas within the city limits. Loveland's estimated water utility service population is currently 63,583 according to figures from the City's Utility Billing division. As of 2003, the City of Loveland comprised about 86 percent of the GMA, while the Loveland Water Department served about 93 percent of that same area. Historical population growth for the City of Loveland (Table K-2) has been substantial since 1990.

Table K-2. City of Loveland Population, 1990 to 2003.

					Rate of Growth
1990	37,360	N.A.	1997	45,100	3.6%
1991	37,670	0.8%	1998	46,710	3.6%
1992	38,230	1.5%	1999	48,390	3.6%
1993	39,110	2.3%	2000	50,610	4.6%
1994	40,340	3.1%	2001	52,830	4.4%
1995	41,990	4.1%	2002	55,580	5.2%
1996	43,520	3.6%	2003	58,170	4.7%

Source: City of Loveland 2004a.

Between the census years of 1990 and 2000, the City of Loveland grew by more than one-third. From 1990 through 2003, Loveland gained more than 20,800 persons, or more than a 50 percent increase. This extraordinary level of growth was concentrated within the last 5 years.

Historical Water Demands

The City of Loveland potable water demand includes residential and non-residential water use inside and outside the City, ranch water picked up by water haulers, construction water delivered through fire hydrants, and wholesale water marketed to the Little Thompson Water District, Fort Collins-Loveland Water District, and the City of Greeley. Focusing on water deliveries to end users, Table K-3 provides a breakdown of historical water use by consumer type.

Total potable water sales to Loveland service area end users increased by 1,060 MG between 1990 and 2002, or about 50 percent. About 80 percent of Loveland’s total water deliveries were dedicated to residential use over this time period.

Commercial water use accounted for 15 percent of water use, while the remainder was accounted for by industrial, city, ranch water, hydrants and wholesale water deliveries. Almost all of the increase in Loveland Water Utility deliveries occurred among the residential sector; non-residential water use has fluctuated in a narrow range largely attributable to weather influences in the period 1990 to 2003. The Loveland Water Utility identified only one large industrial user, Praxair. Praxair’s water use was about 35 MG in 2003 and has not changed much in recent years, nor is it likely to do so in the future (Smith and Rheam 2004). Large commercial water users provide services and retail products to Loveland area residents and businesses.

Table K-3. Potable Water Use by Customer Type in the City of Loveland Water Service Area, 1990 to 2003.

	MG						
1990	1,674	508	N.A.	N.A.	N.A.	N.A.	2,181
1991	1,723	526	N.A.	N.A.	N.A.	10	2,260
1992	1,775	484	N.A.	N.A.	N.A.	130	2,389
1993	1,776	468	N.A.	N.A.	N.A.	138	2,382
1994	1,941	499	N.A.	N.A.	N.A.	269	2,710
1995	1,835	493	N.A.	N.A.	5	200	2,533
1996	2,054	536	N.A.	N.A.	4	328	2,922
1997	1,944	511	39	N.A.	1	276	2,770
1998	2,271	530	56	N.A.	6	231	3,095
1999	2,134	492	45	4	9	225	2,909
2000	2,668	564	63	6	8	468	3,777
2001	2,655	507	56	7	39	404	3,667
2002	2,673	469	37	6	36	20	3,241
2003	2,367	384	48	N.A.	91	7	2,898

Source: Various documents obtained from the City of Loveland Department of Water and Power, July through September 2004.

Table K-4 provides potable gpcd historical data for residential and total use, respectively. Residential gpcd have fluctuated within a narrow range from 1990 to 2003, with an average over that period of 117 gpcd. Total gpcd have also fluctuated within a generally narrow range, with an average of 172 gpcd.

Non-Potable Use

In addition to potable water use, the City of Loveland irrigates most parks and all three municipal golf courses with non-potable water. Non-potable water is also used for augmentation purposes to replace evaporative depletions at gravel pits and irrigation storage ponds. Total non-potable water use fluctuates with weather but has recently averaged around 850 AF annually.

Table K-4. Potable Water Demand per Loveland Service Area Resident for Residential and Total Water Needs, 1990 through 2003.

				gpcd	
1990	113	160	1997	109	168
1991	116	164	1998	123	182
1992	117	171	1999	112	165
1993	115	167	2000	133	204
1994	122	184	2001	127	190
1995	111	165	2002	122	160
1996	119	184	2003	103	136

Source: City of Loveland 2004b.

Total Water Requirements

Table K-5 indicates total potable and non-potable water deliveries by the City of Loveland Water Department plus total raw water requirements, including an 18 percent loss for conveyance, water treatment and distribution shrinkage.

Total water requirements, including potable and non-potable demand and system losses, increased from 9,200 AF to 13,167 AF between 1990 and 2002. This extraordinary 43 percent gain reflects the rapid growth that Loveland has experienced in recent years.

Table K-5. Total Water Requirements for the City of Loveland 1990 to 2003.

Year			Year		Total Water Requirements[1]
	AF			AF	
1990	7,544	9,200	1997	9,351	11,404
1991	7,785	9,494	1998	10,347	12,618
1992	8,181	9,976	1999	9,776	11,922
1993	8,161	9,952	2000	12,441	15,172
1994	9,166	11,178	2001	12,104	14,761
1995	8,624	10,517	2002	10,797	13,167
1996	9,817	11,972	2003	9,743	11,882

[1] Including system losses.

Source: City of Loveland 2004b.

Projected Water Requirements

The study team obtained the water demand projections and methodology followed by the Department of Water and Power, City of Loveland and then revisited these forecasts using a different methodology.

Water Demand Projections Provided by the City of Loveland

The City of Loveland projects water demand to increase from 13,220 AF in 2005 to 29,630 AF at buildout (City of Loveland 2004b). According to the City's Long Range Planning Division, the Loveland GMA is expected to reach a buildout population of 145,000 persons at approximately the year 2042. The Loveland Water Utility, which only serves a portion of the GMA, estimates its ultimate water utility service population to be about 127,000 persons.

The water demand forecasting methodology utilized by Loveland is relatively straightforward. Department of Water and Power staff applied the annual increase in population growth for the City of Loveland, as projected by the Loveland Long Range Planning Division, to year 2002 per capita water demands, i.e., each year, the projected annual increase in population is applied to 2002 per capita water demands and added to the previous year's projected water demand until buildout is reached in the year 2042. This method has a number of potential disadvantages:

- It is uncertain how representative year 2002 water demands actually were because of the drought conditions.
- This method assumes that all Loveland water demand varies directly with a change in population. Since 1990, almost all of the increase in water use has come from the residential sector, but the non-residential water use shows no discernible growth trends.
- Population projections from the Loveland Long Range Planning Division must be evaluated for reasonableness as part of the Windy Gap Firming Gap Purpose and Need Evaluation.

In light of these issues, with the concurrence of the City of Loveland Department of Water and Power staff, the study team independently developed water demand projections for comparison with the City's figures.

Study Team Projections

The study team evaluated the population forecasts for the City of Loveland, as provided by the Long Range Planning Division. Projections indicate an annual growth rate that varies each year, but within a range of 1.74 percent to 2.66 percent, after 2004. This rate of population change is well below the historical growth rate experienced from 1990 to 2003, and compares well with Larimer County growth projections, which range from 1.3 percent to 2.3 percent from 2000 to year 2030 (State of Colorado 2004). The employment projections made by the Long Range Planning Division also vary annually, and range between 1.3 and 2.6 percent from 2005 to 2030. These numbers compare favorably with Larimer County employment projections, which range from 1.3 to 2.2 percent during the same time period (The Center for Business and Economic Forecasting Inc. 2003). Therefore, the Loveland Long Range Planning Division's population and employment projections for the City were determined to be reasonable and were adopted for the water demand projections.

