City of Cheyenne
Board of Public Utilities

Volume 2 – Future Capacity Requirements

2013 Cheyenne Water and Wastewater Master Plans

Final

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City of Cheyenne

Board of Public Utilities

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Abbreviations and Acronyms

AC-FT	Acre-feet
AC	Acre
ADD	Average Day Demand
ADF	Average Daily Flow
BNSF	Burlington Northern and Santa Fe
BOPU	Board of Public Utilities
BSF	Base Sanitary Flow
CBP	Cheyenne Business Parkway
CCWRF	Crow Creek Water Reclamation Facility
CFU	Colony Forming Units
CIP	Capital Improvement Plan
City	City of Cheyenne
DCWRF	Dry Creek Water Reclamation Facility
DEM	Digital Elevation Model
EPA	Environmental Protection Agency
EPS	Economic & Planning Systems, Inc.
ET	Evapotranspiration
FEMA	Federal Emergency Management Agency
gal	Gallon
gpcd	Gallons per Capita per Day
GIS	Geographic Information System
gpm	Gallons per Minute
HGL	Hydraulic Grade Line
I/I	Infiltration and Inflow
IGA	Intergovernmental Agreement
Cheyenne LEADS	Cheyenne-Laramie County Corporation for Economic Development

Master Plans	2013 Cheyenne Water and Wastewater Master Plans
MDD	Maximum Day Demand
MDF	Maximum Day Flow
MG	Million Gallons
mgd	Million Gallons per Day
MMD	Maximum Month Demand
MMF	Maximum Month Flow
MPO	Metropolitan Planning Organization
NCAR	National Center for Atmospheric Research
NRBP	North Range Business Park
PL	Public Law
PLSS	Public Land Survey Systems
PHD	Peak Hour Demand
PHF	Peak Hour Flow
PWD	Peak Week Demand
PUD	Planned Unit Development
RDII	Rainfall-dependent Infiltration and Inflow
SCWSD	South Cheyenne Water & Sewer District
SEO	State Engineers Office
SQ. FT.	Square Feet
SWSS	Surface Water Supply System
TAZ	Transportation Analysis Zones
TMDL	Total Maximum Daily Load
UFW	Unaccounted-for Water
UP	Union Pacific
Volume 2	Volume 2 – Future Capacity Requirements
Volume 3	Volume 3 – Source Water Supply and Delivery
Volume 4	Volume 4 – Potable Water Treatment

Volume 5	Volume 5 – Potable Water Storage and Distribution
Volume 6	Volume 6 – Non-Potable Water Treatment and Distribution
Volume 7	Volume 7 – Wastewater Collection
Volume 8	Volume 8 – Wastewater Treatment
Volume 9	Volume 9 – Financial Plan and Cost of Service Allocation
Volume 10	Volume 10 – Information Technology Master Plan
Warren AFB	F.E. Warren Air Force Base
WDEQ	Wyoming Department of Environmental Quality
WRF	Water Reclamation Facility
WTP	Water Treatment Plant
WWDC	Wyoming Water Development Commission
yr	Year

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2.1 Introduction

This Volume establishes the future system capacity requirements for the Board of Public Utilities (BOPU) operations in the Study Area. This planning investigation examines the physical characteristics of the Study Area, population densities and potential growth, and existing land use and future zoning that will dictate utility service requirements in the future. To evaluate future capacity requirements, population and land use projections over a 50-year planning period are used to establish the magnitude and areas of future water demands and wastewater flows within the BOPU study area. Establishing appropriate water and wastewater service areas and identifying factors that affect growth and development provide a basis for projecting future populations and capacity requirements. Ten (10-), 20-, and 50-year intervals for the overall planning period are the basis for the Cheyenne 2013 Water and Wastewater Master Plans (Master Plans).

Evaluating future facility and distribution/collection system requirements is dependent on many considerations including, but not limited to, the following:

- Service area extents and topography,
- Population growth and density,
- Visiting population and employment impact,
- Land use and zoning,
- Magnitude and type of commercial and industrial activity in the area to be served,
- Potential development and timing, and,
- Condition of the existing systems.

These considerations are addressed herein and used for developing the future capacity requirements for BOPU's systems including:

- Source water supply and conveyance (Volume 3)
- Potable water treatment and distribution (Volumes 4 and 5)
- Raw water irrigation supply and conveyance (Volume 6)
- Class A recycled water treatment and distribution (Volume 6)
- Class B reuse water use (Volume 6)
- Wastewater collection and treatment (Volumes 7 and 8)

Demand projections are established for the potable water and raw water irrigation systems. Flow projections are established for the wastewater system. Demand projections are established for the recycled and reuse water based on available effluent from the water reclamation facilities (WRFs). Comparisons of existing capacity capabilities versus future capacity requirements for each system are provided as a basis for evaluation in the subsequent Volumes of this report.

The source water supply and conveyance capacities required for the planning period including surface water and groundwater supplies is evaluated in detail in Volume 3 – Water Supply and Delivery (Volume 3). The potable water treatment capacity and related analyses are presented in Volume 4 – Water Treatment (Volume 4). The potable water distribution capacity and storage evaluations are presented in Volume 5 – Water Storage and Distribution (Volume 5). The non-potable water supply, treatment, storage and distribution capacity evaluation including for raw water irrigation, Class A recycled water, and Class B reuse water are presented in Volume 6 – Non-Potable Water Treatment and Distribution (Volume 6). The wastewater collection system capacity and lift station requirements are evaluated in Volume 7 – Wastewater Collection (Volume 7). The capacity of wastewater treatment facilities and related analyses are presented in Volume 8 – Wastewater Treatment (Volume 8). Volume 9 – Financial Plan and Cost of Service Allocation (Volume 9) addresses the financial aspects of implementing the recommendations found in the preceding Volumes. Volume 10 – Information Technology Master Plan outlines the improvements recommended to help support the planning, design, operations, and maintenance functions of BOPU utility and administration systems.

2.2 Service Area Boundary Evaluation

The Study Area boundary is developed to establish the limits of the area considered in the Master Plans for the 50-year planning period. The Study Area contains the water (potable water, raw water irrigation, and recycled water) and wastewater service areas. Potable water and wastewater service boundaries are reviewed and expanded for near-term service opportunities based on potential development in the area surrounding Cheyenne and in Laramie County. A summary of the Study Area is provided as the background for determining future capacity requirements.

2.2.1 Study Area

The Study Area boundary includes the 201 Study Area Boundary, plus the Laramie County Archer Complex area to the east and an area extended to the south to the Wyoming and Colorado border to be consistent with the PlanCheyenne planning area (refer to Section 2.3.1) which is used as the basis for population projections. Figure 2-1 shows the Study Area boundary which encompasses approximately 136,000 acres of land.

The area surrounding the City of Cheyenne (City) is used as the basis for defining the Study Area. The Study Area mainly applies to the City limits; the surrounding communities of F.E. Warren Air Force Basin (Warren AFB), South Cheyenne, Fox Farm-College, the Archer Complex, single family ranchettes to the North, and areas within Laramie County in between these communities.

Existing and future utilities within the Study Area boundaries are considered in establishing the future capacity requirements, completing the facility evaluations, and developing recommendations for improving the water and wastewater systems. It is noted that elements of the raw water supply system and the water treatment facilities are located outside of the Study Area boundary. The raw water irrigation distribution, potable water distribution, wastewater collection, and recycled water distribution systems as well as the water reclamation facilities are all within the Study Area boundary.

2.2.2 Potable Water Service Boundary

Average potable water demand is typically estimated based on the total population served and the size and land uses within the area to be served. Maximum daily demands used to establish the design treatment capacity and distribution system requirements are typically based on peaking factors. Within the Study Area, the Potable Water Service Boundary establishes the areas currently being served or that could be served in the near-term, mid-term, and long-term by the potable water distribution system. The Wyoming State Engineers Office (SEO) designates the Potable Water Service Boundary as the “Beneficial Use Boundary” within which BOPU can provide service based on its water rights. The Potable Water Service Boundary generally is outlined by Public Land Survey System (PLSS) Sections with some half and quarter

Sections on the southeast of Cheyenne. Figure 2-2 shows the established Potable Water Service Boundary which covers approximately 70,300 acres.

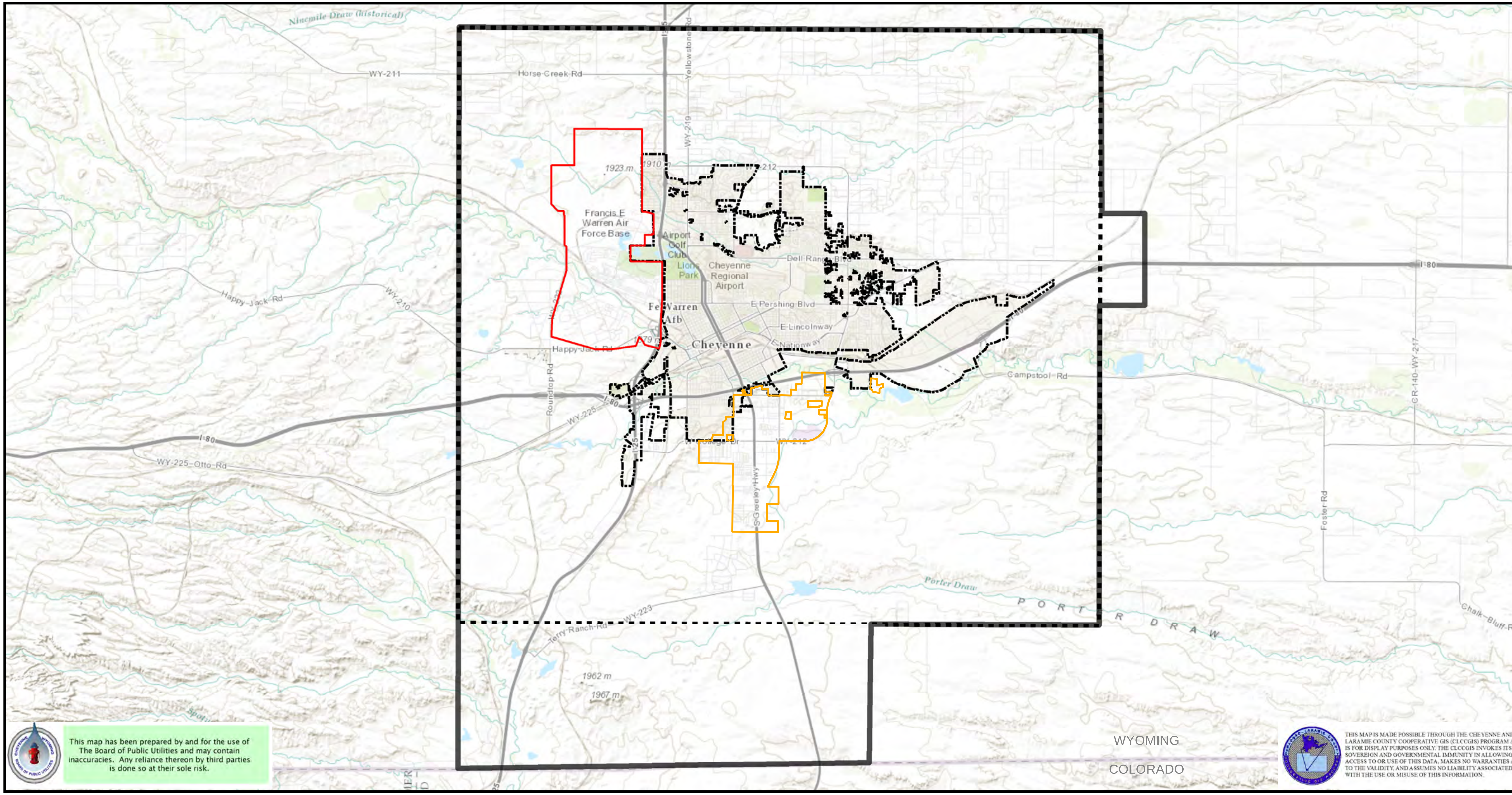
Figure 2-2 shows what is commonly referred to as the “blue line boundary”, which is the area that can be served by gravity flow at a minimum static pressure of 60 psi. The blue line is based on the hydraulic grade line (HGL) of the normal water operating level of 6,357 ft at the Roundtop storage tank. The HGL establishes a serviceable elevation of 6,218 ft at a minimum static pressure of 60 psi. Areas that are outside of the blue line boundary need to be served by pump stations.

The developed areas without BOPU water service are supplied by groundwater wells. To provide water service from the distribution system to the area north and northwest of Cheyenne, known as the “Ranchettes” area, will require new pump stations since the area is generally at elevations with inadequate service pressures provided by gravity from the existing pressure zones. A portion of the undeveloped area to the south and southeast of Cheyenne could be served without pump stations. However, a portion of the remaining area to the south and southeast, including the Swan Ranch development, will require pump stations to supply water based on the maximum gravity HGL elevation of 6,218 ft. These service considerations are detailed in Volume 5. Since expansion of the Potable Water Service Boundary is possible using pump stations, the entire Study Area is used as the basis for developing the water system demand projections.

The raw water irrigation and recycled water distribution systems are considered to be included within the Potable Water Service Boundary area. Only small portions are currently served by these systems with limited expansion planned in the near-term. Either system could be expanded to serve additional portions of the Potable Water Service Boundary area. The expansion of the raw water irrigation and recycled water systems is evaluated in Volume 6.

2.2.3 Wastewater Service Boundary

Wastewater flow is determined by the population served and the size and the land use of the area to be served. Base wastewater flows are adjusted using peaking and infiltration and inflow (I/I) factors to establish design criteria for treatment capacity and collection systems. Within the Study Area, the Wastewater Service Boundary establishes the area currently being served by the wastewater collection system as well as the area within the sewerable boundary line, which is described below. Figure 2-3 shows the established Wastewater Service Boundary which covers approximately 45,650 acres. The Wastewater Service Boundary is smaller than the Potable Water Service Boundary since the wastewater service is more limited by topography due to gravity flow limitations.



Legend

- 2013 Master Plans Study Area
- 201 Study Area Boundary
- City of Cheyenne
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District

1 inch = 2.76 miles

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Figure 2-1
Study Area

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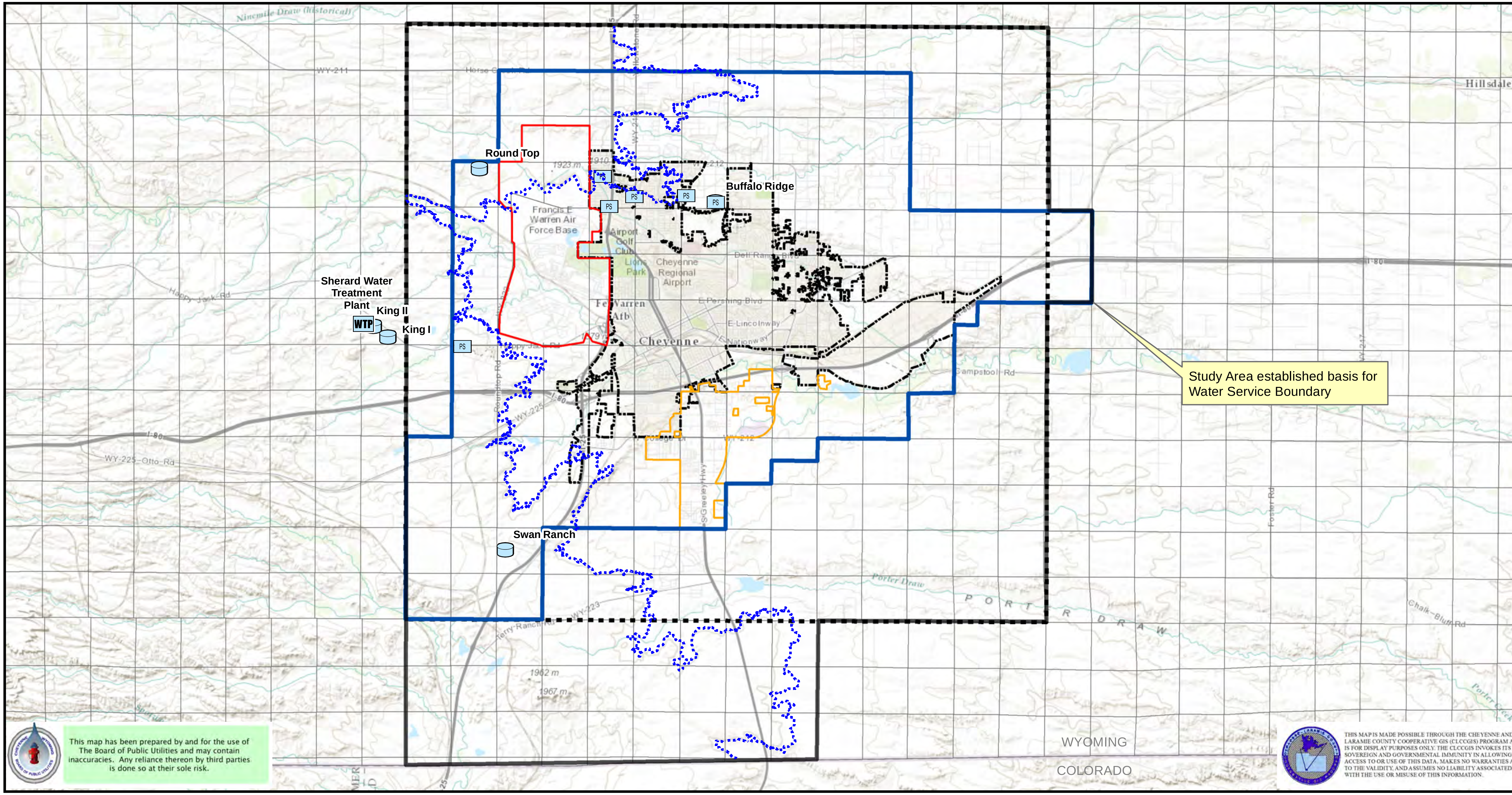
2013 Water and Wastewater Master Plans



Legend

- 2013 Master Plans Study Area
- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- Blue Line
- Water Treatment Plant
- Storage Tank
- Pump Station
- PLSS Sections

Figure 2-2
Potable Water Service Area

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2013 Water and Wastewater Master Plans

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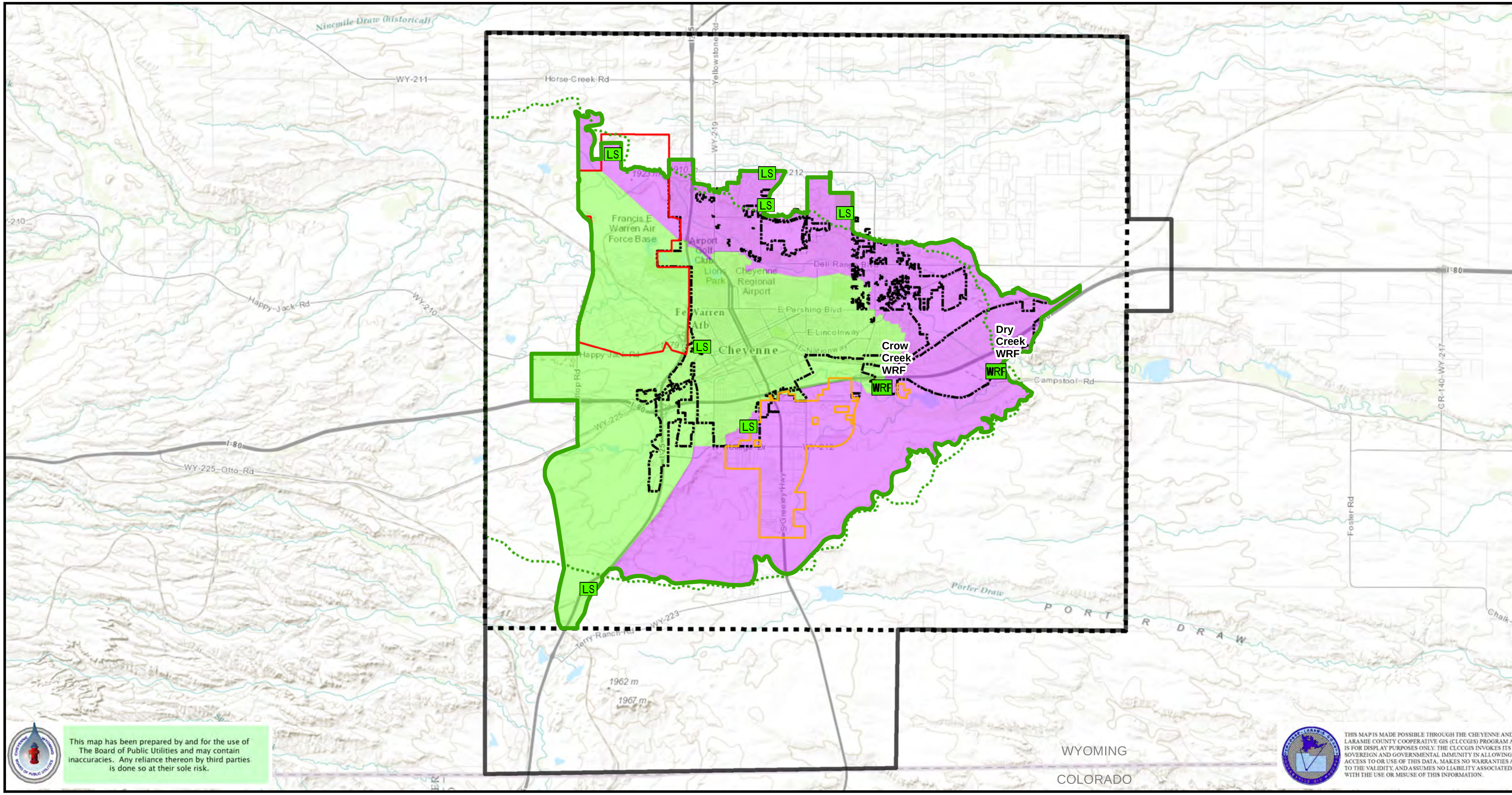

1 inch = 2.76 miles

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Legend

- 2013 Master Plans Study Area
- 201 Study Area Boundary
- City of Cheyenne
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- Wastewater Service Area Boundary
- Sewerable Boundary (Green Line)
- WRF Water Reclamation Plant
- LS Lift Station

Existing WRF Basins

- Crow Creek Basin
- Dry Creek Basin

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Figure 2-3
Wastewater Service Boundary

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As part of a 201 Facility Plan, the City, County, South Cheyenne Water and Sanitation District (SCWSD), and BOPU signed an Intergovernmental Agreement (IGA) on April 25, 1983, to identify areas of responsibility and influence for the various parties. With respect to growth and the provision of proper wastewater treatment and disposal facilities, this IGA defined the following concepts:

- A 201 Wastewater Study Area Boundary. The term "201" refers to that section of Public Law (PL) 92-500 that set forth the United States Environmental Protection Agency (EPA) planning, public participation, and environmental assessment requirements that must be met to participate in EPA's construction grants program. The 201 Study Area established in 1983 is shown on Figure 2-1. This same area has also been defined by Laramie County as the Zoned Boundary for which zoning has been established.
- A sewerable boundary line that encompassed the land that could flow by gravity into either the Crow Creek Water Reclamation Facility (CCWRF) or Dry Creek Water Reclamation Facility (DCWRF). In the IGA, the sewerable boundary is identified as the Wastewater Service Boundary for BOPU. The sewerable boundary or green line is shown on Figure 2-3. The Wastewater Service Boundary line shown on Figure 2-3 is slightly different from the sewerable boundary that was defined in 1983 since it reflects those developments that have connected to BOPU's collection system over the last 30 years through lift stations and connections to the sewer system, some of which are not in the original Wastewater Service Boundary. A portion of these areas added to the original Wastewater Service Boundary are annexations.

The intent of the IGA is to protect groundwater resources from nutrient loading and bacterial contamination caused by high densities of septic systems. It accomplishes this by identifying properties within and adjacent to the sewerable boundary that could be part of the City's urban service area and could connect to BOPU's wastewater collection system. Outside of the sewerable boundary and the potential annexation areas, the City and County share land use responsibility within one mile of the City limits. Properties outside the city limits can have their wastewater handled in the following ways:

- Connect to the BOPU system through an Outside Users Agreement.
- Connect to the SCWSD only with approval of the SCWSD, BOPU, and the City of Cheyenne. Install individual sewage disposal systems, also known as septic systems, or other means (i.e., lagoons) for wastewater management.

These options require coordination with these entities: City, BOPU, Laramie County, SCWSD, Laramie County Environmental Health, and Wyoming Department of Environmental Quality (WDEQ).

The Wastewater Service Boundary was originally developed based on the topographic limits of Crow Creek and Dry Creek basins gravity flow to the Water Reclamation Facilities (WRFs).

Since then, there have been advancements in the reliability and effectiveness of lift stations for wastewater collection service, and as a result there are areas outside the original sewerable boundary that have been added to the Wastewater Service Boundary. In addition, if a new development outside the Wastewater Service Boundary provides a lift station to serve an area outside the basins, then BOPU could consider extending the Wastewater Service Boundary to the development. Since expansion of the Wastewater Service Boundary using lift stations is a possibility, the entire Study Area is used as the basis for developing wastewater flow projections.

Wastewater Service Basins

Cheyenne's Wastewater Service Boundary is comprised of two separate service basins; one for the CCWRF and one for the DCWRF. Table 2-1 summarizes the service basin areas and average daily flow from 2010. Figure 2-3 shows the collection system service basins served by the two WRFs.

Table 2-1
Existing Wastewater Service Basins

Service Basin	Total Area (acres)	Average Daily Flow (2010), mgd
CCWRF	21,430	3.31
DCWRF	24,220	6.43
Total	45,650	9.74

2.3 Study Area Background

The Study Area is located within Laramie County in the State of Wyoming and is positioned in the southeast corner of the state. The City of Cheyenne is the northernmost of the Front Range cities. At the intersection of Interstate 25 and Interstate 80, the City allows convenient access for commuters to employment opportunities and attracts visitors to the area for events such as the Cheyenne Frontier Days.

The City is bordered by the “Ranchettes” area to the north, Warren AFB to the west, urban development to the south in the SCWSD service area, and agricultural lands to the south and east. The majority of the developable land in the Study Area lies to the south and east of current City limits. SCWSD is a consecutive water and sewer district which BOPU provides potable water to and collects wastewater from. SCWSD maintains their own distribution and collection systems within their boundaries.

2.3.1 PlanCheyenne Summary

PlanCheyenne is a regional planning effort within the Cheyenne area organized by the Cheyenne MPO. PlanCheyenne was inaugurated in 2006. In 2011, an update to the 2006 report was initiated for documenting current demographic and economic trends and accumulated data since 2006. The update provides a comprehensive representation of the community and outlines a vision for continued development. The update has yet to be completed put portions are available for use. The second edition of PlanCheyenne will set the precedent for future updates to develop a living document for the Cheyenne area.

A portion of PlanCheyenne that has been recently completed is entitled SnapshotCheyenne[1], and captures the overall existing and future look at the Cheyenne area. Information on population, land use, economy, housing, water utilities, schools, transportation, parks and recreation, historic preservation, and public safety can be found in SnapshotCheyenne (refer to Appendix 2-A). The Master Plans use relevant PlanCheyenne information (as of the 2012 update) as a basis for developing planning level assessments and recommendations for improvements to the water and wastewater systems. Subsequent updates to PlanCheyenne documents are not included in these Master Plans.

2.3.2 Physical Characterization

The physical characteristics of the area to be served, such as topography, geology, and geographical location greatly influence the type of land use and in turn the population density as well as commercial and industrial activity within the area. Figure 2-4 depicts many of the Study Area’s physical characteristics discussed in the following sections.

[1] SnapshotCheyenne, PlanCheyenne, March 2012. (Appendix 2-A)

Geology and Soils

The geology of the Study Area is comprised of silty and sandy substrates; specifically quaternary sandy gravel and loamy colluvium, tertiary deposits of light colored claystone, sandstone and conglomerate, underlain by claystones and sandstones of the tertiary Arikaree and Ogallala formations. The Study Area is classified as moderate relief rangeland, meaning irregular plains with moderate slope, intermittent streams, and a few large perennial streams in the higher relief areas. The geology of the Study Area is comprised mainly of alluvium sediments consisting of sand, silt, clay, gravel, and alluvial fan materials. These materials may be found in the level to gently rolling terrain that exists across much of the Study Area.[2]

Surface Water and Topography

The Study Area is located in the South Platte River Basin. Currently, surface water is imported to the City from Douglas Creek Basin (tributary to the North Platte River), located in the Snowy Mountain Range west of Laramie. Imported (non-native) flows from Douglas Creek are collected along with natural runoff from the Crow Creek Basin west of the City in the Granite and Crystal Reservoirs. Pipelines bring the surface water from Crystal Reservoir to Sherard WTP and other users.

The Study Area contains two major drainage basins, Crow Creek and Dry Creek. These two basins establish the basin service areas for the two WRFs. Upstream of CCWRF are the subbasins consisting of Crow Creek, Clear Creek, Corlett Creek, Spring Creek, Hazard Creek, Diamond Creek, and their tributary areas. Upstream of the DCWRF are subbasins including Dry Creek, Western Hills Draw, Alison Draw, and their tributary areas.

Downstream of CCWRF and upstream of DCWRF, Alison Draw drains into Crow Creek. Dry Creek drains into Crow Creek near the DCWRF. Crow Creek continues downstream of the DCWRF. Figure 2-4 shows the locations of these tributary creeks to the Crow Creek and Dry Creek service basins.

WDEQ is currently evaluating Crow Creek between the west City limit and Morrie Avenue for a total maximum daily load (TMDL) development program for sediment and E. coli. A TMDL has just been issued for selenium in Crow Creek which may affect treatment and operations at the CCWRF.[3] Volume 8 provides more information on this TMDL and its affects at CCWRF.

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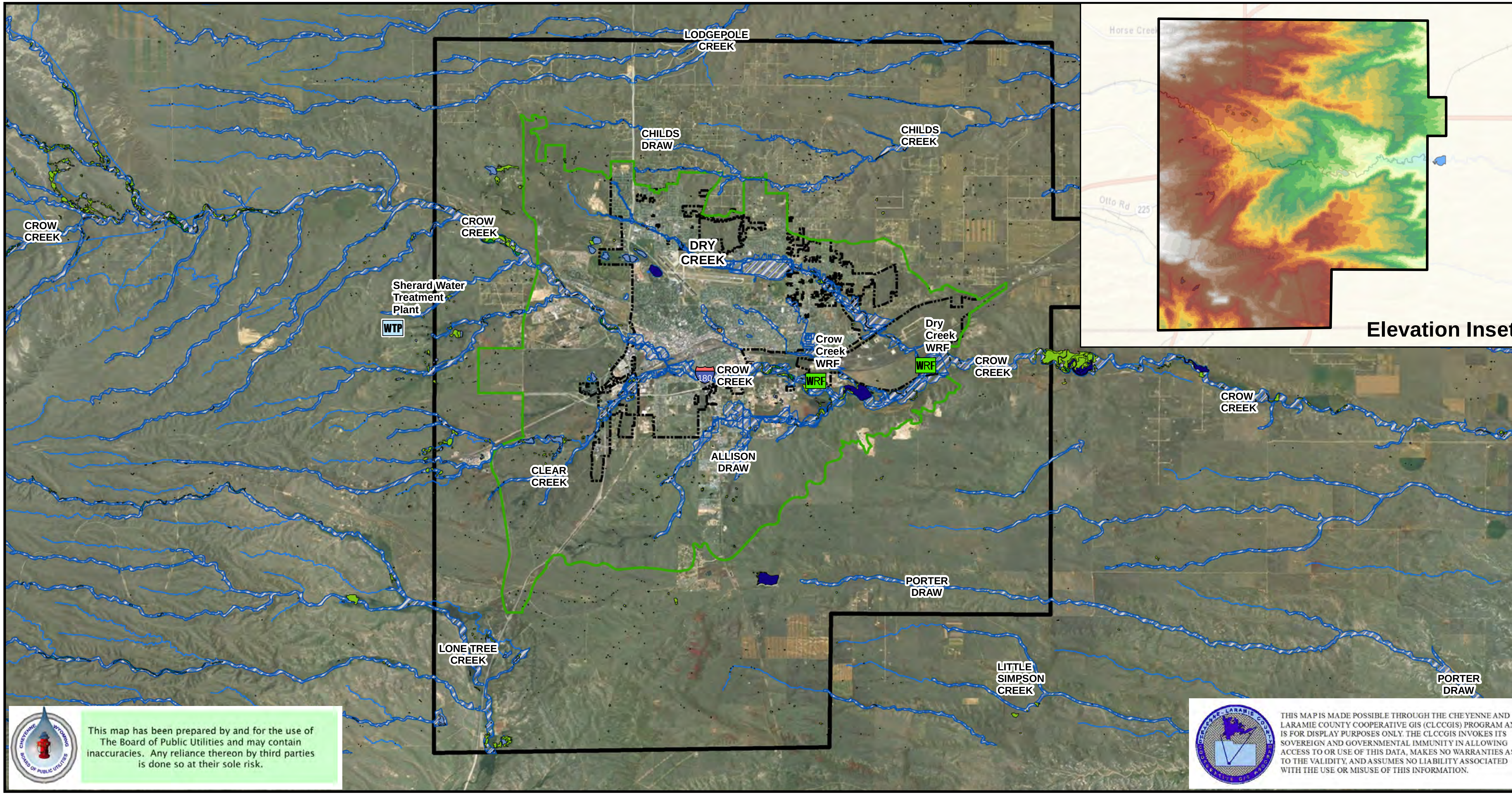
[2] Ecoregions of Wyoming, EPA, http://www.epa.gov/wed/pages/ecoregions/wy_eco.htm, accessed 5/24/13.

[3] SnapshotCheyenne, PlanCheyenne, March 2012, Page 2-11. (Appendix 2-A)



Legend

- 2013 Water and Wastewater Master Plans Study Area
- City_Limits
- Creeks
- 100-year Floodplain (Approx.)

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

1 inch = 2.87 miles

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Figure 2-4
Study Area Characteristics

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Groundwater

In many ways, Wyoming's Platte River Basin presents one of the most complicated groundwater regions in Wyoming for a variety of political, geologic, and hydrogeologic reasons. [4] Where groundwater is available near the surface in the Study Area along Crow Creek, Dry Creek, and their tributaries, the depth is approximately between thirty and forty feet. Other groundwater in the region is located in deep aquifers which BOPU and other stakeholders draw from for municipal and agricultural water supply. BOPU owes and operates four wellfields (Borie, Happy Jack, Bell and Federal) located west of the City.

Water Supply

BOPU owns and operates the source water supply and delivery system. The source water supply from the imported Douglas Creek Basin and Crow Creek Basin runoff is used mainly for potable water supply and secondarily for raw water irrigation supply. Volume 3 presents detailed analysis of the water supply and delivery system and recommendations for improvements.

Floodplain

Federal Emergency Management Agency (FEMA) floodplain maps provide the extents of the 100-year floodplain along Crow Creek, Dry Creek, Allison Draw, Clear Creek, and Lake Minnehaha. The 100-year floodplain extents are depicted on Figure 2-4.

The floodplain maps indicate a 100-year flood elevation of approximately 5,964 ft and 5,895 ft near the CCWRF and DCWRF, respectively. The lowest existing ground elevation at CCWRF is approximately 5,965 ft along the south end of the plant near the outlet to Crow Creek. This elevation appears to be only one foot higher than the 100-year flood elevation. The northeast corner of the DCWRF appears to be located inside the 100-year floodplain with a minimum ground surface elevation of approximately 5,890 ft.

Wetlands

Wetlands are protected by Section 404 of the Clean Water Act. Work typically associated with water and wastewater systems and conducted in wetlands will require coordination with Federal and/or state water quality agencies and the issuance of a permit by the U.S. Army Corps of Engineers. Wetlands are sensitive environmental areas that serve many beneficial functions including ground water recharge, flood control, filtering of surface water runoff, and providing essential wildlife habitat. The wetland areas within the Study Area are shown in Figure 2-4.

[4] Platte River Basin Plan Executivy Summary, Wyoming Water Development Commission, 2006, Page 8, http://waterplan.state.wy.us/plan/platte/Executive_Summary.pdf, accessed 5/24/13.

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2.4 Planning Period Evaluation

A 50-year planning period encompassing 10-year near- and mid-term intervals provides the basis for evaluating improvements or service expansions to Cheyenne's raw water supply and transmission, water treatment, water distribution, raw water irrigation, recycled water supply and distribution, and wastewater collection and treatment systems.

In addition to evaluating the existing performance of BOPU facilities, three specific planning intervals are used for developing demand and flow projections and developing recommended improvements:

1. 10-year near-term (2014-2023).
2. 20-year mid-term (2024-2033).
3. 50-year long-term (2034-2063).

These planning periods are selected in coordination with BOPU recommendations for both near-term improvements and long-term service expansion requirements.

2.4.1 10-Year Interval (Near-Term)

The near-term analyses provide recommendations for improvements addressing existing system weaknesses and for expanding facilities to serve near-term new development areas. For the 10-year time frame, recommended improvements are prioritized, and construction phasing and timeline are developed. Recommended improvements are summarized in a 10-year capital improvement plan (CIP) along with estimated capital costs.

2.4.2 20-Year Interval (Mid-Term)

The mid-term analyses provide an interim benchmark between near-term facility improvements and long-term goals. These analyses provide a basis for the timing of phased improvements and provide a measure of how soon major improvements may be required after the near-term period. Recommended improvements are prioritized and capital improvement cost estimates are provided for general planning purposes.

2.4.3 50-Year Interval (Long-Term)

The 50-year analyses are primarily provided as a basis for evaluating how long-term growth may impact BOPU facilities. Population projections and future development cannot be accurately quantified for this 50-year horizon, but the projections will help identify potential shortfalls in the BOPU system. The 50-year analyses provide a basis for evaluating long-term requirements for raw water, treatment plant, water transmission, wastewater collection and reuse needs. The long-term plan provides a foundation for phasing of improvements and helps avoid installing near- and mid-term improvements that may not account for long-term needs. Estimated construction costs or detailed CIPs will not be developed for a 50-year period.

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2.5 Population Projections

Population trends within the Study Area provide a basis for estimating future population growth and its impact to the water and wastewater conveyance and treatment facilities. The historic growth and population summary and the population projections analysis performed for the Study Area account for populations within the City, South Cheyenne, Warren AFB, and portions of Laramie County. The majority of growth is anticipated to occur to the south and east of Cheyenne. Warren AFB limits development to the west and the developed "Ranchettes" area to the north limits expansion of services to new sites in this area. In-fill and redevelopment of existing areas within the City limits also provide areas for future development.

2.5.1 Historic Population

Laramie County and the Cheyenne Area have experienced steady growth over the past 20 years. The population of Laramie County has increased at an estimated average annual rate of 1.3% percent between 1990 and 2010. Based on PlanCheyenne documents, the existing population (2010) is 81,136 in the Cheyenne area[5]. This population makes up approximately 88.5% of the total Laramie County population and has grown at a similar rate as the county population.

Approximately 72,000 people are currently served by the water distribution system within the Potable Water Service Boundary and by the wastewater collection system within the Wastewater Service Boundary. This estimate of people served by the utility systems is based on the population counts within the Cheyenne MPO TAZ within the service boundaries.

Table 2-2 displays the historic populations of the major communities within the Study Area as well as listing the estimated population served by BOPU. This historic population information is shown graphically on Chart 2-1.

[5] SnapshotCheyenne, PlanCheyenne, March 2012, Page 2-3. (Appendix 2-A)

Table 2-2
Historic Population of the Cheyenne Area

Year	Laramie County(1)	City of Cheyenne(2)	South Cheyenne(3)	Ranchettes Area(4)	Warren AFB(5)	Cheyenne Area(6)	Estimated BOPU Customers(7)
1970	56,360	41,254	-	-	-	-	-
1980	68,649	47,283	-	-	-	-	-
1990	73,141	50,008	6,688	4,038	3,832	-	61,063
2000	81,607	53,411	7,473	4,869	4,440	74,160	64,973
2001	82,554	53,717	-	-	-	-	65,345
2002	83,226	53,103	-	-	-	-	64,599
2003	84,084	54,709	-	-	-	79,141	66,552
2004	85,427	55,461	-	-	-	-	67,467
2005	85,732	55,533	-	-	-	-	67,555
2006	86,819	55,885	-	-	-	-	67,983
2007	87,654	56,313	-	-	-	-	68,503
2008	89,077	57,048	-	-	-	-	69,398
2009	90,430	57,618	-	-	-	-	70,091
2010	91,738	59,466	7,864	5,798	3,072	81,163	72,339
2011	90,394	60,096	-	-	-	81,676	73,105
2012	91,081	-	-	-	-	-	73,836

(1) Wyoming Division of Economic Analysis.

(2) Wyoming Division of Economic Analysis.

(3) U.S. Census Bureau Decennial Census 1990, 2000, 2010. South Cheyenne consists of Fox Farm/College and South Greeley community populations.

(4) U.S. Census Bureau Decennial Census 1990, 2000, 2010.

(5) U.S. Census Bureau Decennial Census 1990, 2000, 2010.

(6) Populations from PlanCheyenne Community Plan Snapshots, March 2005 and March 2012.

(7) Population estimates based on 2010 populations in the TAZs (Cheyenne MPO) within the existing service area.