The study embarked upon the following steps to develop water demand projections:

1. City population projections were converted to Loveland Water Utility service area population projections, using the historical ratio of service area population to city population of 1.08.
2. Service area population projections, with a buildout of 127,000 persons, were applied to the average gpcd since 1990 of 117, to produce residential water sales projections.
3. Employment projections provided by the Loveland Long Range Planning Division for the GMA were used to estimate service area employment projections, utilizing the historical ratio of 0.93 for the service area to GMA population.
4. The projected service area employment was applied to an assumed non-residential consumption of 49 gallons per employee per day, the average since 1999. These non-residential water sales projections for the service area included commercial, industrial, and city water demands.
5. Wholesale water demands, ranch water demands, and construction water demands were assumed to be constant in the future, reflecting recent trends and expectations from the Department of Water and Power (City of Loveland 2004b).
6. Service area residential water projections, non-residential water projections, ranch water projections, hydrant water projections and wholesale water projections were combined to derive total potable water deliveries. To this sum, non-potable water demands of 850 acre-feet in 2003 linearly increasing to 1,700 acre-feet by 2040 were added.
7. System losses of 18 percent were applied to total water deliveries to estimate future water requirements for the City of Loveland.

Table K-6 summarizes the Loveland water demand projections as developed by the study team. The ultimate water demand for the Loveland Water Utility is estimated to be 28,300 AF by the year 2050.

City of Loveland Water and Power Department Staff revisited their water demand projections in the fall of 2004 and presented new figures at a Loveland utilities Commission meeting on September 15, 2004 (City of Loveland 2004d). Staff presented two demand projections approaches, one based on land use and the other on population projections. These water demand projections produced ultimate demand estimates of 28,886 acre-feet and 26,503 acre-feet, respectively. The Commission adopted an ultimate water demand projection for Loveland of 30,000 acre-feet, rounding up from the two staff estimates. These figures tend to corroborate the projections independently derived by the study team and used in this analysis.

Table K-6. Loveland Water Demand Projections, 2005 through 2050.

Year							Total Water Requirements[2]
						AF	
2005	2,800	600	100	3,600	290	11,800	14,400
2010	3,100	700	100	3,900	330	13,000	15,900
2015	3,500	800	100	4,400	370	14,600	17,800
2020	4,000	800	100	4,900	400	16,400	20,000
2025	4,500	900	100	5,600	440	18,500	22,500
2030	5,000	1,000	100	6,100	480	20,300	24,700
2035	5,400	1,100	100	6,600	520	21,900	26,800
2040	5,400	1,200	100	6,700	550	22,400	27,300
2045	5,400	1,300	100	6,900	550	22,800	27,800
2050	5,400	1,500	100	7,000	550	23,200	28,300

[1] Ranch water is assumed to be 6 MG. Rental hydrants are assumed to be 91 MG, and wholesale is assumed to be 7 MG.

[2] Total requirements assumed 18 percent loss from all sources.

Source: Harvey Economics 2004.

Conservation

The City of Loveland began officially serving customers in 1888. Wise use of water has been an important factor as well as providing high quality water at a fair price. The Water Utility uses a number of tools in promoting the wise use of water, as described below.

Water Restrictions

Six years after the Water Utility was established, lawn watering regulations appeared on the books. In 1893, the town fathers passed an ordinance dividing the town into two sections: one area watering from 5 am to 1 pm and the other area watering from 1 pm to 9 pm. This was in effect from April to September each year. The City imposed more formal watering restrictions on its customers during the summer of 1970. The restrictions were in response to moderating the water treatment plant capacity, not in response to inadequate water supplies. Until 1981, water restrictions let customers water only every two or three days per week. The installation of water meters and the expansion of the water treatment plant allowed the restrictions to be lifted (City of Loveland 1989). In 2002, water restrictions were implemented as a risk-averse option to a limited water supply; however, they were lifted once water supply conditions improved.

Water Meters

In July 1979, the Loveland City Council approved an ordinance requiring water meters for all new construction and for existing homes when ownership changed hands. Before that time, the City only required meters for commercial accounts within the City and for all accounts served outside the City limits. Less than a year later in June 1980, the Council passed another ordinance requiring meters for all water customers.

By 1981, the City was completely metered at a cost of over $3 million. The average annual water usage declined by 20 percent. Before metering, the water treatment plant's maximum day demand was 22 MG per day. After metering, the maximum day demand was 16.7 MG per day (City of Loveland 1989).

Water Rates

In 1887, the Water Utility established a flat rate, based on the type of dwelling and number fixtures. Customers paid the yearly fee in advance. Until 1968, water rates were based on a flat fee determined by fixture count. But keeping track of the number of bathrooms and toilet fixtures in homes was difficult; therefore, in July 1968, the City developed a flat rate charge per family based upon average water usage. Lot size determined the rate for lawn sprinkling. Since 1981, the monthly billing has reflected actual water use with the installation of meters. In 1989, the City Council approved a series of rate increases that specified water rates from 1990 to 1997. The revenue from these rate increases allowed Loveland to purchase additional C-BT units and cash fund the recent Green Ridge Glade Reservoir expansion. Currently, Loveland has a uniform rate structure with rates 33 percent lower in 2003 than they were in 2001.

Water Conservation Plan

In May 1996, the City of Loveland prepared a water conservation plan outlining 16 conservation measures it wanted to initiate by 2001 (City of Loveland 1996); since that time, Loveland has implemented a host of water conservation programs:

- The City widely promotes the importance of water conservation with information to its customers to enhance efficient water use patterns.
- The City distributes publications through the Loveland Public Library, the Utility Billing Office, and the Utility Service Center.
- The utility provides customers with dye tablets to test for toilet leaks.
- Working with the Parks Division, Loveland Water Department has updated the Jeff Peterson Xeriscape Garden.
- The Loveland Water Utility promotes the sale of water conservation kits for $5.
- The utility has included water conservation kits and information on its web site.
- The utility plays water conservation videos on the local access channel 16.
- The Loveland Water and Power Department sends postcards to all customers informing them of the water supply management program.
- Conservation information is advertised in the local newspaper.
- Three xeriscape seminars are conducted annually by a landscape architect as a community service.
- In 2004, the utility also embarked upon the sale of hose meters, the installation of a "Please Conserve Water" banner over US Highway 34,

inclusion of a water conservation message in utility bills, and development of a do-it-yourself irrigation audit document.

- The Loveland utility also has an active leak detection program, regularly replacing aging infrastructure to reduce system loss.

Current Status

Total water use was reduced about 13 percent from 2001 through 2003, but much of this savings is believed to be attributable to temporary drought related efforts. Initial per capita consumption rates have been relatively low, compared to the national average. This trend started once customers' water use became metered and continues today. Any savings from these already low consumption rates would be difficult to perceive, another reason why the City chose not to rely on water restrictions to reduce the already lower demand during a 1-in-100 year drought event.

Anticipated Water Need

Assumptions

The evaluation of potential water needs is based on projections of the future water demands for each of the Participants and the existing or anticipated firm supply of water available. Estimates of the firm water supply, often referred to as the dry year yield, indicate the amount of water that is available during a defined period or condition. Often this encompasses a 50-year historical record that includes several dry years. For planning purposes water providers must consider the firm yields available to serve customers during periods of regularly occurring drought. In addition, because water yield from the various water supply sources can fluctuate substantially from year to year, water providers seek to secure water supplies or adequate storage to capture flows during wet years so as to meet their dry year water needs.

Despite the utility of the using firm yield for long-range planning, firm yield is difficult to estimate for several sources of water including C-BT Project water and water reuse. As previously described, C-BT water is a supplemental water supply, with quotas established annually depending on available supplies. Typically C-BT water deliveries are greater during dry years and are lower during wet years, under the assumption that C-BT unit holders need the supplemental water supplies more during dry years. For purposes of this analysis we have assumed a long-term dry year yield for the C-BT Project of 0.6 AF per year. However, except in exceptionally dry years, C-BT may deliver yields of up to 1.0 AF per unit. Thus in many dry years, Participants that own C-BT units may have available C-BT Project water greater than indicated by the assumed 0.6 AF per unit yield.

In addition, firm yield supplies also do not reflect the reuse component for some sources of supply. Transbasin diversions other than C-BT water and some other water sources can typically be captured and reused repeatedly until extinction. For most Participants, reuse water is used to meet non-potable irrigation requirements or downstream obligations. Water for reuse depends on the availability of water for the first use. While Windy Gap water can be reused, if the supply is not firm, then neither is the reuse.

For some Participants, firm supply and demand projections indicate a near-term shortage. However, this shortage is based on dry year conditions and average yields may be adequate to meet current demands, particularly in consideration of available C-BT supplies and reuse water.

The existing firm supply (including the long-term yield for C-BT) and projected future demand described in this analysis provide the best available estimate of anticipated shortages in firm yield. To the extent that there are shortages, Participants will need to acquire or develop other sources of water. Firming the yield of the Windy Gap Project would contribute to meeting projected water needs. The remaining water shortage could be met by developing additional water sources along with additional water conservation measures.

Water Need

Loveland's current water needs are met by C-BT, direct flow rights, irrigation transfers, and the recently completed Green Ridge Glade Reservoir. Water demand is expected to exceed available firm water supplies by about 2015, which would affect the ability of the City to meet dry year water needs depending on C-BT deliveries. A firm water supply shortage of about 6,900 AF in 2030 and about 10,500 AF in 2050 is anticipated, if the Loveland Water Utility relies only on existing usable supplies. Firming the Windy Gap water supply would provide Loveland about 4,000 AF of water, or about 14 percent of the City's 2050 water supply. A firm Windy Gap water supply would also provide a source reusable effluent and the City is evaluating options for potential use of this water. Loveland will continue to pursue other water supply sources and ongoing conservation measures so supplies are developed ahead of the demand.

Figure K-1. Loveland's 2005 Annual Firm Yield vs. Total Projected Water Requirements.

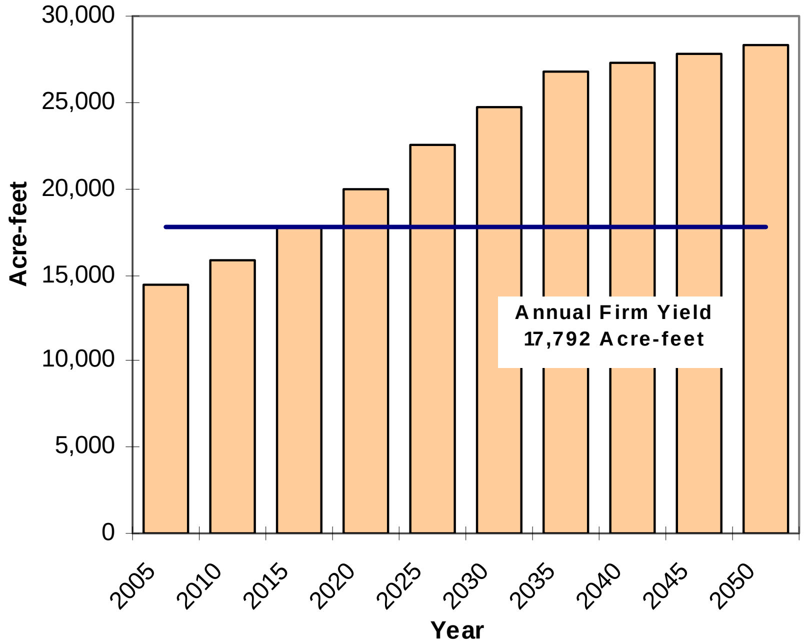
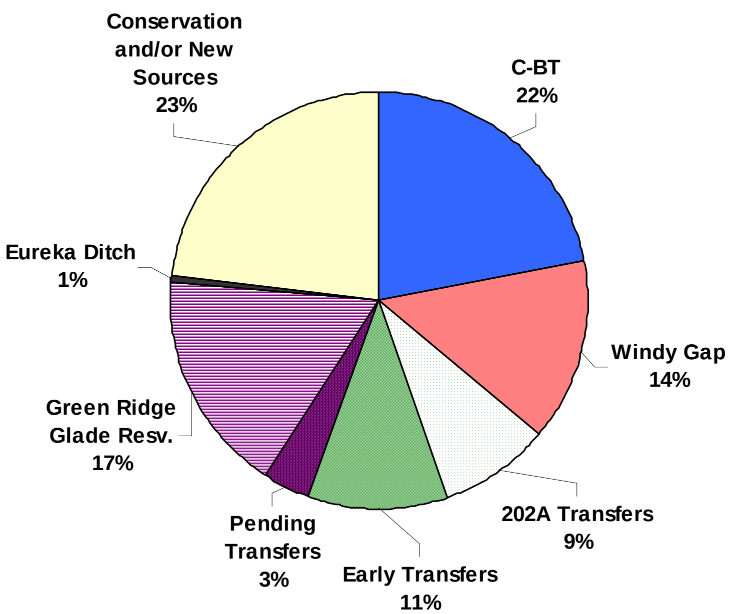


Figure K-2. Loveland's 2050 Projected Firm Water Supply Sources.



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WATER SUPPLY AND DEMAND

MIDDLE PARK WATER CONSERVANCY DISTRICT

Introduction

The Middle Park Water Conservancy District (MPWCD) was formed in 1950 as a direct result of the development of the C-BT Project. The MPWCD serves as a representative of water interests in Grand and Summit Counties and administers distribution of water from several projects to a variety of water users including municipal, private, and water and sanitation districts. MPWCD currently allocates water supplies from the Windy Gap Project and Wolford Mountain Reservoir.

Water Supply

MPWCD's water supply consists of 3,000 AF of Windy Gap water and 3,000 AF of Wolford Mountain Reservoir water (Table L-1). MPWCD also owns conditional water rights at several locations, but there are no immediate plans for development of these water rights.

Table L-1. Inventory of MPWCD Supplies.

		Firm Annual Yield (AF)
Windy Gap Project	3,000 AF	0
Wolford Mountain Reservoir	3,000 AF	0
Total		0

Windy Gap

Pursuant to the Agreement Concerning the Windy Gap Project and Azure Reservoir and Power Project, dated April 30, 1980, and the Supplement to Agreement of April 30, 1980, dated March 29, 1985, the MPWCD receives 3,000 AF of water produced each year from the Windy Gap Project for use within MPWCD. These agreements require that the Subdistrict dedicate and set aside annually, but non-cumulatively, at no cost to MPWCD, the first 3,000 AF of water in Granby Reservoir that is produced each water year from Subdistrict water supplies, for beneficial use without waste, either directly or by exchange or substitution, in MPWCD. The direct beneficial uses do not include instream uses or industrial uses. Any water so stored in Granby Reservoir shall be the last of any Subdistrict water to be spilled from Granby Reservoir if such spill is required.

If MPWCD's Windy Gap water is not used in a given year, it cannot be carried over for the following year. Consequently, any water that is not used reverts back to the Northern Colorado Water Conservancy District (NCWCD). However, MPWCD has transferred or exchanged the water when storage was available elsewhere, such as Wolford Mountain Reservoir.

The MPWCD's inability to firm Windy Gap Project water yield is similar to other Windy Gap Firming Project Participants. During dry years, no Windy Gap water is pumped and during wet years, there may not be enough storage in Lake Granby for Windy Gap water. Thus, MPWCD cannot rely on Windy Gap water each year. Firming annual storage of its 3,000 AF of Windy Gap water would provide MPWCD a reliable water supply to assist in meeting the current and future demands of entities in the MPWCD that contract for Windy Gap water.

Water Reuse

MPWCD water users do not reuse Windy Gap water.

Wolford Mountain Reservoir

MPWCD participated and cooperated in the development of Wolford Reservoir in the Muddy Creek basin north of Kremmling. In a 1992 agreement with the Colorado River Water Conservation District (CRWCD), the MPWCD receives 3,000 AF of storage in Wolford Mountain Reservoir in return for MPWCD's conveyance of its Troublesome Project to the CRWCD. MPWCD allocates water to Wolford Mountain's 28 contractees similar to Windy Gap water. In 2004, Wolford Mountain Reservoir contract holders ordered about 44 AF of water (Bishop-Brogden Associates 2004a).