Chart 2-1
Historical Population of the Cheyenne Area

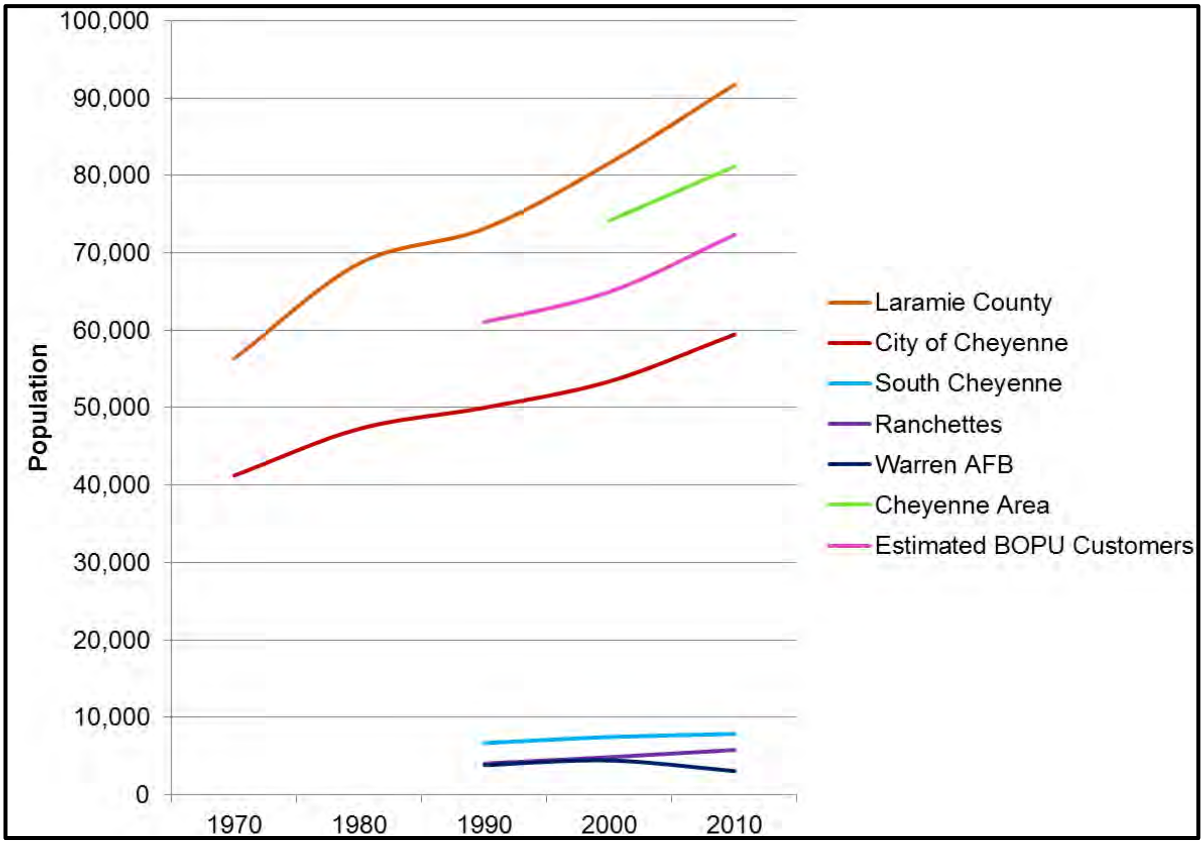


Table 2-3 displays the historic population growth rates of the major communities within the Study Area. From 2000 through 2010, growth rates in Laramie County averaged 1.2%; in the City of Cheyenne averaged 1.1%; and in the Cheyenne Area averaged 0.9%. From 2000 to 2010, the Laramie County population grew slightly faster at 1.24% than it did from 1990 to 2000 at 1.16%. The most significant increase in growth rates has occurred within the city limits with an increase from 0.7% growth from 1990 to 2000 to 1.1% growth from 2000 to 2010. The City of Cheyenne itself has increased annually by 645 people in the last decade, more than double the annual growth of 300 people from 1990 to 2000. However, a high potential for growth exists outside of the city limits within the Study Area due to several planned developments which are described in Section 2.6. The permanent population at Warren AFB has decreased over the last 20 years but is expected to remain consistent at approximately 3,000 residents. The average household size in the Cheyenne Area is 2.40 people based on the PlanCheyenne study[6].

[6] SnapshotCheyenne, PlanCheyenne, March 2012, Page 2-3. (Appendix 2-A)

Table 2-3
Historic Growth Rates of the Cheyenne Area

Year	Laramie County(1)	City of Cheyenne(2)	South Cheyenne(3)	Ranchettes(4)	Warren AFB(4)	Cheyenne Area(5)	BOPU Customers
1970	-	-	-	-	-	-	-
1980	2.18%	1.46%	-	-	-	-	-
1990	0.65%	0.58%	-	-		-	-
2000	1.16%	0.68%	1.17%	2.06%	1.59%	-	0.64%
2001	1.16%	0.57%	-	-	-	-	0.57%
2002	0.81%	-1.14%	-	-	-	-	-1.14%
2003	1.03%	3.02%	-	-	-	2.24%	3.02%
2004	1.60%	1.37%	-	-	-	-	1.37%
2005	0.36%	0.13%	-	-	-	-	0.13%
2006	1.27%	0.63%	-	-	-	-	0.63%
2007	0.96%	0.77%	-	-	-	-	0.77%
2008	1.62%	1.31%	-	-	-	-	1.31%
2009	1.52%	1.00%	-	-	-	-	1.00%
2010	1.45%	3.21%	0.52%	1.91%	-3.08%	0.36%	3.21%
2011	-1.47%	1.06%	-	-	-	0.63%	1.06%
2012	0.76%	-	-	-	-	-	1.00%
Total	61.61%	45.67%	17.58%	43.59%	-19.83%	10.13%	20.92%
Historical Average	1.15%	0.92%	0.81%	1.83%	-1.10%	0.88%	0.87%
Average 10 Years	1.18%	1.08%	0.51%	1.76%	-3.62%	0.91%	1.08%

(1) The total growth percentage is based off of the ratio of the most historic population number versus the latest population number available from Table 2-2.

(2) Historic average percentage is a yearly growth rate based off of the most historic population number versus the latest population number available from Table 2-2.

(3) Average 10 years percentage is a yearly growth rate between 2000 and 2010.

2.5.2 Population Projections

Population projections provide the basis for developing plans for future utilities to serve growth and for analyzing impacts to the existing conveyance and treatment facilities. The population projections are based on methodology described in the Economic & Planning Systems, Inc. (EPS)'s memo entitled "Brief Description of Revised Forecast" dated April 23rd, 2012 (refer to

Appendix 2-B). PlanCheyenne has used this study and applied the results to development in the Cheyenne area. The population forecasts are directly related to employment projections based on economic indicators presented in the EPS study. A majority of employees in the Cheyenne area live and work in the same community. As suggested by similar projected growth rates in population and employment categories over the past 20 years, it is deemed appropriate to analyze employment growth and equate that to population growth potential. A detailed representation of industry-specific growth can be found in Appendix 2-B, Table 3.

Using this approach, EPS created two scenarios for low growth and for high growth to outline the range of potential population growth in Laramie County. Using a range of population projections allows for flexibility in growth expectations and associated capacity requirements through the coming years. The EPS population projections are adjusted by PlanCheyenne to reflect the 88.5% of the Laramie County population that pertains to the Cheyenne area including the City of Cheyenne, South Cheyenne, "Ranchettes" area, Warren AFB, and surrounding County areas within the Study Area.

The PlanCheyenne results provide population projections for 2020, 2035, and 2060 for the Study Area. These projections are converted into the planning periods for this project based on linear interpolation. The population projection values based on the low and high growth rates are displayed in ten-year increments in Table 2-4 and on Chart 2-2. Long-term projections indicate a population for the Study Area ranging from 125,300 to 138,200, or approximately 50% to 64% growth over 2013 population estimates. BOPU customers are estimated to range from 110,000 to 122,000 within 50 years, representing a 63% growth from the present service population.

Table 2-4
Population Projections for the Study Area

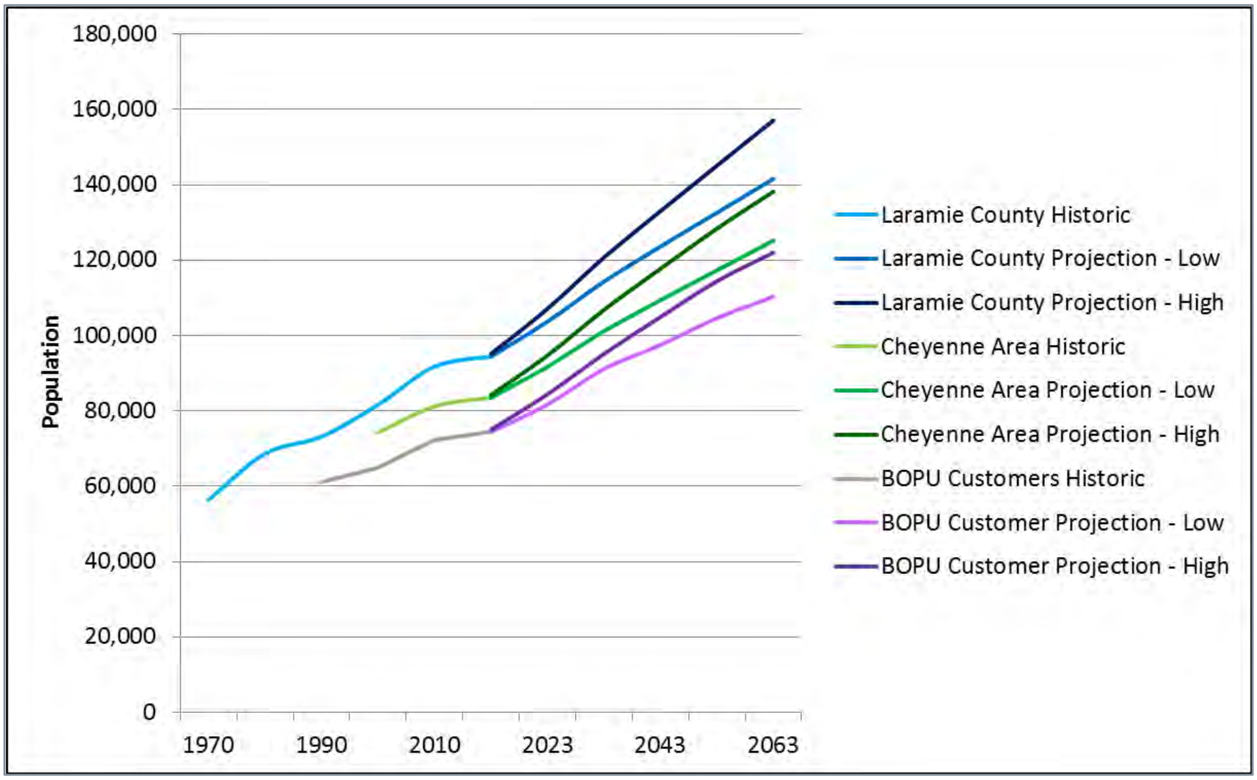
Year	Planning Period	Laramie County Low / High(1)	Study Area Low / High(2)	Estimated BOPU Customers Low / High (3)
2013	Existing	94,400 / 95,100	83,500 / 84,200	74,400 / 75,000
2023	Near-Term	103,700 / 107,100	91,700 / 94,700	81,700 / 84,400
2033	Mid-Term	114,300 / 120,700	101,100 / 106,800	90,100 / 95,100
2043	Long-Term	123,600 / 133,000	109,400 / 117,700	97,500 / 104,900
2053		132,600 / 145,100	117,300 / 128,400	104,600 / 114,000
2063		141,600 / 157,100	125,300 / 138,200	110,300 / 122,000

(1) Laramie County low and high population projections are from the EPS's memo.

(2) The Study Area populations are from the adjusted Laramie county populations based on PlanCheyenne SnapshotCheyenne 2012.

(3) Estimated BOPU customers based on the ratio of existing customers versus total population in the Study Area.

Chart 2-2
Population Projections for the Cheyenne Area



The overall growth rate of the Cheyenne area based on employment potential in the next 50 years is expected to hold steady in the near-term, increase in the mid-term, and decrease slightly in the long-term planning periods. Estimated population growth rates are presented in ten-year increments in Table 2-5. The growth rates shown in the table are based on the population projections in Table 2-4. Even though there are low and high population projections provided by PlanCheyenne they are not different enough to consider two sets of projections for demands and flows. Therefore, only the high population projections and ultimately the estimated BOPU customers are used in developing the demand and flow projections.

Table 2-5
Future Population Growth Rates for the Cheyenne Area

Year	Planning Period	Laramie County Low / High	Cheyenne Area Low / High	BOPU Customers Low / High
2013(1)	Existing	0.97% / 1.22%	0.96% / 1.25%	0.95% / 1.23%
2023	Near-Term	0.99% / 1.26%	0.98% / 1.25%	0.98% / 1.25%
2033	Mid-Term	1.02% / 1.27%	1.03% / 1.28%	1.15% / 1.27%
2043	Long-Term	0.81% / 1.02%	0.82% / 1.02%	0.70% / 1.03%
2053		0.73% / 0.91%	0.72% / 0.91%	0.73% / 0.91%
2063		0.68% / 0.83%	0.68% / 0.76%	0.54% / 0.66%

(1) 2013 growth rates are based on 2010 historic population and 2013 projections.

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2.6 Evaluation of Potential Development

An evaluation of the impacts of potential development on water and wastewater service requirements was completed based on recent development planning documents, known development plans, land use and zoning information, undeveloped land, and unit densities. The evaluation provides general information about where and when development might be expected in the Study Area. From this information, concept-level locations and sizing for water and wastewater service facilities can be evaluated.

The 2012 PlanCheyenne Community Plan Snapshot[7] states the following patterns represent development within the Cheyenne area:

- Large lot rural residential growth continues to be the predominant development pattern, especially in the unincorporated portions of the County.
- New residential subdivisions with mixed densities, unit sizes, and housing types have been developed in recent years; however, additional diversity is needed to attract and retain new employers and employees.

2.6.1 Planning Documents

Two recent 2012 planning studies are referenced for background information within the Study Area. The studies establish the baseline potential for housing growth over the next 10 to 50 years. Potential housing growth relates to population and employment trends.

The EPS study, "Brief Description of Revised Forecast", used to develop the population projections for PlanCheyenne and these Master Plans, also projects growth in housing demand over the next 50 years in Laramie County[8]. According to the EPS study, over the next 10 years the growth for housing demand for Laramie County is estimated to range between 1.2% and 1.5% annually. The growth rates result in additional housing demand representing 5,065 to 6,191 new units between existing (2013) and near-term (2023) estimates. Using the 88.5% population adjustment factor from Laramie County to the Cheyenne Area, the housing unit projections developed are presented in Table 2-6.

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[7] SnapshotCheyenne, PlanCheyenne, March 2012, Page 2-5. (Appendix 2-A)

[8] EPS, "Brief Description of Revised Forecast", August 2012. (Appendix 2-B)

Table 2-6
Future Housing Unit Projections for the Cheyenne Area

Year	Planning Period	Laramie County Low / High	Cheyenne Area Low / High
2013	Existing	42,052 / 42,409	37,216 / 37,532
2023	Near-Term	47,775 / 49,404	42,281 / 43,723
2033	Mid-Term	54,487 / 57,574	48,221 / 50,953
2043	Long-Term	61,283 / 66,076	54,236 / 58,478
2053		68,101 / 74,662	60,269 / 66,076
2063		74,918 / 83,248	66,303 / 73,674

Additionally, AVI's study "Market Context Summary, Fox Farm Road Corridor and Area Planning Summary" presents housing demand for Laramie County over the next 10 years[9]. The study states that the demand for housing within Laramie County could accommodate 6,200 new housing units within the next 10 years. Applying the 88.5% population adjustment factor from Laramie County to the Cheyenne area, the result is an estimated demand for an additional 5,487 new housing units over the next ten years which agrees with the EPS study projections for the same time period. In the same 10 year period, the study states that the demand for non-residential space is an additional 2.65 million square feet.

2.6.2 Development Areas

BOPU, HDR and AVI hosted a Development Open House on February 27th, 2013 to inform the public on the master planning process and seek input on potential developments areas. General information received during this event, such as location and timing of the development plans, are included in the development evaluation. However, specifics, such as number of units, square footage of commercial space, etc., are not included since development plans can change sufficiently in a short timeframe in regards to unit density and layout. Instead Laramie County Land Use Regulation unit densities and maximum property areas are used for all future developable areas. This information helps identify the potential locations and timing of planned development in the next 20 years, over the near-term and mid-term planning periods, and helps with directing the development of water and wastewater improvements.

[9] AVI, Market Context Summary, Fox Farm Road Corridor and Area Planning Summary, August 2012. (Appendix 2-C)

Several planned developments are identified in the Development Open House and are briefly described in the following sections. These developments have the potential of significantly impacting water and wastewater services. The potential growth areas, in addition to proposed Cheyenne area transportation corridors, will be utilized in later sections of the Master Plans to develop water and sewer main corridor routes, sizing, and system extension locations.

PlanCheyenne has identified ten focus areas of expected development in the next 10 to 20 years. They are not inclusive of all development areas within the Study Area but generally contain the expected larger development areas. Table 2-7 lists and Figure 2-5 shows these Draft PlanCheyenne Focus Areas. There are a number of community / regional and mixed-use commercial activity centers. These activity centers are included as a single focus area, identified as Focus Area 4. The following sections summarize some of these focus areas and other key potential development areas with the Study Area for which preliminary information are available.

Table 2-7
PlanCheyenne Draft Focus Areas(1)

Focus Area	Focus Area Name	Location Description	General Land Use Type(s)
1	Swan Ranch Industrial Park	West of I-25 and South of W College Dr.	Industrial, Commercial
2	Swan Ranch East	East of I-25 and South of W College Dr.	Industrial, Commercial, Residential
3	South Greeley Highway Corridor	Along S Greeley Hwy south of South Greeley to the WY/CO border	Commercial, Residential
4	Community / Regional and Mixed-Use Activity Centers	Across Study Area	Mixed Use
5	Downtown Area Re-Development	Downtown Cheyenne	Commercial, Mixed Use
6	Sweetgrass	East of S Greeley Hwy and South of E College Dr	Residential, Mixed Use, Commercial
7	Whitney Property	North of Dell Range Blvd and West of Whitney Rd	Residential, Commercial
8	Swan Ranch West	West of I-25 and South of I-80	Industrial, Commercial
9	Holdings Area	North of I-80, South of Warren AFB, and West of I-25	Commercial, Mixed Use, Industrial
10	Cole Property / Section 20	East of Powderhouse Rd, West of Converse Ave, and North of Dell Range Blvd	Residential, Mixed Use, Commercial

(1) Draft PlanCheyenne Focus Areas, dated June 12, 2012.

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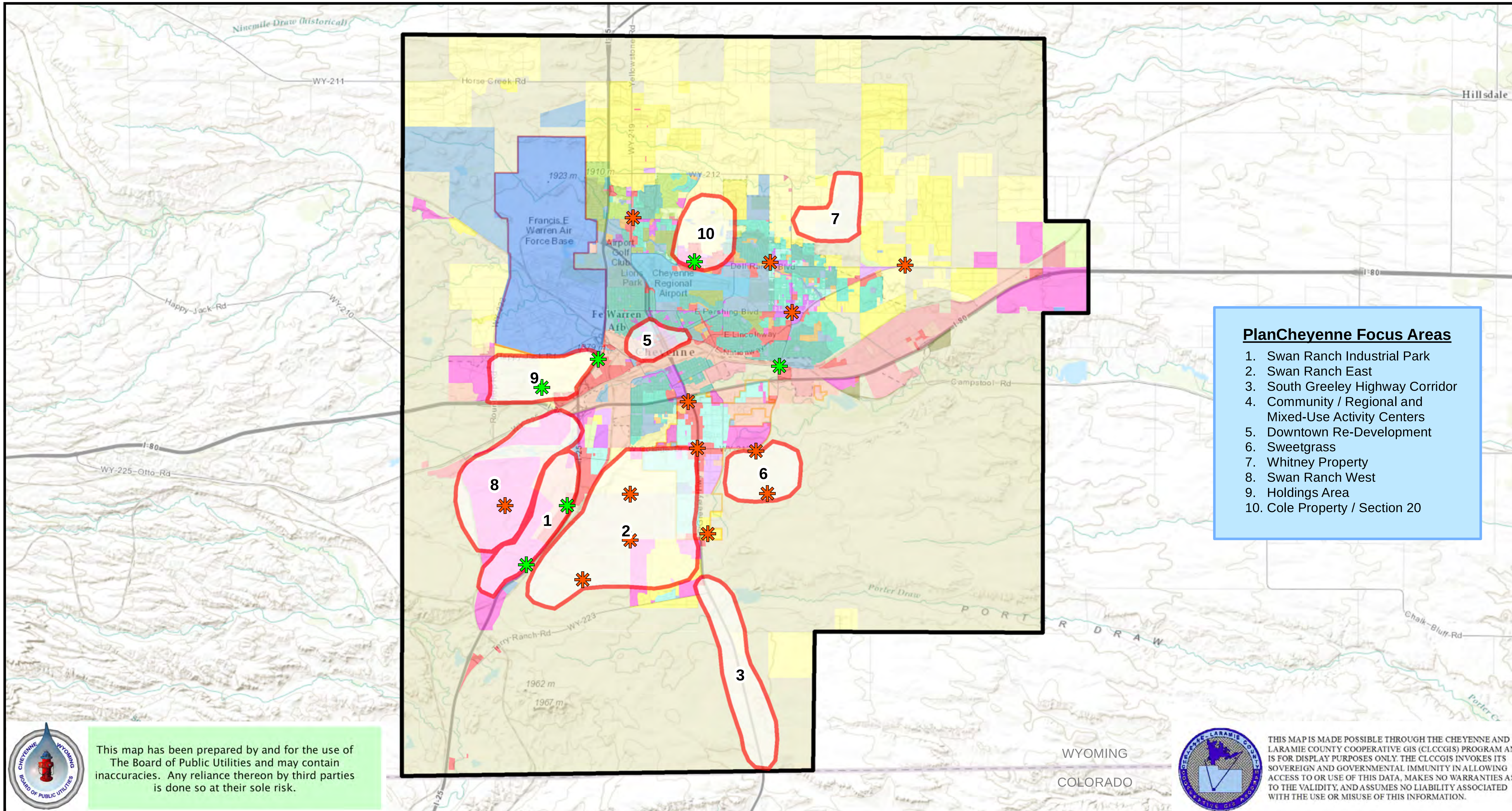

1 inch = 2.76 miles

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Legend

Activity Centers (Focus Area 4)

- Community/Regional
- Mixed-Use Commercial
- PlanCheyenne Focus Areas
- 2013 Water and Wastewater Master Plans Study Area

Note: County Zoning is shown in the background. Refer to Figure 2-7 for zoning legend.

Last Updated: 9/27/2013

Figure 2-5
PlanCheyenne 2102 Update
Draft Focus Areas

Swan Ranch – PlanCheyenne Focus Areas 1 and 2

The Swan Ranch Industrial Park currently under development remains a significant contributor to expected future job growth in Cheyenne. It is an area primarily for industry and commercial development based around a rail-served industrial park. The Swan Ranch Industrial Park, also known as the Cheyenne Logistics Hub, is a planned unit development (PUD) situated near I-25 on the south side of Cheyenne. The entire Swan Ranch area includes 7,200 acres along Interstates 25 and 80. Granite Peak Development is currently developing a 500-acre industrial park within the Swan Ranch area.

The development is accessed by the new High Plains interchange that was recently constructed on I-25, north of the Terry Ranch Road exit. The development is planned to eventually continue on the east side of I-25 with the possibility of some residential units. Construction on 55 acres of the park began during the summer of 2010. The development has the potential for high water demand base on planned industrial uses in the area; however, the quantity of the water demands have not been determined to date since additional industrial users haven't quantified their water and sewer needs.

A total buildout of 1,300 acres is planned for the Swan Ranch Industrial Park development over the next 10 to 20 years.[10] BOPU's current plans include providing water and sewer service to this area.

Cheyenne Power Park – No PlanCheyenne Focus Area

Cheyenne Power Park is a mixed-use PUD comprising 60 acres of commercial, light industrial, and mixed uses integrated with the option of single-family residential property as a primary or secondary use. The Cheyenne Power Park site is located west of South Greeley Highway and north of Dayshia Lane.[11]

This development is expected to take 10-20 years to reach total build-out. BOPU's current plans include providing water and sewer service to this area.

Sweetgrass – PlanCheyenne Focus Area 6

The Sweetgrass development is a mixed-use PUD comprising 2,350 acres of residential and commercial development. The Sweetgrass area is located south of East College Drive and east of South Greeley Highway. Development of this property will begin in 2013. A maximum of 5,000 residential units has been established within the planning area. A Village Center is planned to provide a broad range of retail goods and services and business and professional

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[10] Comprehensive Annual Financial Report, Board of Public Utilities, 2012, Page iv.

[11] Cheyenne Power Park, Planned Unit Development Zone District, January 2013.

offices. Recreational areas including parks, open space, and golf/equestrian areas are planned. There is a potential for recycled water demand within this development.[12]

This development is expected to take up to 20 years to reach total build-out. BOPU's current plans include providing water, sewer, and Class A recycled water service to this area.

North Range Business Park – No PlanCheyenne Focus Area

The North Range Business Park (NRBP) consists of 21 sites with a total of 620 acres of land, with 270 acres available in parcels from eleven acres to one hundred acres. NRBP is one of two business parks being developed by Cheyenne LEADS (Cheyenne-Laramie County Corporation for Economic Development). The park is located adjacent to the crossroads of I-80 and I-25. Master planning is complete and infrastructure has been extended throughout the park. The North Range Business Park has its own interchange onto I-80. Wal-Mart's automated distribution center is the anchor business on a 150 acre site within the NRBP.[13]

Microsoft currently has Phase 1 of a potential four phase project under construction which may be operational by summer of 2013. Average day water demands for Phase 1 may total 90 gpm (0.13 mgd) with peak hour demands of up to 200 gpm (0.29 mgd) due to the water-based cooling systems during the summertime. Average day wastewater flows for Phase 1 may total 30 gpm (0.04 mgd) with peak hour flows of up to 60 gpm (0.09 mgd). Phase 2 is already in the planning and design stage and may begin construction by the end of 2013. Average day water demands for the four phases may total 1,140 gpm (1.64 mgd) with peak hour demands of up to 2,000 gpm (2.88 mgd). Average day wastewater flows may total 380 gpm (0.55 mgd) with peak hour flows of up to 670 gpm (0.96 mgd).[14]

The National Center for Atmospheric Research (NCAR) and its managing organization, the University Corporation for Atmospheric Research, have recently constructed a Cheyenne supercomputing center in the NRBP. NCAR's water demands and wastewater flows are expected to be near to Microsoft's Phase 2 demand and flow projections presented in the previous paragraph.

NRBP is approximately 60% built out and is expected to take up to 10 years to reach total build-out. BOPU's current plans include continuing to provide water and sewer service to this area.

[12] Sweetgrass Planned Unit Development Plan, December 2012.

[13] http://www.cheyenneleads.org/business-parks/north-range-business-park.php, accessed 05/27/13.

[14] Email from Herman Noe, Board of Public Utilities, 01-16-2013.

Cheyenne Business Parkway – No PlanCheyenne Focus Area

The Cheyenne Business Parkway (CBP) encompasses a total of 900 acres immediately east of central Cheyenne and within city limits. The CBP is the second business park being developed by Cheyenne LEADS. The CBP has 200 acres available in parcels ranging from a few acres to fifty acres, 80 acres of which are available for technology development.[15]

CBP is approximately 80% built out and is expected to take up to 10 years to reach total build-out. BOPU's current plans include continuing to provide water and sewer service to this area.

Cheyenne Prairie Generating Station

Black Hills Power and Cheyenne Light Fuel & Power have begun the process of adding new electric generation at the Cheyenne Prairie Generating Station. The natural gas-fired generating station will serve electricity to customers in the Black Hills of South Dakota and in Cheyenne. The station will be located adjacent and south of I-80, situated just west of the DCWRF. The station is expected to be operational by October 2014. In an effort to conserve water resources, the station proposes to use Class B reuse water from the neighboring DCWRF for the bulk of its process water needs.

Water demands and wastewater flows for the Cheyenne Prairie Generating Station are projected to be: [16]

Phase 1 (2014)

- Potable Water Demands
  - 300 gpm (0.43 mgd) peak
  - 180 gpm (0.26 mgd) maximum day
  - 7 gpm (0.01 mgd) average day
- Class B Reuse Water Demands
  - 622 gpm (0.90 mgd) peak
  - 451 gpm (0.65 mgd) maximum day
  - 45 gpm (0.07 mgd) average day
- Wastewater Effluent Flows
  - 150 gpm (0.22 mgd) peak
  - 139 gpm (0.20 mgd) maximum day
  - 14 gpm (0.02 mgd) average day

Future Buildout

- Potable Water Demands

[15] http://www.cheyenneleads.org/business-parks/cheyenne-business-parkway.php, accessed 05/27/13.

[16] Letter from Jason Hartman, Black Hills Corporation, 04/10/13.

   - 600 gpm (0.86 mgd) peak
   - 417 gpm (0.60 mgd) maximum day
   - 174 gpm (0.25 mgd) average day
- Class B Reuse Water Demands
   - 1,200 gpm (1.73 mgd) peak
   - 1,389 gpm (2.00 mgd) maximum day
   - 625 gpm (0.90 mgd) average day
- Wastewater Effluent Flows
   - 300 gpm (0.43 gpm) peak
   - 417 gpm (0.60 mgd) maximum day
   - 208 gpm (0.30 mgd) average day

Various Residential and Commercial Development Areas

There are a number of smaller 10 to 20-acre residential and commercial developments identified within the Study Area including The Bluffs – 9th Filing, Scenic Development Apartments, Skyline Ridge, Niobrara Energy Park, Saddle Ridge East, Summit-Carla and others. The impacts of these developments on water and sewer services are captured in the regular growth projections.

2.6.3 Existing Land Use

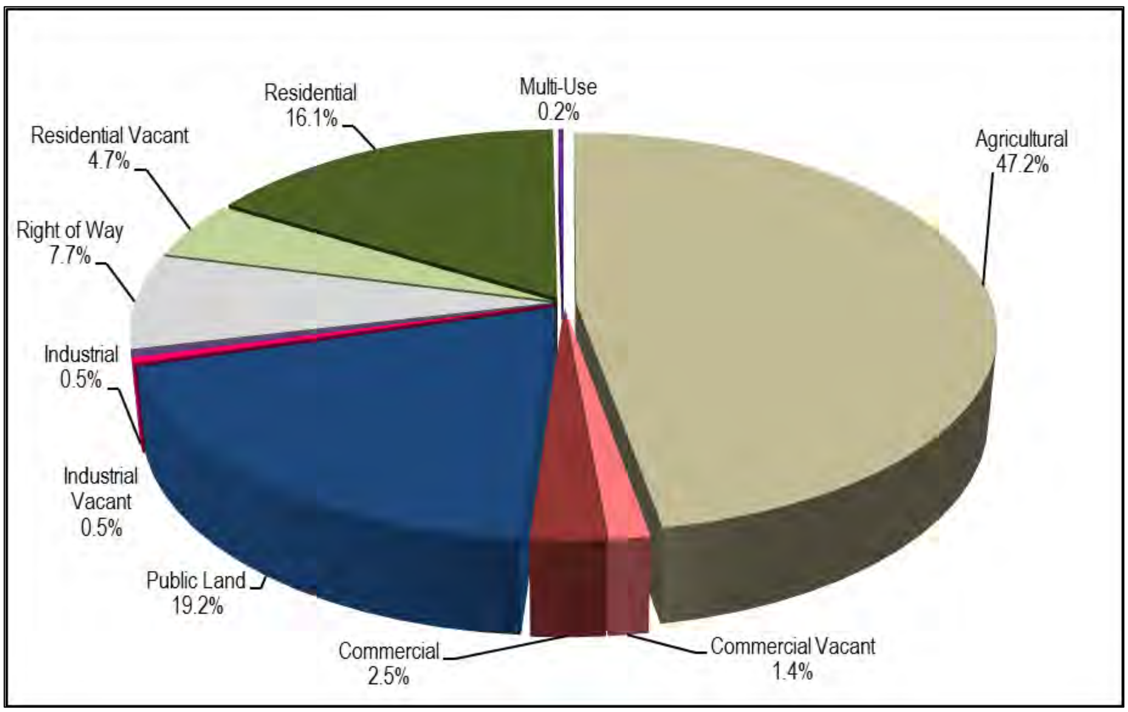
Land use in and around the City of Cheyenne over the past 15 to 20 years has steadily changed from predominately agricultural to residential, commercial and industrial general land use types. The purpose of this section is to document the existing land uses and estimate future land uses as the basis for population and wastewater flow projections.

Figure 2-6 provides a map of current land use for the Study Area based on available Laramie County parcel assessment GIS data. Approximately half of the Study Area currently consists of agricultural use. A summary of the developed lands within the Study Area is provided in Table 2-8 and Chart 2-3. These land areas provide a reference point for comparing with future conditions.

Table 2-8
Existing Land Use Summary

Land Use Type	Developed Area (acres)	Percent of Total Area
Agricultural	64,269	47.2%
Commercial Vacant	1,859	1.4%
Commercial	3,424	2.5%
Public Land	26,137	19.2%
Industrial Vacant	641	0.5%
Industrial	707	0.5%
Right of Way	10,421	7.7%
Residential Vacant	6,398	4.7%
Residential	21,908	16.1%
Multi-Use	315	0.2%
Total	136,079	100.0%

Chart 2-3
Existing Land Use Summary (Percent of Total Area)



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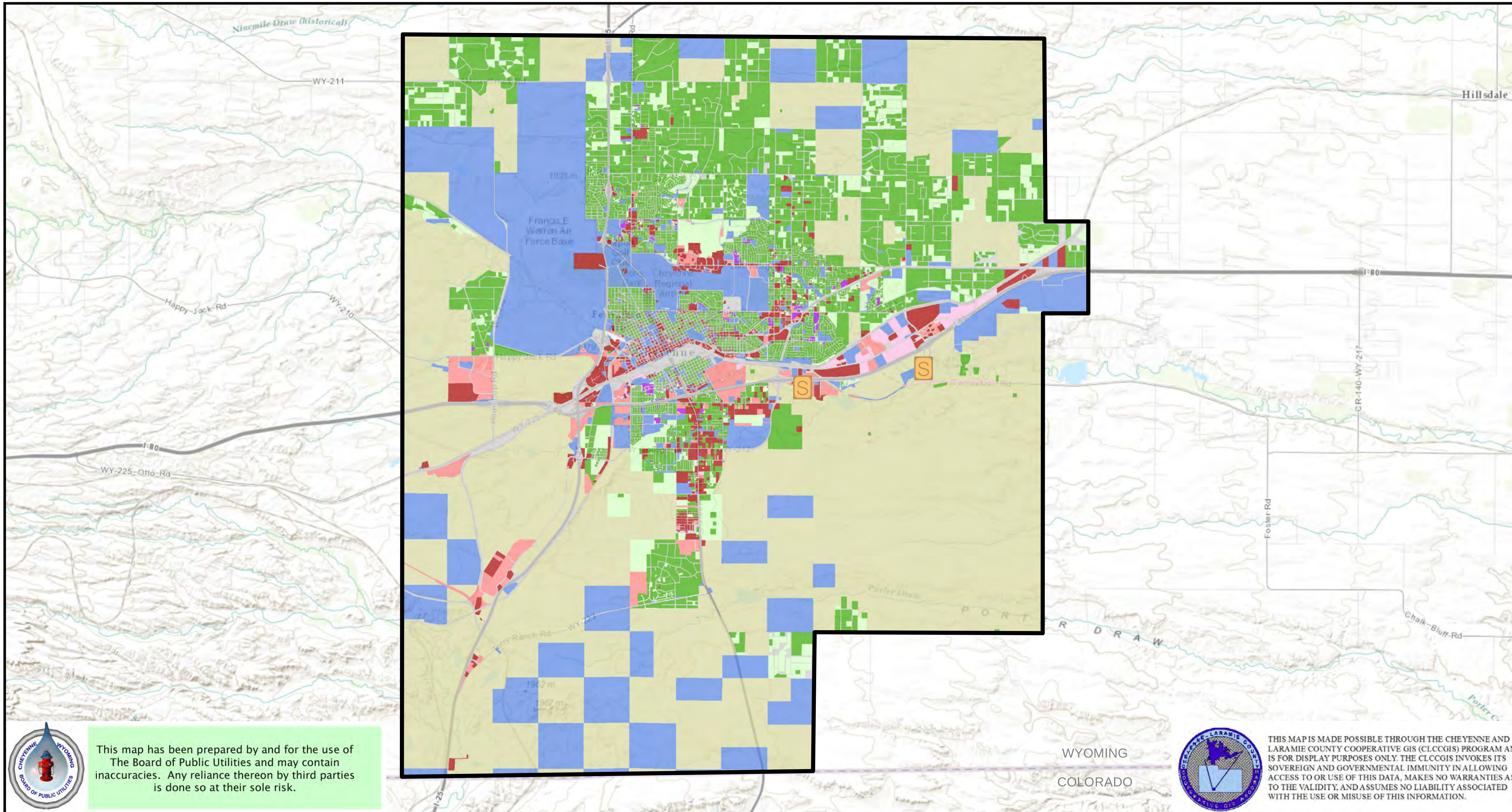

Legend

2013 Water and Wastewater Master Plans Study Area

Land Use

- Right of Way
- Agricultural
- Commercial Vacant
- Commercial
- Public Land
- Industrial Vacant
- Industrial
- Multi-Use
- Residential Vacant
- Residential

1 inch = 2.76 miles

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HDR

Last Updated: 9/27/2013

Figure 2-6
Existing Land Use

Volume 2 - Future Capacity Requirements

2013 Water and Wastewater Master Plans

2.6.4 Current Zoning

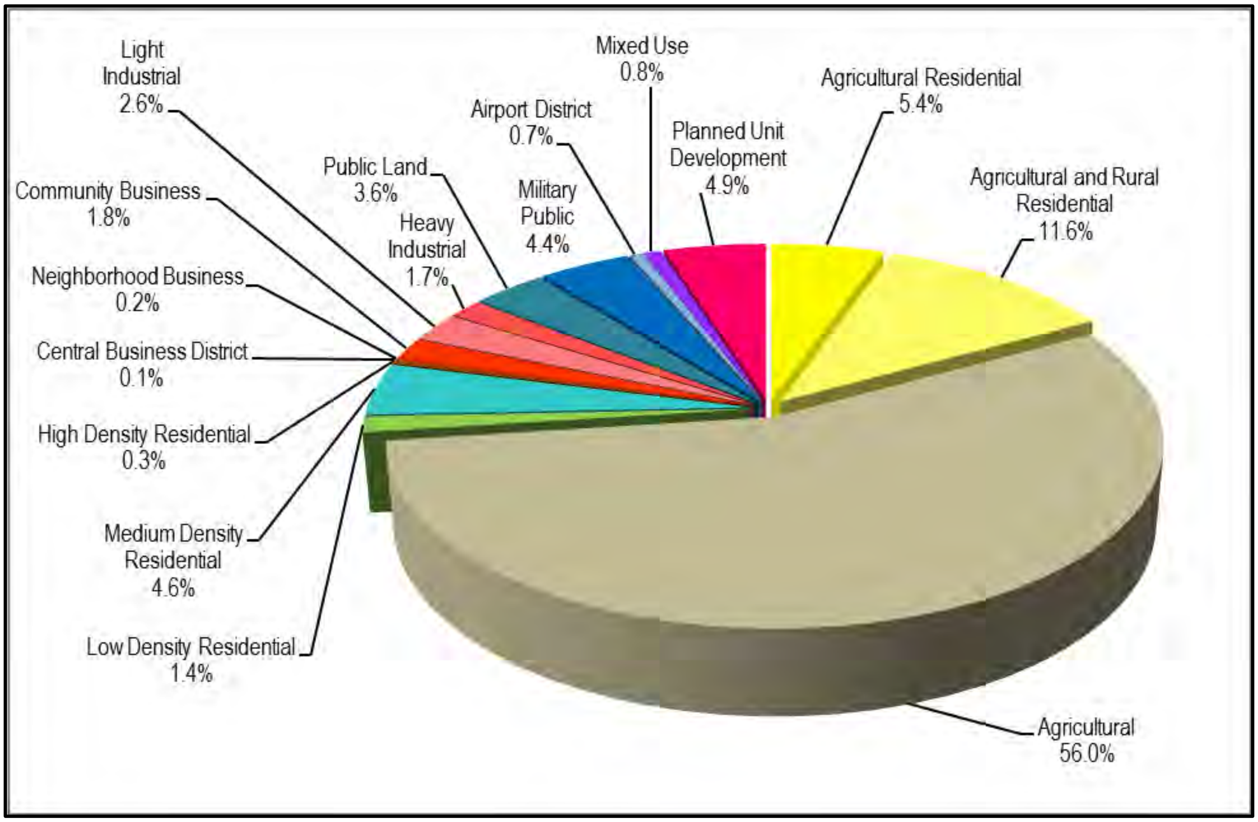
Current zoning for this study is defined by the Laramie County zoning data and shown on Figure 2-7. A summary of the current zoning, within the Study Area, is provided in Table 2-9 and Chart 2-4. The current zoning provides a basis for anticipated land use and associated development over the next 20 years. Land use, unit density, and future unit estimates are based on the current zoning. As zoning is updated the Master Plans can be modified to reflect updated information.

Areas of Laramie County to the south and east of the Study Area are not in the County Zoned Area and therefore do not have zoning data available. For the purposes of these Master Plans, the zoning is assumed to be similar to the existing land use information and has been apportioned on this basis. The area to the south outside the County Zoned Area is considered to be more relevant to the long-term planning period based on the relative distances from BOPU systems. The area to the east is small and its impacts are anticipated to be minimal if the zoning changes.

Table 2-9
Current Zoning Summary

Zoning Type	Zoning Area (acres)	Percent of Total Area
Agricultural Residential	7,381	5.4%
Agricultural and Rural Residential	15,749	11.6%
Agricultural	76,156	56.0%
Low Density Residential	1,890	1.4%
Medium Density Residential	6,269	4.6%
High Density Residential	401	0.3%
Central Business District	123	0.1%
Neighborhood Business	211	0.2%
Community Business	2,484	1.8%
Light Industrial	3,477	2.6%
Heavy Industrial	2,256	1.7%
Public Land	4,908	3.6%
Military Public	6,006	4.4%
Airport District	907	0.7%
Mixed Use	1,150	0.8%
Planned Unit Development	6,711	4.9%
Total	136,079	100.0%

Chart 2-4
Current Zoning Summary (Percent of Total Area)



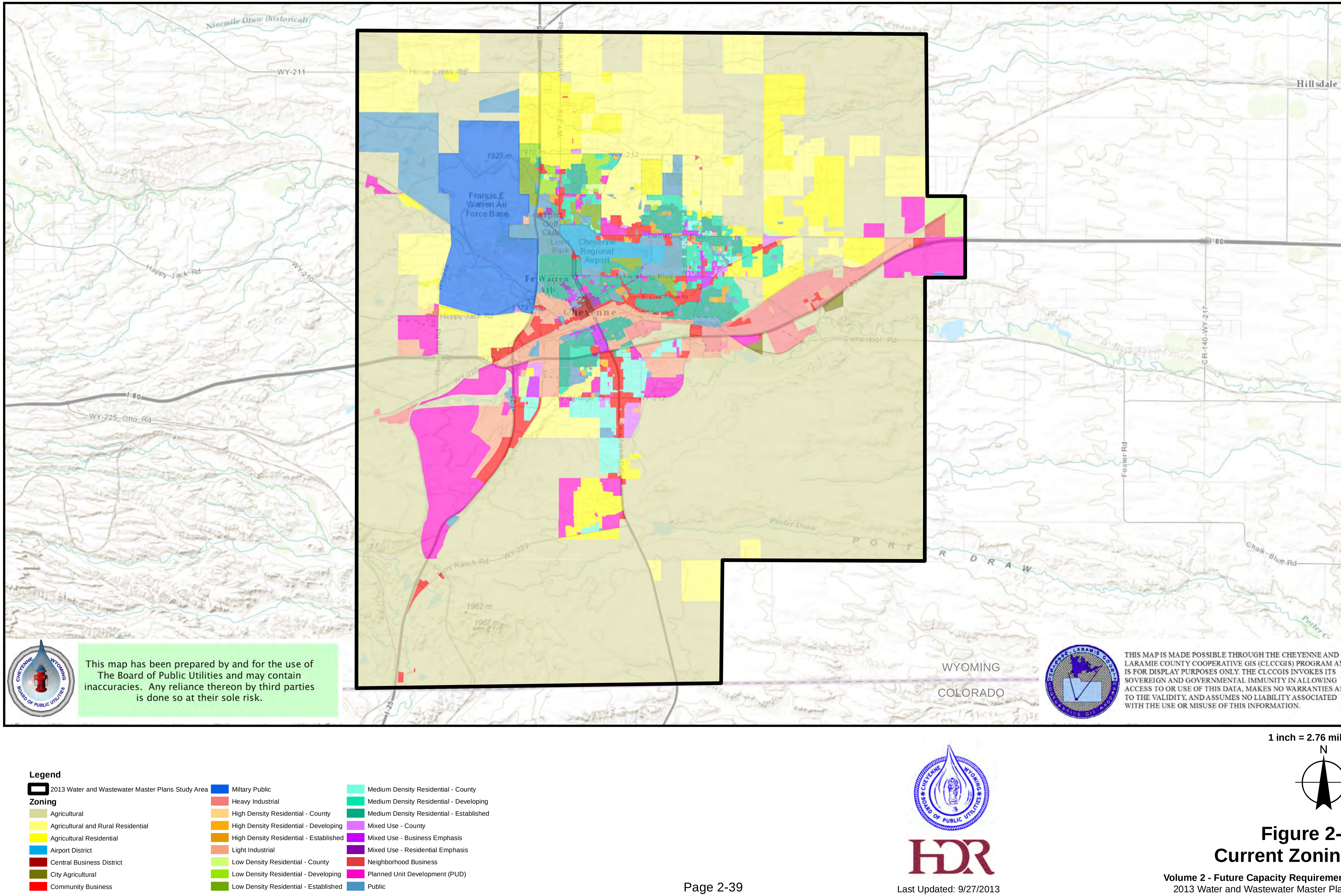


Figure 2-7
Current Zoning

Volume 2 - Future Capacity Requirements
2013 Water and Wastewater Master Plans

Last Updated: 9/27/2013

2.6.5 Potential Developable Land

Potential development areas are defined as the vacant residential, commercial and industrial land identified in the Land Use coverage and the parcels that intersect the identified draft PlanCheyenne development focus areas. As development conditions continuously change, the developable areas are only a representation of what may occur in the next 10 to 20 years. The ability to predict the location and timing of development areas becomes difficult beyond this interval. **Therefore, the areas identified in this section as developable and their development timing should not be considered definite.**

Current zoning designations for potential development areas are used to prepare the estimated unit densities for projecting water demands and wastewater flows. For those development plans known to include changes to the zoning designation, the appropriate unit densities are adjusted according to the intended land use.

Unit Densities

Unit densities are based on Laramie County Unified Development Code. There are density exceptions for several zoning types in the Land Use Requirement; however, to remain consistent across the land use designations, only the general unit density is assigned to each development. Table 2-10 summarizes the development densities used in the evaluation of future unit capacities of the potential development areas.

Table 2-10
Unit Densities per Zoning Type

Agricultural		
Zoning Type	Density (acres/unit)	Maximum Building Coverage
Agricultural Residential	5 (Single-family)	N/A
Agricultural and Rural Residential	10 (Single-family)	N/A
Agricultural	20 (Single-family)	N/A
Residential		
Zoning Type	Density (sq. ft./unit)	Maximum Building Coverage
Low Density Residential	9,000 (Single-family) 4,500 (Duplex/Townhouse) 2,500 (Multi-family)	40%
Medium Density Residential	7,000 (Single-family) 3,500 (Duplex / Townhouse) 2,000 (Multi-family)	70%
High Density Residential	5,000 (Single-family) 3,000 (Duplex / Townhouse) 1,600 (Multi-family)	85%
Commercial, Industrial, and Public		
Zoning Type	Density (sq. ft./unit))	Maximum Building Coverage
Neighborhood Business	N/A	75%
Community Business	N/A	85%
Light Industrial	N/A	85%
Heavy Industrial	N/A	90%
Public	N/A	85%
Mixed Use and PUD		
Zoning Type	Density (sq. ft./unit)	Maximum Building Coverage
Mixed Use	7,000 (Single-family) 3,500 (Duplex / Townhouse) 1,860 (Multi-family)	60% (Non-residential)
Planned Unit Development(1)	7,000 (Single-family) 3,500 (Duplex / Townhouse) 1,860 (Multi-family)	60% (Non-residential)

(1) PUD unit densities are assumed for these Master Plans to be similar to mixed use since they can vary widely.

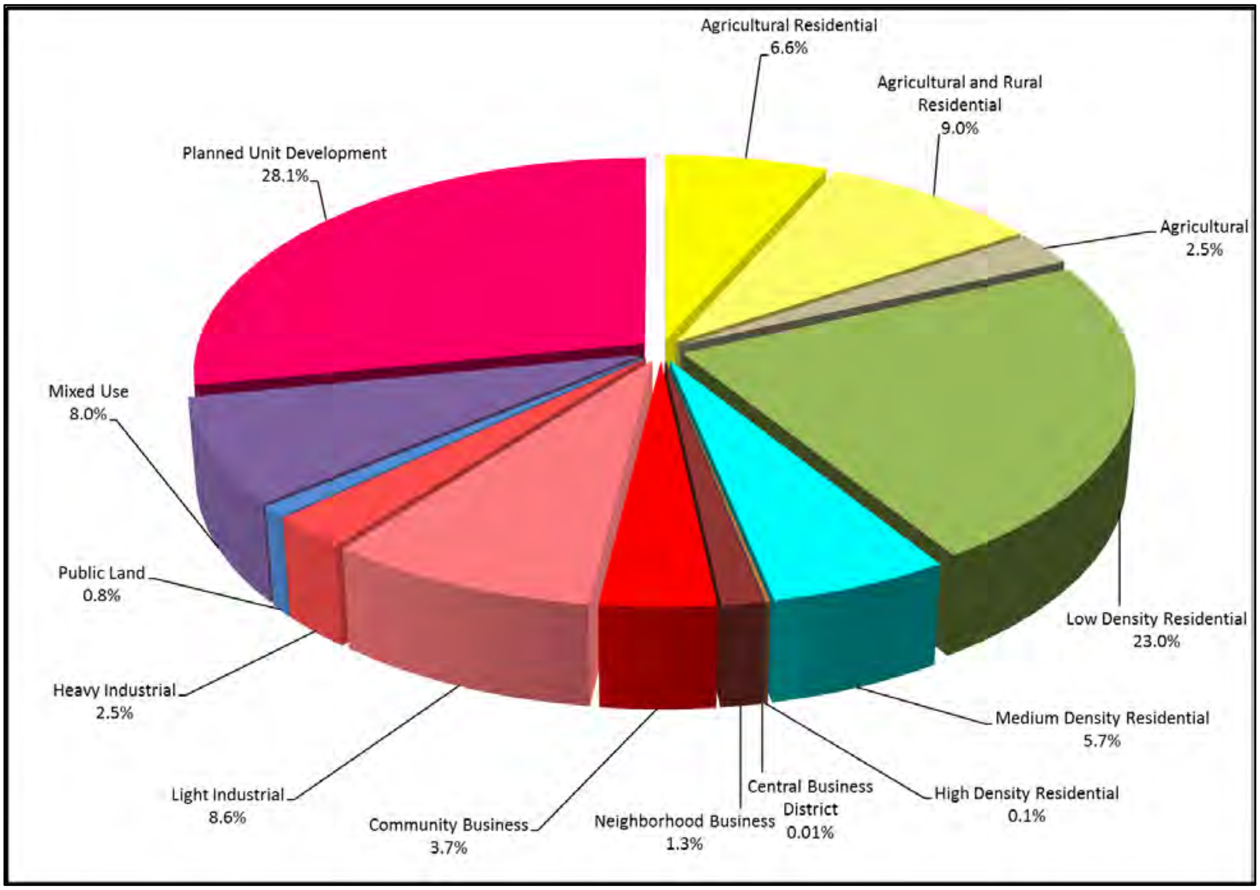
Potential Development Summary

Development densities from Laramie County Land Use Requirements are applied to the potential development areas established from vacant land and known future development parcels to estimate a number of potential future residential and commercial/industrial areas within the Study Area. Zoning densities and maximum allowable building coverage are applied from Table 2-10 to the potential developable lands. The potential development areas for the Study Area are summarized in Table 2-11. Chart 2-5 provides a summary of the future developments by zoning type.

Table 2-11
Potential Developable Area Summary

Zoning Type	Zoning Area (acres)	Percent of Total Area	Housing Units	Non-residential Space (million sq. ft.)
Agricultural Residential	1,610	6.63%	317	N/A
Agricultural and Rural Residential	2,180	8.98%	216	N/A
Agricultural	610	2.51%	26	N/A
Low Density Residential	5,578	22.96%	16,446	N/A
Medium Density Residential	1,385	5.70%	4,621	N/A
High Density Residential	31	0.13%	105	N/A
Central Business District	2	0.01%	N/A	0.02
Neighborhood Business	325	1.34%	N/A	2.65
Community Business	893	3.67%	N/A	8.26
Light Industrial	2,088	8.60%	N/A	19.30
Heavy Industrial	617	2.54%	N/A	6.04
Public Land	204	0.84%	N/A	1.11
Military Public	0	0%	0	0.00
Airport District	0	0%	0	0.00
Mixed Use	1,942	8.00%	2,969	7.51
Planned Unit Development	6,824	28.09%	6,145	22.67
Total	24,289	100%	30,845	67.60

Chart 2-5
Potential Development Area (Percent of Total Developable Area)



Timing of potential development is estimated based on proximity to the City and BOPU's water and wastewater systems and known current development plans. The cumulative additional residential units for each of the planning periods is based on the high housing unit projections presented in Table 2-6. The balance of housing units available beyond the planning period demands are assumed to be developed beyond 2063. Table 2-12 presents the population, housing unit, and non-residential development area changes for the planning periods. Figure 2-8 shows the potential developments with assigned land use categories and the approximate planning period for build-out.

Table 2-12
Potential Development and Timing

Planning Period	Study Area Population at End of Period	Cumulative Population Change from 2010	Cumulative Additional Housing Units from 2010	Cumulative Additional Non-Residential Area from 2010 (sq. ft.)
2013 to 2023 (Near-term)	94,700	10,500	6,191	2,740,000
2023 to 2033 (Mid-term)	106,800	22,600	13,421	3,720,000
2033 to 2063 (Long-term)	138,200	54,000	36,142	5,382,000

These potential development areas and approximate timing of development are used for establishing future water distribution and wastewater collection system service in Volumes 5, 6 and 7 and distributing future demands and flows in the hydraulic models. The population projections presented in Table 2-4 are used as the basis of demand and flow projections on a per capita basis.

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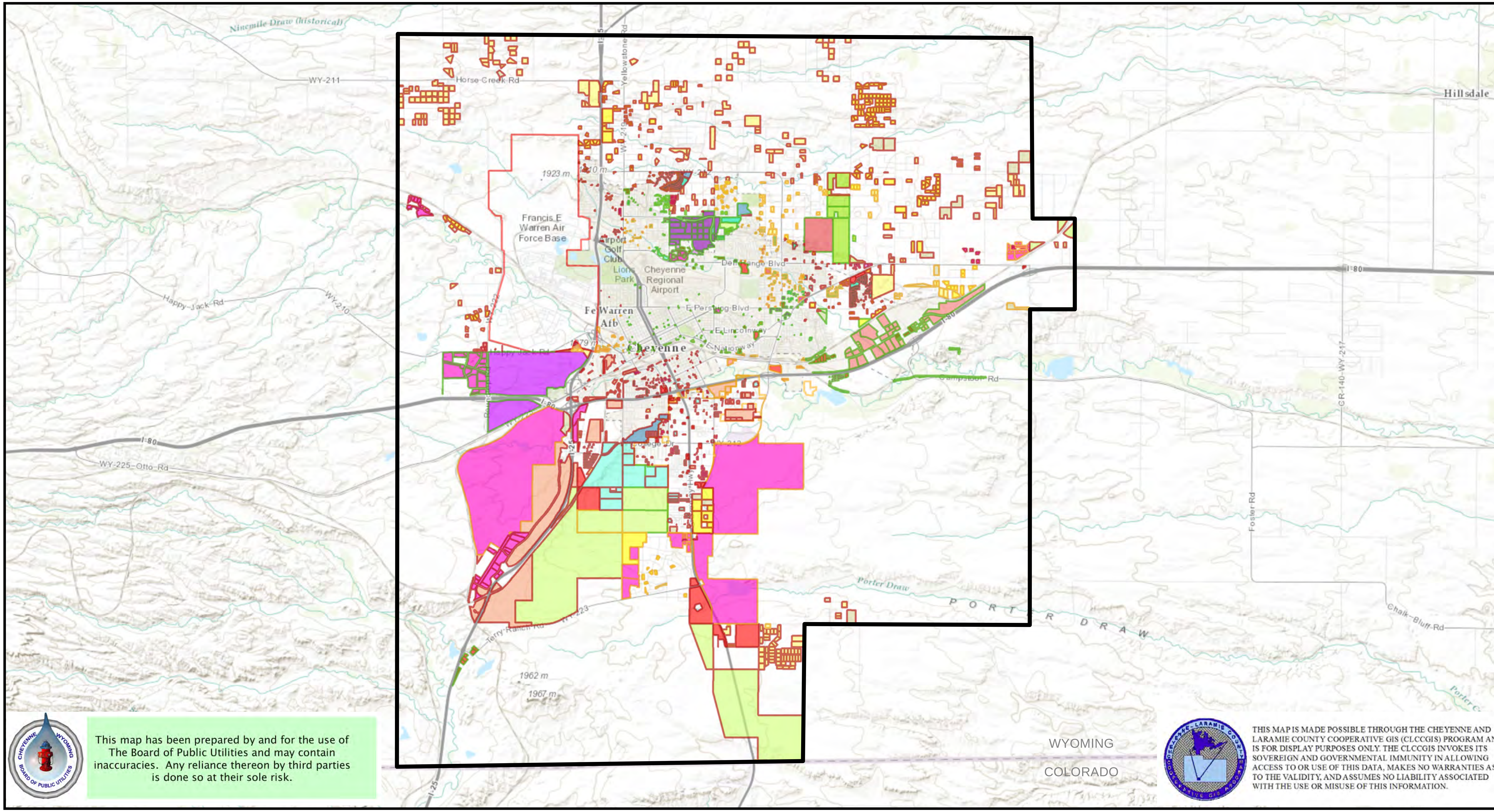


Legend

2013 Water and Wastewater Master Plans Study Area

Potential Developable Land - Estimated Zoning

- Agricultural
- Agricultural and Rural Residential
- Agricultural Residential
- Central Business District
- Community Business
- Heavy Industrial
- High Density Residential - County
- High Density Residential - Developing
- High Density Residential - Established
- Light Industrial
- Low Density Residential - County
- Low Density Residential - Developing
- Low Density Residential - Established
- Medium Density Residential - County
- Medium Density Residential - Developing
- Medium Density Residential - Established
- Mixed Use - County
- Mixed Use - Business Emphasis
- Mixed Use - Residential Emphasis
- Neighborhood Business
- Planned Unit Development (PUD)
- Public

Estimated Development Buildout Timing

- 2023
- 2033
- 2063 or Beyond

Note: As development conditions continually change, the developable land areas are only a representation of what could occur in the next 10 to 20 years. The ability to predict the location and timing of development areas becomes difficult beyond the 20 year timeline. None of the areas identified in this section as developable nor their development timing is definite.

Last Updated: 9/27/2013

1 inch = 2.76 miles

N

Figure 2-8
Potential Developable Land

2.7 Potable Water Demand Projections

Potable water demand projections are based on evaluation of historic data and provide a reasonable degree of conservatism based on exceedence probabilities. The potable water is supplied by Sherard Water Treatment Plant (WTP) and several groundwater wells and is used for domestic, commercial, industrial, and irrigation water. Currently the Sherard WTP is rated at 35 mgd capacity supplying the distribution system with potable water. Annual average and peak water use along with the distribution of use by customer class are evaluated. Peaking factors for maximum day and peak hour demands are developed. Potable water projections for average day, maximum day, and peak hour are provided for the planning period.

2.7.1 Demand Forecast Terminology

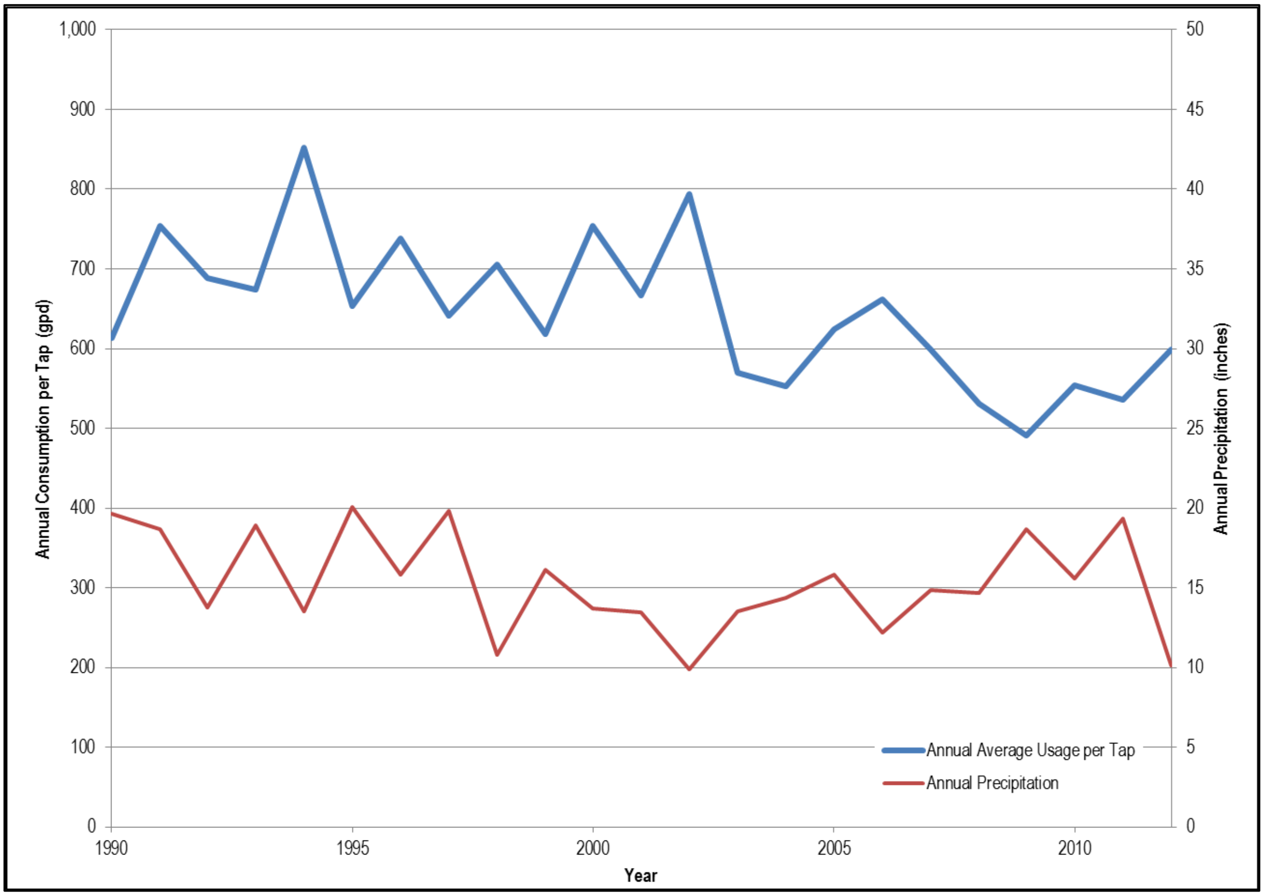
Potable water demand varies throughout the year and can vary throughout any given day. The relationship between average daily demand over a given year to instantaneous and maximum daily demands are referred to as peaking factors. Peaking factors are used as a basis for evaluating and designing different components of water treatment facilities and distribution systems. The terminology for each of the potable water peaking factors used in these Master Plans is described below.

- **Average Day (ADD).** This is the total amount of water utilized throughout the year divided by 365 days per year. Average day demand is used primarily to determine the adequacy of the water system to deliver the total amount of water needed during the year. It is also used as the common basis for developing peak demand projections.
- **Monthly Distribution**. This is the historic distribution of total annual water use by month. This information is used to determine the adequacy of the water systems to meet seasonal demands.
- **Maximum Month (MMD).** This is simply the highest of the monthly distributed water values. Over the past 10 years, July is typically the month in which the greatest amount of potable water is used in the service area.
- **Maximum Day (MDD).** This is the maximum recorded daily demand, representing a single highest system demand for a given year.
- **Peak Hour (PHD).** This is the demand during the hour with the highest system demands and is the highest peaking factor. Due to irrigation uses, water demands typically peak during the summer and during certain hours of the day when customers irrigate landscaping either early or late in the day in combination with people getting ready for or coming home from work.

2.7.2 Historic Demands

Historic potable demands over the past 10 years provide the basis for projecting annual water demand. This interval provides a general cross-section of water use during wet and dry years. It is noted that after the 2002 drought, BOPU established a formal water conservation and water restriction program. Since 2003, water use per tap has dropped by an average of 18.8% compared to the period from 1990 to 2002. The average water use per tap dropped from 704 gpd to 572 gpd between 1990 to 2002 and 2003 to 2012. The water conservation efforts as well as more efficient fixtures installed in new buildings are expected to maintain the unit demands at current reduced levels. From 2003 through 2012, the number of new water taps per year has averaged 1.36%. Chart 2-6 shows the annual average potable water use per tap over the past 20 years along with annual precipitation values. As can be expected, years with less precipitation generally result in higher water use.

Chart 2-6
Historic Potable Water Use from 1990 to 2012



The foundation for most water demand forecasts is system-wide annual use, which is the total amount of water delivered from the source to the potable water system divided by the permanent population in the service area. This calculation includes both potable water demands and unaccounted-for water (UFW) since it is based on treated water instead of billed water volume, and is presented in terms of gallons per capita per day (gpcd).

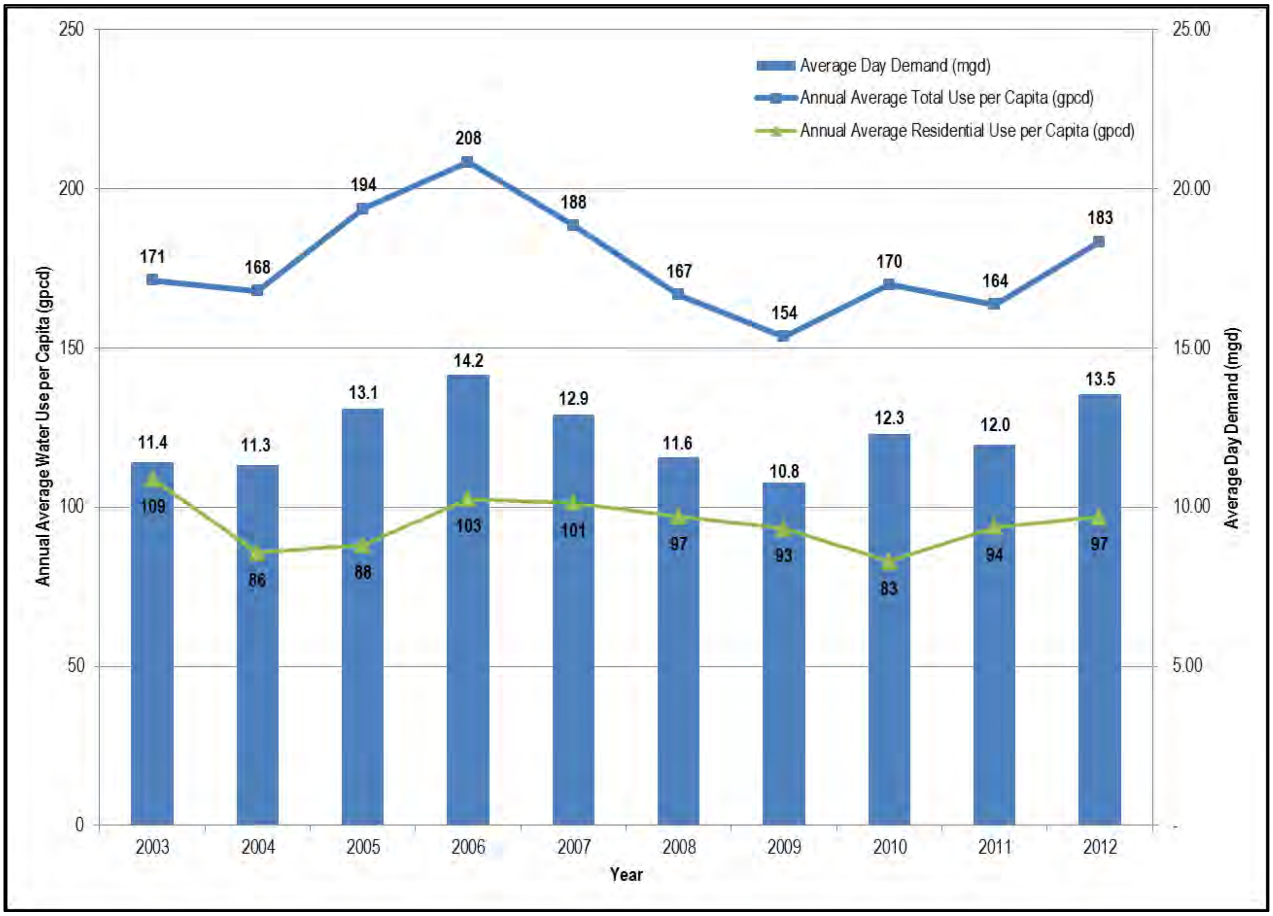
Table 2-13 and Chart 2-7 show the potable water use per capita per day for the past 10 years. These values include all categories of consumption. Based on the reviewed data, it appears that per capita water use varies considerably from year to year, but does not show any significant trends in the past 10 years. The variation year to year is likely due to changes in precipitation levels between the years and the resulting change in irrigation use. The average system-wide potable water use from 2003 to 2012 is 177 gpcd, compared to the average potable water use of 198 gpcd calculated in the 2003 Master Plans. The average residential water use from 2003 to 2012 is 95 gpcd after removing other types of demand. Residential water use is typical the industry average water use, usually estimated at approximately 100 gpcd.

Table 2-13
Historic Potable Water Demand per Capita

Year	Water Delivered (mgd)	Estimated Population Served	Water Demand Per Capita (gpcd)	Residential Demand Per Capita (gpcd)[1]
2003	11.40	66,552	171	109
2004	11.33	67,467	168	86
2005	13.09	67,555	194	88
2006	14.17	67,983	208	103
2007	12.91	68,503	188	101
2008	11.57	69,398	167	97
2009	10.76	70,091	154	93
2010	12.29	72,339	170	83
2011	11.97	73,105	164	94
2012	13.54	73,836	183	97
10-Yr Average	12.30	69,683	177	95

[1] Established using only residential consumption and the City of Cheyenne population.

Chart 2-7
Historic Water Use per Capita



Top Water Users

Top water users can have a significant effect on the overall dynamics of a water system including the supply and distribution components. The top 17 users account for up to 41% of daily water use. A list of top water users in 2012 is presented in Table 2-14.

Table 2-14
Top Water Users - 2012

Water User	2012 Annual Consumption (1000's of gallons)	2012 Annual Average Consumption (gpd)	Percent of 2012 Average Day Demand (%)
Holly Refining & Marketing Company	814,667	2,225,866	17.2%
South Cheyenne Water and Sewer District	377,308	1,030,896	8.0%
FE Warren Air Force Base	277,709	758,768	5.9%
City of Cheyenne	129,840	354,754	2.7%
School District #1	92,892	253,803	2.0%
State of Wyoming	51,339	140,270	1.1%
Cheyenne Regional Medical Center	23,997	65,566	0.5%
Cheyenne Housing Authority	23,241	63,500	0.5%
Department of Veterans Affairs	15,942	43,557	0.3%
Echostar	14,636	39,989	0.3%
The Pointe HOA	14,091	38,500	0.3%
Pershing Pointe Apartments	13,591	37,134	0.3%
Wal-Mart Distribution Center	12,607	34,445	0.3%
Mountainside Apartments	11,769	32,156	0.2%
Wal-Mart Stores	11,745	32,090	0.2%
Pinewood Village	11,511	31,451	0.2%
Wyoming Military Department	11,353	31,019	0.2%
Laramie County	10,973	29,981	0.2%

Unaccounted-for Water

Unmetered, lost water, fire hydrant use, main flushing, water main breaks, meter error, and other UFW in the potable water system should be accounted for when doing demand projections, either by using unit demands that include UFW or by adding UFW to the base consumption use. Since the per capita demands are based on total delivered water to the distribution system, they include UFW volumes, and the projections can be based on those values. Unbilled City water use is not included in the UFW volume since it is being metered.

Table 2-15 presents the UFW summary from 2003 to 2012 based on delivered water versus accounted-for (metered) water. The average percentage of UFW water compared to the total delivered volume to the distribution system over the period of 2003-2012 is approximately 7.8%, not including 2003 and 2009 which had negative UFW volumes. This is about the same as reported in the 2003 Master Plans of 8% UFW. It is recommended that the International Water Association / American Water Works Association (IWA/AWWA) Water Audit Method be used internally at BOPU to calculate a more accurate UFW percentage. These calculations only provide a reference level of UFW and are not included in the demand projections since potable water volumes delivered to the system which includes UFW are used as the basis of the demand projections.

Table 2-15
Unaccounted-for Water Summary – 2003 to 2012

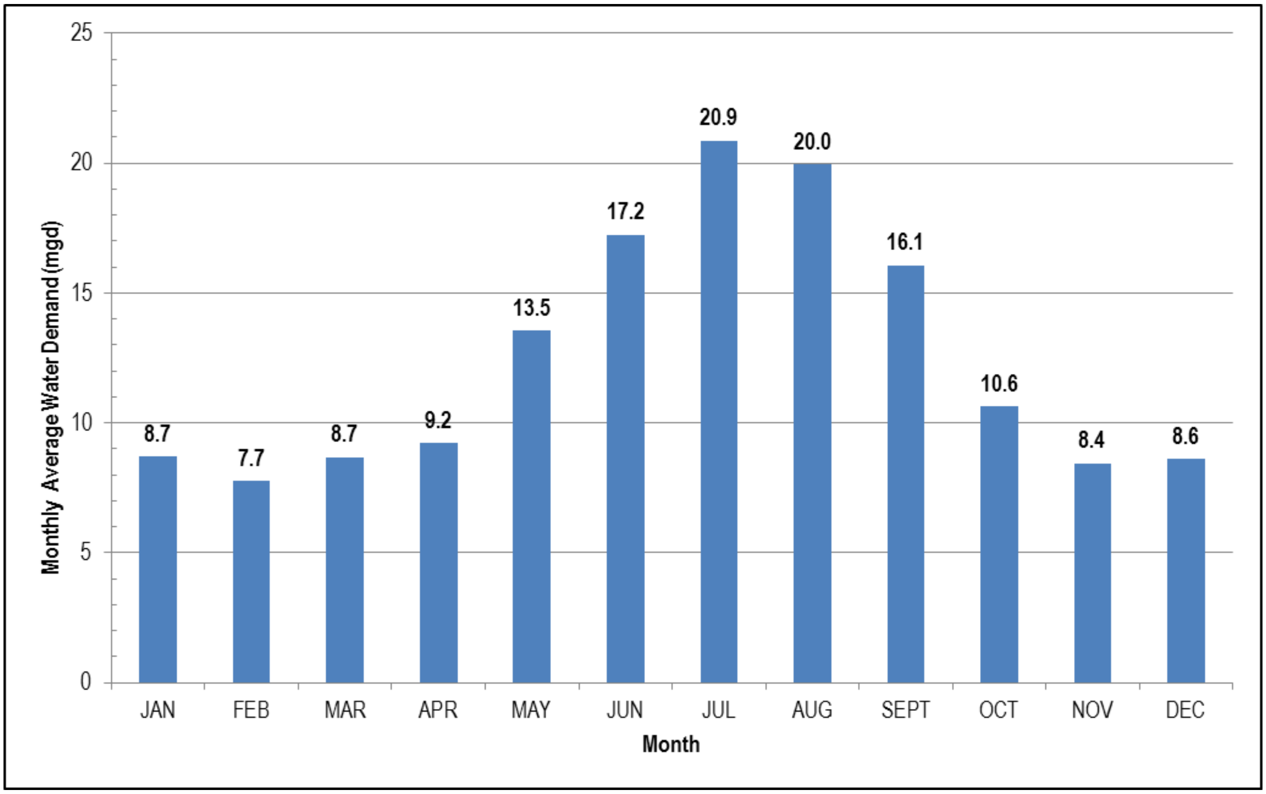
Year	Delivered Water (MG)	Metered Water (MG)	Unaccounted-for Water(1) (MG)	Percent of Delivered Water(1) (%)
2003	4,160	3,906	254	6.1%
2004	4,137	3,753	384	9.3%
2005	4,778	4,146	632	13.2%
2006	5,171	4,575	596	11.5%
2007	4,712	4,247	465	9.9%
2008	4,223	4,210	12	0.3%
2009	3,928	4,102	-174	-4.4%
2010	4,485	4,171	314	7.0%
2011	4,369	4,117	366	8.2%
2012	4,941	4,696	245	5.0%
Average	4,502	4,192	363	7.8%

(1) A negative UFW value could be due to billing cycles between years. Weather conditions and peak demands near the beginning and end of the year can cause this value to be inaccurate on a calendar year basis. A 10-year average UFW is a better representation than a yearly UFW value. The negative UFW and percent of delivered water values are not included in the averages.

Monthly Distribution

The monthly distribution for potable water demands is estimated for the period from 2002 through 2012. Chart 2-8 shows the projected monthly distribution of potable water demand. As expected, the peak month is July and August is a close second due to irrigation use. May through September represents the typical potable water irrigation season.

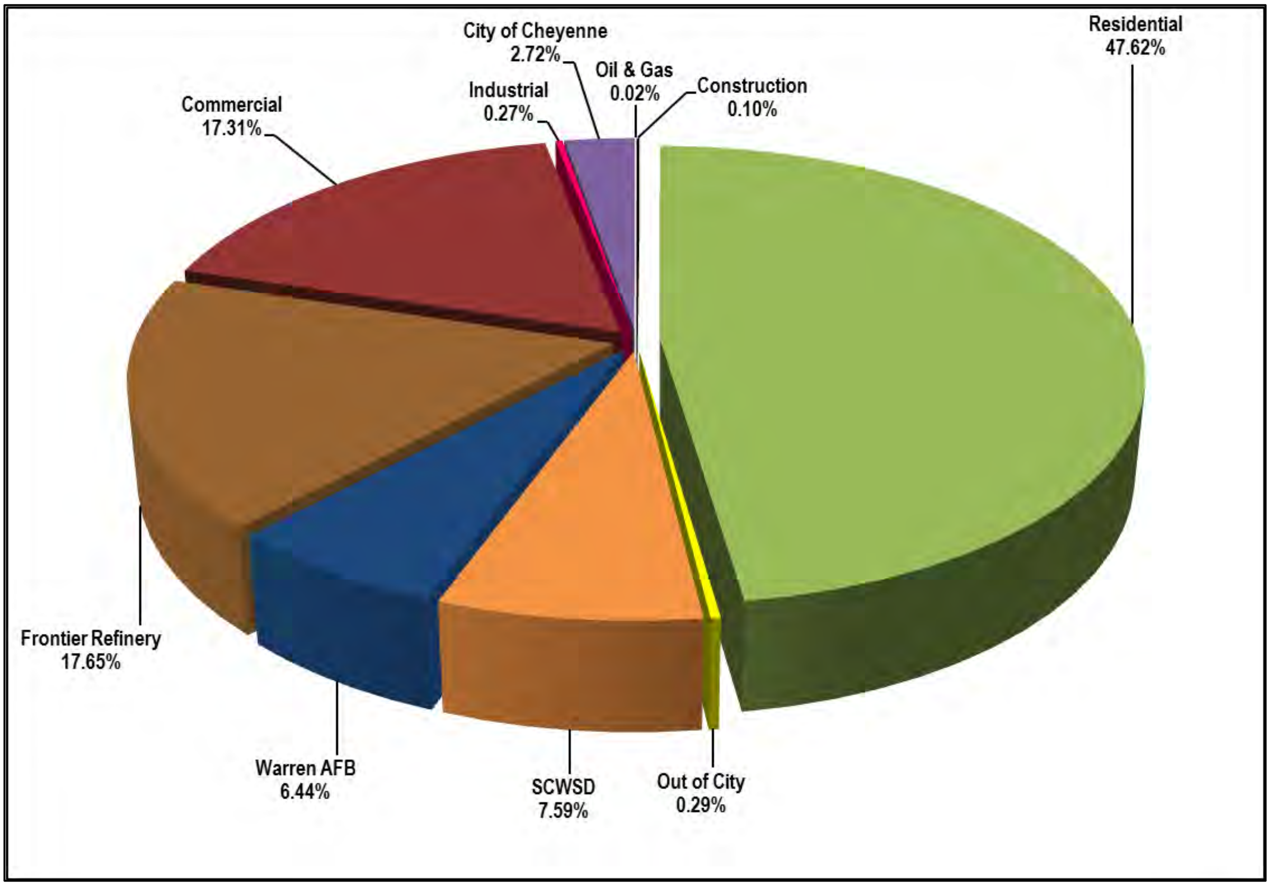
Chart 2-8
Average Monthly Distribution of Potable Water Demands (2003-2012)



Potable Demand by Customer Classification

When forecasting future demands, the distribution of water use among customer classifications provides information on where the water is being consumed. Chart 2-9 is a pie chart that illustrates annual water use for major customer classifications. The data found in the chart is based on annual average metered use from 2008-2012 per customer classification. Approximately 50 percent of the total annual demand is for residential use. Residential use typically includes a considerable portion attributed to outside irrigation.

Chart 2-9
Distribution of Potable Water Use among Customer Classifications (2008-2012 Average)

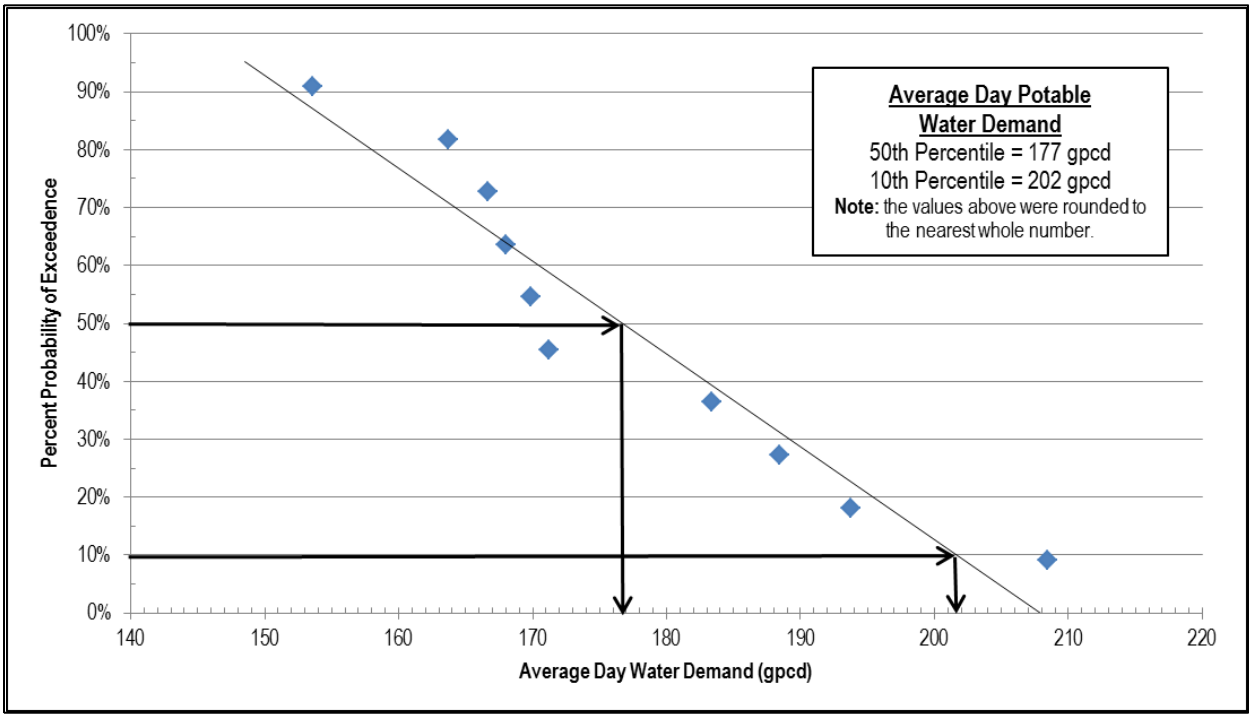


2.7.3 Average Demand Projections

Establishing demand projections depends on using recurrence intervals to establish a level of conservatism in the forecast. For example, a recurrence interval of 10 percent refers to an event that is likely to occur once every 10 years. The probability plots included in this report show this concept as the percent probability of exceedence. For example, for a 10 percent probability of exceedence, water demands are likely to be higher than the value shown only one year out of ten.