Water Demands

The Middle Park Water Conservancy District is a wholesale water supplier for 67 water providers and users in Grand and Summit Counties. These entities have a contract with MPWCD to use Windy Gap water, as requested and as available, on an annual basis. The water providers, also known as contractees, include towns, suburban water districts, rural water districts, agricultural water users, consumers and ski areas. Together, the contractees account for 80 percent of the residents of Grand and Summit Counties (Bishop-Brogden 2004a, 2004c). The largest contractees own about two-thirds of the water served by MPWCD and include:

- Grand County Water and Sanitation District
- Town of Granby
- Town of Silverthorne
- Town of Kremmling
- Snake River Water District
- Winter Park Water and Sanitation District
- Town of Frisco
- Town of Fraser
- Three Lakes Water and Sanitation District
- Summit County
- Town of Breckenridge

Smaller contract holders include subdivisions, homeowner associations, and private individual homeowners. A complete list of MPWCD Windy Gap Project contractees is included at the end of this document.

Historical Water Demands

The MPWCD contractees utilize MPWCD waters for augmentation purposes in conjunction with other supplies. Some of the larger contract holders of MPWCD Windy Gap water rely on a variety of other primary sources of water to meet their total demand including surface water diversion, ditches, exchange agreements, and alluvial ground water. In addition, the MPWCD utilizes its water supply for exchanges, trades and other agreements with other Colorado water providers, such as Denver Water. Currently MPWCD Windy Gap water provides supplemental water to contract entities and only a portion of each individual entity's water supply. However, MPWCD water is the sole source of water for a number of small private augmentation water users, such as subdivisions and private landowners. Also, because Windy Gap water is used primarily to augment ground water pumping or stream diversions only the consumptive use is replaced by releases from Lake Granby, thus maximizing the use of available Windy Gap water. None of the MPWCD allocation of Windy Gap water is directly used by contract allottees (ERO 2004).

Given the nature of MPWCD water use, no records are available as to water demands by type of customer or by year. What is known is that the contractees to MPWCD request each year waters from the District to utilize in their own way. The allotments cost the contractees $115 per acre-foot annually, escalated by the rate of inflation from 2001 to the present, and out into the future (MPWCD 2001). This suggests that the entities requesting water are utilizing that water in a beneficial manner. In 2004, MPWCD contractees requested 2,680 AF of the 3,000 AF of Windy Gap water supplies (MPWCD 2004a). Actual delivery of Windy Gap water to the MPWCD has ranged from 0 AF to 624___ AF. Windy Gap waters from the MPWCD are utilized to the extent that these waters are available and can be used by the allottee, as of 2004.

Water Demand Projections

The MPWCD does not prepare its own water demand projections. The District's role is simply to respond to the needs of its contractees to the limit of its water supplies. To evaluate the future water demand or allotment needs for MPWCD, the study team has examined overall future water resource requirements for Grand and Summit Counties as an indication of contractees' demands.

Published in 2003, Hydrosphere Resource Consultants prepared the Upper Colorado River Basin Study (UPCO), which, among other things, provided water demand projections for the Colorado River headwater counties, Grand and Summit (Hydrosphere Resource Consultants 2003). The consultant surveyed almost all the water providers in Grand and Summit Counties, along with major water users, such as ski areas. From this study, current and future water demand projections were presented in the report, as identified in Table L-2.

Table L-2. UPCO Study Water Demand Projections for Grand and Summit Counties.

	AF	
Grand County	3,132	14,167
Summit County	8,027	17,871
Total	**11,159**	**32,038**

Source: Hydrosphere Resource Consultants 2003.

Based upon surveys of individual water providers, these water demand projections suggest that MPWCD will face a considerable increase in future water demands for its resources as these water providers seek to meet future needs.

To evaluate the timing of those needs, the study team examined various changes to the drivers of water demand as a function of time out into the future. Residential, commercial, agricultural and snowmaking water uses were examined for Summit and Grand Counties.

Residential Water Use. Population projections in Table L-3 for Summit and Grand Counties provide an indication of residential water demand.

Table L-3. Year-Round Population Projections for Summit and Grand Counties, 2000 to 2030.

		Grand County Population
2000	25,700	12,900
2005	28,200	14,300
2010	32,400	16,700
2015	36,700	19,600
2020	41,400	22,500
2025	46,000	25,700
2030	50,400	28,800

Source: DOLA 2004a.

By 2030, Summit County year-round population is projected to increase by 96 percent over the year 2000; Grand County year-round population is expected to increase by 123 percent over that same period. These figures do not include seasonal residents or visitors to either county.

Residential water demands will be driven in the future by increases in the number of housing units. In the year 2000, there were an estimated 24,200 housing units in Summit County and 10,900 housing units in Grand County. These housing units include permanent year-round homes, apartments, and seasonal or second homes. Regardless, all of these housing units must be supplied with water when needed. If the number of total housing units of all types grows in line with population growth, 23,230 new housing units will be needed in Summit County and 13,400 new housing units will be required in Grand County by the year 2030. Assuming an average of 657 gallons per housing unit per day at peak usage, total peak day use would be 24.1 MG per day (Bishop-Brogden Associates, Inc. 2004c). If year-round use is half peak daily use, a total of 13,500 AF of new water demand from the residential sector would be forthcoming for Summit and Grand Counties together by the year 2030.

Commercial Water Demands. New water demands must also be met from growth in the commercial sectors within Summit and Grand Counties. Employment projections for both counties are provided in Table L-4.

Table L-4. Summit and Grand Counties Average Annual Employment Projections, 2000 to 2030.

		Grand County Employment
2000	21,700	8,300
2005	21,800	9,300
2010	28,200	11,900
2015	34,300	14,100
2020	40,100	16,300
2025	45,400	18,200
2030	51,600	20,300

Source: DOLA 2004b.

Summit County employment is expected to increase by 138 percent or 29,900 employees, between the year 2000 and 2030. Grand County employment is expected to increase by 144 percent, or 12,000 employees, during that same period.

Commercial water demand projections for these two counties can be estimated based upon employment growth and an assumed 80 gallons per day per employee for water use (Bishop-Brogden Associates, Inc. 2004c). Total new water demand from the commercial sector in Summit and Grand Counties is projected to be 3,750 AF between the years 2000 and 2030.

Livestock Watering. Cattle, calves and other livestock will need watering in the rural areas of Grand and Summit Counties in the future. The study team examined historical trends for the number of cattle and calves on farms since 1992 and found a decline in the number of cattle and calves. On the basis of this trend, no new water demands for the agricultural sector in Grand and Summit Counties is assumed for this study (USDA National Agricultural Statistics Service 2004).

Snowmaking. As of 2004, there were four ski areas in Summit County – Arapahoe Basin, Breckenridge, Keystone, and Copper – and two ski areas in Grand County – Winter Park/Mary Jane and Sol Vista (Colorado Ski Country USA 2004a). Together these ski areas represent over 10,000 acres of skiable terrain, and these operations provide snowmaking to a combined 2,468 acres as of 2004 (Colorado Ski Country USA 2004a). An average of 1 AF per acre per year is required for snowmaking (Bishop-Brogden Associates, Inc. 2004c). The study team was unable to obtain reliable projections of snowmaking terrain for the Summit and Grand Counties ski areas, although past experience suggests that both skiable terrain and the proportion of a ski area subject to snowmaking have both increased over time. Even so, past trends in skier visits for these ski areas do not suggest an upward trend, and so projections of any increases in snowmaking demand were not made as part of this study (Colorado Ski Country USA 2004b).

Conservation. The larger 67 water providers in Summit and Grand Counties are required to have water conservation plans in response to state regulations applicable in 1996. Given the transient nature of the populations in these counties, water conservation represents special challenges. Once meeting initial demands, the headwater counties in the Colorado River Basin offer a high proportion of return flows that rejoin the stream system for downstream users.