Chart 2-10 is a probability of exceedence evaluation of system-wide potable water average day demand for the period from 2003 through 2012. As shown, the system-wide average day demand use has averaged 177 gpcd (the 50 percent probability of exceedence value). Since nearly two-thirds of the annual use is for outside irrigation of lawns and gardens, the statistical variability is primarily due to climatic conditions.

Chart 2-10
Average Day Potable Water Demand Distribution



With respect to public health, safety, and welfare, as well as the economic vitality of a community, an adequate amount of water during a multi-year drought must always be available. In this regard, note that watering restrictions typically have more impact on reducing maximum day demand than average day use. Although BOPU has a water conservation plan, conservatively forecasting how much water will be needed during extended drought periods is a conservative approach providing for a measure of reliability in planning water supply needs and treatment capacity improvements.

Accordingly, it is recommended that the 10 percent probability of exceedence value, or 202 gpcd, presented on Chart 2-10, be used for determining the adequacy of BOPUs potable water system capacity for meeting system demands. The difference between the highest system-wide demand in the past 10 years (208 gpcd) and the 10 percent exceedence value (202 gpcd) is approximately 3 percent. Regional communities have shown it is possible to reduce annual consumption by at least 10 percent without implementing severe restrictions. Therefore, BOPU should be able to constrain the system-wide potable demand to 202 gpcd through a combination of long-term and short-term demand management techniques with its water conservation program.

Considering the potential near-term future large water users and the potential for other large water users in Swan Ranch, additional average day demands are included in the demand projections depending on their estimated start-up dates.

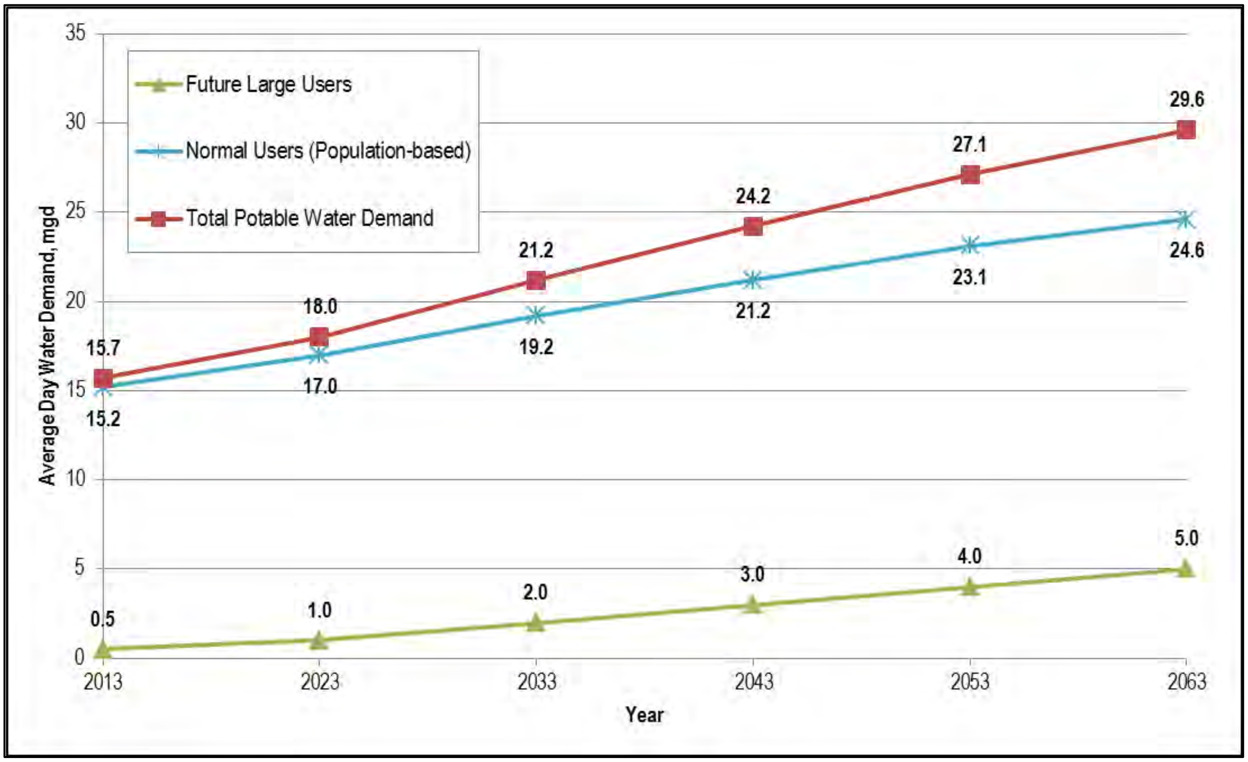
Table 2-16 and Chart 2-11 present the total system-wide average day demand potable water forecast using 202 gpcd through the year 2063 based on the estimated BOPU service population projections.

Table 2-16
Average Day Potable Water Demand Projections

		Normal Users (Population-based)	Large Users(1)	Total
Year	Planning Period	Demand (mgd)	Demand (mgd)	Demand (mgd)
2013	Existing	15.2	0.5	15.7
2023	Near-Term	17.0	1.0	18.0
2033	Mid-Term	19.2	2.0	21.2
2043	Long-Term	21.2	3.0	24.2
2053		23.1	4.0	27.1
2063		24.6	5.0	29.6

(1) Large users demand includes known commercial/industrial users in the near-term including those in the Swan Ranch and business park areas discussed in Section 2.6.2. These demands do not include current top users which are included in the normal users demand projections.

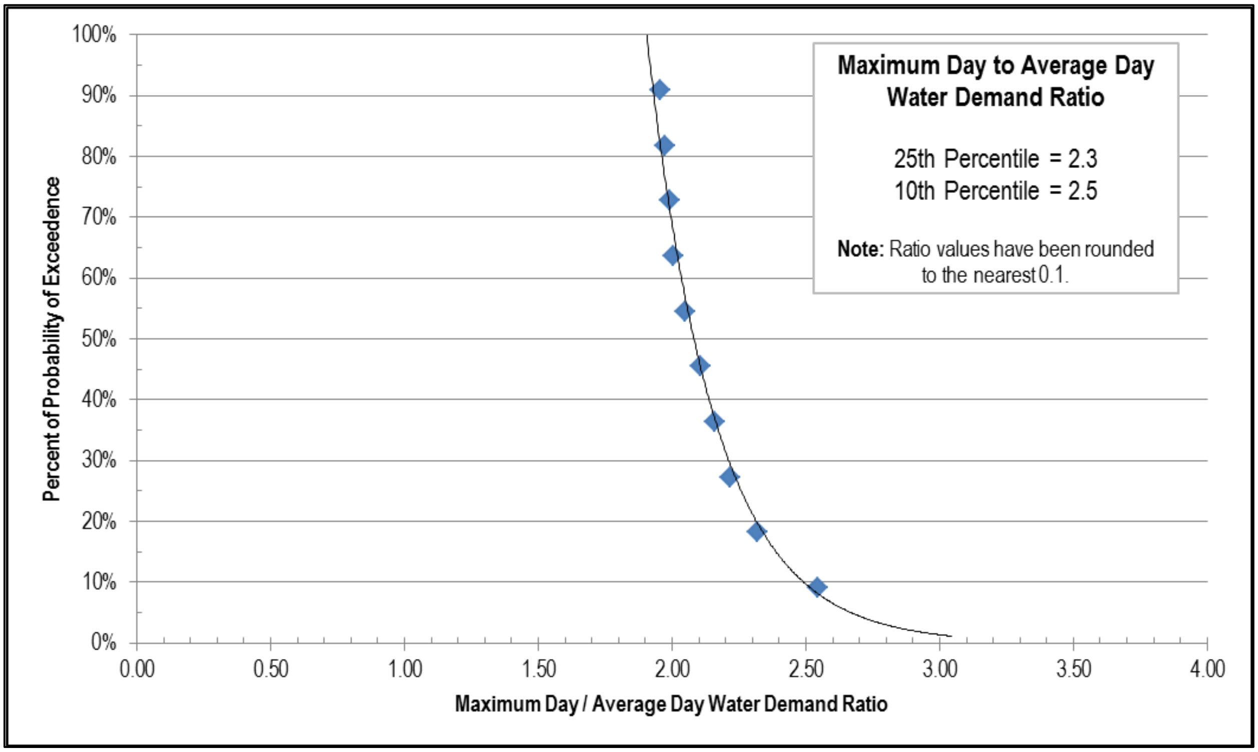
Chart 2-11
Average Day Potable Water Demand Projections



2.7.4 Peaking Factor Determination

The first step in estimating the design peaking factors for potable water system is to look at historic system-wide demands. Chart 2-12 is the probability of exceedence analysis for maximum day to average day water demand ratios from 2003 to 2012. Maximum day demands in BOPU's water systems usually occur in July or August.

Chart 2-12
Potable Water Maximum Day to Average Day Demand Ratio Distribution



In estimating the design maximum day to average ratio, with respect to probability of exceedence, the 25th percentile of probability of exceedence for the maximum day demands are used. This means that 75 percent of the time, maximum day demands will be less than the projection values during a year of average water use. The maximum day peaking factor for a 25th percentile probability of exceedence is 2.3.

Previous Water Master Plans have used a peak hour to average day ratio of 4.25. A peak hour peaking factor of 4.25 is within the range of what is typically seen in other Colorado and Wyoming communities. Therefore, the 4.25 value for the peak hour peaking factor is used for these Master Plans to remain consistent.

Based on the data presented on Chart 2-12, Table 2-17 summarizes the peaking factors for maximum day and peak hour conditions. Values are presented in terms of both ratios and gpcd so the values can be compared in terms of their affect on facility sizing. Large users do not have as high of peaking factors since their use is more consistent. A maximum day to average day peaking factor of 1.75 is calculated based on the projected industrial demand projections provided. A peak hour to average day peaking factor of 2.25 is utilized based on typical diurnal patterns for industrial water use.

Table 2-17
Potable Water Peaking Factor Comparison

Parameter	Normal Users	Large Users
Average Day		
Demand, gpcd	202	-
Maximum Day		
Ratio (MDD/ADD)	2.3	1.75
Demand, gpcd	465	-
Peak Hour		
Ratio (PHD/ADD)	4.25	2.25
Demand, gpcd	859	-

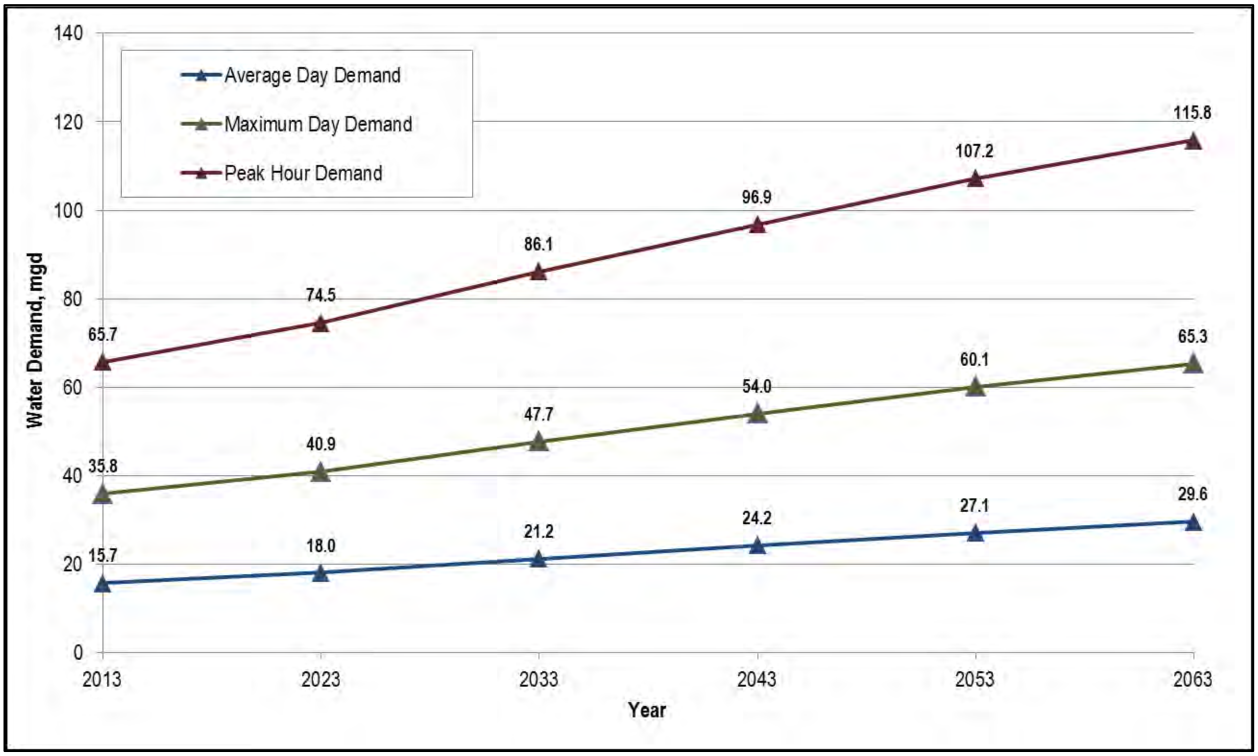
2.7.5 Peak Demand Projections

The next step is to use the peaking factors presented in Table 2-17 to determine the projected maximum day and peak hour demands for the potable water system. The maximum day and peak hour potable water demand projections are presented in Table 2-18 and Chart 2-13 for the average day demand projections. The projected demands account for the estimated UFW in the system.

Table 2-18
Potable Water Demand Projections

Year	Planning Period	Average Day (ADD) (mgd)	Maximum Day (MDD) (mgd)	Peak Hour (PHD) (mgd)
2013	Existing	15.7	35.8	65.7
2023	Near-Term	18.0	40.9	74.5
2033	Mid-Term	21.2	47.7	86.1
2043	Long-Term	24.2	54.0	96.9
2053		27.1	60.1	107.2
2063		29.6	65.3	115.8

Chart 2-13
Potable Water Demand Projections



For comparison, average day water demands in 2002 (a drought year) were 15.5 mgd and those projected for 2013 are 15.7 mgd. The projected 2013 average day demands are slightly higher than 2002 so that they are conservative for both growth and drought risk based on a 202 gpcd demand instead of average day observed use of 177 gpcd and include 0.5 mgd of additional large user demand. None of the years from 2003-2012 had average day water demands near the 2013 projection of 15.7 mgd, with the closest being 14.2 mgd in 2006.

Maximum day water demands in 2002 were 40 mgd and those projected for 2013 are 36 mgd. The projected 2013 maximum day water demands are lower than 2002 (a drought year); however, with the water conservation and restriction programs established since 2002, the 2013 projection of maximum day water demands appears reasonable. None of the years from 2003-2012 had maximum day water demands near the 2013 projection of 36 mgd, with the closest being 31 mgd in 2007. The potable water demand projections are somewhat conservative for the future if population and large user projections remain within estimated ranges.

2.8 Raw Water Irrigation Demand Projections

Water demand projections within the existing BOPU service area for raw water irrigation uses are based on historic data. In this case, raw water refers to the water from the BOPU source water supply used in the raw water irrigation system and for replenishing recreational lakes. This does not refer to the balance of the source raw water supply used for potable treatment or livestock tank replenishment. Annual average and peak irrigation use are evaluated. Peaking factors for maximum day and peak hour demands are developed. Raw water irrigation projections for average day, maximum day, and peak hour are provided for the planning period.

Since 1998 BOPU has provided raw water for major greenbelt irrigation and lake replenishment demands in the northwest portion of the City as part of a raw water demand management plan. Approximately 333 acres of turf and 83 acres of lakes are provided with raw water, comprising an average of 3.2% of the total raw water used from 1999 through 2012. Maximum use of 2.0 to 2.5 mgd is noted during maximum day (24-hour) periods. The acreage and lake areas served by the raw irrigation water system do not include any ranches (Belvoir Ranch, Polo Ranch, Round Top Lake or the Research Station); these areas and water demands are supplied separately. The raw water irrigation system reduces average day and maximum day demands on the Sherard WTP treatment capacity as well as decreases the overall potable water demand.

The existing raw water irrigation system currently provides water to four intermittent use (discharge and re-pump) customers via the lakes. In some cases, the raw water delivered to the raw water irrigation system is simply used to replace evaporative and seepage losses from a lake. In other cases, the lake is used as a storage pond from which the customer re-pumps the water into its own irrigation system.

2.8.1 Demand Forecast Terminology

Raw water irrigation use varies throughout the year based on seasonal demands and use varies over the course of any given day. The categories of demand related to average daily use are typically referred to as peaking factors. Peaking factors are used as a basis for evaluating and designing different components of the raw water irrigation supply and distribution system. The terminology for each of the raw water peaking factors used in these Master Plans is described below.

- **Average Day (ADD).** This is the total amount of water utilized throughout the year divided by 275 days per year (9-month irrigation season). Average day demand is used primarily to determine the adequacy of the water system to deliver the total amount of water needed during the year. It is also used as the common basis for developing peak demand projections.
- **Monthly Distribution**. This is the historic distribution of total annual water use by month. This distribution differs between the potable and raw water irrigation systems since there is little or no outside irrigation or lake replenishment demand during the winter resulting

in low to no flows for several months. This information is used to determine the adequacy of the water systems to meet seasonal demands.

- **Maximum Month (MMD).** This is simply the highest of the monthly distributed water values. Typically, July is typically the month in which the greatest amount of raw water is used in the service area.
- **Maximum Day (MDD).** This is the maximum recorded daily demand, representing the single highest system demand for a given year.
    - Note that maximum day to average day demand ratios are higher for the raw water irrigation system than for the potable water system since there is little or no water use in the winter. For example, the maximum day to average day demand ratio for raw water customers is estimated at 3.2 based on the observed peak flow on July, 4th 2012. On the other hand, system-wide maximum day to average day demand ratios for potable water use, are historically in the range of 2.0 to 2.5. The year-round use of potable water, especially by commercial and industrial customers that have more uniform use water throughout the year, tends to lower the system-wide maximum day to average day demand ratio.
- **Peak Hour (PHD).** This is the demand during the hour with the highest demand and is the highest peaking factor. It is typical for water demands to peak during the summer and during certain hours of the day.

2.8.2 Historic Demands

Historic raw water demands over the past 10 years provide the basis for demand projections. This interval provides a general cross-section of water use in both wet and dry years. Table 2-19 shows raw water irrigation system use from 1999 to 2012 for turf irrigation and lake use.

Chart 2-14 shows the annual raw water irrigation use over the past 14 years along with annual precipitation values. As can be expected, years with less precipitation generally result in higher water use. The annual average demand for the period of 1999 to 2012 is 467 ac-ft. The maximum day raw water irrigation demand from July 4th, 2012 was 7.1 acre-ft. The peak month raw water demand from July 2002 is 199 ac-ft.

Table 2-19
Historic Raw Water Irrigation Use from 1999 to 2012

Year	Use (ac-ft/yr)	Use(1) (ac-ft/ac/yr)	Percent of Total Water Use(2)
1999	536	1.29	3.20%
2000	738	1.77	5.29%
2001	578	1.39	3.73%
2002	637	1.53	3.53%
2003	332	0.80	2.53%
2004	404	0.97	3.09%
2005	299	0.72	2.00%
2006	448	1.08	2.75%
2007	378	0.91	2.55%
2008	351	0.84	2.64%
2009	334	0.80	2.70%
2010	387	0.93	2.73%
2011	300	0.72	2.19%
2012	818	1.97	5.12%
Average	467	1.12	3.15%

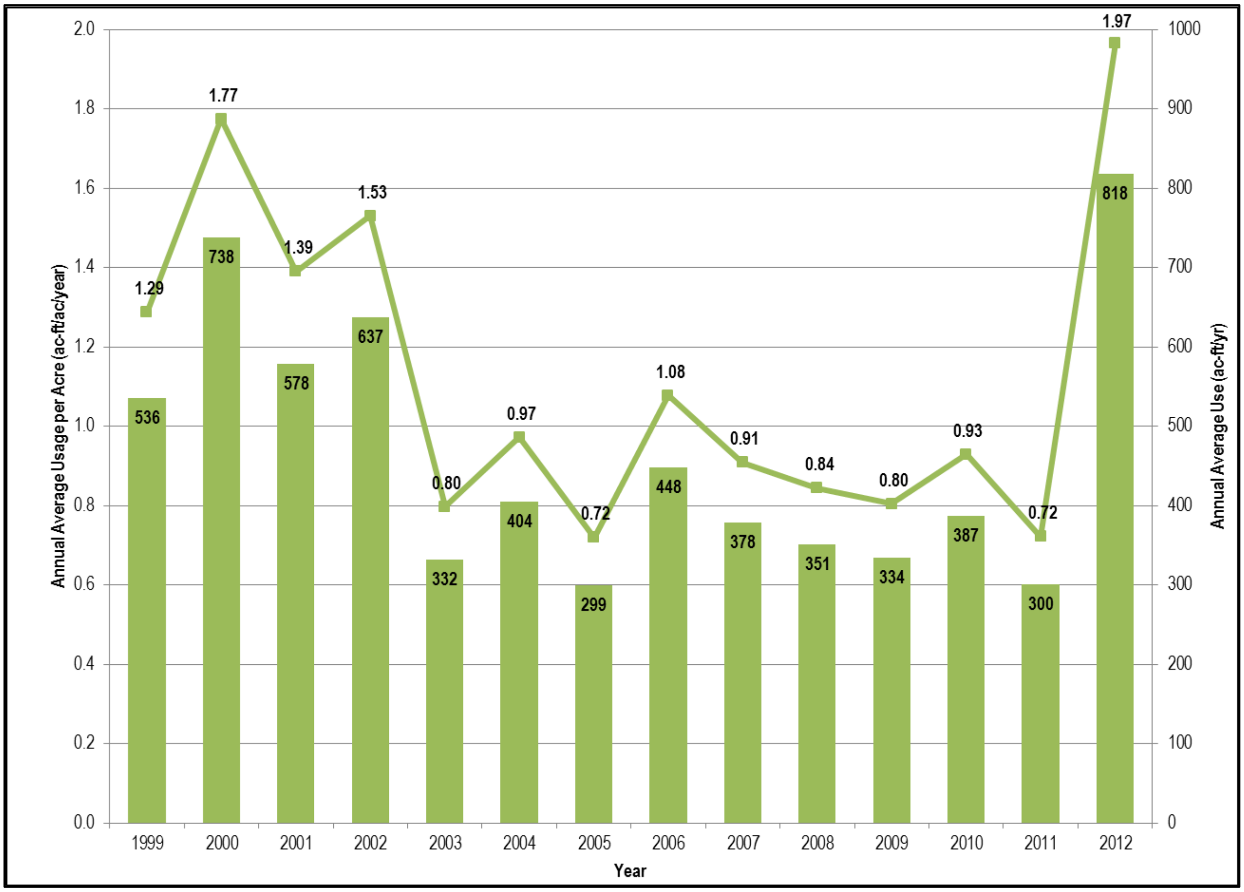
(1) Includes 333 acres of turf plus 83 acres of lakes.

(2) Includes potable plus raw water use.

Chart 2-14
Historic Raw Water Irrigation Use from 1999 to 2012

Chart 2-15 shows the raw water irrigation use per acre for the past 14 years calculated by dividing the yearly water use by total delivery area of 416 acres. It appears that water use varies considerably from year to year, but does not show any significant trends in the past 10 years. The average raw water irrigation use from 1999 to 2012 is 1.12 acre-ft/ac/year.

Chart 2-15
Historic Raw Water Irrigation Use per Acre



Unaccounted-for Water

Unmetered use, lost water, lake seepage, and other UFW is accounted for when developing demand projections either by using unit demands that include UFW or by adding UFW to the base use. Since the demand values presented above are based on the sum total of individual water meters in the irrigation system, they do not include UFW volumes. Thus, a UFW factor is used to provide a relative estimate for UFW demands. Irrigation water used by the City is metered thus providing an accurate baseline estimate for demand. The other raw meter accounts included in this analysis are Warren AFB (Lake Pearson), Cheyenne Country Club (Lake Absarraca), Airport Golf Club (Kiwanis Lake), and Lions Park (Sloans Lake).

Table 2-20 presents the UFW summary from 2003 to 2011 on delivered raw water versus accounted-for (metered) water. Delivered water is the sum total of the City's irrigation use and the other raw water accounts. The balance of supplied irrigation water represents the UFW demand for the system. A portion of 2012 raw water irrigation supply was delivered by Ware

Infiltration Gallery pipeline which is unmetered. Therefore, 2012 is not included in the UFW calculations. The average percentage of UFW water compared to the total supplied volume over the period of 2003 through 2011 is 45%.

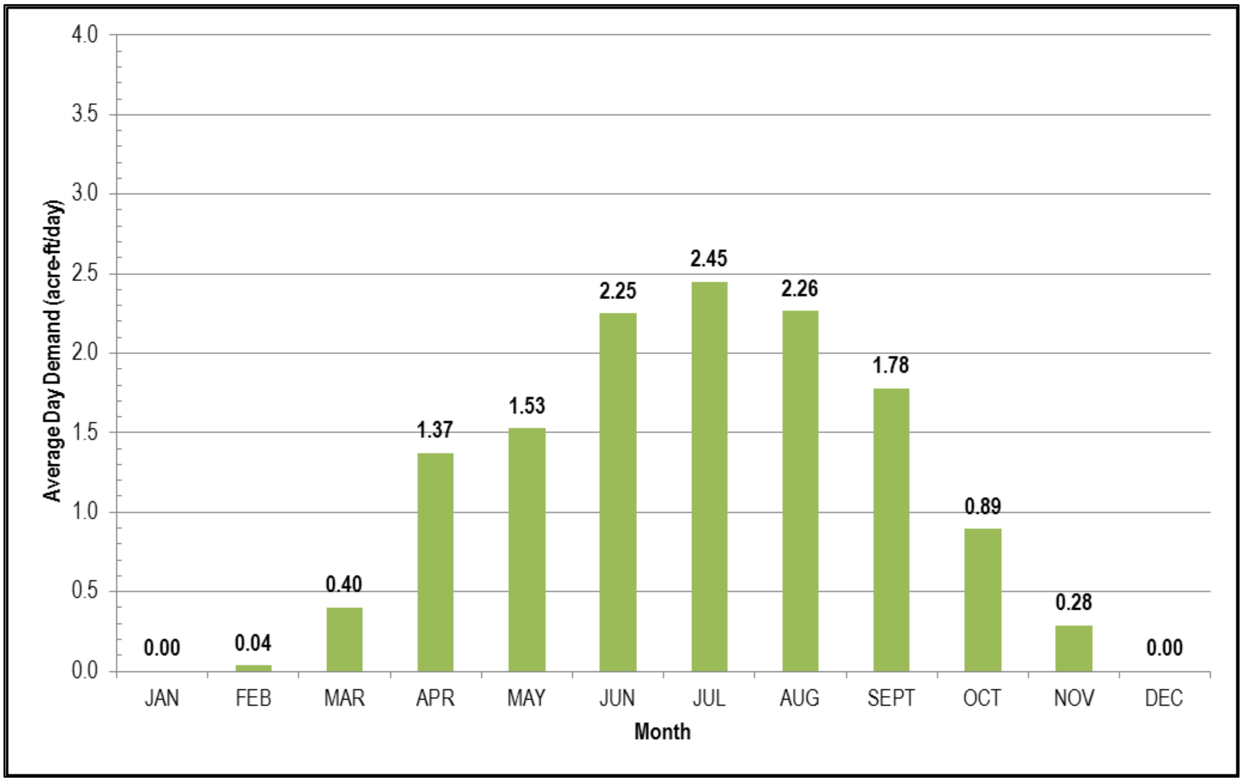
Table 2-20
Unaccounted-for Water Summary – 2003 to 2011

Year	Supplied Water (ac-ft)	Delivered Water (ac-ft)	Unaccounted-for Water (ac-ft)	Percent of UFW (%)
2003	749	332	417	56%
2004	714	367	347	49%
2005	732	413	319	44%
2006	784	470	314	40%
2007	778	416	362	47%
2008	757	418	338	45%
2009	562	339	223	40%
2010	992	468	524	53%
2011	573	381	192	34%
Average	738	400	337	45%

Monthly Distribution

The monthly distribution for raw water irrigation demands is estimated from the last 10 years of monthly raw water use data. Chart 2-16 shows the monthly distribution of raw water irrigation demands. As expected, the peak month is July, with June and August a close second due to greater turf irrigation during these months. May through September represents the major raw water irrigation season with minimal or no demands for the period of November through March. Therefore, in this section, the average day demands presented in ac-ft/day are based on a 275-day raw water irrigation season.

Chart 2-16
Average Monthly Distribution of Raw Water Irrigation Demands

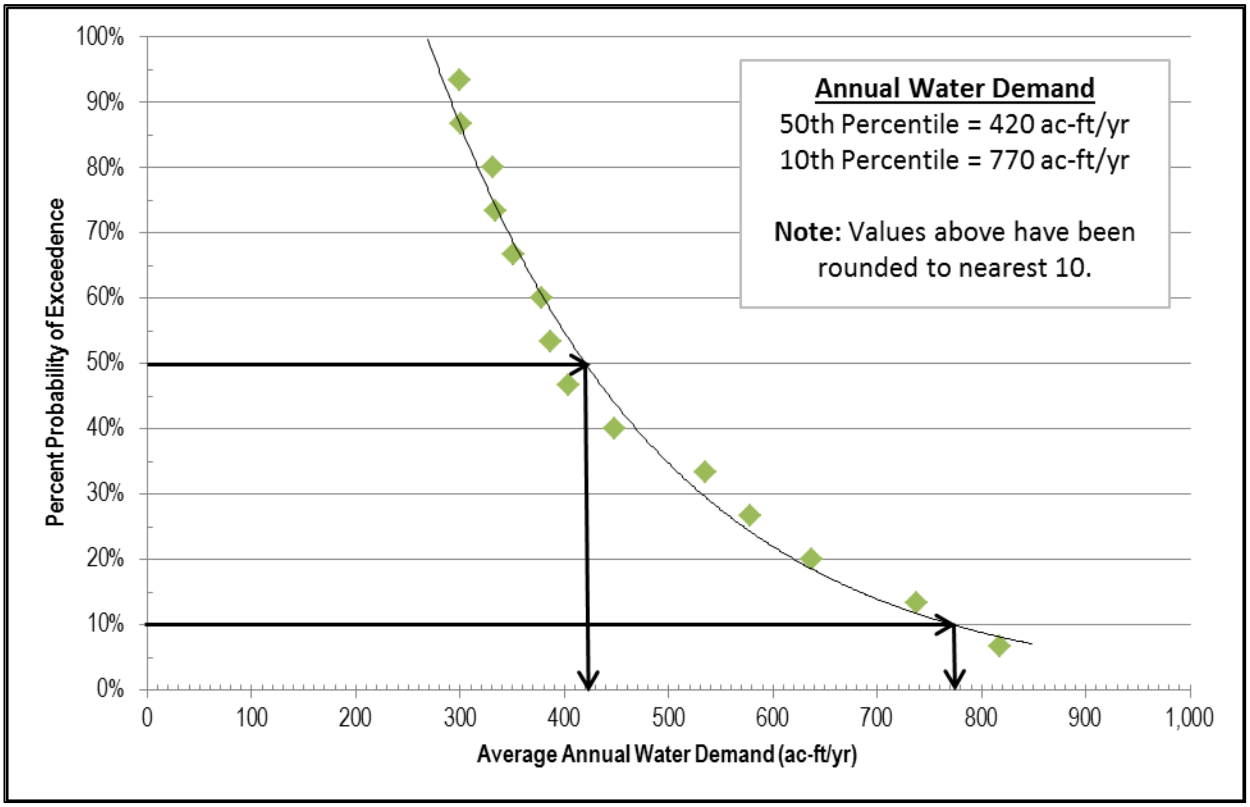


2.8.3 Average Demand Projections

Demand projections are based on recurrence intervals to establish a level of conservatism in the forecast. For example, a recurrence interval of 10 percent refers to an event that is likely to occur once every 10 years. The probability plots included in this report show this concept as the percent probability of exceedence. That is for a 10 percent probability of exceedence, water demands are likely to be higher than the value shown only one year out of ten.

Chart 2-17 illustrates the probability of exceedence evaluation for annual raw water irrigation demand over the period 1999 through 2012. As shown, the annual average demand averages 420 acre-ft/year, represented by the 50 percent probability of exceedence value.

Chart 2-17
Average Annual Raw Water Demand Distribution



The 10 percent probability of exceedence value, or 770 ac-ft/year, is recommended as the baseline demand for determining the adequacy of the raw water irrigation supply. The difference between the highest system-wide demand in the past 10 years (818 gpcd) and the 10 percent exceedence value (770 ac-ft/year) is 6 percent. Regional communities have shown it is possible to reduce annual irrigation consumption by at least 10 percent without implementing severe restrictions. Also, with available irrigation storage in the lakes, having raw water for irrigation is not as critical as having adequate potable water supply. BOPU should be able to constrain the system-wide demand to 770 ac-ft/year through a combination of short-term and long-term demand management techniques including capital improvements such as lake lining to reduce seepage or pipeline rehabilitation to reduce leakage.

Table 2-21 and Chart 2-18 present the total annual raw water irrigation demand forecast through the year 2063 using 770 ac-ft/yr as the baseline existing demand and assuming the raw water irrigation system grows at similar rates as population. Since the raw water irrigation system reduces average day and maximum day potable water demands, it may be expanded as is reasonable to accommodate increased irrigation demands.

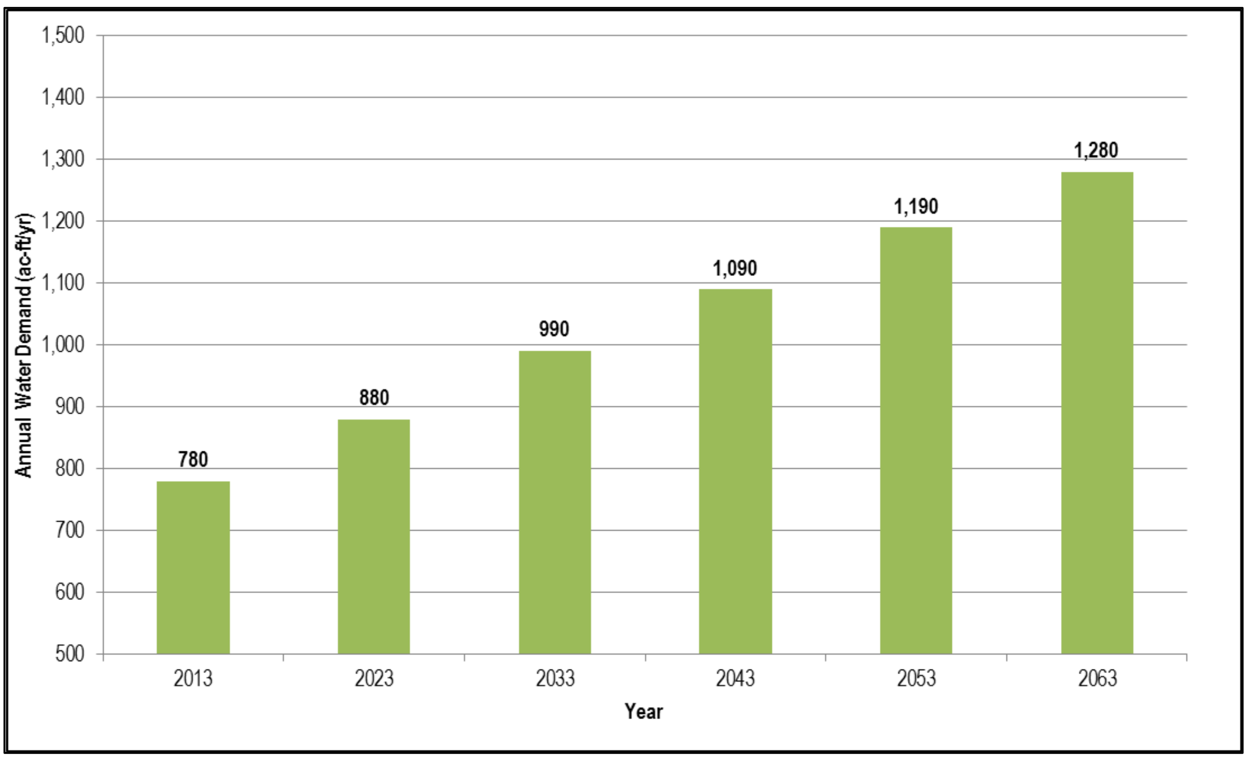
Recommendations for expansion of this system will be addressed in Volume 6 of the Master Plans. Any expansion is likely to consist of large amounts of water associated with each customer for irrigation needs, instead of the gradual increases found in the potable water demand projections. Therefore, the projections are shown in stair-steps instead of a linear fashion on Chart 2-18.

Table 2-21
Annual Raw Water Irrigation Demand Projections

Year	Planning Period	Demand (ac-ft/yr)	Demand (ac-ft/day)(1)
2013	Existing	780	2.8
2023	Near-Term	880	3.2
2033	Mid-Term	990	3.6
2043	Long-Term	1,090	4.0
2053		1,190	4.3
2063		1,280	4.7

(1) Based on a 275-day raw water irrigation season (March through November).

Chart 2-18
Annual Raw Water Irrigation Demand Projections



2.8.4 Peaking Factor Determination

The first step in estimating the design peaking factors for the water systems is to look at historic system-wide demands. Peak day demands in BOPU's raw water irrigation system usually occur in July or August. Table 2-22 summarizes the raw water irrigation peaking factors for maximum day and peak hour. Values are presented in terms of both ratios and acre-ft/day. For the Master Plans, these peaking factors are used to determine long-term water supply requirements for Volume 3 and to determine requirements for raw water irrigation distribution facilities in Volume 6.

Table 2-22
Raw Water Irrigation Peaking Factors

Average Day	
Demand, ac-ft/day	2.8
Maximum Day	
Ratio (MDD/ADD)	2.4
Demand, ac-ft/day	6.7
Peak Hour	
Ratio (PHD/ADD)	6.0
Demand, ac-ft/day	16.8

For the MDD/ADD ratio, based on year 2012 data is used as a basis for calculating the maximum day peaking factor. The metered use on that day was 7.1 acre-ft. Using an average day use for 2012 of 3.0 acre-ft results in a maximum day peaking factor of 2.4.

The previous Master Plans have used a peak hour to average day ratio of 3.6. However, considering the maximum day to average day ratio is 2.4 and all of the raw water customers could feasibly be pumping from the lakes at the same time during typical irrigation times in the night, a PHD to ADD ratio of 6.0 is used in this study to remain conservative on the distribution side of the raw water irrigation system. The storage in the lakes provides the volume necessary to supply these peak hour demands to the customers.

2.8.5 Peak Demand Projections

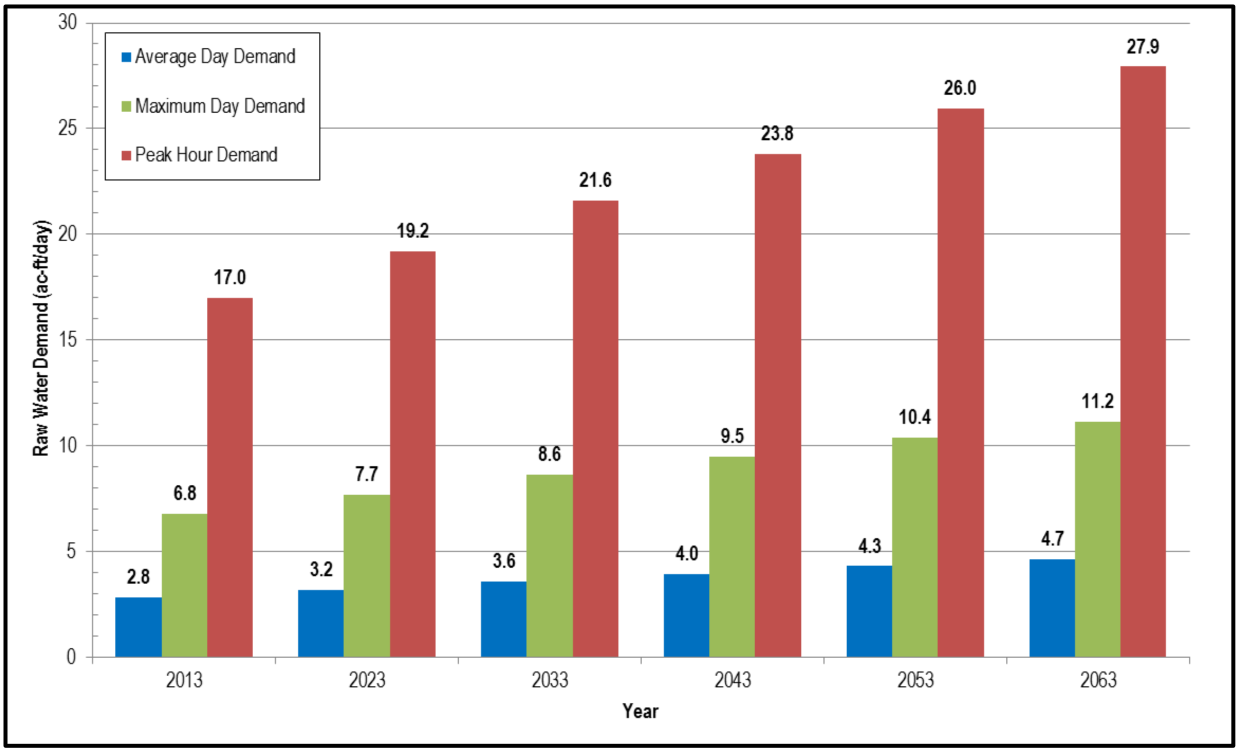
Peak demand projections for the raw water irrigation system are developed using the peaking factors presented in Table 2-22 to determine the projected maximum day and peak hour demands. The maximum day and peak hour raw water irrigation demand projections are presented in Table 2-21 and Chart 2-19.