The study team contacted seven of the larger water providers in Summit and Grand Counties, which are also allottees to the MPWCD, regarding their conservation programs and practices. Interviews were completed with six of the seven Participants contacted; the Town of Granby elected not to respond to this inquiry. The water suppliers that did respond to the survey indicated a wide range of water conservation programs and practices as of November 2004 (Harvey Economics 2004):

Town of Winter Park – Winter Park is 100 percent metered. This community has a public information program consisting of regular newsletters and water conservation reminders enclosed with water bills. Winter Park has a leak detection program and restricts outdoor water use under drought conditions.

Grand County Water and Sanitation District – Grand County's customers are also 100 percent metered. The County has a leak detection program and water restrictions that mirror those of Denver Water. Grand County has a low flow plumbing fixture requirement and an inclining block rate schedule. This water provider also advertises in a local newspaper to promote conservation efforts. In the future, Grand County hopes to work with other water providers to decrease irrigation and landscaping in future developments.

Town of Breckenridge – Breckenridge is fully metered and has an inclining rate block structure with an excess use fee. The Town has an active leak protection program that entails a full system survey every three years and has saved about 10 percent of total water use. Low flow plumbing devices are required in new construction and replacement plumbing fixtures. The town adopted an ordinance requiring separate tap fees, metering, rates and billing of irrigated areas, both for new construction and existing irrigation meters. In addition, mandatory watering restrictions are imposed as needed and enforced by written warning, fines, and shut-off. To encourage conservation, the Town offers reduced tap fees for efficient water use designs for new commercial and industrial water customers. Public education efforts include information in the Town Bulletin, mailings, door hangers and conservation reminders in billings. Breckenridge plans to implement a xeriscaping program that will include incentives to developers.

Snake River Water District – This water district has a leak detection program, is fully metered and promotes water conservation through bill stuffers. Water restrictions can be implemented when needed.

Town of Fraser – Fraser has a biannual leak detection survey effort. Low flow plumbing fixtures are required in Fraser according to the National Plumbing Code. Two new large developments in the Town of Fraser allow no outside irrigation, and promote xeriscape as the only landscaping alternative. Fraser has a public education program including newsletters that promote water conservation. Fraser is in the process of completing its metering efforts, which should be completed by year-end 2005.

Town of Silverthorne – Silverthorne is 100 percent metered. The Town performs a leak detection survey twice a year. This community also has low flow plumbing requirements and landscape restrictions in newly developed areas. Silverthorne performs a public education effort promoting water conservation through billing inserts. Water restrictions are applied as needed.

Summary. Summit and Grand Counties are likely to experience substantial increases in water demand between the years 2000 and 2030, primarily from residential and commercial growth. Total potable demand is projected to increase by as much as 17,000 AF. This does not include potential losses that each Summit and Grand County water provider experiences from the point of diversion back to the tap. These new demand requirements also do not include any new snowmaking or agricultural demands and are therefore considered conservative.

Anticipated Water Needs

The MPWCD is anticipated to need additional reliable sources of water supply to meet both current demand and anticipated future demands. Currently almost 90 percent of the Windy Gap Project water is contracted for. While actual use has varied from year to year, the projected future increase in residential and commercial demand of about 17,000 AF by 2030 in this analysis indicate a substantial shortage. A firm Windy Gap water supply would provide the MPWCD with reliable annual supply of 3,000 AF of water, which is about 10 percent of the estimated demand in 2030. The contractees to MPWCD are responsible for providing their own supplies; some or all of these entities will need to secure additional water resources between 2004 and 2030.

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WINDY GAP PROJECT MPWCD CONTRACT ENTITIES (2004)

Ben and Sandy Schneller
Blue River Water District
Bob Cooks — previously: Leslie and Nancy Gwin
Bravo Developing Inc.
C.D. Peper (1/22/96)
Casey and Rhonda Farrell
Christine French
Columbine Lake Water District
Copper Mountain Consolidated Metropolitan District
DeLoach, Jimmy
Dillon Valley Water and Sanitation District
Dr. Boyace Holland
Elkhorn Ridge Homeowners Association
Frank and Rebecca Newcommer
Fred Garrett
Giberson
Granby Jones, Inc.
Grand County
Grand County Water and Sanitation District
Grand Lake Recreation District
Hidden River Ranch Homeowners Association, Inc. (Gile)
High Lonesome Trails Homeowners Association, Inc.
Jim and Karon Warner (Tibbetts)
John Thompson (Wiebe)
Kenneth A. and Kristina M. Arellano (Tibbetts)
King, Morris
Koenigs, Chris
Lakeridge Homeowners Association
Liberty National Bank and Trust Co. of Oklahoma
Marilyn K. Hauge
Mark Unicume
MDJ Holdings, LLC
Mesa Cortina Water and Sanitation District
Mountain Parks Concrete Inc.
North Shore Water and Sanitation District
Parsons, Beverly
Pinon Ridge Homeowners Association, Inc.
Ranch Creek Ranch Owners Association Inc.
Richard R. and Linda V. Kelley
Roger Pierce (Wiebe) (1/8/96)

Ron VanVleet and Claire Silk
Shorewood Owners Association
Snake River Water District
Spring Branch Augmentation Association (Atwater)
Spruce Valley Ranch Foundation
Summit County
Sunnyshore Park Well Group
Sunset Ridge Estates Homeowners Association
Sunyshore
Sydney and Ardith White (Marquez)
Thompson Properties (Hahn)
Three Lakes Water and Sanitation District
Town of Breckenridge
Town of Fraser
Town of Frisco
Town of Granby
Town of Kremmling
Town of Silverthorne
Whitfield
Winter Park Recreational Association
Winter Park Water and Sanitation District
Wynstra

WATER SUPPLY AND DEMAND

PLATTE RIVER POWER AUTHORITY

Introduction

Platte River Power Authority (Platte River) is a joint action governmental entity owned by the Municipalities of Estes Park, Fort Collins, Loveland, and Longmont. Platte River was established in 1973 to meet the wholesale electric energy requirements of these municipalities, and is governed by an eight-member board with two members from each of the four municipalities.

The Rawhide Energy Station (Rawhide) is owned and operated by Platte River and provides a net output of 270 megawatts from Rawhide Unit 1, a coal-fired generating unit completed in 1984. Four gas-fired simple cycle combustion turbine (CT) units, also located at Rawhide, provide peaking power and back up for other Platte River energy sources. The coal used at Rawhide is mined at the Powder River Basin in Wyoming. Currently, most of the 270 MW generated at Rawhide, along with other Platte River energy sources, are used to supply electric energy for Estes Park, Fort Collins, Longmont and Loveland. Other energy sources include an allocation of hydroelectric power from the Western Area Power Administration of the Department of Energy and 154 MW of coal-fired generation from an 18 percent ownership in the Craig Units 1 and 2, located near Craig, Colorado. Platte River also owns and operates wind generators located near Medicine Bow, Wyoming, which produce approximately 10 MW. A small amount of surplus power is sold under contract to Xcel. Non-firm power, when available, is marketed to Tri-State Generation and Transmission Association, Inc., Xcel, Pacificorp, the Western Area Power Administration and other electric utilities in the western power grid (ERO 2004).

Water use at Rawhide is mainly for two purposes: boiler water for the steam-driven turbine and cooling water for the steam used to generate electricity. Water is recycled and used again after condensation. Ultimately, all water at Rawhide is used to extinction; no water is discharged from the Rawhide Energy Station site.

Platte River needs both a firm reliable supply of water for its existing Rawhide facilities and the anticipated need for additional power generation in the next 10 to 15 years. The need for additional power generation is based on growth projections provided by each of the four owner Municipalities, as well as Platte River's independent load estimates (ERO 2004). A number of different potential generation projects with varying water supply requirements, many of which are not located at the Rawhide site are possible (Id.).

Platte River would take delivery of firmed Windy Gap water in the same manner it currently takes non-firm and "in lieu" deliveries of Windy Gap water. The firmed Windy Gap water would improve delivery of water to the City of Fort Collins for first use under the existing Reuse Agreement and this would, in turn, improve the subsequent delivery of effluent reuse return flow to Rawhide, as well as direct Windy Gap water deliveries from Horsetooth Reservoir to Rawhide for boiler and potable water use.