Table 2-23
Raw Water Irrigation Demand Projections

Year	Planning Period	Average Day (ADD) (acre-ft/yr)	Average Day (ADD)[1] (acre-ft/day)	Maximum Day (MDD) (acre-ft/day)	Peak Hour (PHD) (acre-ft/day)
2013	Existing	780	2.8	6.8	17.0
2023	Near-Term	880	3.2	7.7	19.2
2033	Mid-Term	990	3.6	8.6	21.6
2043	Long-Term	1,090	4.0	9.5	23.8
2053		1,190	4.3	10.4	26.0
2063		1,280	4.7	11.2	27.9

(1) Based on a 275-day raw water irrigation season (March through November).

Chart 2-19
Raw Water Irrigation Demand Projections



For comparison, average day raw water irrigation demands in 2012 were 3.0 ac-ft/day and those projected for 2013 are 2.8 ac-ft/day. The projected 2013 average day demands are slightly lower than 2012; however, they are still conservative since they are based on a 10 percent exceedence probability. The summer of 2012 was uncommonly dry and hot. Also, in 2012 the Cheyenne Country Club was not switched over to potable water for irrigation use for part of the year as has been done in previous years. None of the years between 1999 and 2011 had average day water demands at the 2013 projection of 2.8 ac-ft/day, with the closest being 2.7 ac-ft/day in 2000.

Likewise, maximum day water demands in 2012 were 7.1 ac-ft/day and those projected for 2013 are 6.8 ac-ft/day. The projected 2013 maximum day water demands are slightly lower than 2012; however, considering the above discussion on the 2012 climate, the 2013 projection of maximum day water demands is reasonable. The raw water demand projections are somewhat conservative overall for the future if the raw water irrigation system expansion follows the population growth estimates.

2.8.6 Raw Water Irrigation Supply Requirements

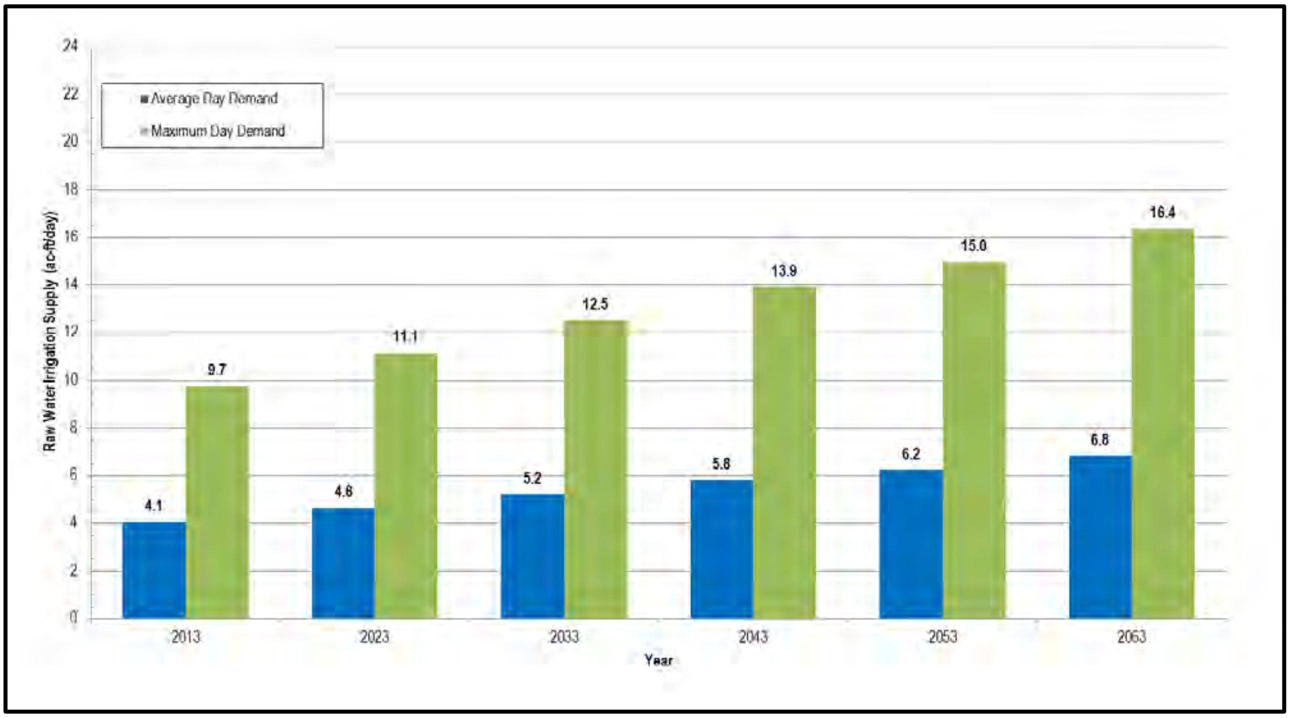
Using the peak demand projections provided previously and the average UFW percentage, an estimate of total raw water irrigation supply requirements to the lakes through the raw water delivery pipelines is displayed in Table 2-24. The average UFW is estimated to be 45%. These values are displayed as average day and maximum day in Chart 2-20. Peak hour values are not provided as the lake storage is assumed to be sufficient enough to supply the peak hour demand.

Table 2-24
Raw Water Irrigation Supply Requirements

Year	Planning Period	Average Day (ADD) (ac-ft/yr)	Average Day (ADD) (ac-ft/day)(1)	Maximum Day (MDD (ac-ft/day)
2013	Existing	1,131	4.1	9.7
2023	Near-Term	1,276	4.6	11.1
2033	Mid-Term	1,436	5.2	12.5
2043	Long-Term	1,581	5.8	13.9
2053		1,726	6.2	15.0
2063		1,856	6.8	16.4

(1) Based on a 275-day raw water irrigation season.

Chart 2-20
Raw Water Irrigation Supply Requirements



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2.9 Wastewater Flow Projections

Wastewater flows vary throughout the year, although the magnitude of the change is considerably less than water demands since the base sanitary flow (BSF) varies little throughout the year. The majority of the seasonal variation in wastewater flow is attributable to inflow and infiltration into the wastewater collection system. Wastewater collection systems can be significantly influenced by daily variations in wastewater flow as a result of potable use patterns throughout the City. The travel time within the collection system helps dampen the peak flows reaching the WRFs, which is commonly referred to as flow attenuation. In addition, rainfall-dependent inflow and infiltration (RDII), the flow portion caused directly from storm events, can contribute significantly to peak hour flows.

The MMF capacities of CCWRF and DCWRF are currently rated at 6.5 mgd and 10.5 mgd, respectively. More detail about their respective capacities is provided in Volume 8 – Wastewater Treatment. The hydraulic capacities for both WRFs are evaluated for re-rating in Volume 8.

2.9.1 Flow Forecast Terminology

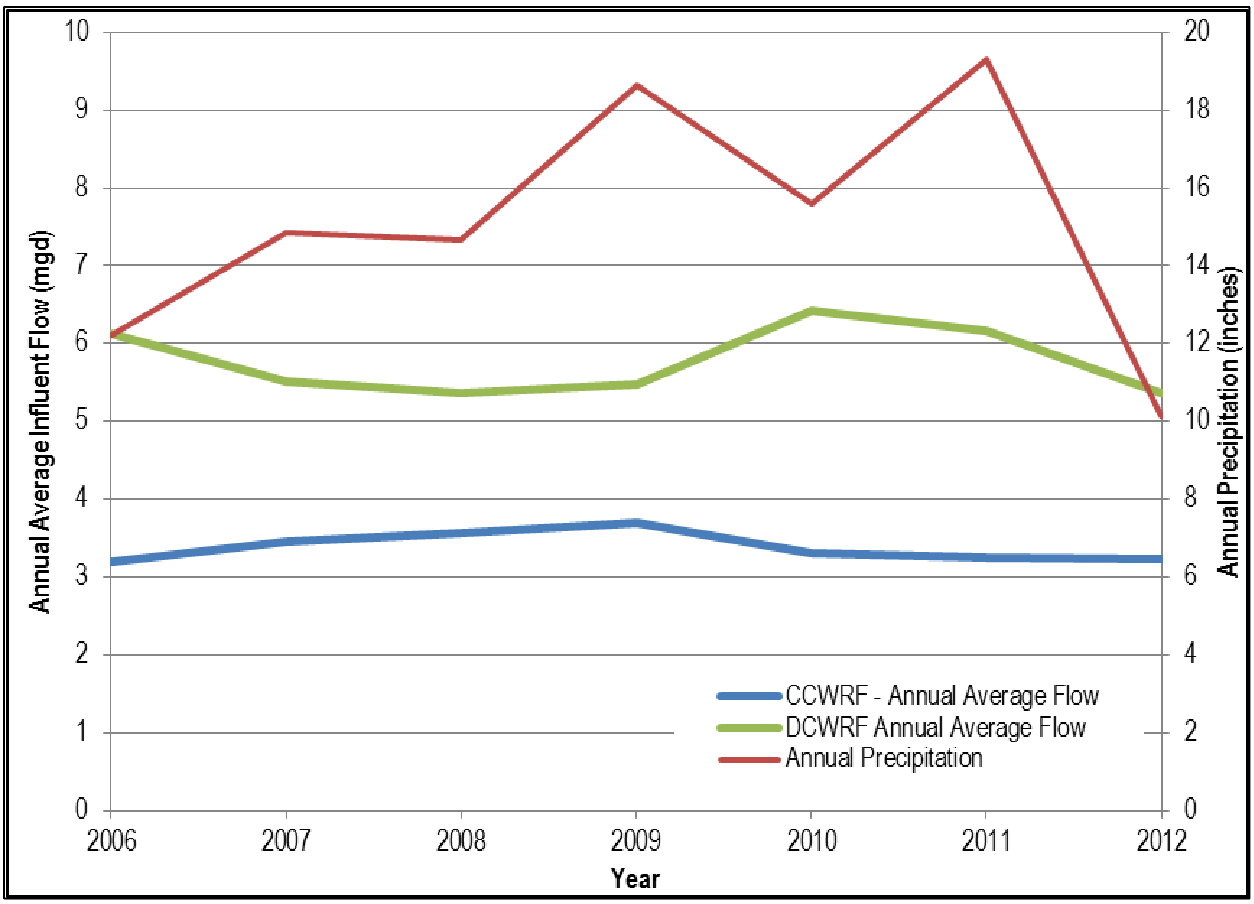
Wastewater flows vary throughout the year and during different hours of the day. The types of flow rates typically used to design the different components of wastewater collection and treatment systems are discussed below:

- **Base Sanitary Flow (BSF).** This is the wastewater volume generated by the customers without any infiltration and inflow (I/I).
- **Average Day Flow (ADF).** This is the total amount of wastewater flow treated throughout the year divided by 365 days per year. Average day flow is used primarily as the basis for making peak flow projections. ADF includes I/I averaged over the year.
- **Maximum Day Flow (MDF).** The maximum day is the day with the highest flows which is typically occurs after a rainfall event. Certain processes in the WRFs, such as determining equalization basin volumes, depend on having MDF flow projections.
- **Maximum Month Flow (MMF).** The maximum month is the highest of the average monthly wastewater flow values. Typically, the maximum month occurs in the early summer when groundwater rates reach their peak. Maximum month flow is the design condition for the biological treatment processes at the WRFs. MMF includes I/I averaged over the month with the maximum amount of flow.
- **Peak Hour Flow (PHF).** Wastewater systems experience peak flows during intense rainfall events. Inflow of runoff from a rainfall event can cause significant peak flows in the collection system and at the WRFs. Both the collection system and the hydraulically-sensitive components of the WRFs are designed to handle the peak flow. PHF includes I/I averaged over the hour with the peak flow.

2.9.2 Historic Flows

Total permanent population and system-wide average daily flow are the basis for all wastewater flow calculations. Hourly wastewater influent flow records from the SCADA system from both CCWRF and DCWRF for the years from 2006 to 2012 provide the basis for evaluating historic wastewater flows. Chart 2-21 shows the annual average influent flow. The total rainfall for each year is also included to show the relationship between rainfall and wastewater flows. Although, the peak flows from RDII can be high, they are usually of a short duration (a few hours to a couple of days) and are substantially averaged out by the annual average flow.

Chart 2-21
Historic Wastewater Influent Flows from 2006 to 2012



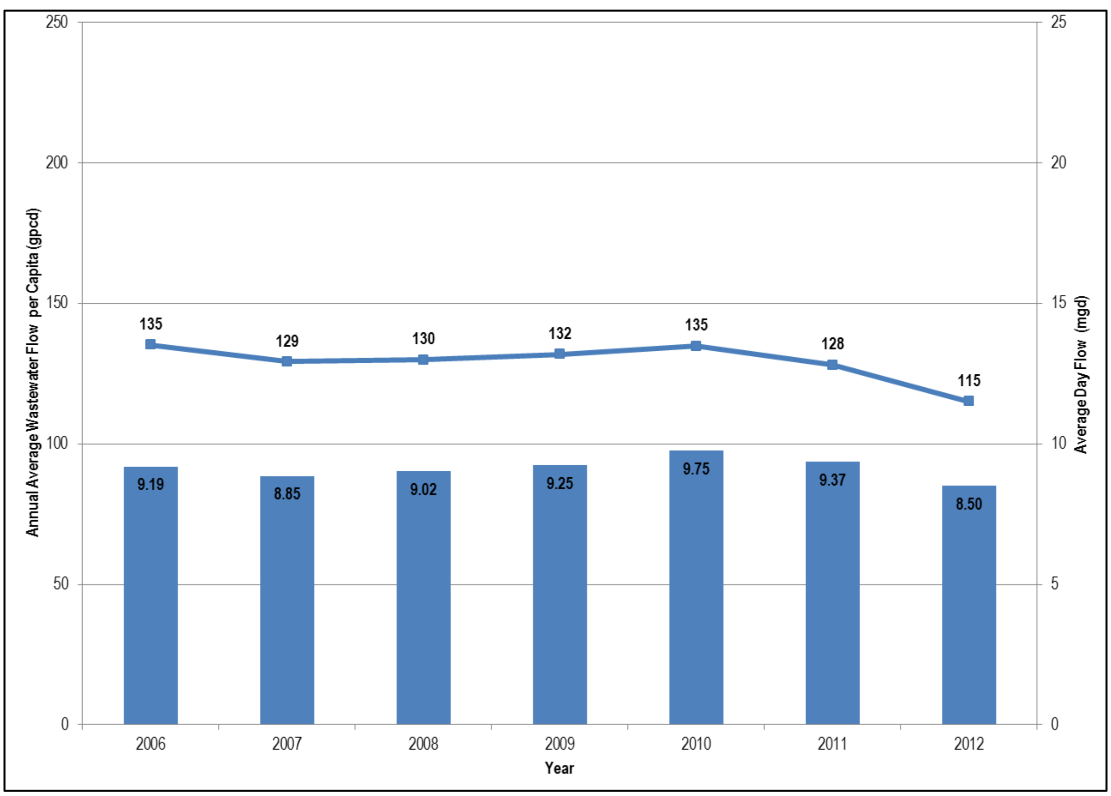
Similar to the potable water demands, system-wide per capita wastewater flow is determined by dividing the average flow at the WRFs by the total population served by BOPU. Table 2-25 and Chart 2-21 shows the per capita wastewater flow (ADF) by year from 2006 through 2012. The average wastewater influent flow per capita for the entire system is 129 gpcd over the last 7 years for both WRFs combined.

Table 2-25
Historic Wastewater Influent Flow per Capita

Year	CCWRF ADF Influent[1] (mgd)	DCWRF ADF Influent[1] (mgd)	Total ADF Influent (mgd)	Estimated Population Served	ADF Per Capita (gpcd)
2006	3.09	6.12	9.21	67,983	135
2007	3.46	5.51	8.97	68,503	131
2008	3.57	5.36	8.93	69,398	129
2009	3.69	5.48	9.18	70,091	131
2010	3.31	6.43	9.73	72,339	135
2011	3.26	6.17	9.43	73,105	129
2012	3.23	5.38	8.61	73,836	117
7-Yr Average	3.37	5.78	9.15	70,751	129

[1] Influent flows from CCWRF and DCWRF are obtained from the SCADA data.

Chart 2-22
Historic Wastewater Flow per Capita



For comparison, the 2003 Master Plans determined a 145 gpcd average wastewater influent flow (ADF) for both WRFs combined. The overall decrease is likely due to the water conservation practices including requirements for efficient fixtures and better water use habits. Rehabilitation of the sewer mains could slightly reduce system I/I and therefore the overall ADF.

North Front Range Water Quality Planning Association's Utility Plan Guidance document recommends using a residential wastewater flow factor of 85 gpcd, which includes a 10 gpcd base infiltration and inflow component. Additional comparisons in the region include 102 gpcd in Boulder, 79 gpcd in Evans, 85 gpcd for Metro Wastewater Reclamation District, 58 gpcd in Erie, 70 gpcd in Estes Park, and 95 gpcd in Loveland. Cheyenne's average wastewater influent flow is likely higher than the other utilities since it represents residential as well as industrial and commercial flows which increases the unit flow factor.

Wastewater Flow Composition

Wastewater flow is made up of two main components: BSF and I/I. BSF is that portion of the total wastewater flow directly attributable to what is predominantly indoor water use by BOPU's customers. BSF is assumed to have little seasonal variation. Similar to most utilities, BOPU does not meter the majority of its wastewater accounts. Therefore, the BSF is estimated from water billing records.

For this study, it is assumed that the average water demand from December through February provides a representative estimate of BSF. Since there is minimal outdoor water use during these months, it can be reasonably assumed that a majority of water used ends up as wastewater flow. For the Master Plans the difference between the ADF and the BSF is assumed of consisting of a combination of I/I. I/I is made up of two components, infiltration that occurs from groundwater contributions and rainfall-dependent infiltration and inflow (RDII) from storm event contributions. The groundwater infiltration is part of average day and maximum month flows. RDII is added to average day flows to represent maximum day and peak hour flows.

Infiltration and Inflow

Since the total annual RDII volume is small, even though peak wet-weather flow rates can be very high, the majority of the average I/I rate is assumed to be infiltration due to groundwater. Table 2-26 shows the estimated I/I rate for the past five years (2008-2012) based on the influent flow and estimated BSF. The I/I calculations are based on February ADF influent flows due to the estimated BSF being based on water meter data when outdoor water use is at a minimum. A portion of the flow entering DCWRF is sludge flows from the primary and secondary clarifiers at CCWRF and is accounted for using both CCWRF and DCWRF influent flow meters.

Therefore, the sludge flows have been subtracted from total influent flow in the I/I calculations. Only five years of estimated BSF (sewer consumption) values are readily available for this analysis.

Table 2-26
Estimated Annual I/I Rates

Year	ADF Total Influent (mgd)	Estimated BSF [(1)] (mgd)	I/I (mgd)	I/I Rate %
2008	8.4	6.1	2.2	27%
2009	8.5	6.0	2.5	29%
2010	9.0	5.9	3.1	34%
2011	8.8	5.9	2.9	33%
2012	8.2	5.9	2.3	28%
5-yr Average	8.6	6.0	2.6	30%

[(1)] Based on February ADF values for each year. Therefore, they will not equal the ADF values found in Table 2-25.

I/I contributes significantly to the overall wastewater flow treated at the WRFs. BOPU used portable flow monitors to identify those areas of the collection system that are significantly impacted by I/I. These basin-specific I/I factors are discussed in more detail in Volume 7.

Septage Flow

Septage from septic systems within Laramie County is transported to DCWRF for disposal and treatment. Over the past 7 years, an estimated average of 0.43 MG of septage per year is accepted with a reported high of 1.4 MG in 2012. Assuming a conservative estimate of 2.00 MG of septage a year delivered to DCWRF, septage only accounts for 0.005 mgd of additional influent. This will not affect the average or peak flows into DCWRF; however, the concentrated wastewater of the septage may affect influent loading values at the WRF.

Table 2-27
Historic Septage Flows

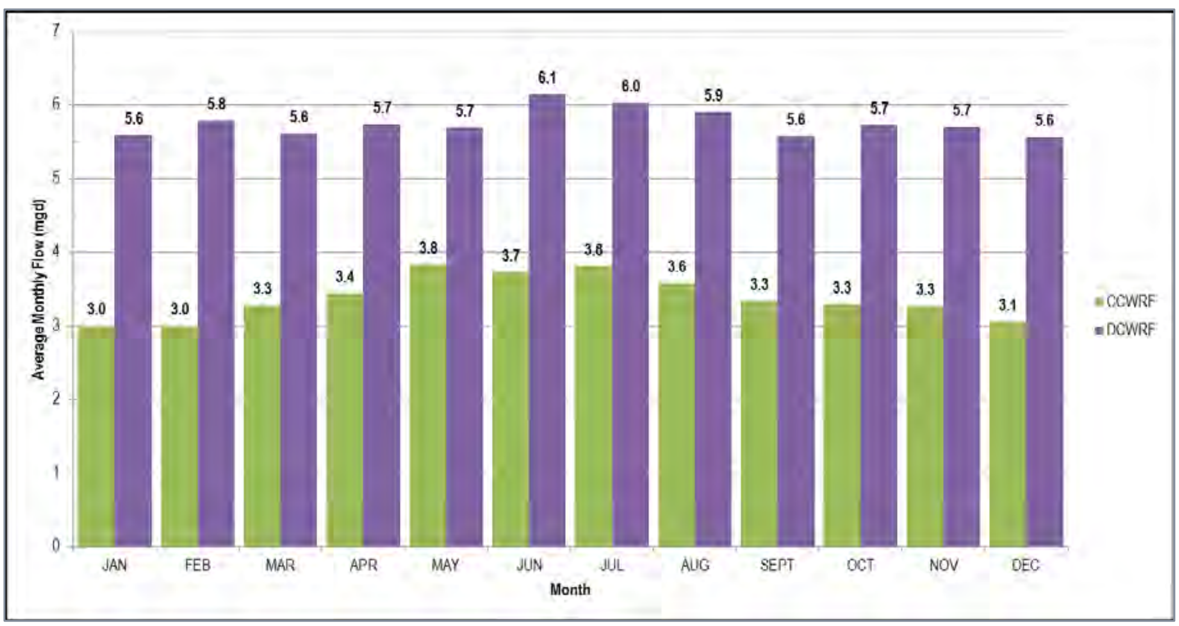
Year	Septage (MG)	DCWRF Influent (MG)	Percent Septage
2006	0.17	1,946	0.009%
2007[1]	N/A	2,318	-
2008	0.14	1,939	0.007%
2009	0.19	1,946	0.010%
2010	0.52	2,318	0.022%
2011	0.11	2,252	0.005%
2012	1.43	1,963	0.073%
Average	0.43	2,098	0.021%

[1] Septage data from 2007 is not available.

Monthly Distribution

The monthly distribution for wastewater flows is estimated based on the last 7 years of monthly influent flow information at both WRFs. Chart 2-23 shows the projected monthly distribution of wastewater flow. There is a noticeable increase in influent flow at both WRFs during the period from May through July when irrigation ditches and stream flows are increased causing higher groundwater levels.

Chart 2-23
7-year Average Monthly Distribution of Wastewater Influent Flows

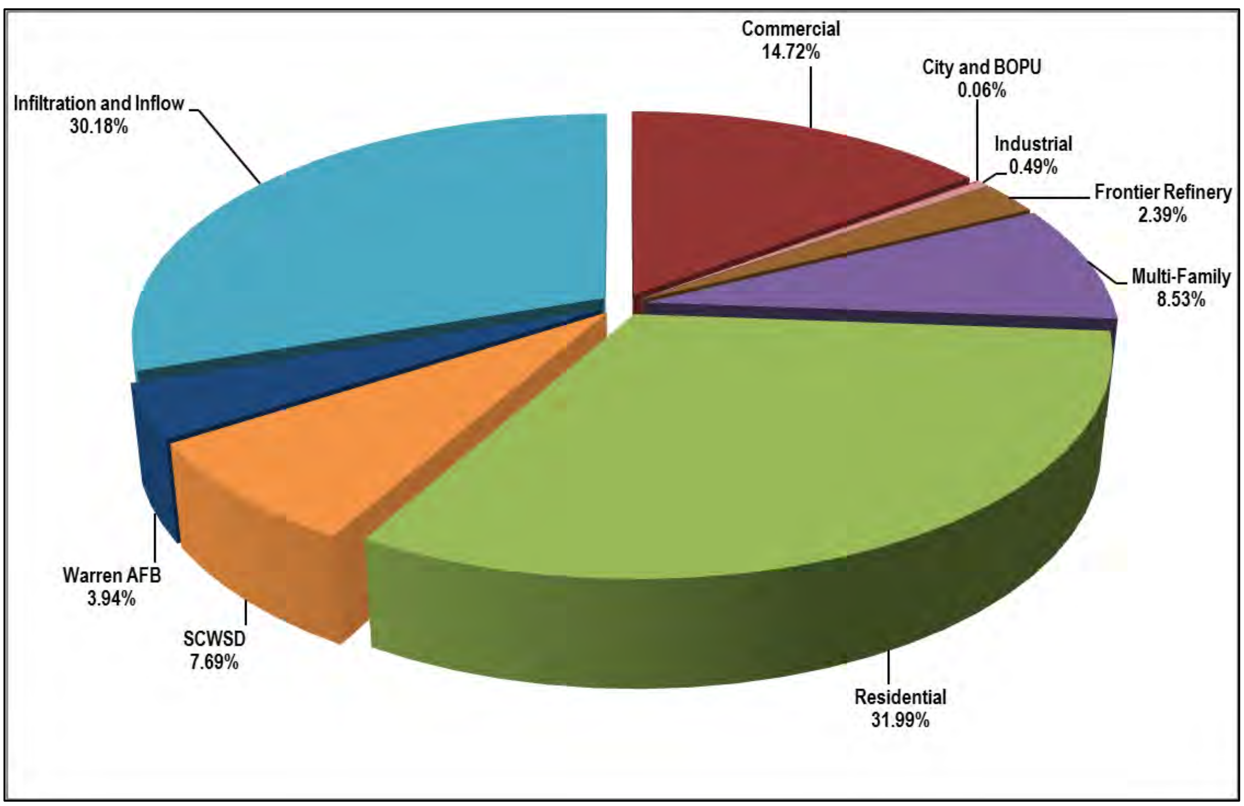


Wastewater Flow by Customer Classification

When forecasting future flows, the distribution of wastewater flows among customer classifications provides information on where the wastewater is being generated. Wastewater flow estimates are typically derived from available influent flow data since there is only minimal billing data available for establishing the BSF. BOPU monitors wastewater flow from Warren AFB, SCWSD, and Frontier Refinery; therefore wastewater flows for these three contributors are based on metered flow data. Both domestic and process wastewater from Frontier Refinery is discharged into BOPU's Crow Creek collection system. Frontier Refinery pre-treats the process wastewater prior to discharging into the collection system. BOPU meters the flow and it has an annual average contribution to the collection system of 0.20 mgd for the past 5 years. In addition, four of the water billing customer classes are not applicable to wastewater customers, namely potable irrigation, raw water irrigation, hydrant water, and recycled water.

The remaining customer classes flow contributions are derived from the average water use for the past 5-years in the February billing cycle. Chart 2-24 shows the contribution to wastewater flow by the various customer classes for both WRFs for the February billing cycle over the past 5 years.

Chart 2-24
Distribution of Wastewater Flow among Customer Classifications (2008-2012 Average)



2.9.3 Average Flow Projections

Establishing flow projections depends on using recurrence intervals to establish a level of conservatism in the forecast. For example, a recurrence interval of 10 percent refers to an event that is likely to occur once every 10 years. The probability plots included in this report show this concept as the percent probability of exceedence. That is for a 10 percent probability of exceedence, wastewater flows are likely to be higher than the value shown only one year out of ten.

Similar to the system-wide potable water demands, average day flow projections are based on the 10 percent probability of exceedence. Chart 2-25 shows the probability plot for average daily flow for the past 7 years from 2006 to 2012. For this study, 140 gpcd is used as the 10 percentile average day flow. For comparison, 155 gpcd was used during the 2003 Master Plans. The difference between the highest observed flow to the WRFs in the past 10 years (135 gpcd) and the 10 percent exceedence value (140 gpcd) is approximately 4 percent. The average daily flow includes the sludge flows from CCWRF since DCWRF will continue treating the solids from CCWRF.

Chart 2-25
Average Day Wastewater Flow Distribution

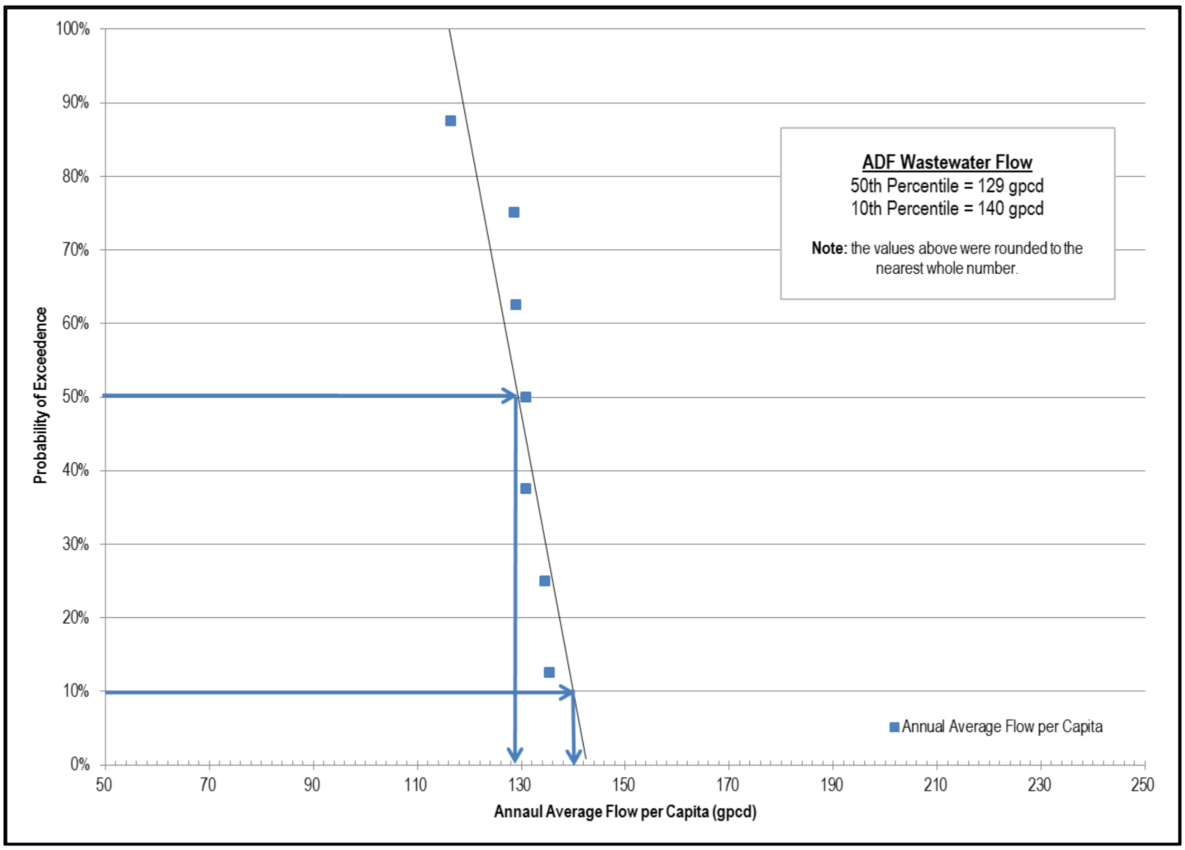


Table 2-28 and Chart 2-26 present the total average day wastewater influent flow forecast using 140 gpcd through the year 2063 with BOPU customer population projections for the approximate future wastewater service basins. The percentage of flow transfer from CCWRF to DCWRF including sludge, flushing and overflow flows is expected to stay the same since DCWRF will continue to treat sludge and overflow flows from CCWRF. Historically, over the past 10 years, approximately 35.5% of the flow arriving at CCWRF was transferred to DCWRF.

Considering the potential near-term future large BSF contributors and the potential for other large water users, average daily flow estimates are increased depending on estimated start-up dates of the developments.

Future wastewater basins are approximated using the existing service basin boundaries and the hydrologic drainage basins. A majority of the land area in the future wastewater service basins are areas outside the sewerable boundary and will need to be served using lift stations, especially in the future Dry Creek Service Basin. However, an estimated 67% of potential development and resulting population growth is within the sewerable boundary. Population projections for each of the service basins are estimated using the ratio of potential development land within each service basin to the overall Cheyenne area population growth.

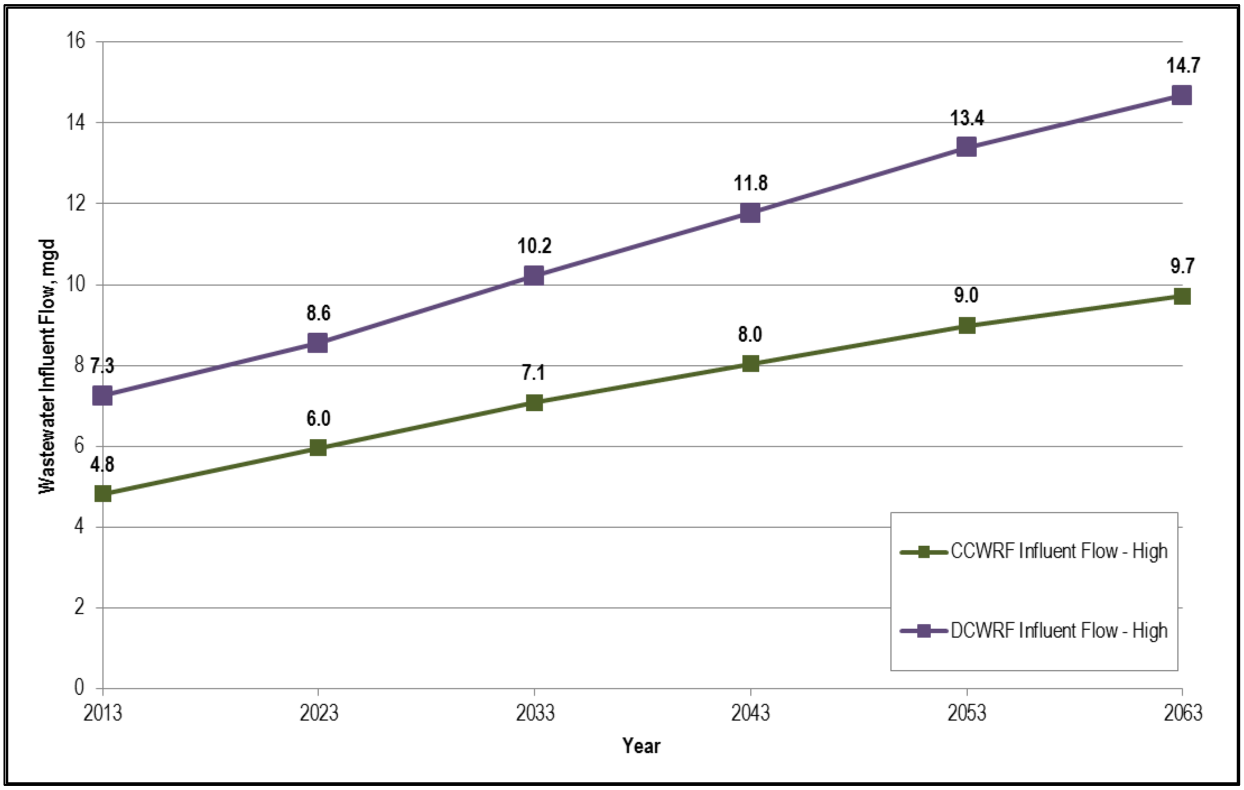
Figure 2-9 shows the approximate future wastewater service basins and potential developable land.

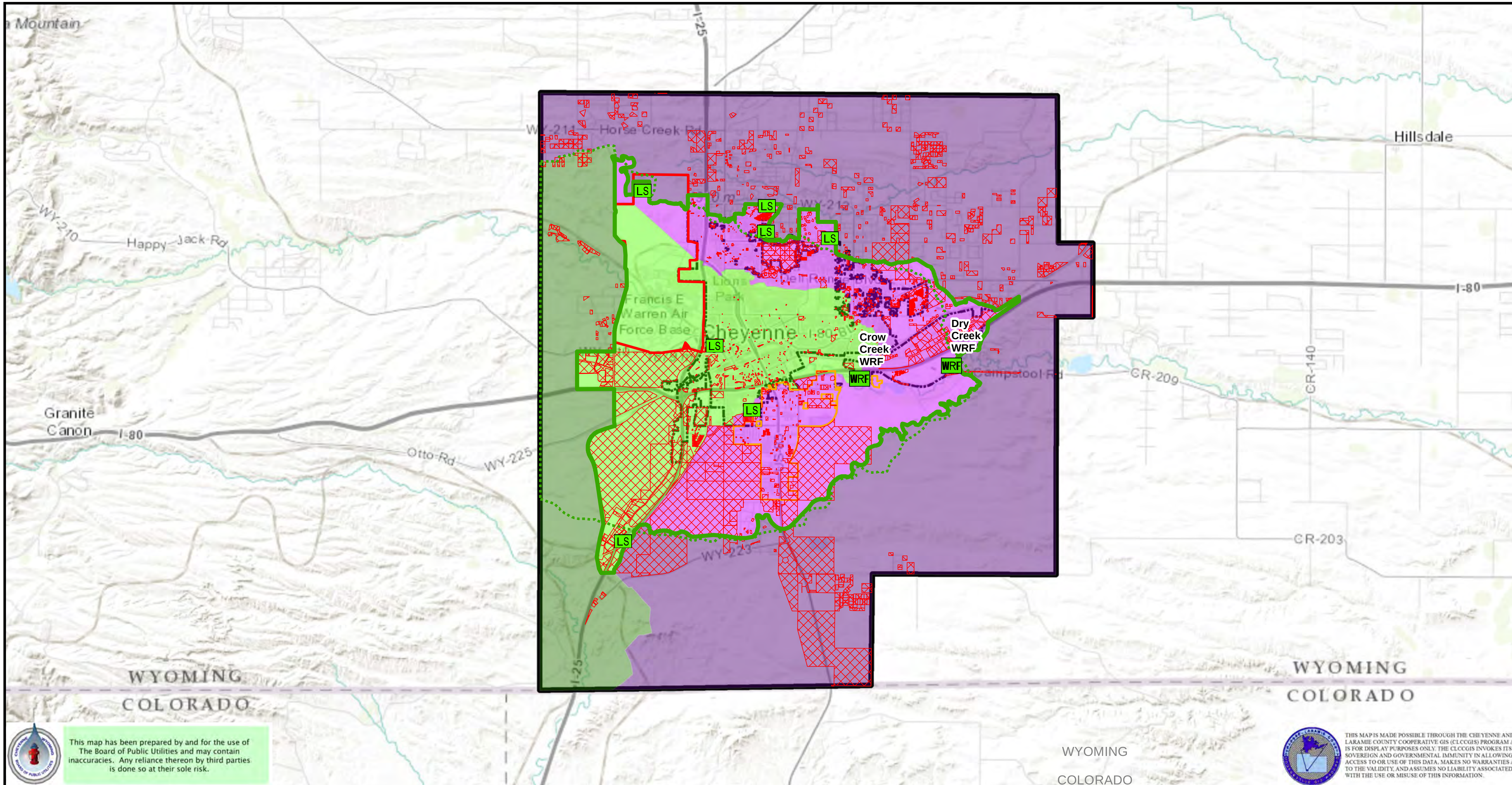
Table 2-28
Average Day Wastewater Flow Projections

		CCWRF		DCWRF	
Year	Planning Period	Large Contributors (mgd)	ADF Influent Flow[1] (mgd)	Large Contributors (mgd)	ADF Influent Flow[1] (mgd)
2013	Existing	0.0	4.8	0.0	7.3
2023	Near-Term	0.6	6.0	0.1	8.6
2033	Mid-Term	1.1	7.1	0.5	10.2
2043	Long-Term	1.5	8.0	0.9	11.8
2053		1.9	9.0	1.4	13.4
2063		2.2	9.7	1.8	14.7

[1] Flow includes contribution from Large Contributors.

Chart 2-26
Average Day Wastewater Flow Projections





1 inch = 3.43 miles

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Legend

- 2013 Master Plans Study Area
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- City of Cheyenne
- Sewer Service Area Boundary
- Sewerable Boundary (Green Line)
- WRF Water Reclamation Facility
- LS Lift Station

Future WRF Basins

- Existing Crow Creek
- Future Crow Creek
- Existing Dry Creek
- Future Dry Creek
- Potential Developable Land

HDR

Last Updated: 9/27/2013

Figure 2-9
Approximate Future Wastewater Service Basins

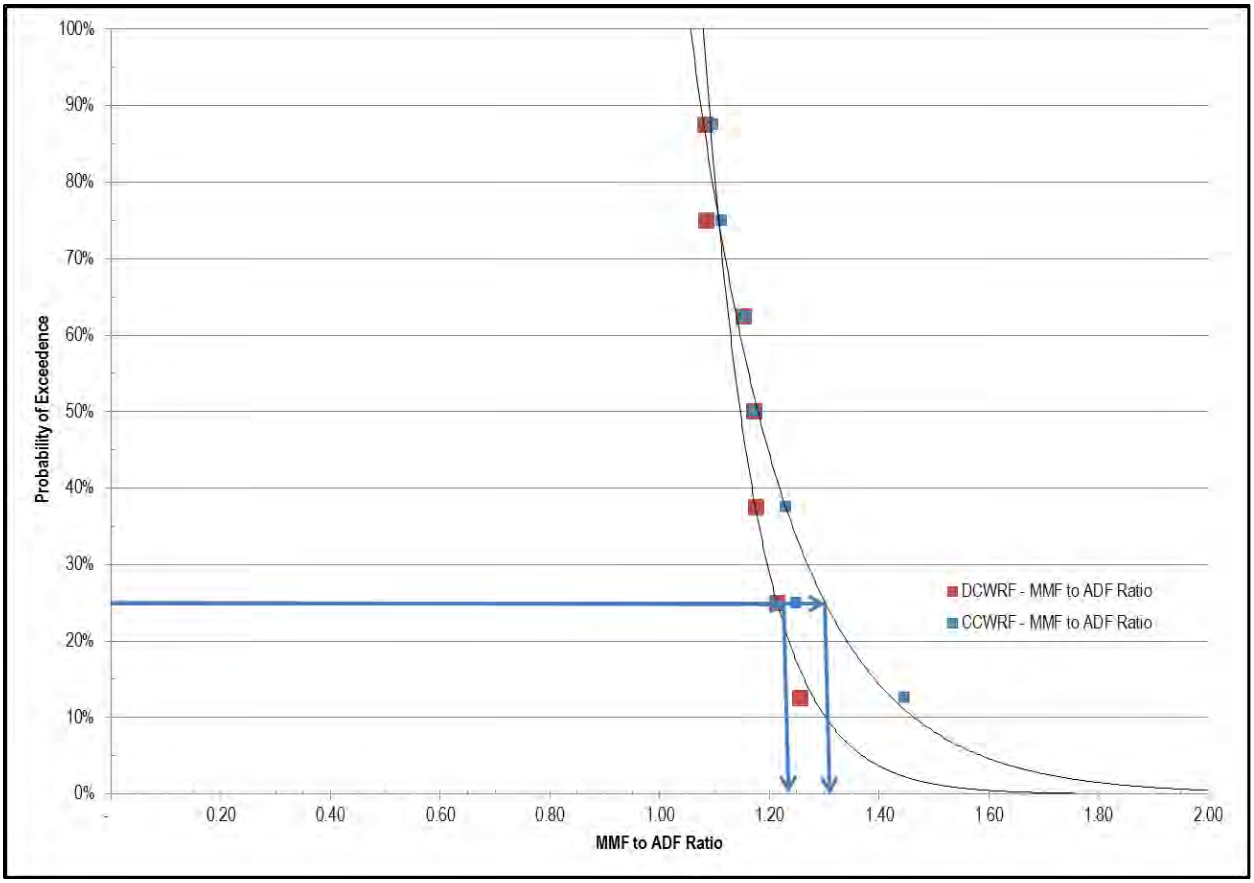
Volume 2 - Future Capacity Requirements
2013 Water and Wastewater Master Plans

2.9.4 Peaking Factor Determination

The first step for estimating peaking factors for the wastewater system is to evaluate historic flows. Maximum month, maximum day, and peak hour flows are considered in section for use in Volume 8. A 25th percentile exceedence probability is used for the peaking factor determination since peak flow projections are based on average day flow projections which used a 10th percentile , so stacking the exceedence probabilities in this fashion give conservative results.

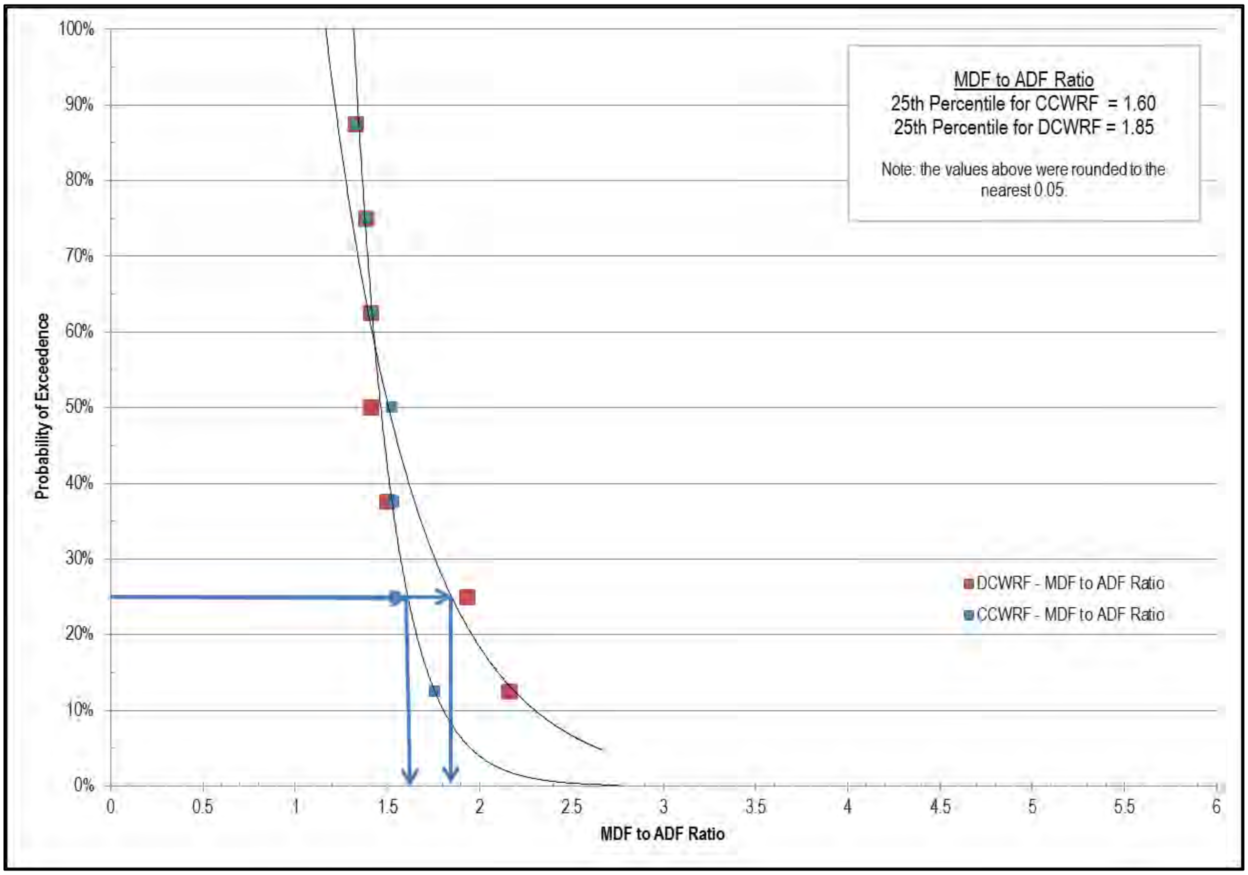
Chart 2-27 illustrates the probability of exceedence analysis for MMF to ADF wastewater flow ratios from 2006 to 2012. Maximum month flows typically occur during the early summer months as a result of additional I/I due to higher groundwater levels and rainfall events. A 25th percentile exceedence probability establishes a MMF to ADF ratio of 1.30 and 1.25 for CCWRF and DCWRF, respectively. The higher MMF flows seen at CCWRF could show a slightly higher I/I contribution in the Crow Creek Service Basin than in the Dry Creek Service Basin.

Chart 2-27
Maximum Month to Average Day Flow Distribution



MDF values are taken from each year in 2006 to 2012 and compared to the ADF for the same year. Chart 2-28 illustrates the probability of exceedence analysis for MDF to ADF flow ratios from 2006 to 2012. A 25th percentile exceedence probability establishes a MDF to ADF ratio of 1.60 and 1.85 for CCWRF and DCWRF, respectively.

Chart 2-28
Maximum Day Flow to Average Day Flow Distribution



PHF values are taken from each year in 2006 to 2012 and compared to the ADF for the same year. Chart 2-29 illustrates the probability of exceedence analysis for PHF to ADF wastewater flow ratios from 2006 to 2012. A 25th percentile exceedence probability establishes a PHF to ADF ratio of 2.30 and 3.0 for CCWRF and DCWRF, respectively.

DCWRF's influent flow metering is downstream of the influent screens which causes artificial peaks in the hourly influent flow data when the screens are cleaned. To filter these artificial peaks out of the data for this peak hour flow analysis, flow data is compared to precipitation values in Cheyenne and the duration of the peak flow events. If there was no precipitation or only trace precipitation during peak flow event and/or the duration of increased flow was under only 1 hour, these values are removed from the data set.

Chart 2-29
Peak Hourly Flow to Average Day Flow Distribution

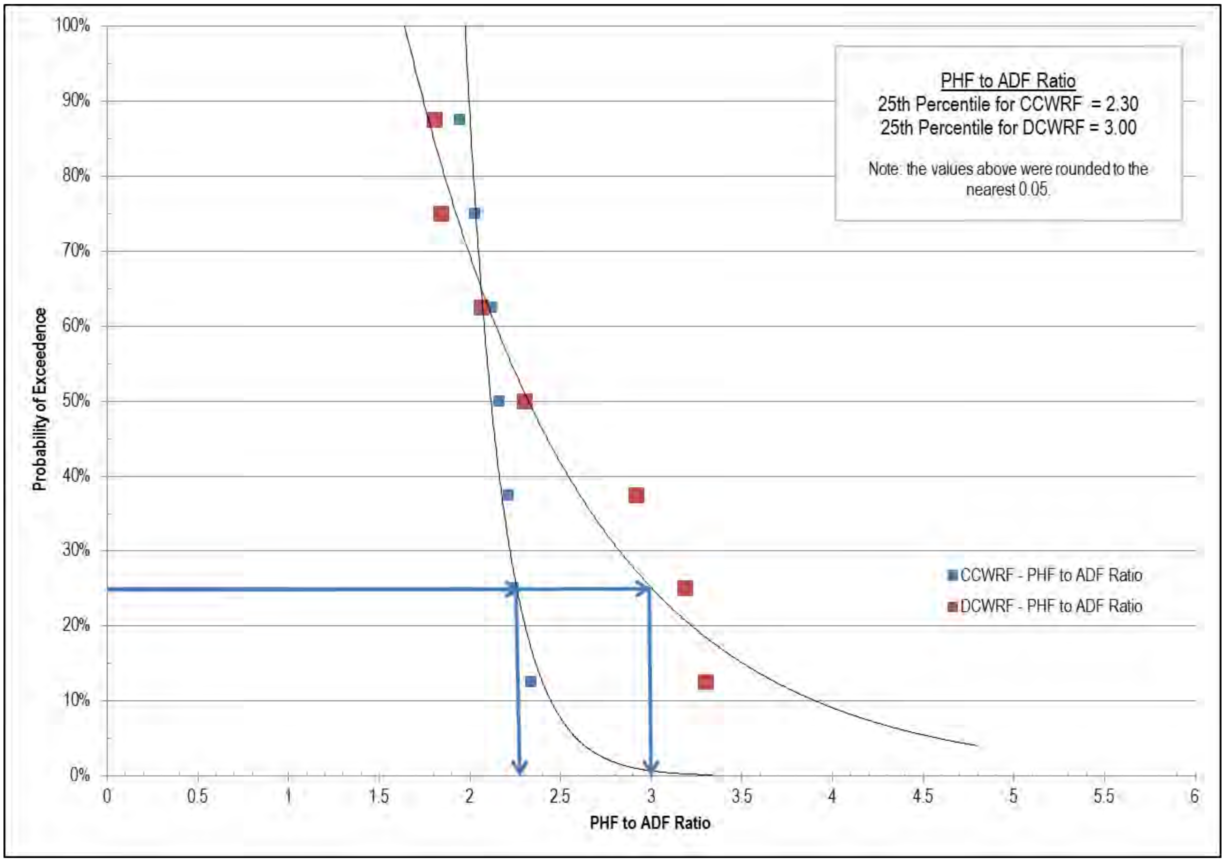


Table 2-29 summarizes the wastewater peaking factors for MMF, MDF, and PHF. Values are presented in terms of both ratios and unit flows. These peaking factors are used to determine the flow projections in this Volume, wastewater collection system requirements for Volume 7 and wastewater treatment requirements in Volume 8.

Table 2-29
Wastewater Peaking Factors

	CCWRF	DCWRF
Average Day Flow		
Unit flow, gpcd	140	140
Maximum Month Flow		
Ratio (MMF/ADF)	1.35	1.25
Unit flow, gpcd	189	175
Maximum Day Flow		
Ratio (MMF/ADF)	1.60	1.85
Unit flow, gpcd	224	259
Peak Hour Flow		
Ratio (PHF/ADF)	2.30	3.00
Unit flow, gpcd	322	420

2.9.5 Peak Flow Projections

To develop wastewater flow projections for the planning intervals, the ADF (140 gpcd) and peaking factors are applied to the population projections. For CCWRF, the MMF, MDF, and PHF projections are presented in Table 2-30 and Chart 2-30.

Table 2-30
CCWRF - Wastewater Flow Projections

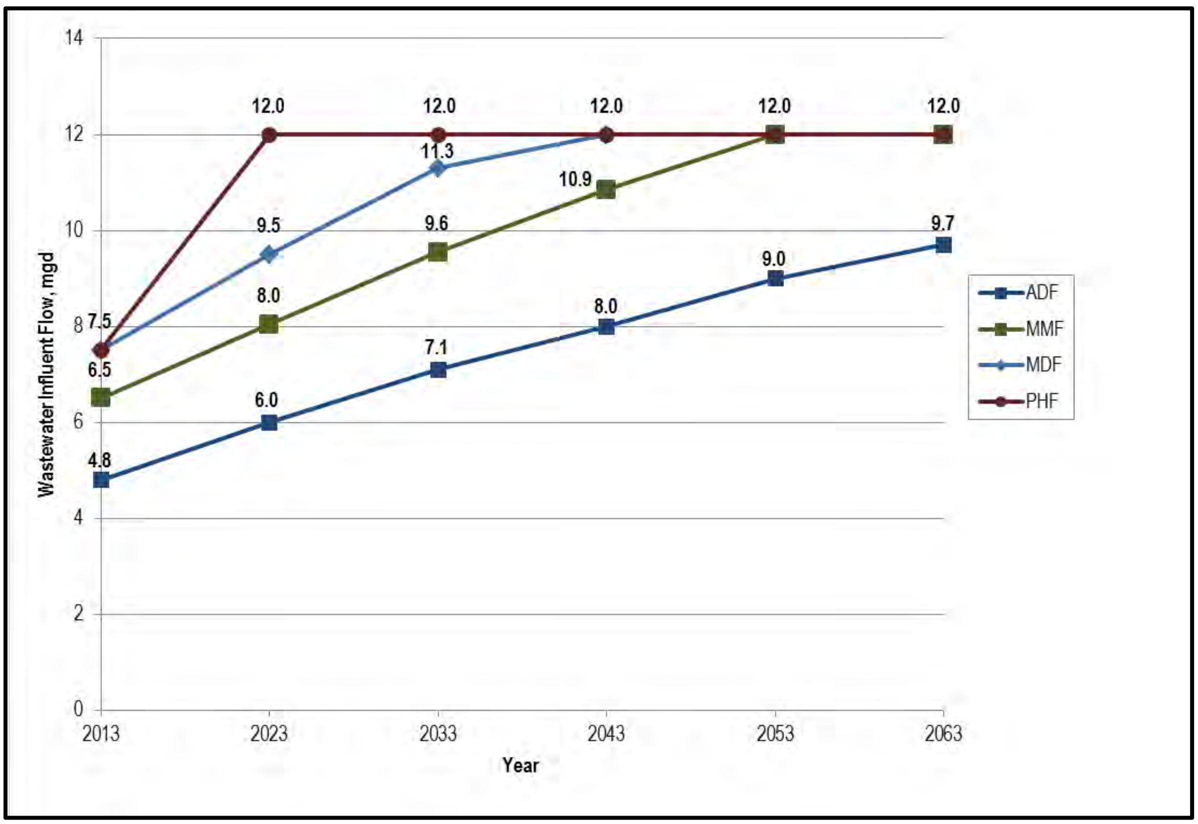
Year	Planning Period	Average Day (ADF)		Maximum Month (MMF)		Maximum Day (MDF)(1)		Peak Hour (PHF)(1)	
		Influent Flow (mgd)	Flow to DCWRF(1) (mgd)	Influent Flow(2) (mgd)	Flow to DCWRF(3) (mgd)	Influent Flow(2) (mgd)	Flow to DCWRF(3) (mgd)	Influent Flow(2) (mgd)	Flow to DCWRF(3) (mgd)
2013	Existing	4.8	1.0	6.5	1.3	7.5	1.7	7.5	4.6
2023	Near-Term	6.0	1.3	8.0	1.6	9.5	1.9	12.0	3.0
2033	Mid-Term	7.1	1.5	9.6	1.9	11.3	2.2	12.0	5.8
2043	Long-Term	8.0	1.6	10.9	2.2	12.0	2.6	12.0	6.5
2053		9.0	1.8	12.0	2.5	12.0	4.2	12.0	8.7
2063		9.7	1.9	12.0	3.5	12.0	5.9	12.0	12.3

(1) ADF to DCWRF includes estimated flushing water and sludge flows from CCWRF.

(2) Flow projections over 7.5 mgd for 2013 and 12.0 mgd for 2023-2063 are adjusted down as the diversion weir in the CCWRF influent pumping station is set to divert the flows over these values to DCWRF. The differences between the flow projections and the maximum CCWRF influent limits are added to the DCWRF flow projections.

(3) MMF, MDF, and PHF to DCWRF includes estimated flushing water, sludge flows, and flow diversion to DCWRF based on an existing and future CCWRF influent limit of 7.5 and 12 mgd, respectively.

Chart 2-30
CCWRF - Wastewater Flow Projections



Note: This chart reflects the diversion of flow to DCWRF above 7.5 for 2013 and 12.0 mgd for 2023-2063.

For comparison of actual and projected CCWRF flows, the highest ADF of 3.7 mgd occurred in 2009 and the projected ADF for 2013 is 4.8 mgd. The projected 2013 ADF is higher than previous years; it is assumed to be conservative and accounts for recent large contributor impacts, general growth, and associated I/I contributions. Likewise, at CCWRF, the highest PHF of 8.3 mgd was in 2009 and the projected PHF for 2013 is 11.1 mgd.

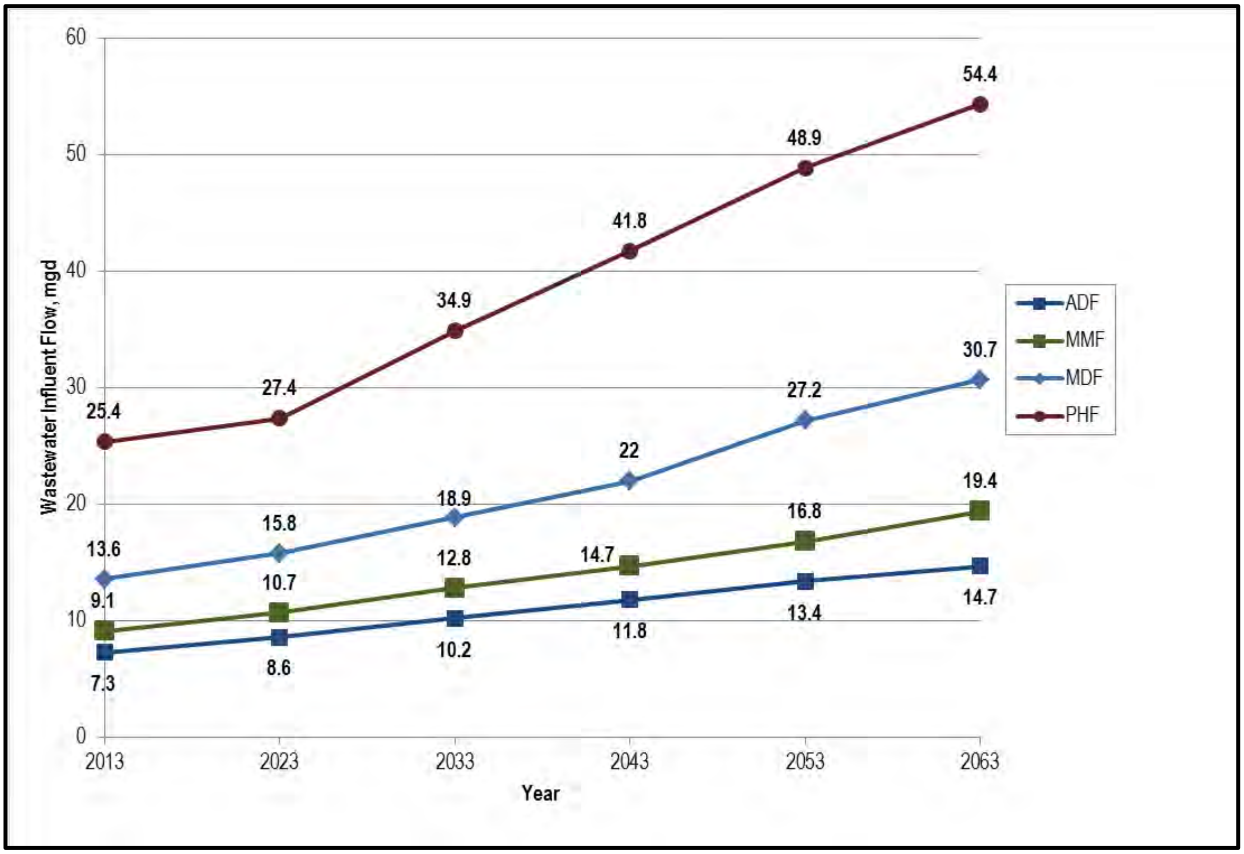
For DCWRF, the MMF, MDF and PHF projections are presented in Table 2-31 and Chart 2-31. Currently, during high flow periods, BOPU diverts flow over 7.5 mgd to DCWRF because of the limitation of the single headworks screen at CCWRF. Headwork improvements at CCWRF are currently being designed and will be constructed by 2015 which will remove this limitation. Therefore, for flow projections over 12.0 mgd at CCWRF which are only projected beyond 2013, the difference between the projection and the overflow level at 12.0 mgd is added to the DCWRF projection as that portion of flow will be diverted to DCWRF.

Table 2-31
DCWRF –Wastewater Flow Projections

		Average Day (ADF)		Maximum Month (MMF)		Maximum Day (MDF)		Peak Hour (PHF)	
Year	Planning Period	Flow from CCWRF(1) (mgd)	Influent Flow) (mgd)	Flow from CCWRF(2) (mgd)	Influent Flow (mgd)	Flow from CCWRF(2) (mgd)	Influent Flow (mgd)	Flow from CCWRF(2) (mgd)	Influent Flow (mgd)
2013	Existing	1.0	7.3	1.3	9.1	1.7	13.6	4.6	25.4
2023	Near-Term	1.3	8.6	1.6	10.7	1.9	15.8	3.0	27.4
2033	Mid-Term	1.5	10.2	1.9	12.8	2.2	18.9	5.8	34.9
2043	Long-Term	1.6	11.8	2.2	14.7	2.6	22.0	6.5	41.8
2053		1.8	13.4	2.5	16.8	4.2	27.2	8.7	48.9
2063		1.9	14.7	3.5	19.4	5.9	30.7	12.3	54.4

(1) ADF from CCWRF includes estimated flushing water and sludge flows from CCWRF which is included in the DCWRF influent ADF flow projections.
(2) MMF, MDF, and PHF from CCWRF includes estimated flushing water, sludge flows, and max day flow diversion which is included in the DCWRF influent PDF flow projections.

Chart 2-31
DCWRF - Wastewater Flow Projections



Note: This chart reflects the diversion of flow from CCWRF above 12.0 mgd (peak flows only).

For comparison of actual and projected DCWRF flows, the highest ADF of 6.4 mgd occurred in 2010 and the projected ADF for 2013 is 7.3 mgd. The projected 2013 ADF is higher than previous years; it is assumed to be conservative and accounts for recent large contributor impacts, general growth, and associated I/I contributions. Likewise, at DCWRF, the highest PHF of 18.8 mgd was in 2009 and the projected PHF for 2013 is 21.8 mgd.

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2.10 Recycled and Reuse Water Demand Projections

Recycled and reuse water reduces the overall demand for ground and surface water supplies, thereby extending the effective capacity of these high quality water sources. WDEQ regulates recycled and reuse water use based on the level of treatment provided and type of application. BOPU uses both Class A recycled water and Class B reuse water for different uses.

Class A recycled water and Class B reuse water are defined as follows:

- Class A recycled water is treated wastewater which has received advanced treatment and/or secondary treatment and a level of disinfection so that the maximum number of fecal coliform organisms is 2.2 colony forming units (CFU per 100 ml or less. Class A recycled water is typical of that treated by the BOPU recycled water treatment facility and sent to the recycled water distribution system for authorized uses of primarily irrigation.
- Class B reuse water is treated wastewater which has received the equivalent of secondary treatment and a level of disinfection so that the maximum fecal coliform level is greater than 2.2 CFU per 100 ml and less than 200 CFU per 100 ml. Class B reuse water is typical of water produced by the BOPU WRFs for construction water purposes by contractors and use within the WRFs. Unused Class B reuse water is discharged into the receiving creeks as part of the WRF effluent discharge.

As noted previously, the use of raw water for irrigation and lake replenishment demands could supply a small portion of BOPU's total water demand on an average day basis. This could be further increased if BOPU finds other raw, recycled, and reuse water customers that can use these water sources in varying capacities. For every ac-ft of reuse or recycled water that is used, it reduces BOPU's need for additional ground or surface water sources.

BOPU produces Class A recycled water at CCWRF through biological treatment, filtration and disinfection of wastewater effluent. During upgrades to CCWRF between 2004 and 2006, BOPU added supplemental sand filtration and sodium hypochlorite disinfection, along with distribution pumping facilities. The additional treatment allows BOPU to treat the Class B reuse water to Class A recycled water standards. Class A recycled water meets the highest water quality requirements established by WDEQ for recycled water. The recycled water is a safe, drought resistant source of water for irrigation and non-potable industrial uses. Cheyenne started using recycled water to irrigate parks, athletic fields, and green spaces in 2007.

Currently, the Class A recycled water treatment facilities at CCWRF have a 4 mgd capacity. To date, Phases 1 and 2 of the recycled water distribution system have been completed and total approximately 14 miles of distribution pipelines. Phase 1 completed in 2007 provides up to 2.2 mgd recycled water to 14 locations including schools, golf courses, athletic fields, parks, cemeteries, and the Veterans Affairs center. Phase 1 also includes a pump station located at

CCWRF and a pump station and storage pond located at the Prairie View Golf Course. Phase 2 completed in 2009 provides recycled water to five new locations including schools and parks at a rate of up to 0.6 mgd. Phase 2 also includes relining the Prairie View Golf Course pond and increased pumping capacity at the Prairie View Golf Course pump station. The 2012 total amount of existing irrigated land with recycled water is approximately 277 acres. The recycled water irrigation season is assumed to be 250 days over March through November from metered use data.

Currently, the amount of Class A recycled water use is limited by the availability of effluent during irrigation season from CCWRF. Since there is not a lot of storage available at CCWRF for effluent or treated recycled water, treatment and distribution of recycled water is dependent on the volume of CCWRF influent. In the future, effluent at DCWRF could be pumped back to CCWRF for treatment to Class A recycled water.

Class B reuse water is currently limited to use at the WRFs and for construction water use supplied to contractors at DCWRF.

2.10.1 Demand Forecast Terminology

The rate at which recycled water is used varies on a seasonal basis, as well as during different hours of the day. The categories of demand rates are typically referred to as peaking factors. Peaking factors are used to design the different components of the recycled and reuse water systems. The terminology for each of the recycled water peaking factors used in these Master Plans is described below.

- **Average Day (ADD).** This is the total amount of water used throughout the year divided by 275 days per year (9-month irrigation season). Average day demand is used primarily to determine the adequacy of the water system to deliver the total amount of water that will be needed during the year. It is also used as the basis for making peak demand projections.
- **Monthly Distribution**. This is the historic distribution of total annual water use by month. This distribution differs between the potable and recycled water systems since there is little or no outside irrigation or lake replenishment demand during the winter resulting in low to no flows for several months. This information is used to determine the adequacy of the water systems to meet seasonal demands.
- **Maximum Month (MMD).** This is simply the highest of the monthly distribution values. Typically, July or August is the month in which the greatest amount of recycled water is used in the service area.
- **Maximum Day (MDD).** This is the demand during the day with the highest system demands. For outside irrigation, the maximum day and peak week demand rates are the same as long as each day's water use is only that needed to meet the evapotranspiration (ET) requirements for the watering interval selected by the applicator.

- For example, if customers water an average of once every three days and apply 3/7th of the weekly ET demand each time, then maximum day and peak week demand rates are identical, as shown below:
    - (3/7 x 2 inches) x (1/3 of customers) = 1/7 of the weekly demand
- If all customers should try to irrigate the total week's worth of ET all on the same day, then the maximum day rate will be higher than the peak week. With the potable water system, the number of individual customers is large, they have different watering cycles, and the amount of acreage irrigated on any one day should be approximately the same. The key is to educate and manage the customer base in a way that prevents overwatering or all on the same day.

- **Peak Hour (PHD).** This is the demand during the hour with the highest and is the highest peaking factor. It is typical for recycled water demands to peak during the summer and during certain hours of the day. Note that peak hour to average demand ratios are higher for the recycled water system since there is currently little to no control over when customer's irrigate.

2.10.2 Historic Demands

Historic recycled water demand records for 2007 through 2012 provide the basis for projections and provide a general cross-section of water use in both wet and dry years, as the summer of 2012 was relatively dry and the summer of 2011 was relatively wet. Table 2-32 shows recycled water delivered from CCWRF to the recycled water distribution system from 2007 to 2012 for irrigation. Table 2-33 shows the average day reuse water use at DCWRF from 2007 to 2012. The CCWRF Class B reuse volume is minimal (less than 0.06 mgd at maximum flows) and use is sporadic; therefore it is a not significant use of wastewater effluent historically. The ADD for Class B reuse water at DCWRF during the period of 2008 to 2012 is 0.15 mgd.

Chart 2-32 shows the annual recycled water use per acre over the past 6 years along with annual precipitation values. The values represent delivered recycled water volumes and do not include UFW. As can be expected, years with less precipitation generally result in higher water use. The annual average demand of recycled water during the period of 2008 to 2012 is 516 ac-ft/yr. The years 2007 and 2009 are not included in the averages since they were only operated from July/August through November, a partial year of delivery, due to construction on the recycled water distribution system.

Table 2-32
Historic Class A Recycled Water Use from 2007 to 2012

Year	Annual Use (ac-ft/yr)	Annual Use (ac-ft/ac/yr)(1)	Percent of Annual Available CCWRF Effluent(2)
2007(3)	223	1.42	15.7%
2008	461	2.94	17.4%
2009(3)	102	0.37	9.3%
2010	587	2.12	23.5%
2011	428	1.55	21.4%
2012	657	2.37	29.1%
Average	533	2.24	22.7%

(1) Includes 157 acres of turf from 2007-2008, and 277 acres of turf from 2009-2012.

(2) Average available effluent (influent – reuse – sludge flow) based on an average of 84% of influent is available effluent for recycled water.

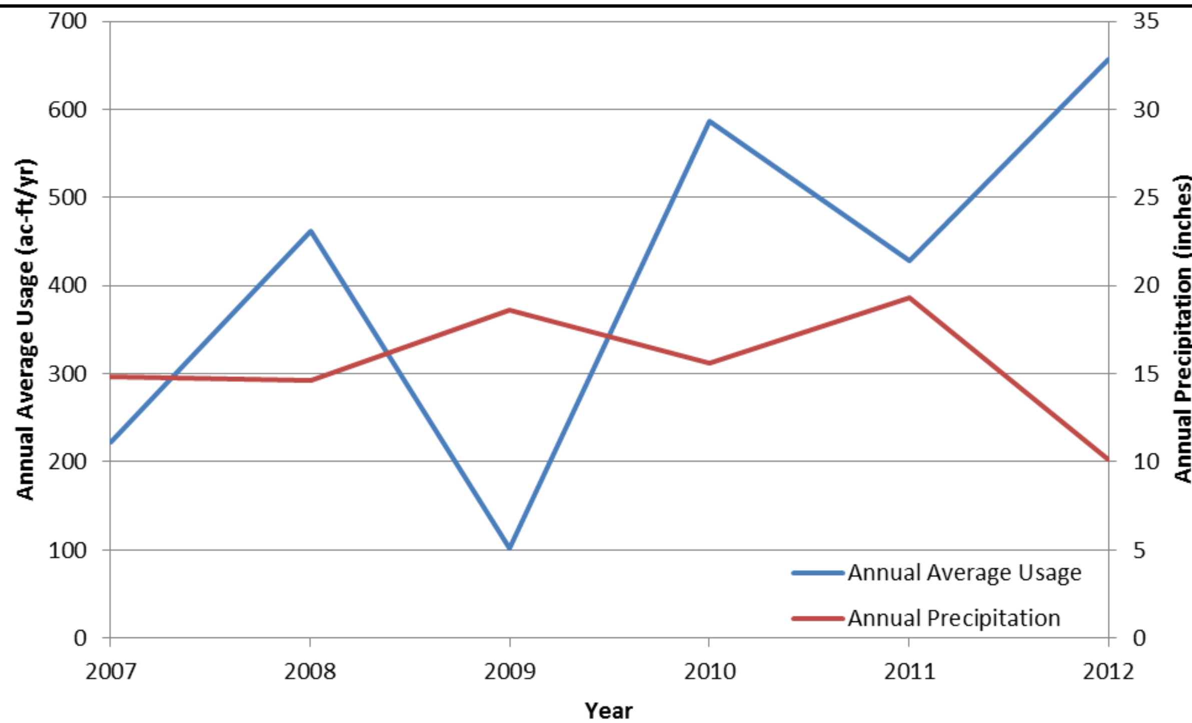
(3) Partial year of delivery. Not included in Averages.

Table 2-33
Historic DCWRF Class B Reuse Water Use from 2007 to 2012

Year	Average Day Use (mgd)	Percent of Average Day Available DCWRF Effluent(1)
2007	0.14	2.5%
2008	0.15	2.8%
2009	0.13	2.4%
2010	0.16	2.4%
2011	0.15	2.4%
2012	0.19	3.6%
Average	0.15	2.7%

(1) Average available effluent based on an average of 98% of influent is available effluent for reuse water.

Chart 2-32
Historic Class A Recycled Water Use from 2007 to 2012



Note: 2007 and 2009 were partial delivery years from July/August to November. In 2009, the irrigation area served was increased from 221 to 390 acres.

Chart 2-33 shows the recycled water use per acre for the past 6 years. It appears that recycled water use varies from year to year and does not show any significant trends when accounting for annual precipitation. The average recycled water use from 2008 to 2012 is 2.24 ac-ft/ac/yr not including 2009.

Chart 2-33
Historic Class A Recycled Water Use per Acre from 2007 to 2012

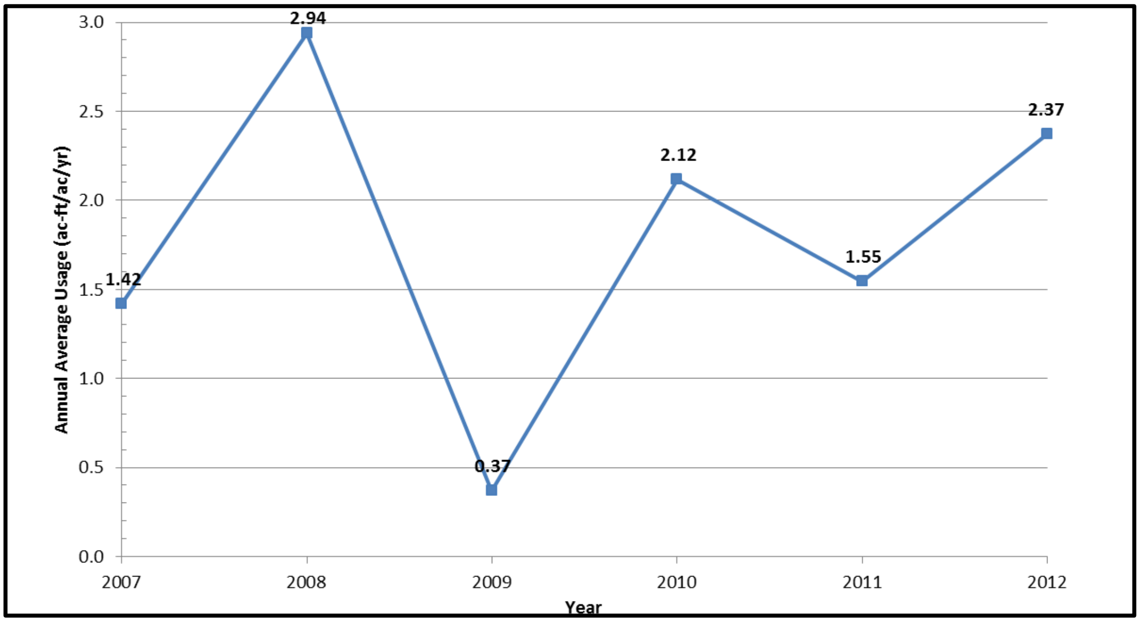
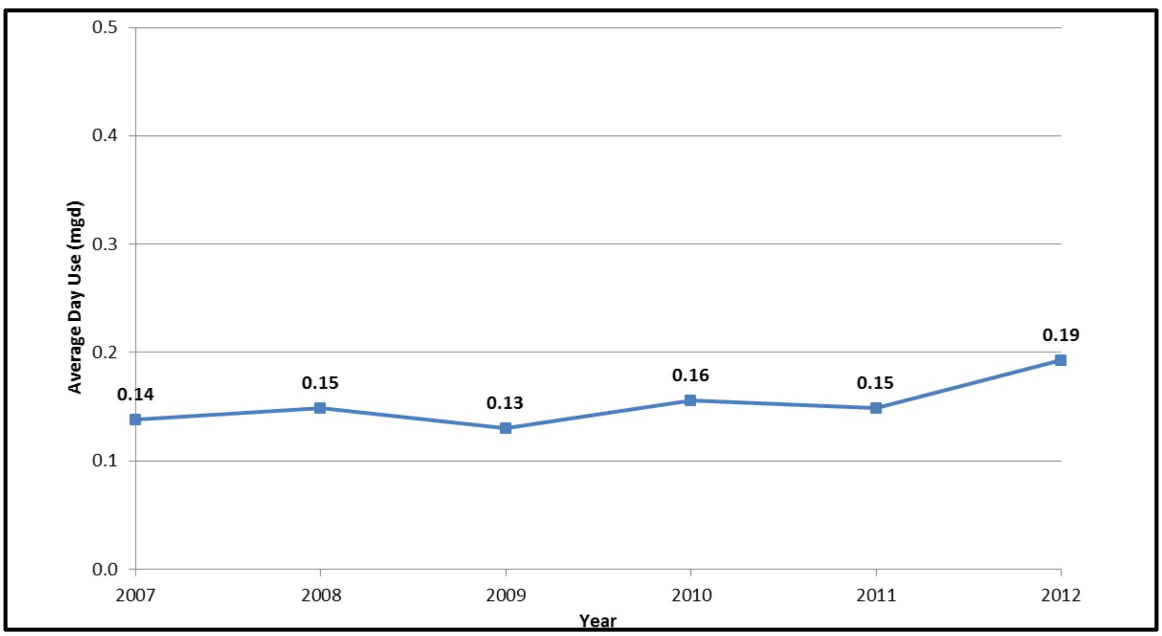


Chart 2-34 shows the reuse water use for the past 6 years. It appears that reuse water use varies slightly from year to year showing a very small trend upwards at around 1% per year averaged over the past 6 years.

Chart 2-34
Historic Class B DCWRF Reuse Water Use from 2007 to 2012



Unaccounted-for Water

Unmetered use, lost water, lake seepage, and other UFW is accounted for when developing demand projections either by using unit demands that include UFW or by adding UFW to the base use. Since the demand values presented above are based on the sum total of delivered water to the recycled water system, they do include UFW volumes. Thus, a UFW factor is not required in the projections. However, to determine the level of UFW in the recycled water system including the losses in the distribution system and storage at Prairie View Golf Course, annual UFW since 2007 is calculated. Recycled water used by the City and other customers is metered thus providing an accurate baseline estimate for demand.

Table 2-34 presents the UFW summary from 2007 to 2012 on delivered recycled water versus accounted-for (metered) water. Delivered water is the sum total of the City's recycled use and the other recycled water accounts. The balance of supplied recycled water represents the UFW demand for the system. The average percentage of UFW water compared to the total supplied volume over the period of 2007 through 2012 is 24%.

Table 2-34
Class A Recycled Unaccounted-for Water Summary – 2007 to 2012

Year	Supplied Water (ac-ft)	Delivered Water (ac-ft)	Unaccounted-for Water (ac-ft)	Percent of UFW (%)
2007	2007	223	19	9%
2008	2008	461	127	28%
2009	2009	102	60	59%
2010	2010	587	103	18%
2011	2011	428	69	16%
2012	2012	657	97	15%
Average		410	79	24%

Reuse water does not have any calculable UFW since it is directly consumed on site at DCWRF or put into construction water tanks.