Water Supply

Platte River's raw water supply is based on Windy Gap water and a Reuse Agreement with Fort Collins and the Water Supply and Storage Company (WSSC) involving exchanges that include Windy Gap water. (Table M-1). Platte River direct flow rights, reservoir storage rights in Hamilton Reservoir, and a limited number of native ditch shares in Larimer County Canal No. 2 provide other minor sources of water (Platte River 2004).

Table M-1. Inventory of Platte River Water Supplies.

			Firm Annual Yield (AF)
Transbasin Sources			
Windy Gap Project	160		0
Provided to Fort Collins under the Reuse Agreement W-9322-78 (April 24, 1979)	N.A.	4,200[1]	0
Direct delivery of Windy Gap water from Horsetooth Reservoir	950 AF[2]	N.A.	0
Direct Flow Rights			
Poudre River Decrees	1.6 cfs and 15.19 cfs	N.A.	0
Reservoir Storage			
Hamilton Reservoir Storage Decree	16,308 AF	N.A.	N.A.
Ditch Shares			
Larimer County Canal No. 2	0.1393	N.A.	N.A.
Total	—	4,200[3]	0

[1] A portion of Platte River's Windy Gap water supply is provided through a Reuse Agreement (W-9322-78 [April 24, 1979]) with Fort Collins and WSSC, which provides up to 4,200 AF of reusable effluent for use by Platte River in exchange for 4,200 AF of Windy Gap. Platte River and Fort Collins are considering a transfer of some of the Windy Gap water provided to Fort Collins under the Reuse Agreement to the City of Fort Collins. If this transfer occurs, the Windy Gap water transferred to Fort Collins would still be used as it is currently used to meet the requirements of the Reuse Agreement.

[2] Platte River takes direct delivery of up to 950 AF of Windy Gap water via an existing 10-inch pipeline from Horsetooth Reservoir when water is available.

[3] Actual deliveries vary annually with the availability of Windy Gap water and opportunities for in-lieu borrowing of C-BT water.

Transbasin Water

Windy Gap

Windy Gap water is used as part of a Reuse Plan to meet Rawhide Unit 1's annual water requirements. Up to 4,200 AF of reusable effluent from the City of Fort Collins is delivered by the City for use at Rawhide under a Reuse Agreement with the City and WSSC. In return Platte River provides Fort Collins with an equivalent amount of Windy Gap water (Table M-1). The reusable effluent is delivered to the Hamilton Reservoir on-site at Rawhide via an existing 24-inch pipeline from Fort Collins' Drake Water Reclamation Facility. In addition, Platte River takes delivery of 950 AF of its Windy Gap water directly from Horsetooth Reservoir via an existing 10-inch pipeline when water is available (ERO 2004). Windy Gap water is taken as continuous flow throughout the year. The Water Reuse section provides more discussion of the Reuse Agreement.

Platte River owns 160 units of Windy Gap water. The delivery of 4,200 AF of Windy Gap water allows Platte River to meet its obligations under the Reuse Agreement, although in dry years or when no storage is available in the C-BT system for Windy Gap, insufficient Windy Gap water is available. In such years, the potential for exchanges under the Reuse Agreement and in-lieu borrowing of C-BT water is reduced. Platte River is requesting 13,000 AF of storage to firm 51.5 Windy Gap units for current use in power generation at Rawhide. Ultimately, Windy Gap water could also be used for future power generation at Rawhide or at other locations.

Direct Flow Rights

Platte River's Poudre River decrees have a junior water right and are only infrequently available during the spring runoff or in extremely wet years. Although the Poudre River decrees can provide an estimated 400 AF of water (non-firmed) in certain years, this water is not reliable.

Reservoir Storage

Treated sewage effluent received from Fort Collins is stored in Hamilton Reservoir for use in cooling at the Rawhide Energy Station. Platte River must treat the water prior to use to reduce phosphorus and adjust pH. Hamilton Reservoir provides a total of 16,308 AF of storage and no firm yield (Id.). Platte River is limited to a drawdown of approximately 2,450 AF on this reservoir. Any further drawdown causes problems with the circulating water pumps and with the cooling capacity of the reservoir. Platte River took this into account when sizing the 13,000 AF firming storage request.

Ditch Rights

Larimer County Canal No. 2 ditch rights provide a very limited backup water supply for Platte River needs and serves as an alternate source for well water used to irrigate Platte River's Headquarters Office Facility in Fort Collins. Larimer County Canal No. 2 usually yields around 5 AF of water each year (42.687 AF per share/0.1393 shares), but does not provide any firm yield.

Water Reuse

Platte River's water reuse program has two components: First, the majority of the water (4,200 AF) used for cooling is effluent supplied by Fort Collins under the Reuse Agreement. Second, Platte River continues to recycle and reuse this cooling water to extinction.

Under a Reuse Agreement, Fort Collins, WSSC, and Platte River use a series of exchanges in order to meet each entity's respective water needs. Windy Gap water is used to meet Platte River's exchange obligation under the Reuse Agreement. The Reuse Agreement with Fort Collins includes an exchange whereby, Platte River provides Fort Collins with 4,200 AF per year of Windy Gap water in exchange for 4,200 AF of reusable effluent from Fort Collins. In addition, Platte River retained the return flows from the 4,200 AF of Windy Gap (about 55-65%) provided to Fort Collins. If Platte River's Windy Gap water falls short in a given year due to drought or for any other reason, then Fort Collins contribution of reusable effluent and the Windy Gap return flows could be reduced if other satisfactory arrangements weren't made. The Reuse Agreement also calls for a series of exchanges between Fort Collins and WSSC for water released from Joe Wright Reservoir and Long Draw Reservoir to the Larimer County Canal and North Poudre Canal with accompanying credits for reusable water to Fort Collins. The City's use of the reusable water generates reusable effluent that is made available for Platte River's use.

In addition to the effluent received from the Drake Water Reclamation Facility, Platte River pumps 950 AF of Windy Gap water directly to the Rawhide site from the Soldier Canyon pump station at Horsetooth Reservoir. About 50 percent of this water goes to Hamilton Reservoir and is used for cooling and is recycled to extinction. The remainder of this 950 AF is used for plant service water and boiler water. This water is recycled and ultimately used to extinction.

Water Demands

Platte River's current operational water demand for the 270-megawatt Rawhide Unit 1 is about 4,520 AF per year. Rawhide Station includes a coal-fired facility, plus four gas-fired CT units to meet peak power needs and to provide backup and reserve power. Platte River's four owner Municipalities utilize most of the 270 megawatts of total Rawhide coal-fired capacity; the remainder is sold into the Western Power Grid.

Historical Water Use

Since the plant went into operation, it has used a relatively consistent amount of water in order to run at maximum efficiency. A total of about 4,200 AF of water is delivered to the Rawhide Energy Station annually. This includes 3,261 AF on average of effluent from the City of Fort Collins for use primarily for cooling and 950 AF of relatively cleaner water taken directly from Horsetooth Reservoir and used for boiler make-up water and potable water. Platte River has an additional need for 309 AF to meet well and ditch augmentation requirements and a long-term lease obligation with Larimer County. A total of about 4,200 AF of water is fully consumed each year (ERO 2004). Any surplus water available provides an operational reserve to meet fluctuations in water demand or if not required, the water is leased.

Future Water Demands

Future water demands will depend upon increased power requirements and related generating facility development to meet those electricity demands. Energy load projections for Platte River forecast a continued increase for demand for electric power within Platte River's owner Municipalities as these areas continue to grow. This will result in a need for additional power generation within the next 15 years. Platte River is currently evaluating options for this new generation. Water demands for Platte River's portion of the new power generation will be approximately the same proportion as that used for current coal-fired generation. A location for the future generation facility has not yet been determined. Platte River's Windy Gap water may be used to help meet the water requirements of such new generation. Future demand projections will be continually updated by Platte River to determine the timing of power generation needs and the associated water requirements. In sum, it is clear that in the future, Platte River's water needs will expand with its generation requirements, but given uncertainty about when, where, and how that generation will be provided, these future needs have not been quantified for the Windy Gap Firming Project.