Monthly Distribution

The monthly distribution for recycled water demands is estimated based on last 6 years of monthly recycled water use information. Chart 2-35 shows the projected monthly distribution of recycled water demand. As expected, the peak month is July with June and August a close second due to turf irrigation. May through September represents the major recycled water irrigation season with minimal use in November and March and no recycled water use in December, January or February.

Chart 2-35
Average Monthly Distribution of Class A Recycled Water Demands (2007-2012)

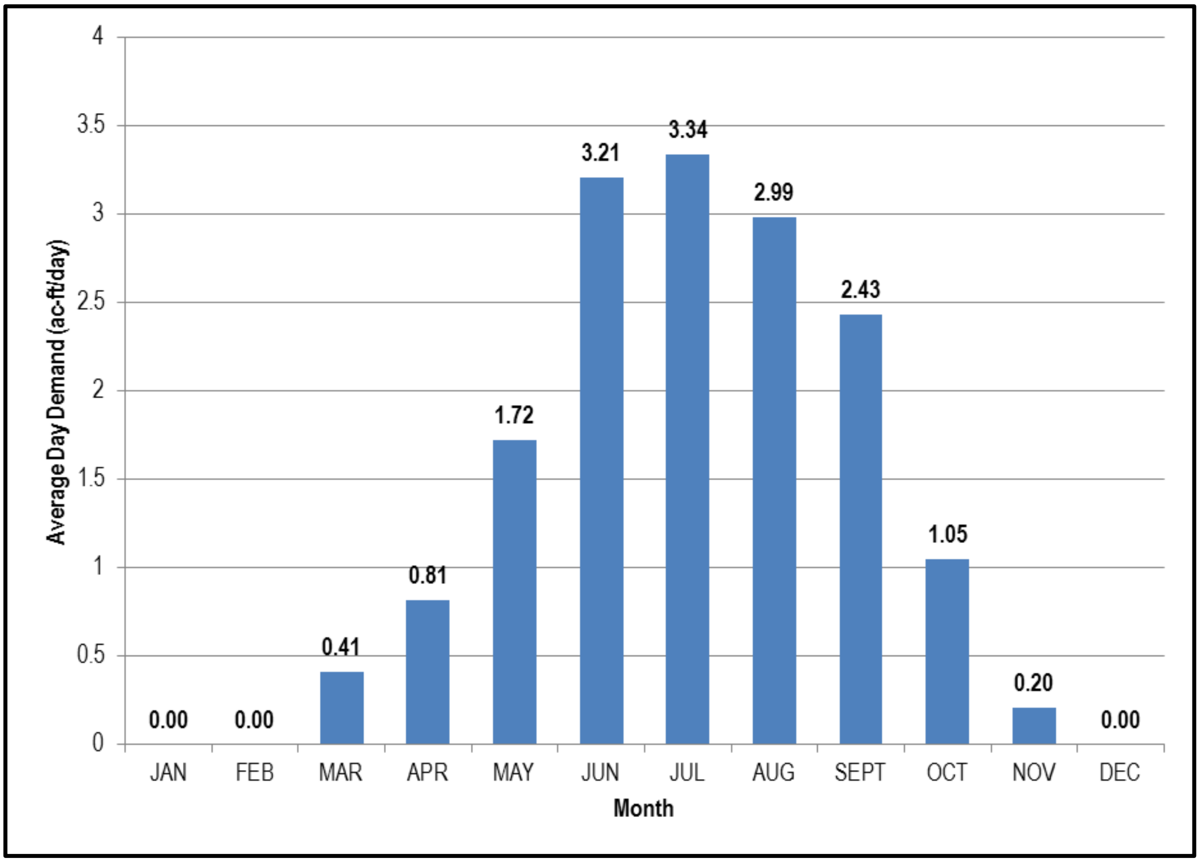
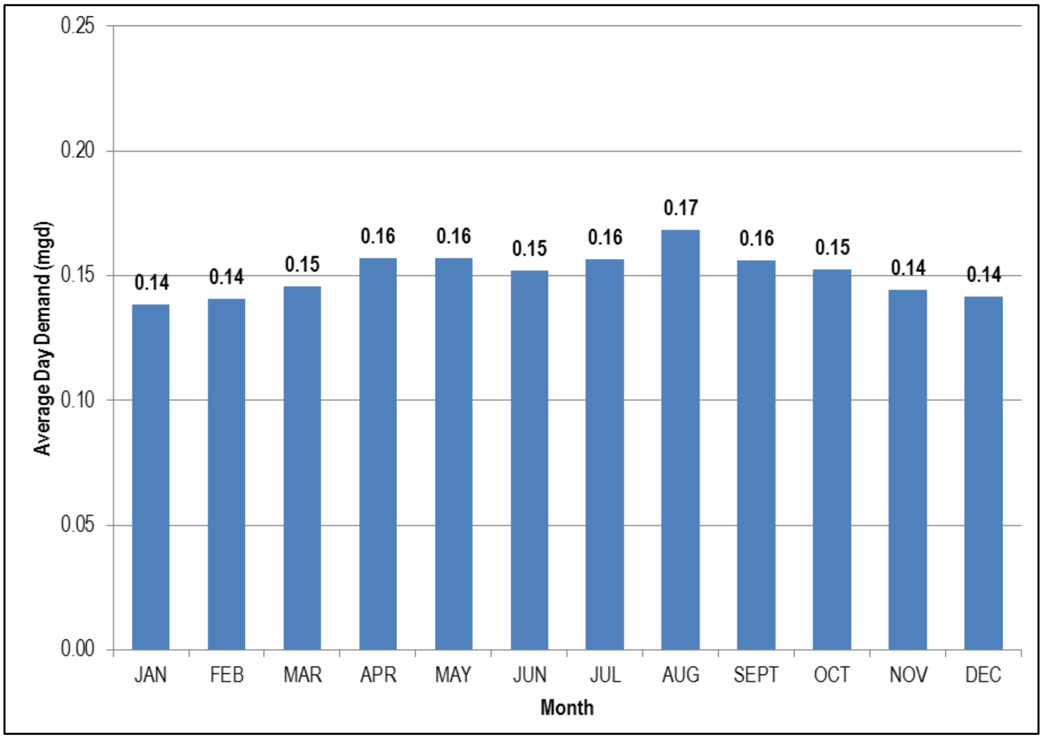


Chart 2-36 shows the monthly distribution of reuse water demand at DCWRF. There is a negligible difference in reuse water use over the year with a slight increase during the summer likely due to increased construction activity and water need.

Chart 2-36
Average Monthly Distribution of DCWRF Class B Reuse Water Demands (2007-2012)



Wastewater Effluent Utilization

The actual recycled water treated and delivered to the distribution system compared to the available wastewater effluent can be described as wastewater effluent utilization. Chart 2-37 shows the average available effluent flow per month at CCWRF used for recycled water production. Additional storage of effluent or treated recycled water at CCWRF would allow the CCWRF effluent to be more utilized for supplying the recycled system; additional details on this point can be found in Volume 6.

Chart 2-37
Average Monthly Wastewater Effluent Utilization at CCWRF (2007-2012)

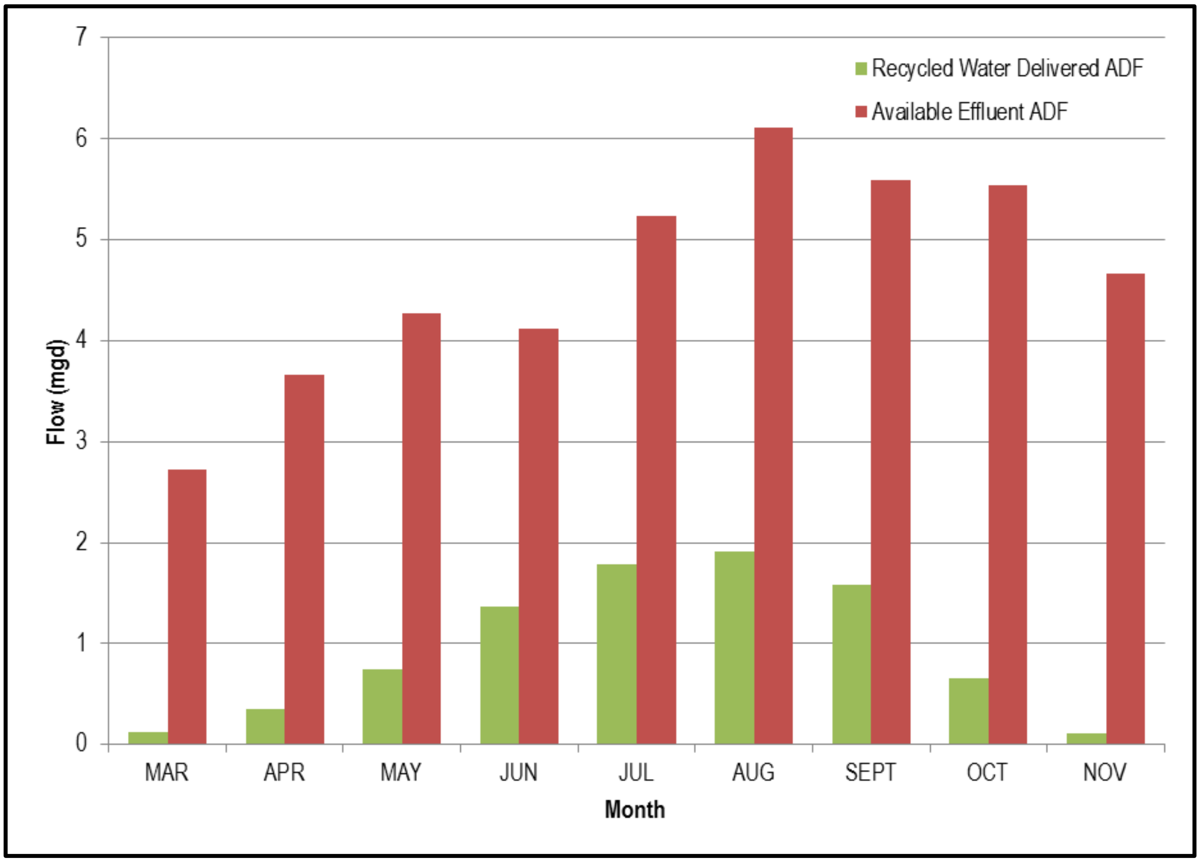
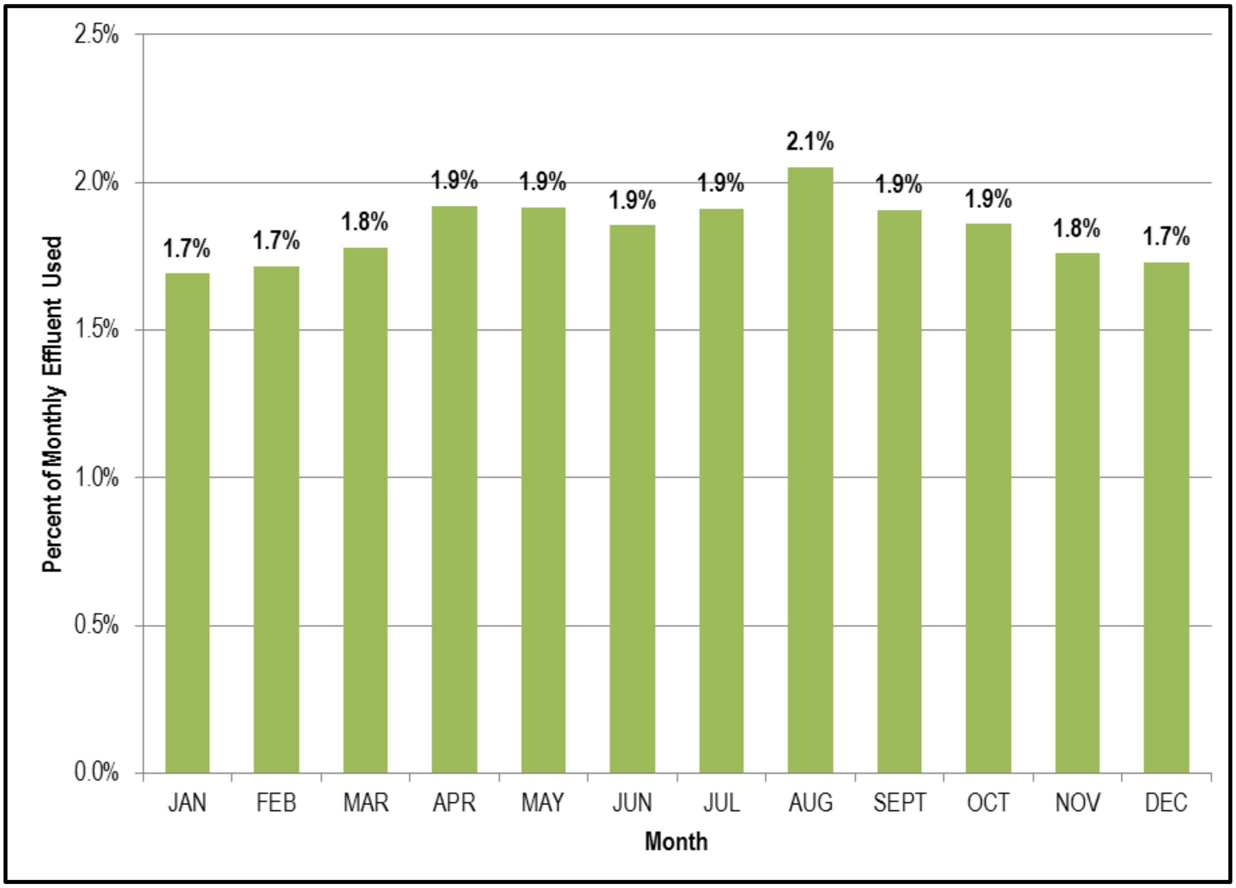


Chart 2-38 shows the average available effluent flow per month at DCWRF used for reuse water. Additional storage of effluent at DCWRF for reuse purposes would allow the DCWRF effluent to be more utilized for supplying the reuse system, if required in the future.

Chart 2-38
Average Monthly Wastewater Effluent Utilization at DCWRF (2007-2012)

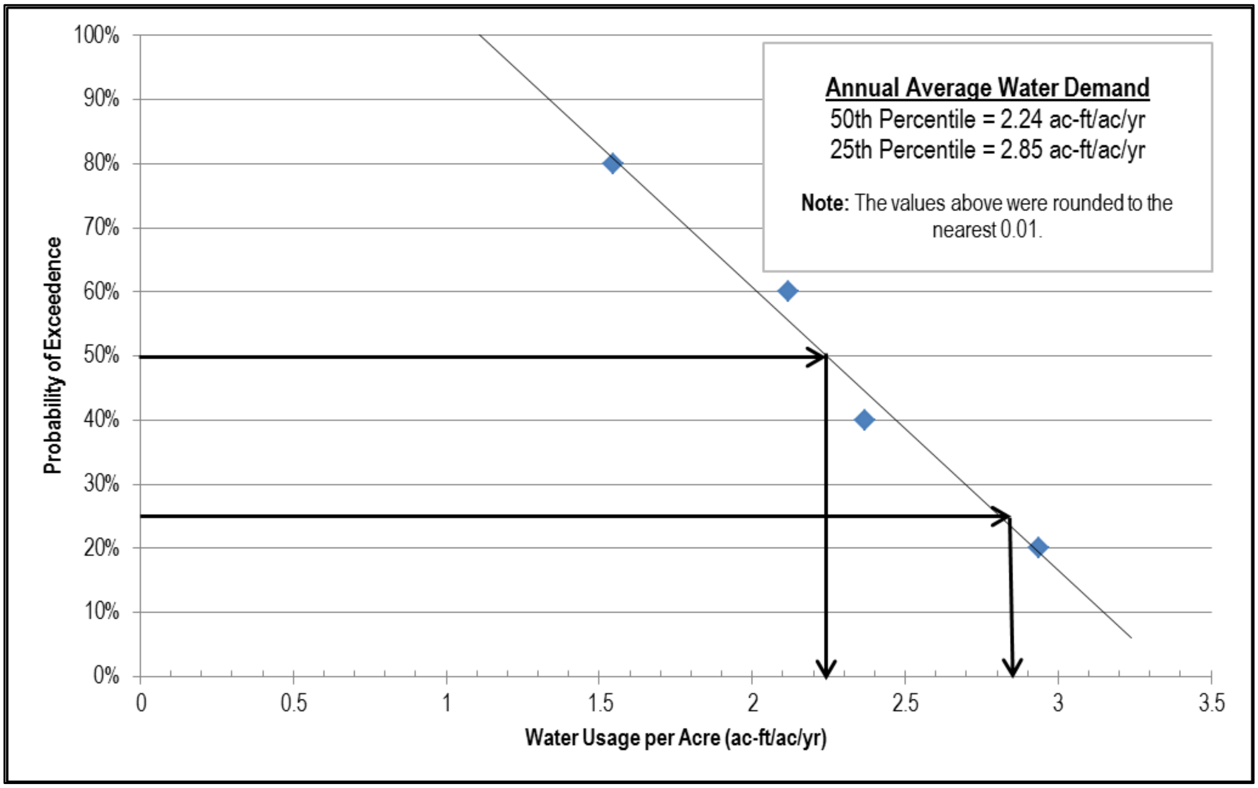


2.10.3 Average Demand Projections

Establishing demand projections is based on using recurrence intervals to establish a level of conservatism in the forecast. For example, a recurrence interval of 25 percent refers to an event that is likely to occur once every 2.5 years. The probability plots included in this report show this concept as the percent probability of exceedence. That is, for a 25 percent probability of exceedence, recycled and reuse water demands are likely to be higher than the value shown once every 2.5 years out of ten. Since the recycled and reuse water systems are not as critical as the potable distribution system, a 25 percent probability of exceedence was considered reasonable. If needed, conservation efforts including irrigation scheduling and/or restrictions could be expanded to the recycled water system to control demands on the Class A reuse water supply.

Chart 2-39 is a probability of exceedence evaluation of annual recycled water demand per acre for the period from 2008 through 2012 not including 2009. As shown, the annual average demand use averages 2.24 ac-ft/ac/yr, representing the 50 percent probability of exceedence value.

Chart 2-39
Annual Average Class A Recycled Water Demand per Acre Distribution



The 25 percent probability of exceedence value, or 2.85 ac-ft/ac/yr, is recommended as the baseline for determining the adequacy of the recycled water supply. The difference between the highest system-wide demand in the past 6 years (2.94 ac-ft/ac/yr in 2008) and the 10 percent exceedence value (2.85 ac-ft/year) is 3 percent. The current ADD demand of 2.85 ac-ft/ac/yr equates to the ET value of 34.12 in/sf per year used in Volume 6 and includes an allowance for UFW. The 10-year average (2003 to 2012) ET value for the Cheyenne area is 24.72 in/sf per year accounting for rainfall according to the NOAA-reported ET values at the Cheyenne Regional Airport (station WSO). The difference between reported ET and ET values used in this evaluation is to account for losses within the recycled water treatment and distribution systems.

Recycled water demands depend on available land for irrigation and on recycled water being made available as the recycled water distribution system expands. The development of the future customer requirements is contained in Volume 6. Approximately 977 acres of future irrigated area has been identified for potential future Class A recycled water service while an additional total of 889 acres is planned to be served within the 50-year planning period. The potential future Class A customers were grouped so new customers could be brought on line gradually to avoid large treatment, storage and pumping infrastructure improvements in the near-term planning horizon. The potential Class A customers were then further grouped into suggested expansion timeframes for the near-term, mid-term, and long-term planning horizons. These customer groupings were the basis for recycled water demand projections. Table 2-35 and Chart 2-40 presents the average day Class A recycled water demand projections.

Table 2-35
Average Day Class A Recycled Demand Projections

Year	Planning Period	Demand (ac-ft/year)	Demand (mgd)(1)
2013	Existing	786	1.03
2023	Near-Term	932	1.22
2033	Mid-Term	1,536	2.01
2043	Long-Term	1,881	2.46
2053		2,264	2.96
2063		3,306	4.32

(1) Based on a 250-day estimated irrigation season.

Chart 2-40
Average Day Class A Recycled Demand Projections

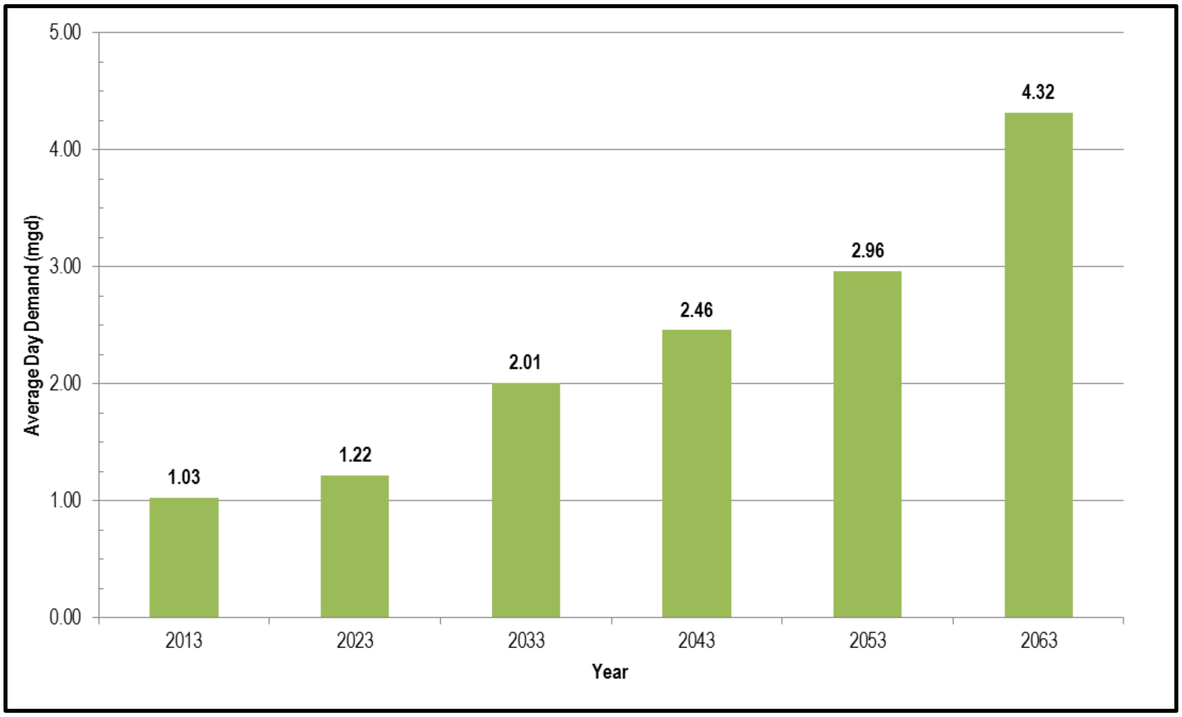


Chart 2-41 is a probability of exceedence evaluation of daily reuse water demand for the period from 2007 through 2012. As shown, the ADD use averages 0.15 mgd, representing the 50 percent probability of exceedence value.

The 10 percent probability of exceedence value, or 0.19 mgd, is recommended as the baseline for determining the adequacy of the reuse water supply. The highest system-wide demand in the past 6 years (0.19 mgd in 2012) and the 25 percent exceedence value (0.18 mgd) is 6 percent.

Chart 2-41
Average Day Class B Reuse Water Demand Distribution

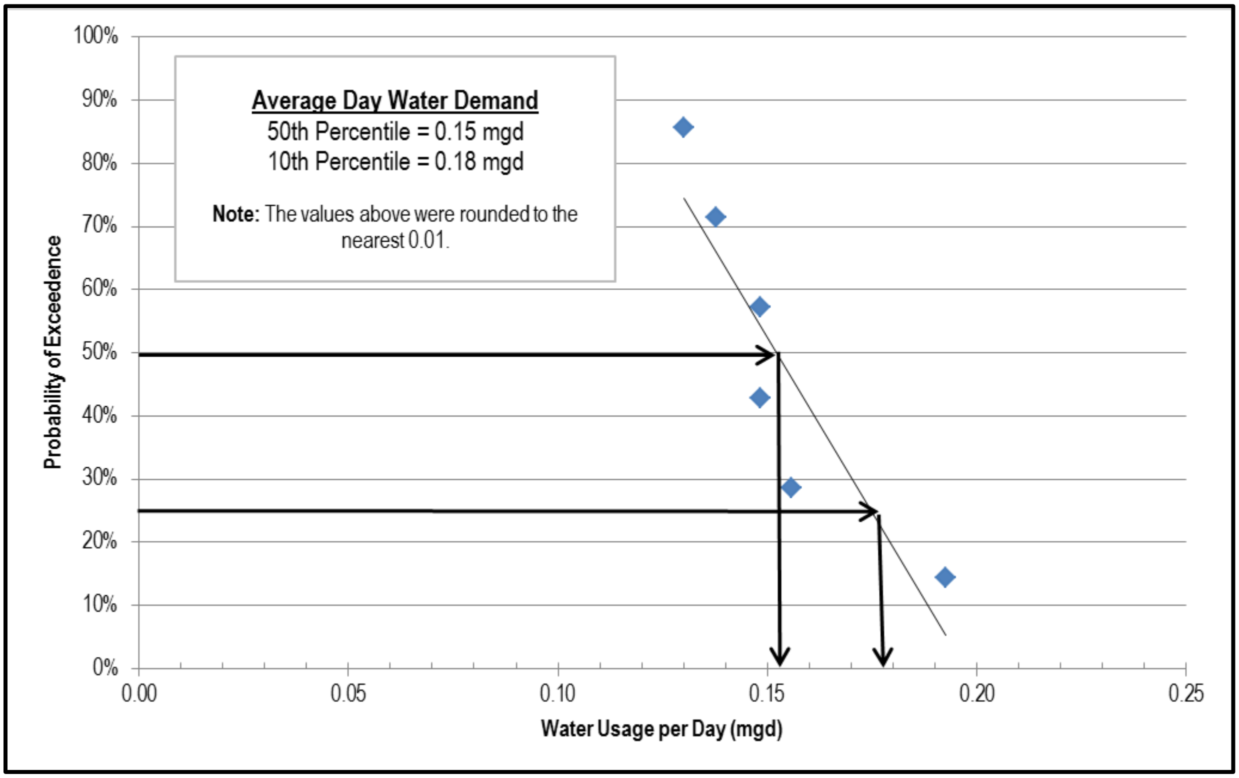
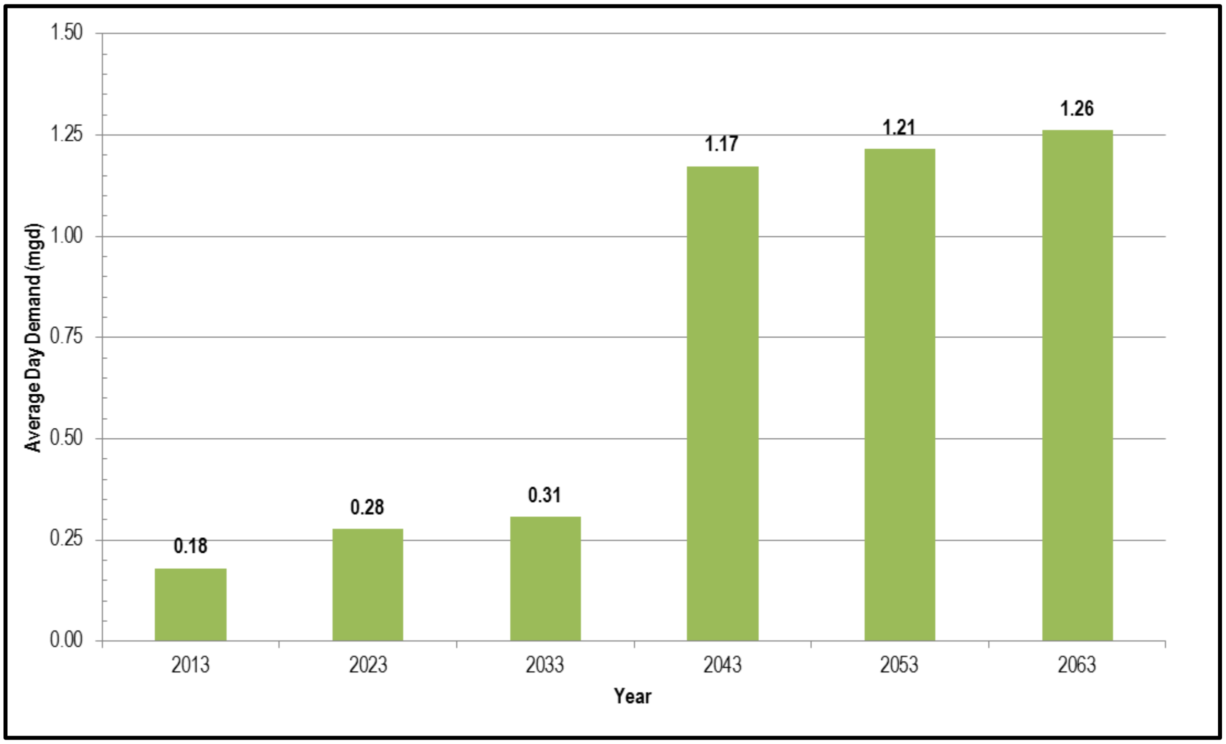


Table 2-36 and Chart 2-42 present the reuse water ADD forecast through the year 2063 using 0.19 mgd as the baseline existing demand and assuming the reuse water demand grows at 1.5% per year, a conservative increase estimate based on the 6-year historic trend of 1% average increase per year. Estimated average day Cheyenne Prairie Generating Station reuse demands (from Section 2.6.2) are added to the base reuse water ADD.

Table 2-36
Average Day Class B Reuse Demand Projections

Year	Planning Period	Demand (mgd)
2013	Existing	0.18
2023	Near-Term	0.28
2033	Mid-Term	0.31
2043	Long-Term	1.17
2053		1.21
2063		1.26

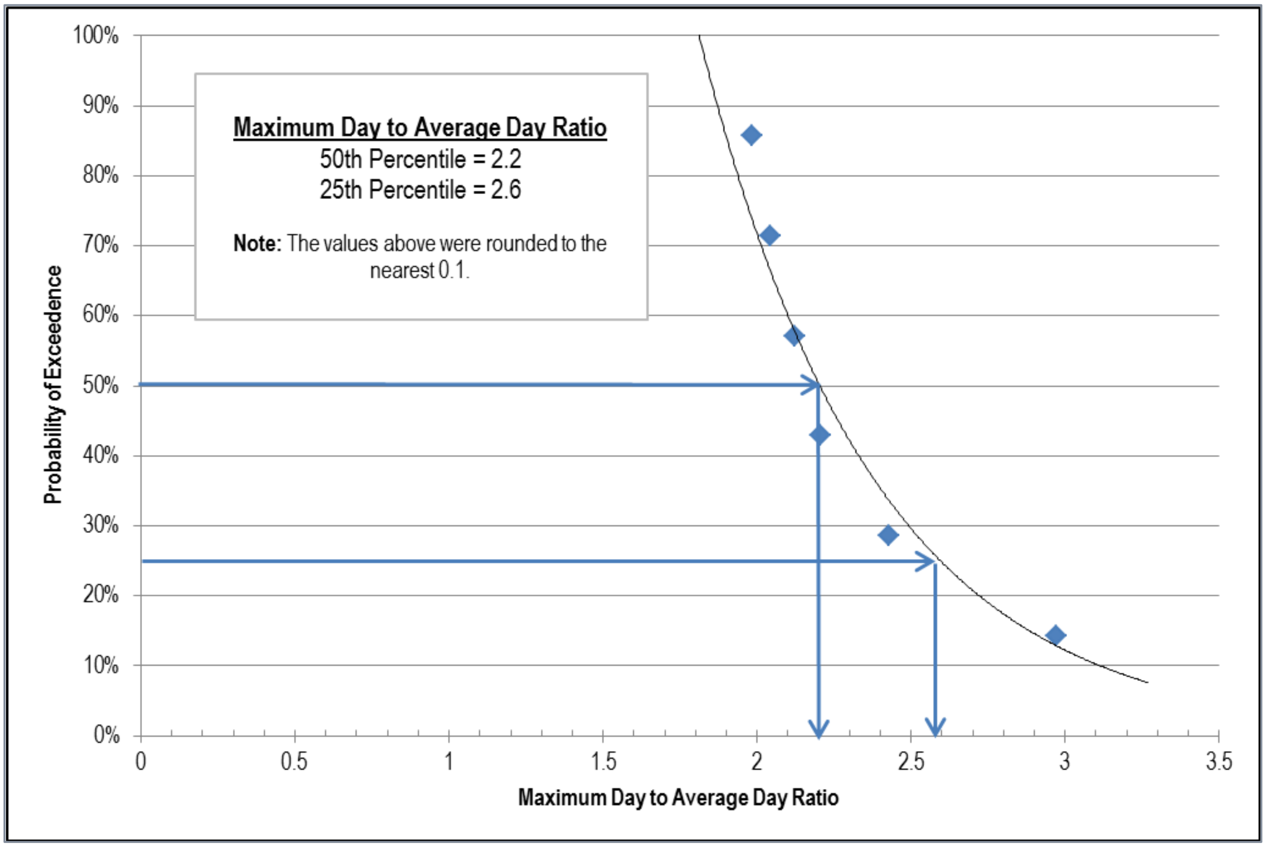
Chart 2-42
Average Day Class B Reuse Demand Projections



2.10.4 Peaking Factor Determination

The first step in estimating the peaking factors for the recycled water system is to evaluate historic system-wide demands. Maximum day demands in BOPU's recycled water system usually occur in July or August. Chart 2-43 is the probability of exceedence analysis for MDD to ADD recycled water demand ratios from 2007 to 2012. A 25th percentile exceedence probability suggests a maximum day to average day ratio of 2.6.

Chart 2-43
Class A Recycled Maximum Day to Average Day Flow Distribution



The PHD values are taken from each year in 2007 to 2012 and compared to the ADD for the same year. Chart 2-44 is the probability of exceedence analysis for peak hour to average day wastewater flow ratios from 2007 to 2012. A 50th and 25th percentile exceedence probability suggests a PHD to ADD ratio of 5.0 and 6.8, respectively. The 50th percentile was used as operational changes and conservation measures should be enacted if the PHD peaking factor exceeds 5.0 to even out peak demands. Existing recycled water storage at CCWRF and the pond at Prairie View Golf Course in the distribution system as well as future storage can provide storage for meeting peak hour demands.

Chart 2-44
Class A Recycled Peak Hour to Average Day Demand Distribution

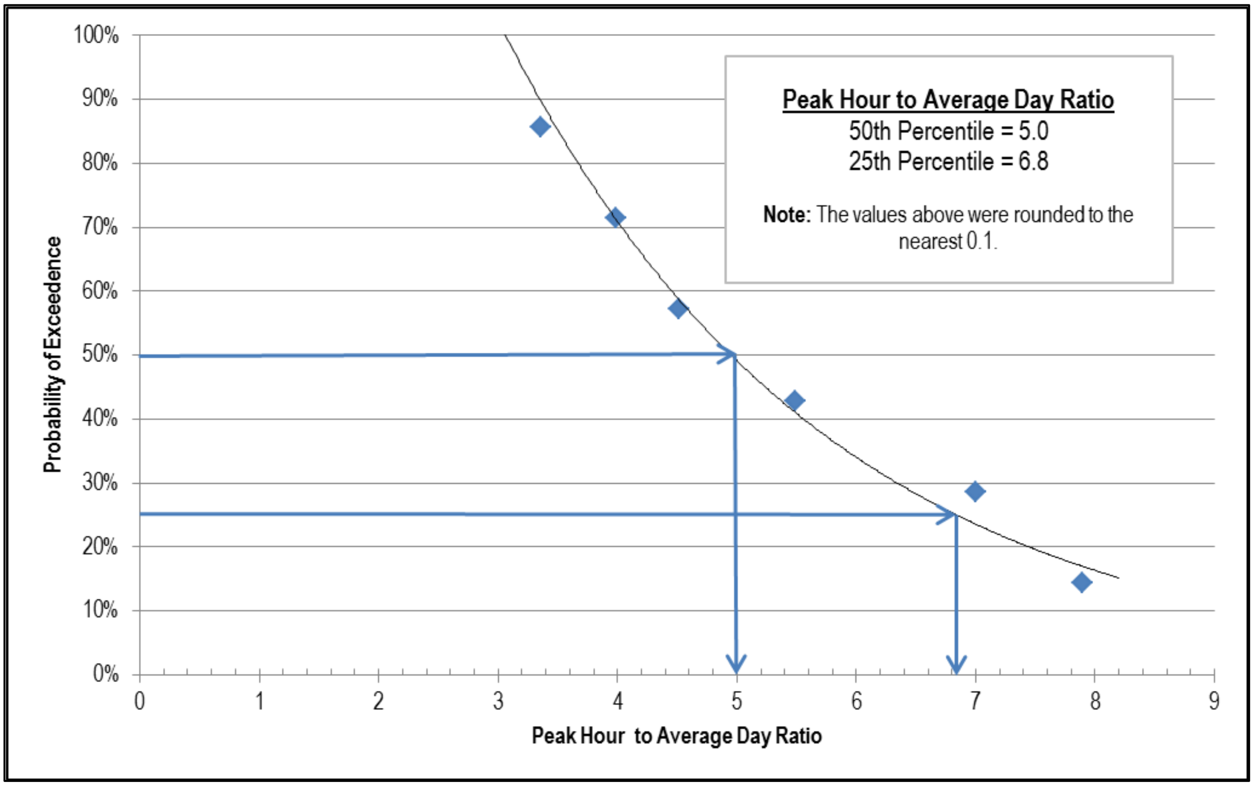


Table 2-37 summarizes the recycled water peaking factors for maximum day and peak hour. Values are presented in terms of both ratios and ac-ft/ac/yr. These peaking factors are used to determine long-term recycled water supply and distribution requirements in Volume 6.

Table 2-37
Class A Recycled Water Peaking Factors

Average Day	
Demand, ac-ft/ac/year(1)	2.84
Maximum Day	
Ratio (MDD/ADD)	2.6
Demand, ac-ft/ac/year	7.38
Peak Hour	
Ratio (PHD/ADD)	5.0
Demand, ac-ft/ac/year	14.2

(1) Based on a 250-day irrigation season.

For reuse water demands, the variation between years is not significant enough to warrant a statistical determination of peaking factors. Instead, the peaking factors are determined from the greatest maximum day and peak hour demands in the past 6 years which both occurred in 2012. The maximum day use historically was on May 21st, 2012 of 0.28 mgd which equates to a maximum day peaking factor of 1.5. The peak hour use historically was on August 16th, 2012 at 7pm of 0.44 mgd which equates to a peak hour peaking factor of 2.3. Table 2-38 presents the peaking factors used for peak reuse water projections.

Table 2-38
Class B Reuse Water Peaking Factors

Average Day	
Demand, mgd	0.18
Maximum Day	
Ratio (MDD/ADD)	1.5
Demand, ac-ft/ac/year	0.27
Peak Hour	
Ratio (PHD/ADD)	2.3
Demand, ac-ft/ac/year	0.41

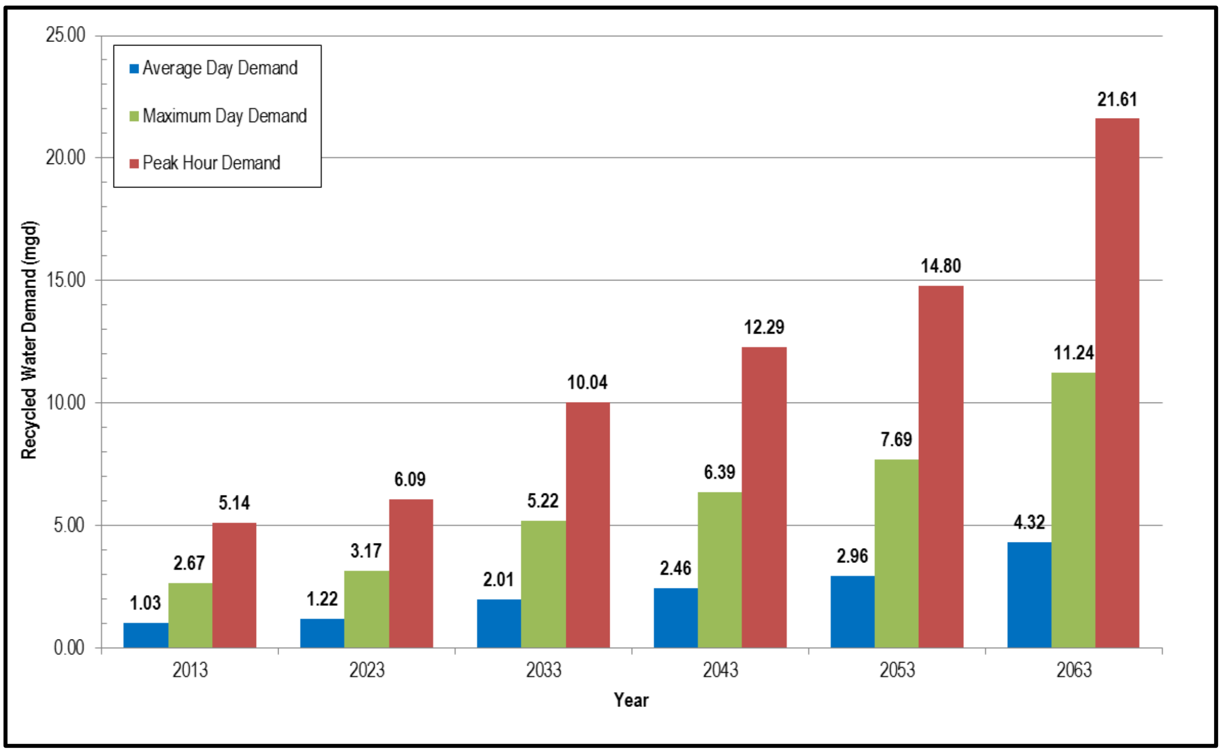
2.10.5 Peak Demand Projections

Peak demand projections for the recycled water are developed using the peaking factors presented in Table 2-37 to determine the projected maximum day and peak hour demands. The maximum day and peak hour recycled water demand projections are presented in Table 2-39 and Chart 2-45.