It is important to note that these water requirements understate the net additional Platte River needs for water, given the uncertainty in annual water supplies. As described above in the Platte River water supply discussion, it is necessary to strategically plan for water supply needs each year, and the current approach is vulnerable to drought and other uncertainties. Existing supplies are not sufficiently reliable to ensure the continuous reliable operation of this capital-intensive plant, which is essential to the welfare of four northern Colorado cities served by Platte River. The firming of Windy Gap water supplies would assure the Rawhide's current water needs are fully met and that additional water is available for future requirements.

Conservation

Water conservation at Platte River's Rawhide site is essentially 100 percent because, through recycling, the plant water is used and reused again and again to extinction. Water recycling also occurs at the ash disposal ponds and at the phosphorus removal system. The Hamilton Reservoir Dam is regularly monitored to ensure that no unnecessary seepage occurs.

Platte River is considering additional water conservation at Rawhide, although all of these measures might not be technically feasible. First, if the generating facility were able to improve its heat rate, this would mean greater generation with less resource requirements, including water. Platte River is exploring this possibility but it is uncertain at this point if it is practical. Platte River employs a performance engineer to oversee and manage improvements in energy usage and heat rate, and thereby reduce water usage at the Rawhide site. Finally, Platte River might consider a hydro-cooling tower, a combination of wet-dry cooling, or more CT generation at the plant site. The feasibility of any of these options is highly uncertain.

Anticipated Water Need

Platte River's ability to meet its existing water demand is subject to the availability of Windy Gap water and the continued operation of the Reuse Agreement and the associated exchanges with Fort Collins and WSSC. Operation of the Rawhide Energy Station requires a reliable annual supply of water. Although current supplies can provide up to 5,150 AF when Windy Gap water is available, actual deliveries vary annually and there is no firm yield from existing water supplies.

Platte River needs to firm at least 5,150 AF of water to meet existing average demand of 4,520 AF, including an operational reserve of 630 AF for the Rawhide plant to continue operation if, in a given year, water supplies are less than expected or water demands are greater than expected. There are numerous scenarios (i.e., drought) under which there is no assurance that Platte River's water supplies will be sufficient or available when needed. Without the firming of the Windy Gap units, the ongoing operation of the Rawhide Energy Station is vulnerable to curtailed operation. As a utility providing power to four northern Colorado cities, Platte River asserts correctly that this vulnerability of a multi-million dollar generating facility on which citizens depend for their daily welfare is unacceptable.

In conclusion, the firming of Platte River's Windy Gap units is justified to meet current demands. Water to meet future generation needs offers further justification

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WATER SUPPLY AND DEMAND

TOWN OF SUPERIOR

The Town of Superior is located in southeast Boulder County and northern Jefferson County and is considered part of the greater Denver Metropolitan Area. Adjacent communities include Louisville, Broomfield, and the City of Boulder. The Town of Superior borders the Rocky Flats Environmental Technology Site and SH 128 to the south, Boulder City and County Open Space to the west and northwest, US 36 to the east and northeast, and the City and County of Broomfield and Jefferson County to the southeast.

The Town of Superior was founded in 1896 with an economy based on coal mining and farming (Town of Superior 2001). The Town remained small until the early 1990's when the Rock Creek Ranch residential development began construction. The Town has grown rapidly during the past decade, but as of 2004, population growth has tapered as the areas zoned for residential development approach buildout. Future water needs are expected to occur primarily from commercial and retail development and community parks (ERO 2004).

The following discussion provides a summary of Superior's water supply and demand.

Water Supply

Currently, the Town of Superior relies primarily on C-BT water, Windy Gap water when available, and local ditch water to meet its municipal and commercial water requirements (Table N-1).

Transbasin Water

Colorado-Big Thompson Project

The Town of Superior owns 2,080 units of C-BT water, which is delivered via the Southern Water Supply Pipeline (SWSP) from Carter Lake. C-BT water is delivered to the 400 AF Terminal Reservoir prior to treatment and delivery in the Town's distribution system. Superior's share of the capacity in the SWSP is 6.0 cfs.

Annual deliveries of C-BT Project water vary from year to year depending on available water supplies, the needs of shareholders, and the annual quota established by the NCWCD Board of Directors. Historically, C-BT quotas have ranged between 0.5 and 1.0 AF per unit. However, quotas are adjusted to actually deliver more water in dry years. This is the opposite situation from most water rights in Colorado, because the C-BT Project was designed to provide supplemental water in dry years when native water supplies yield less water. Historically, the C-BT Project has delivered 1 AF in dry years and as little as 0.5 AF in wet years or in extremely dry years, such as the drought of 2002-2004 when the C-BT Project was limited by the physical supply of water that it could actually deliver. Superior, like most municipalities, has not assembled a water portfolio that would deliver a full supply of water in extreme drought years for economic reasons. Based on analysis of hydrology and C-BT operations through historical drought periods from 1950 to present, NCWCD has determined that the firm yield of the C-BT project is 0.6 AF per unit.

Table N-1. Inventory of Superior Water Supplies.

		Firm Annual Yield (AF)
Transbasin Sources		
C-BT Project	2,080 units	1,248[1]
Windy Gap Project[2]	22 units	0
Reservoir Storage		
Terminal Reservoir	400 AF	0
Marshall Lake	385 AF	0
Ditch Shares		
FRICO Ditch	54.47 units	202
South Boulder and Coal Creek Ditch	1 units	37
Goodhue Ditch	15 units	0
Ground Water		
Laramie-Fox Hill Aquifer	N.A.	57
Total[3]		**1,544**

[1] C-BT yield is variable from year to year. C-BT's long-term firm yield is assumed to be 0.6 AF/unit for purposes of this analysis.

[2] When available, a portion of Windy Gap Project yield is also reused for irrigation purposes. The reuse component is not included in this table.

[3] The firm yield for purposes of this analysis is 1,544 AF; however, Superior has maintained a sufficient water portfolio to meet all current demands. It uses increased quotas from is C-BT units in dry years and Windy Gap yields in wet years when C-BT quotas are lower. It also operates pursuant to the Integrated Operating Criteria, which allows Superior to collateralize Windy Gap water with C-BT water. In doing so, it has significant reuse water available for irrigation purposes. The Windy Gap Firming Project is essential to meet future demands. Upon completion of the Project, Superior will be able to use its C-BT units to meet future demands, rather than using them as collateral for Windy Gap units.

Windy Gap Project

Windy Gap Project water provides an additional source of transbasin water. The Town of Superior currently owns 22 units of Windy Gap water, but is in the process of selling 7 units to the City of Erie. Windy Gap water is delivered to Superior through the SWSP—the same as C-BT water. Windy Gap has not provided a firm supply of water on which Superior can rely to meet its water requirements without in lieu borrowing of C-BT water. Windy Gap deliveries have ranged from about 70 to 2,200 AF per year.

Ditch Shares

Superior owns 54.47 shares in the Farmer's Reservoir and Ditch Company (FRICO), one share in the South Boulder and Coal Creek Ditch Company and 15 shares in the Goodhue Ditch Company. Superior's share of FRICO water is delivered through the Community Ditch. These ditch shares are used solely as a non-potable water supply for irrigation of parks and open space except 7.96 FRICO shares and its one share in the

South Boulder and Coal Creek Ditch Company, which have been adjudicated for municipal use in addition to irrigation. The yield of the FRICO shares was adjudicated to provide 3.71 AF per share. The South Boulder and Coal Creek Ditch share was adjudicated to provide 37.5 AF per year. The shares yield more water in wet years.

Ground Water

Superior also owns water rights in the non-tributary Laramie-Fox Hills Aquifer underlying the Town. The yield from these wells has averaged 56.6 AF per year.

Reservoir Storage

Superior's only potable water storage facility is at Terminal Reservoir, which is used to store Windy Gap and C-BT water prior to treatment. By virtue of its ownership of FRICO shares, Superior also has a pro rata share of storage in Marshall Lake, which can be used to store ditch water for future use. FRICO water is also temporarily stored in several small ponds throughout Superior for use in irrigation.

Water Reuse and Irrigation

Currently, Superior has an extensive reuse and raw water irrigation program that allows for the reuse of about 32 percent of its Windy Gap water when it's available and when Superior provides C-BT water as collateral. Superior is currently not able to store effluent during the winter due to lack of storage space, so all available effluent is used during the summer. Reuse water and Superior's ditch shares are used to irrigate the Town's parks and greenways. When the Windy Gap water is firmed, Superior will no longer need to use its C-BT water to collateralize its Windy Gap units. Those C-BT units will be used to meet future demands.

Water Demands

Superior was historically a small community until development began in earnest in the 1990s. Surrounding the original town of small homes is a rapidly growing bedroom community for Boulder and other Front Range cities. The total planning area including the existing town limits and potential annexation areas is 2,736 acres or about 4.3 square miles (Town of Superior 2001).

Historical Water Demands

As of 2004, the Town of Superior's population was estimated at 11,000 (ERO 2004). Table N-2 provides historical population trends and the total number of water taps for the Town of Superior for those years in which such information is available.

As population growth commenced in the early 1990s, average annual growth became extraordinary, with an average population increase of 33 percent from 1990 through 2004. The town's population tripled in 1993. Since 2000, the average annual population growth has slowed in relative terms but still exceeds 5 percent on an annual basis. The growth in the number of water taps also slowed after the year 2000, but still grew more than 20 percent between the year 2000 and 2003.

Table N-2. Population and Water Taps for the Town of Superior, 1990 to 2004.

		Total Number of Water Taps
1990	250	N.A.
1991	308	N.A.
1992	313	N.A.
1993	1,180	N.A.
1994	1,960	N.A.
1995	2,300	N.A.
1996	3,689	N.A.
1997	5,417	N.A.
1998	6,332	N.A.
1999	7,870	N.A.
2000	9,011	2,800
2001	9,863	3,202
2002	9,963	3,408
2003	10,212	3,468
2004	11,000	N.A.

Source: DOLA 2004; Vranesh and Raisch 2004.

Potable Water Demands

Superior does not serve any other communities with water nor does it receive water from other communities. Table N-3 indicates total water consumption and production from Superior's water treatment plant, from 1995 through the year 2003.

Table N-3. Potable Water Deliveries and Treatment Plant Production for the Town of Superior, 1995 to 2003.

	MG	
1995	138	140
1996	209	214
1997	239	243
1998	344	351
1999	366	373
2000	430	439
2001	448	457
2002	466	475
2003	480	490

Source: Vranesh and Raisch 2004a.

Superior's total water deliveries more than tripled between 1995 and 2003, reaching a peak of 480 MG in 2003. Superior has a 2 percent system loss, on average, from the treatment plant outflow to the end-user (ERO 2004). Average annual growth in water deliveries was 33.5 percent from 1995 through 2003. A breakdown of water use by type of user was not available for Superior. The Town of Superior does not serve any large industrial customers as of 2004.

Table N-4 presents average gpcd and gallons per tap per day for the Town of Superior from 1995 through 2003.

Table N-4. Potable Water Use per Capita and per Tap for the Town of Superior.

		Gallons per Tap per Day
1995	164	N.A.
1996	156	N.A.
1997	121	N.A.
1998	149	N.A.
1999	127	N.A.
2000	131	421
2001	125	384
2002	128	374
2003	120	379

Source: DOLA 2004; Vranesh and Raisch 2004, 2004a.

From 1995 to 2003, Superior's total gpcd averaged 135. From the year 2000 through 2003 Superior's gallons per tap per day averaged 390.

Non Potable Demands

Non-potable waters, primarily re-use water supplies, are used extensively within the Town of Superior. Non-potable water is used for parks and common green areas for multi-family projects and certain commercial activities. The re-use water is supplemented by ditch water in the summer months. Non-potable demands increased from 130 MG, or 400 AF in 1996 to about 228 MG, or about 700 AF by the year 2003 (Town of Superior 2004).

Total Water Requirements

Table N-5 presents total water requirements from potable and non-potable customers for the Town of Superior from 1995 through 2003.

Table N-5. Total Water Requirements for the Town of Superior, 1995 through 2003.

					Total Water Requirements[1]
				AF	
1995	138	N.A.	138	424	446
1996	209	130	340	1,043	1,098
1997	239	111	349	1,071	1,127
1998	344	226	570	1,749	1,841
1999	366	182	548	1,682	1,770
2000	430	300	730	2,240	2,358
2001	448	228	676	2,075	2,184
2002	466	226	692	2,124	2,235
2003	480	225	705	2,163	2,277

[1] Including system losses.

Source: Vranesh and Raisch 2004a; Town of Superior 2004; ERO 2004.

Water deliveries are adjusted to total water requirements by accounting for a distribution loss of 2 percent and losses from the point of diversion to the treatment plant of an estimated 3 percent (ERO 2004). Total water requirements have increased from 1,127 AF in 1997 to 2,277 AF in 2003, an increase of 1,150 AF. The considerable increases in annual water requirements for the Town of Superior have slowed in recent years as population growth tapers off.

Projected Potable Water Requirements

The Town of Superior develops its own water demand projections, which are driven by increases in the number of dwelling units by type and projections of office and retail space for the town. To each of these projections, the Town of Superior applies a water usage rate to arrive at total water use by type of user. These totals are then aggregated to get annual projections (ERO 2004).

Population projections and buildout assumptions drive the water demand projections. The Town of Superior assumes that buildout will occur in the year 2014, when the population of the town reaches 15,400 persons. Compared with the 2004 population estimate of 11,000, the Town is expected to experience an average annual growth of 3.4 percent. This figure is very much reduced from historical population growth for the community, but more in-line with regional growth. The study team believes these population projections are reasonable as long as future development is constrained by the Town of Superior's boundaries and its land use plans and policies. If those should change, these projections could be low.

Office and retail growth is projected by the Town of Superior on the basis of population and expectations about future developments within the community. These projections are determined in large part on near term plans of developers and are considered reasonable for water demand forecasting in this instance.

The water use factors for single family, multifamily, office and retail uses are based on actual consumption experience of customers within the Town during 2002. This represents a reasonable basis for deriving such water factor assumptions and the study team adopts these use factors for the Town of Superior projections. Table N-6 depicts the Town of Superior's projected water use by type of user through the year 2014.

Table N-6. Projected Annual Change in Town of Superior Water Deliveries by Type of User, 2004 through 2014.

	AF				
2004	17	3	0	3	1,500
2005	25	5	1	11	1,523
2006	25	4	1	2	1,565
2007	25	13	2	5	1,642
2008	25	11	2	5	1,685
2009	0	7	2	4	1,697
2010	0	0	2	1	1,701
2011	0	0	2	2	1,706
2012	0	0	2	1	1,708
2013	0	0	2	0	1,710
2014	0	0	1	0	1,711

Source: Vranesh and Raisch 2004b.

Potable water deliveries are expected to increase by 211 AF from 2004 through 2014. Total potable water usage is projected to exceed 1,700 AF by the year 2014. This level of increase is considered by the study team to be reasonable, if not low. If average gpcd were applied to buildout population projections, future potable demand would exceed 2,300 AF.

Projected Non-Potable Demands

The Town of Superior plans on maximizing the use of non-potable water for outdoor uses in the future. This would include new public water uses and green spaces for multifamily, office or retail customers. Superior has a goal of using 100 percent of its reusable water. Irrigation of future parks is expected to rely upon reusable water. Total increases in non-potable use call for a doubling from 2004 level, or from 700 AF, to 1,400 AF at buildout (ERO 2004).

Total Projected Water Requirements

Table N-7 presents total projected water requirements for the Town of Superior through the buildout year 2014. Total water requirements are projected to increase from 2,340 AF in 2004 to 3,275 AF in 2014.

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