Table 2-39
Class A Recycled Water Demand Projections

Year	Planning Period	Average Day (ADD) (mgd)	Maximum Day (MDD) (mgd)	Peak Hour (PHD) (mgd)
2013	Existing	1.03	2.67	5.14
2023	Near-Term	1.22	3.17	6.09
2033	Mid-Term	2.01	5.22	10.04
2043	Long-Term	2.46	6.39	12.29
2053		2.96	7.69	14.80
2063		4.32	11.24	21.61

Chart 2-45
Class A Recycled Water Demand Projections



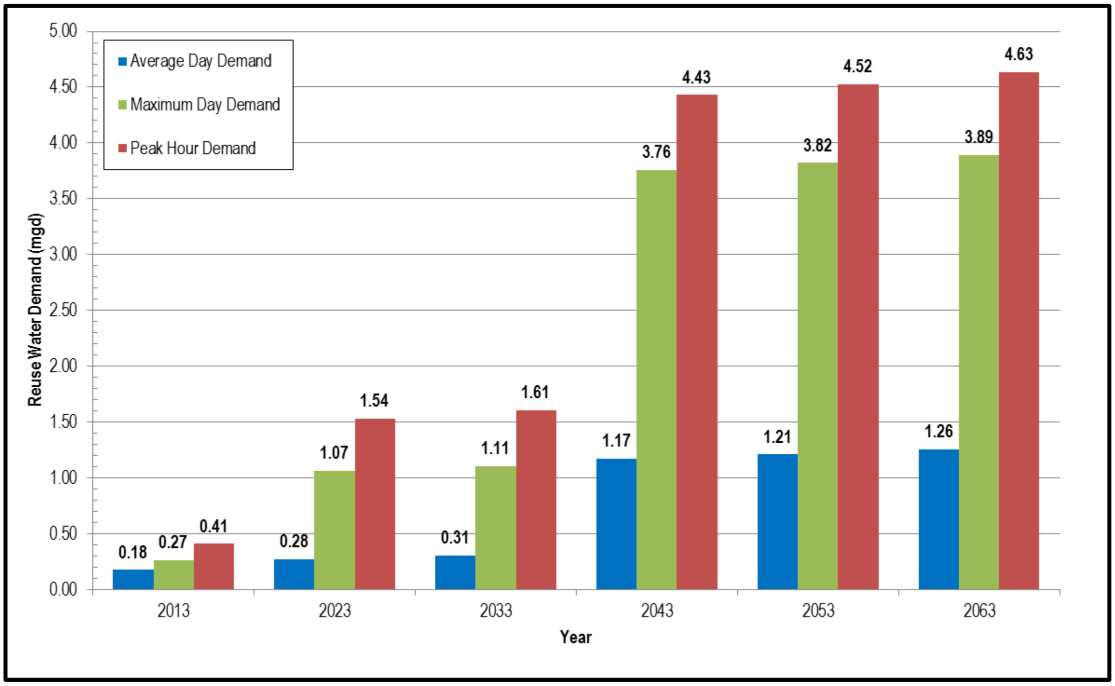
For comparison, average day recycled water demands in 2012 were 0.86 mgd and those projected for 2013 are 1.03 mgd. Likewise, maximum day water demands in 2008 were 2.65 mgd and those projected for 2013 are 2.67 mgd. The peak hour water demands in 2007 were 5.37 mgd and those projected for 2013 are 5.14 mgd.

Peak demand projections for the reuse water are developed using the peaking factors presented in Table 2-38 to determine the projected maximum day and peak hour demands. The maximum day and peak hour reuse water demand projections are presented in Table 2-40 and Chart 2-46. Estimated Cheyenne Prairie Generating Station reuse demands (from Section 2.6.2) are added to the base reuse demands.

Table 2-40
Class B Reuse Water Demand Projections

Year	Planning Period	Average Day (ADD) (mgd)	Maximum Day (MDD) (mgd)	Peak Hour (PHD) (mgd)
2013	Existing	0.18	0.27	0.41
2023	Near-Term	0.28	1.07	1.54
2033	Mid-Term	0.31	1.11	1.61
2043	Long-Term	1.17	3.76	4.43
2053		1.21	3.82	4.52
2063		1.26	3.89	4.63

Chart 2-46
Class B Reuse Water Demand Projections



For comparison, average day reuse water demands in 2012 were 0.19 mgd and those projected for 2013 are 0.18 mgd. Likewise, maximum day water demands in 2012 were 0.28 ac-ft/day and those projected for 2013 are 0.27 mgd. The projected 2013 maximum day water demands are slightly lower than 2012.

2.10.6 Wastewater Effluent Supply Availability Projections

The ability to meet peak demand projections depends on the availability of wastewater. The estimated total effluent flow available for treatment through the recycling facility is the sum total of effluent flows from each WRF minus process losses through the recycling treatment train (e.g. filter backwash) or other Class B water demands. *In this evaluation is assumed that all wastewater effluent including that originating from both native and import water sources can be used to extinction (Volume 6 accounts for the difference in effluent supply due to native and non-native sources).*

A couple of uses of Class B wastewater effluent to be factored into evaluating available wastewater effluent supply availability include the following:

- Cheyenne Prairie Generating Station will use approximately 0.07 to 2.0 mgd of Class B wastewater effluent from DCWRF from 2015 onwards. Therefore, this quantity of effluent has been removed from the 2023 through 2063 wastewater effluent supply projections from DCWRF.
- Class B wastewater effluent for reuse water use at the WRFs. The reuse water use flows at DCWRF includes in-plant use and construction water use (e.g. hauled water for construction compaction, dust control, etc.).

The remaining wastewater effluent accounting for these other uses equals the Class B effluent available for treatment to Class A recycled water. For the available DCWRF effluent to be used, it must be transferred to the CCWRF recycle treatment plant with a pump station.

CCWRF available effluent is approximately 84% of the influent flows as calculated based on influent flows, sludge production, and nonpotable uses over a period from 2007 through 2012. DCWRF available effluent is approximately 98% of the influent flows as calculated based on influent flows and nonpotable use over a period from 2007 through 2012. However, due to evaporation and sludge production in the treatment process, a total percentage of influent available for recycled water of 90% at DCWRF has been assumed. In addition, future reuse demands at the Cheyenne Prairie Generating Station have been removed from available recycled water supply availability.

Comparing the total water entering the recycled water filter inlet and the recycled water leaving CCWRF at the pump station from 2008 to 2012, an average of 18% of the water is lost through the treatment system (filter backwash, sludge blowdown, etc.), leaks and evaporation from the recycled water storage tanks. This loss factor is included in the recycled water supply availability projections.

Using the information above, effluent availability projections for recycled water supply are developed for both WRFs over the planning periods and are presented in Table 2-41. The total supply available from the two WRFs is the quantity that may be available for supplying the recycled water demands. With the existing amount of storage, only average day and maximum month flows can currently be reliably captured for the recycled water treatment system. In the future, with additional storage and treatment capacity, maximum day effluent flows should be able to be treated to maximize Class A recycled water distribution. To utilize the total available supply for recycled water a number of capital improvements are needed to store and transfer the wastewater effluent and treated recycled water. These improvements will be addressed in Volume 6.

Table 2-41
Class A Recycled Water Supply Availability Projections

		CCWRF			DCWRF[1]			Total
Year	Planning Period	Average Day (mgd)	Maximum Month (mgd)	Maximum Day (mgd)	Average Day (mgd)	Maximum Month (mgd)	Maximum Day (mgd)	Available ADF (mgd)
2013	Existing	3.7	4.5	5.3	5.4	6.7	9.9	10.4
2023	Near-Term	4.5	5.5	6.5	6.3	7.9	11.7	10.8
2033	Mid-Term	5.1	6.6	7.8	7.5	9.4	13.9	12.6
2043	Long-Term	5.8	7.5	8.2	8.7	10.8	16.2	14.5
2053	Long-Term	6.4	8.2	8.2	9.9	12.4	20.1	16.3
2063	Long-Term	6.8	8.2	8.2	10.8	14.3	22.7	17.6

[1] Additional flow has been subtracted from the DCWRF supplies to account for Class B wastewater effluent (reuse) demands at the Cheyenne Prairie Generating Station.

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2.11 Summary of Capacity Requirements

The purpose of this section is to summarize the capacity requirements to provide service to BOPU customers for the 10-yr, 20-yr, and 50-yr planning periods. The existing capacities for the facilities are summarized and compared with future capacity requirements. The existing capacities for supply and treatment control the immediate ability to serve existing system requirements and set the baseline ability for expanding the system in the future. The future capacity requirements provide the basis for evaluating the need for expanding supply and treatment and the approximate phasing of recommended expansions. The future capacity requirements are compared to the 2003 Master Plans requirements to note any significant differences to focus on during subsequent water supply, distribution, collection, and treatment system analyses.

2.11.1 Source Water Supply Capacity

Source water for potable water treatment and raw water irrigation distribution is supplied through a combination of surface water and groundwater sources. The total source water requirements for the next 50 years can be found in Table 2-42. Refer to Volume 3 for further discussion of the capacity of existing water supplies and recommendations for meeting future water supply requirements.

Table 2-42
Source Water Demand Projections

Year	Planning Period	Projected Total (ac-ft/yr)	Projected Raw Water Irrigation (ac-ft/yr)	Projected Potable Water (ac-ft/yr)
2013	Existing	18,378	780	17,598
2023	Near-Term	21,056	880	20,176
2033	Mid-Term	24,753	990	23,763
2063	Long-Term	34,459	1,290	33,179

Approximately 39,420 ac-ft of surface water storage in BOPU's reservoirs is available for existing water supply if the reservoirs are full. The surface water source pipelines supplying the Sherard WTP have a hydraulic capacity of up to 58 mgd. Additional surface water supply system details and the evaluation of future surface water supply needs are provided in Volume 3.

Total annual adjudicated groundwater supply is 5,500 ac-ft (4.9 mgd) over a 10-year period with a one year cap of 10,000 ac-ft (8.9 mgd). The well fields and collection system supplying groundwater for potable use have an existing capacity of 8 to 11 mgd over a sustained 30-day capacity depending on which wells are being used simultaneously. During the higher demand periods of the year more groundwater is used and less during lower demand periods. Additional details on the groundwater supply and the evaluation of future groundwater supply needs are provided in Volume 3.

2.11.2 Potable Water Treatment and Distribution Capacity

The Sherard WTP is currently rated at 35 mgd; however, it has the capacity to provide up to 46.5 mgd upon rerating of its treatment process train. Additional details concerning the Sherard WTP's capacity are evaluated in Volume 4.

Potable water treatment facilities are typically sized to meet maximum day demands. Peak hour demands are typically managed using available distribution system, storage and conveyance facilities are designed to account for operational storage volumes. Potable water distribution facilities, i.e. pump stations, are typically sized to meet peak hour demands.

Based on the projections discussed in this volume, Table 2-43 summarizes potable water delivery requirements for meeting average day, maximum day, and peak hour demands for the various planning periods. The potable water delivery requirements do not include water use in Sherard WTP itself; actual raw water routed to the WTP will need to include process losses through the plant. For example, delivering 32 mgd to the distribution system, generally requires approximately 35 mgd entering the WTP.

Table 2-43
Potable Water Demand Projections

Year	Planning Period	Average Day (ADD) (mgd)	Maximum Day (MDD) (mgd)	Peak Hour (PHD) (mgd)
2013	Existing	15.7	35.8	65.7
2023	Near-Term	18.0	40.9	74.5
2033	Mid-Term	21.2	47.7	86.1
2043	Long-Term	24.2	54.0	96.9
2053		27.1	60.1	107.2
2063		29.6	65.3	115.8

The projected maximum day demands are forecasted to exceed the existing capacity of Sherard WTP in 2013; however, BOPU has groundwater sources to supplement the potable water capacity. Therefore, the potable water treatment capacity will need to be split between surface and groundwater supplies. This split between types of source water for potable treatment and use as well as future treatment capacity needs is determined in Volume 3.

Raw water irrigation and recycled water systems will reduce the demands on the potable water system. In addition, recycled water use reduces demands on surface and groundwater supplies. Additional non-potable water system improvements will further offset potable water demands and should be factored into subsequent planning efforts.

2.11.3 Raw Water Irrigation Supply and Distribution

Water supply and distribution for raw water irrigation uses are sized to meet MDD. PHD are assumed to be managed through available storage volume in the raw water lakes. Certain raw water irrigation distribution facilities, such as pump stations and delivery pipelines, will need to meet PHD. Table 2-44 summarizes the raw water irrigation requirements to meet ADD and MDD supply projections for supply and PHD projections for distribution. The raw water irrigation system is supplied entirely by surface water. Volume 3 evaluates the availability of surface water supply for raw water irrigation demands. Volume 6 evaluates the recommended storage and distribution requirements for the raw water irrigation system.

Table 2-44
Raw Water Irrigation Supply and Distribution Requirements

Year	Planning Period	Average Day (ADD) (ac-ft/yr)	Average Day (ADD)(1) (ac-ft/day)	Maximum Day (MDD)(1) (ac-ft/day)	Peak Hour (PHD)(2) (ac-ft/day)
2013	Existing	1,131	4.1	9.7	17.0
2023	Near-Term	1,276	4.6	11.1	19.2
2033	Mid-Term	1,436	5.2	12.5	21.6
2043	Long-Term	1,581	5.8	13.9	23.8
2053		1,726	6.2	15.0	26.0
2063		1,856	6.8	16.4	27.9

(1) Supply projections including UFW to raw water lakes based on a 275-day irrigation season.
(2) Demand projections to distribution system from customer pump stations with supply drawn from the raw water lakes.

2.11.4 Wastewater Collection and Treatment

The maximum month treatment capacities of CCWRF and DCWRF are currently rated at 6.5 mgd and 10.5 mgd, respectively. More detail about their respective treatment capacities is provided in Volume 8. The treatment capacities for both WRFs are evaluated for re-rating treatment capacity; this analysis is included in Volume 8.

The WRFs are generally sized to treat MMF. However, some treatment components of the WRFs are sized to handle the MDD and PHF. The wastewater collection system must be sized to handle the PHF. Table 2-45 and Table 2-46 summarize ADD, MMF, and PHF for the various planning periods. Volume 8 will determine the adequacy of the existing WRFs for meeting the projected flows at to each WRF.

Table 2-45
CCWRF - Wastewater Influent Flow Projections

Year	Planning Period	Average Day (mgd)	Maximum Month (mgd)(1)	Maximum Day (mgd)(1/2)	Peak Hour (mgd)(1/2)
2013	Existing	4.8	6.5	7.5	7.5
2023	Near-Term	6.0	8.0	9.5	12.0
2033	Mid-Term	7.1	9.6	11.3	12.0
2043	Long-Term	8.0	10.9	12.0	12.0
2053		9.0	12.0	12.0	12.0
2063		9.7	12.0	12.0	12.0

(1) Maximum day and peak hour flow projections include contributions from RDII.

(2) Flow projections over 7.5 mgd for 2013 and 12.0 mgd for 2023-2063 are adjusted down to 12.0 mgd as the diversion weir in the CCWRF influent pumping station is set to divert the flows over 7.5 mgd currently and 12.0 mgd in the future to DCWRF. The difference between peak flow and CCWRF flow limitation is added to the DCWRF flow projections.

Table 2-46
DCWRF - Wastewater Flow Projections

Year	Planning Period	Average Day (mgd)	Maximum Month (mgd)(1)	Maximum Day (mgd)(1/2)	Peak Hour (mgd)(1/2)
2013	Existing	7.3	9.1	13.6	25.4
2023	Near-Term	8.6	10.7	15.8	27.4
2033	Mid-Term	10.2	12.8	18.9	34.9
2043	Long-Term	11.8	14.7	22.0	41.8
2053		13.4	16.8	27.2	48.9
2063		14.7	19.4	30.7	54.4

(1) Maximum day and peak hour flow projections include contributions from RDII.
(2) Flow projections adjusted up as the diversion weir in the CCWRF influent pumping station is set to divert the flows over 7.5 mgd currently and 12.0 mgd in the future to DCWRF. The difference between peak flow and CCWRF flow limitation is added to the DCWRF flow projections.

2.11.5 Recycled and Reuse Water Treatment and Distribution

The recycled water treatment facilities at the CCWRF are currently rated with a treatment capacity of 4 mgd. More detail on the treatment capacity of the recycled water treatment facility is covered in Volume 6. The recycled water treatment facility's discharge to the distribution system is currently limited by the availability of wastewater effluent from CCWRF to be treated.

Table 2-47 summarizes the recycled water requirements to meet average day and maximum day projections for supply and peak hour demand projections for storage and distribution. The recycled water treatment facility is designed to meet MDD. PHD can generally be offset using storage in the CCWRF storage tanks and at Prairie View Golf Course pond. As discussed in Section 2.10, Volume 6 will establish future requirements for recycled water supply, treatment, distribution and storage to meet these demands.

Table 2-47
Class A Recycled Water Demand Projections

Year	Planning Period	Average Day (ADD) (mgd)	Maximum Day (MDD) (mgd)	Peak Hour (PHD) (mgd)
2013	Existing	1.03	2.67	5.14
2023	Near-Term	1.22	3.17	6.09
2033	Mid-Term	2.01	5.22	10.04
2043	Long-Term	2.46	6.39	12.29
2053		2.96	7.69	14.80
2063		4.32	11.24	21.61

The estimated available wastewater effluent for recycling is based on estimated flows from each WRF minus the losses through the recycled treatment facilities and other uses of wastewater effluent for reuse water. The recycled water supply available for delivery to the distribution system for each of the planning periods is presented in Table 2-48. The estimated available flows are considered the upper limit for supplying recycled water during ADF, MMF, and MDD effluent conditions.

Table 2-48
Recycled Water Supply Availability Projections

		CCWRF			DCWRF(1)		
Year	Planning Period	Average Day (mgd)	Maximum Month (mgd)	Maximum Day (mgd)	Average Day (mgd)	Maximum Month (mgd)	Maximum Day (mgd)
2013	Existing	3.5	4.2	5.0	4.8	6.0	8.8
2023	Near-Term	4.2	5.2	6.2	5.6	6.4	9.5
2033	Mid-Term	4.9	6.3	7.4	6.6	7.7	11.5
2043	Long-Term	5.5	7.1	7.8	6.8	7.6	12.7
2053		6.1	7.8	7.8	7.9	9.0	16.1
2063		6.5	7.8	7.8	8.7	10.7	18.4

(1) Additional flow has been subtracted from the DCWRF supplies to account for Class B wastewater effluent (reuse) demands at the Cheyenne Prairie Generating Station.

Table 2-49 summarizes the reuse water requirements to meet average day and maximum day projections for supply and peak hour demand projections for storage and distribution. As discussed in Section 2.10, Volume 6 will establish future requirements for reuse water supply and storage to meet these demands.

Table 2-49
Class B Reuse Water Demand Projections

Year	Planning Period	Average Day (ADD) (mgd)	Maximum Day (MDD) (mgd)	Peak Hour (PHD) (mgd)
2013	Existing	0.18	0.27	0.41
2023	Near-Term	0.28	1.07	1.54
2033	Mid-Term	0.31	1.11	1.61
2043	Long-Term	1.17	3.76	4.43
2053		1.21	3.82	4.52
2063		1.26	3.89	4.63

2.11.6 Capacity Requirement Comparison to 2003 Master Plans

The 2003 Master Plans provide potable water, wastewater, and non-potable demands as the basis for evaluating future improvements. The non-potable demands are a combination of raw water and recycled water demands, with no clean distinction between each. Therefore, the following comparisons are only provided for potable water and wastewater system demands.

Potable Water Requirements

Table 2-50 compares the potable water demand requirements for current condition through the various planning intervals. Between the 2003 and 2013 Master Plans, the near-term potable water demand requirements do not change significantly. The 2013 Master Plan demands are slightly lower due to the lower average historical water demand of 177 gpcd versus 198 gpcd. In the mid- and long-term periods, the potential for large user demands considered in the 2013 Master Plan projections overcomes the lower unit demand compared to the 2003 Master Plan.

Table 2-50
2003 and 2013 Comparison - Potable Water Demand Requirements

		Average Day (ADD)		Maximum Day (MDD)		Peak Hour (PHD)	
Year	Planning Period	2013 (mgd)	2003 (mgd)	2013 (mgd)	2003 (mgd)	2013 (mgd)	2003 (mgd
2013	Existing	15.7	16.6 (2012)	35.8	41.2 (2012)	65.7	71.4 (2012)
2023	Near-Term	18.0	18.2 (2022)	40.9	45.3 (2022)	74.5	78.3 (2022)
2033	Mid-Term	21.2	-	47.7	-	86.1	-
2043	Long-Term	24.2	-	54.0	-	96.9	-
2053		27.1	24.7 (2052)	60.1	61.3 (2052)	107.2	106.2 (2052)
2063		29.6	-	65.3	-	115.8	-

Wastewater Treatment Requirements

Table 2-51 compares the wastewater flow requirements for current conditions through the various planning periods. Since the 2003 Master Plans do not split projected wastewater flows by service basin, the sum of the WRFs' 2013 projections are used for comparison purposes. Additionally, maximum day or peak hour flow projections are not provided in the 2003 Master Plans. Comparing the 2003 and 2013 master plans, the wastewater flow requirements are higher in the 2013 master plans. This is mainly due to including the potential for BSF contributions from large commercial and industrial customers.

Table 2-51
2003 and 2013 Comparison – Wastewater Flow Requirements

		Average Day Flow (ADF)		Maximum Month (MM)	
Year	Planning Period	2013 (mgd)	2003 (mgd)	2013 High (mgd)	2003 (mgd)
2013	Existing	12.1	11.4 (2012)	15.6	14.8 (2012)
2023	Near-Term	14.6	12.6 (2022)	18.7	16.4 (2022)
2033	Mid-Term	17.3	-	22.4	-
2043	Long-Term	19.8	-	25.6	-
2053		22.4	17.0 (2052)	28.8	22.1 (2052)
2063		24.4	-	31.4	-

Appendices

Volume 2 – Future Capacity Requirements

Appendix 2-A - 2012 PlanCheyenne Snapshots

Appendix 2-B - EPS - Brief Description of Revised Forecast

Appendix 2-C - AVI - Market Context Summary, Fox Farm Road Corridor and Area Planning Summary

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Appendix 2-A
2012 PlanCheyenne Snapshots

Welcome to *SnapshotCheyenne*

The following Snapshot reports and inventory maps provide information and analysis about the state of the community today—in a brief "snapshot" format. The information benchmarks the Cheyenne Area's population, economy and employment, and other data for use throughout the *PlanCheyenne* process and beyond. Vast amounts of "existing condition" data and information is available about the Cheyenne Area; these reports summarize information that is available through various organizations but put it in one accessible place. The reports list other sources for additional, more detailed information about particular topics. The Transportation Master Plan and The Parks and Recreation Master Plans also contain more detailed information and maps.

The first edition of *PlanCheynne* was adopted in 2006. Since that time, the Cheyenne community has changed in many ways. In order to keep the plan current and up-to-date with current trends, this Snapshot report was updated in late 2011 to set the foundation for the first update to the plan.

SnapshotCheyenne is One of Four Parts–*PlanCheyenne*

SnapshotCheyenne is the first part of *PlanCheyenne*—a four-part comprehensive plan that defines the Cheyenne area's future. The *StructureCheyenne handbook*, Part 2, contains the Structure Plan map and design principles for the Cheyenne area—the form-giving and design-based part of the larger planning effort. It also includes principles for development in the public realm and for new development of housing, employment, and commercial areas. *ShapeCheyenne*, is the third part. It establishes the guiding principles for how and where the community should grow. Finally, *BuildCheyenne* sets forth strategies to implement the plan.

Contents

The *Snapshot* reports contain the following data and information for the Cheyenne Area (current as of late 2011):

1. Population;
2. Land Use;
3. Economy;
4. Housing and Neighborhoods;
5. Water, Sewer, and Stormwater;
6. Schools and Cultural Facilities;
7. Transportation;
8. Parks, Recreation, and Trails;
9. Historic Preservation; and
10. Public Safety (Fire and Police).

Following the reports, are the inventory maps, the basis for *PlanCheyenne*.

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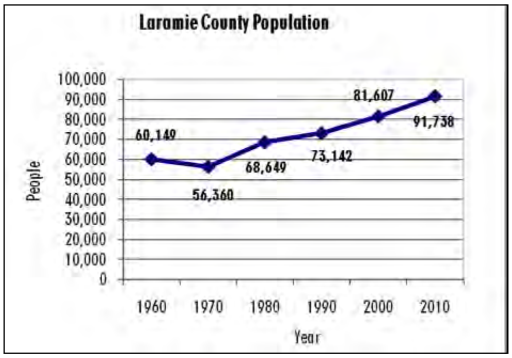
SNAPSHOT

CHEYENNE AREA POPULATION

March 2012 (revised)

FACTS AT A GLANCE

The Cheyenne Area population has continued to grow over the past decades. In 2010, the Cheyenne Area accounted for 88% of the total population in Laramie County, so trends in Laramie County generally reflect those in the Cheyenne Area. The following statistics and data are relevant to the Cheyenne Area (the planning area for *PlanCheyenne*).



2010 U.S. Census Population and Households Profile

- **Population:** In 2010, the Cheyenne Area had a population of 81,163 people in 35,920 households (up from 74,160 people in 2000, US Census, Census Blocks). Of the entire population living in the Cheyenne Area, most people (73%) people in the Cheyenne Area lived within the City of Cheyenne.
- **Growth:** On a yearly basis from 1990 to 2010, the population of Laramie County (and thus the Cheyenne Area) grew at an annual rate of 1.3%.
- **Household Size:** The average household size in the Cheyenne Area is 2.40 people.
- **1960 to 2010 Growth:** Laramie County had 60,100 residents in 1960 and in 2010 had over 91,700 residents.
- **Median Age:** The median age of residents in Laramie County is rising—from 31.9 in 1990, to 35.3 in 2000, and 37.0 in 2010.
- **Race and Ethnicity:** Cheyenne residents are a mix of ethnicities, including White (87%), Black (3%); Native American (1%); and Asian (1%). Hispanic or Latino residents of all races comprise 14.5% of the population.

Laramie County Population

	1960	1970	1980	1990	2000	2010
Census Population	60,149	56,360	68,649	73,142	81,617	91,738
Median Age	26.7	26.7	28.1	31.9	35.3	37.0

Estimated 2011 Cheyenne Area Population and Households

- From 2010 to 2011, 495 new residential building permits were issued in the city and county. In addition, 576 new address points have been recorded in the Cheyenne Area since 2010, 510 (88.5%) of which are for residential properties.
- Therefore, by the end of 2011, the Cheyenne Area had 36,320 households (34,032 occupied) and a population of 81,676.

TRENDS AND KEY ISSUES

- The City of Cheyenne increased in population by an average of 645 people per year from 2000 to 2010, which is more than double the average increase of 300 people between 1990 and 2000.
- The State of Wyoming and other major Wyoming cities grew at a similar annual rate as the Cheyenne Area from 2000 to 2010, with the State population growing at 1.3% annually, Casper at 1.1% annually, and Laramie at 1.3% annually.
- From 2000 to 2010, the total Cheyenne Area population grew faster than it did from 1990 to 2000.
- The population is growing older, and it is important to consider the needs of a growing senior population, including housing (see *Snapshot Cheyenne Area Housing* report).

Sources:
U.S. Census 2010 - Census Block data for the 3,046 blocks that correlate with the planning area. State of Wyoming Center for Economic and Business Data, Economic Indicators, September, 2011; Economic and Planning Systems, Population, Employment, and Housing Forecast, 2012.

Increasingly Cheyenne is viewed as a part of the Front Range economy, and experiences similar trends. The following table shows how growth rates have varied along the Front Range from Denver to Cheyenne in the past four decades. Laramie County experienced the greatest growth between 2000 to 2010, whereas the northern Colorado communities listed below experienced more growth between 1990 and 2000, and have seen less growth since 2000.

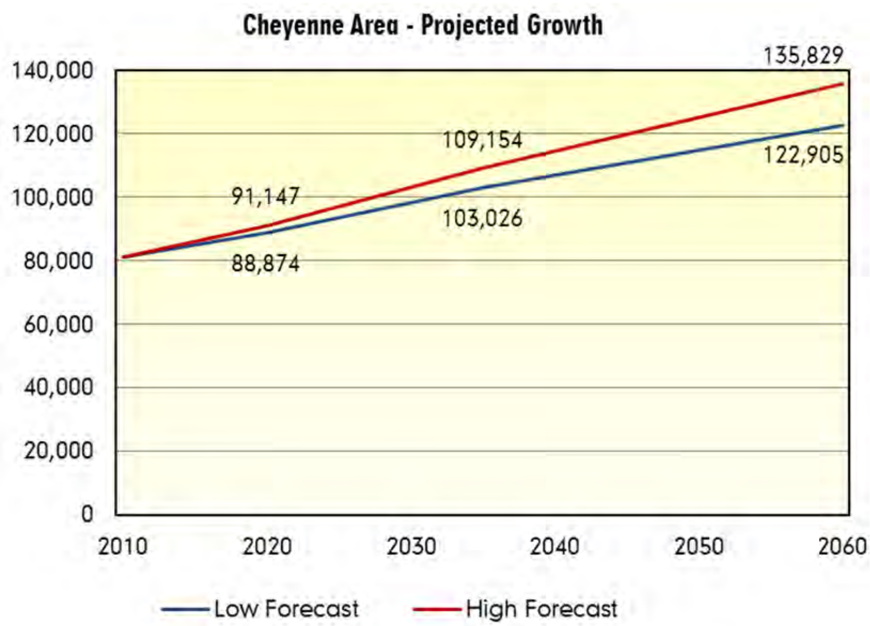
Front Range Population Totals by Decade

	1960	1970	1980	1990	2000	2010
Adams County, CO	120,296	185,789	245,944	265,038	363,857	441,603
Denver County, CO	493,887	514,678	492,694	467,610	554,636	600,158
Longmont, CO	11,489	23,209	42,942	51,555	71,093	86,270
Larimer County, CO	53,343	89,900	149,184	186,136	251,494	299,630
Loveland	9,734	16,220	30,215	37,352	50,608	66,859
Fort Collins	25,027	43,337	65,092	87,758	118,652	143,986
Weld County, CO	72,344	89,297	123,436	131,821	180,936	252,825
Greeley	26,314	38,902	53,006	60,536	76,930	92,889
Laramie County, WY	60,149	56,360	68,649	73,142	81,607	91,738
Cheyenne, WY	43,505	41,254	47,283	50,008	53,011	59,466

Front Range Overall Growth by Decade

		1960-1970	1970-1980	1980-1990	1990-2000	2000-2010
Adams County, CO		54.4%	32.4%	7.8%	37.3%	21.4%
Denver County, CO		4.2%	-4.3%	-5.1%	18.6%	8.2%
Longmont, CO		102.0%	85.0%	20.1%	37.9%	21.3%
Larimer County, CO		68.5%	65.9%	24.8%	35.1%	19.1%
Loveland		66.6%	86.3%	23.6%	35.5%	32.1%
Fort Collins		68.5%	65.9%	24.8%	35.1%	21.4%
Weld County, CO		23.4%	38.2%	6.8%	37.3%	39.7%
Greeley		47.8%	36.3%	14.2%	27.1%	20.7%
Laramie County, WY		-6.3%	21.8%	6.5%	11.6%	12.4%
Cheyenne, WY		5.2%	14.6%	5.8%	6.0%	12.2%

Low and high forecasts for population growth in the Cheyenne Area are illustrated below.



** Note: In 2011, the Cheyenne Planning Area was expanded. The 2011 Cheyenne Area population estimate is 81,676 persons.*

PROJECTED GROWTH

- As illustrated in the chart below, depending on how much growth occurs over the next 25 years, the Cheyenne Area could grow at a rate of between 1.08% and 1.38% to a population of between 103,026 to 135,829 residents in 2035.
- The amount of growth that occurs will have significant implications on City services, such as utilities, transportation, and parks. While forecast assumptions will be made for the planning process, it is important to monitor the growth rate over time and adjust our plans accordingly.

CHEYENNE AREA LAND USE

March 2012

FACTS AT A GLANCE

The Cheyenne Area covers 213 square miles. The City of Cheyenne incorporated area) covers 25.3 square miles. F.E. Warren Air Force Base covers 9.2 square miles.

2011 Existing Land Use—Cheyenne Area

- 73,724 acres (54%) are currently used for Agricultural/Rural purposes.
- 15,888 acres (11.6%) are County Low Density Residential (residential development on large lots surrounding the city).
- 9.4% of the land is classified as vacant.
- 73% of the land is privately-owned, 20% is public/quasi-public, and 7% is right-of-way.

Cheyenne Area Existing Land Use

Land Use	County (ac)	City (ac)	Total (ac)	% of Total
Agricultura/Rural	73,017	707	73,724	54.2%
Low Density Residential	15,888	589	16,478	12.1%
Medium Density Residential	377	3,122	3,498	2.6%
High Density Residential	160	410	570	0.4%
Mobile Home Residential	337	9	346	0.3%
Neighborhood Business	10	6	16	0.1%
Community Business	1,137	1,261	2,398	1.8%
Central Business District		74	74	0.1%
Regional Business		297	297	0.2%
Light Industry	340	120	460	0.3%
Heavy Industry	180	192	372	0.3%
Other	27	2	29	0.1%
Open Space and Parks	417	1,401	1,818	1.3%
Public Land	10,896	2,214	13,110	9.6%
Right of Way	5,999	4,124	10,123	7.4%
Vacant Land	11,146	1,681	12,827	9.4%
Total*	**119,930**	**16,208**	**136,138**	**100%**

** Planning Area was expanded in 2011 to include the area south of the City along Highway 85. Source: Existing Land Use Map, Clarion Associates, December 2011.*

Recent Growth and Development Patterns

- Approximately 576 new addresses have been recorded in the Cheyenne Area since the year 2010. Of those new addresses, 140 (24%) are in the County, and 436 (76%) are in the city (including recently incorporated areas).
- Since 2010, 495 building permits for new residences have been issued in Cheyenne and Laramie County.* The Cheyenne/Laramie Health Department issued 171 rural septic permits for residential use in the County since 2010.

TRENDS AND KEY ISSUES

DEVELOPMENT PATTERNS

- Large lot rural residential growth continues to be the predominant development pattern, especially in the unincorporated portions of the County.
- Some new residential subdivisions with mixed densities, unit sizes, and housing types have developed in recent years; however, additional diversity is needed to attract and retain new employers and employees.

CITY/COUNTY ONE-MILE PLANNING AREA

- Additional discussion is needed to resolve issues related to urban development limits, the provision of infrastructure and services, and annexation within the City/County One-Mile Planning Area.

DEVELOPMENT POTENTIAL

- Residential development potential needs to be re-evaluated within the context of planned employment in Swan Ranch and surrounding areas.

Sources:

Laramie County Assessor's data
*Center for Economic and Business Data, *"Economic Indicators for Greater Cheyenne." September 2011.*

See Maps:

Existing Land Use & Land Use 2011
Existing Zoning
Development Status
Ownership

Potential Development (Based on Available Land Supply)

The table below provides a snapshot of the current land development status and potential development in the Cheyenne area based on the available vacant land as currently zoned.

In the City of Cheyenne, the approximately 2,260 acres of vacant and agricultural land could accommodate 3,257 new residential housing units, and more than 7.7 million square feet of business and industry (as currently zoned). The vacant land that is currently zoned could accommodate a variety of housing types and industries. 52% of the city vacant land is zoned for residential uses. 25% is zoned for business and industry, with 23% of the city's vacant land zoned for heavy industry.

Outside of the city, the overwhelming majority of the vacant land (almost 62,000 acres) is zoned for agricultural and rural residential uses. Almost 60,600 acres are zoned A-2 (agricultural use with 1 unit/20 acre residential density permitted). 1,249 acres are zoned for Agricultural Residential (agricultural/rural uses with 1 unit/per acre density permitted). This land could accommodate almost 4,280 new housing units if current development patterns of large lot development continue. 16,755 new residents could reside in the county based on current zoning. In addition, 6,562 acres of county land are zoned for business and industry, potentially accommodating over 4.5 million square feet of space and over 11,200 new jobs. These numbers do not reflect the fact that some parcels platted before current zoning standards will develop at higher densities.

INFILL AND REDEVELOPMENT

- Accommodating some new growth through infill and redevelopment and more compact development patterns can help offset the need for future expansion of the urbanized area.

OWNERSHIP

- Approximately 22% of the planning area is comprised of public lands.

	City (ac)	County (ac)	Total (ac)
Open Space & Parks	1,401	417	1,818
Private Land	8,265	90,581	98,846
Public Land	2,417	23,512	25,929
TOTAL (excl. ROW)	12,083	114,510	126,593

Source: Ownership Map, Clarion Associates, October 2011.

Cheyenne Area - City and County Potential Development

		CityPotential Development ("A" zone districts and Vacant Land)			County Potential Development ("A" zone districts and Vacant Land)			All Potential Development		
Land Use	**avg**		**Housing**	**Population**		**Housing**	**Population**		**Housing**	**Population**
Agricultural & Residential	**(du/ac)**	**(Acres)[1]**	**(Units)**	**(People)**	**(Acres)[1]**	**(Units)**	**(People)**	**(Acres)**	**(Units)**	**(People)**
County Agricultural (A-2)	0.05	465	23	52	60,594	3,030	6,793	61,059	3,053	6,845
City Agricultural (AG)	0.05	81	4	9	0	0	0	81	4	9
Agricultural Residential (A-1)	0.20	152	30	68	2	0	1	154	31	69
Rural Residential (AR)	1.0	65	65	146	1,249	1,249	2,801	1,315	1,315	2,948
Low Density Residential (LR)	4.0	58	230	516	67	267	598	124	497	1,114
Medium Density Residential (MR)	8.0	261	2,088	4,682	206	1,648	3,696	467	3,737	8,378
High Density Residential (HR)	12.0	29	352	790	10	116	260	39	468	1,050
Mixed Use (Residential Portion - MU)	8.0	58	464	1,039	145	1,163	2,606	203	1,626	3,646
Residential Subtotal		*1,169*	*3,257*	*7,303*	*62,273*	*7,473*	*16,755*	*63,442*	*10,730*	*24,057*
Business and Industry	**(FAR)**	**(Acres)[1]**	**(SF)**	**(Jobs)**	**(Acres)[1]**	**(SF)**	**(Jobs)**	**(Acres)**	**(SF)**	**(Jobs)**
Neighborhood Business (NB)	0.20	2	19,924	50	16	137,026	343	18	156,949	392
Community Business (CB)	0.20	196	1,710,738	4,277	80	693,166	1,733	276	2,403,904	6,010
Central Business District (CBD)	0.75	3	90,264	226	0	0	0	3	90,264	226
Mixed Use (Business Portion - MU))	0.30	58	757,196	1,893	145	1,899,016	4,748	203	2,656,212	6,641
Planned Unit Developmet (PUD)	var.	105	var.	var.	6,102	var.	var.	6,206	var.	var.
Light Industrial (LI)	0.20	196	1,706,425	4,266	188	1,635,314	4,088	384	3,341,739	8,354
Heavy Industrial (HI)	0.15	529	3,454,855	5,182	32	211,343	317	561	3,666,198	5,499
Business and Industry Subtotal		*1,089*	*7,739,402*	*15,894*	*6,562*	*4,575,865*	*11,228*	*7,651*	*12,315,267*	*27,122*
Total		**2,258**			**68,835**			**71,093**		

Source: Clarion Associates, Development Status Map, December 2011.

Key: du/ac = "Dwelling unit/acre"; FAR = "Floor-to-Area Ratio"; SF = "square feet";

Assumptions:

Residential. Residential Net = 100%. Household Occupancy Rate = 2.39 persons/household. 94% housing units occupancy rate.

Jobs. Business = 2.5 jobs/1,000 sf; Heavy Industry = 1.5 jobs/1,000 sf; Light Industry = 2.5 jobs/1,000 sf

CHEYENNE AREA ECONOMY

March 2012

FACTS AT A GLANCE

Economic indicators for the past five years show that despite a national recession, the Cheyenne Area economy has made gains and is growing. Cheyenne's employment and market conditions indicate that it functions independent of national trends.

Job Profile

- Wage and salary employment in Laramie County increased by 5,912 jobs between 2000 and 2010.
- Factoring in inflation over the past decade, average annual wages have increased 1.6% per year for the decade; in most areas of the nation, wages adjusted for inflation have been flat.
- Health care and social assistance, transportation and warehousing, and public administration were the three industries that increased by the most amount of jobs between 2000 and 2010.
- The average local unemployment rate in for 2011 in the County (6.5%) is slightly above the state rate (6.0%) and well below the national rate (9.1%).
- Total full-time employment in Laramie County is projected to increase from 45,536 in 2010 to between 56,698 and 63,213 in 2035 a compound increase of between 0.88 and 1.32 percent annually.

Major Employers

- The top five employers in the Cheyenne Area in 2011 were F.E Warren AFB (3,820), the State of Wyoming (3,379), Laramie County School District No. 1 (2,157), the Federal Government (1,804), and Cheyenne Regional Medical Center (1,618).
- In addition to the Cheyenne Regional Medical Center, major private employers in the area include Sierra Trading Post, the Union Pacific Railroad, Lowe's Companies, Echo Star Communications, and Frontier Oil.

Employment Percentage by Industry

Industry	L.C.	WY	U.S.
Services	36.4%	37.2%	42.2%
Retail Trade	14.7%	11.4%	11.6%
Government	13.5%	6.5%	4.9%
Construction	7.1%	8.7%	6.8%
Transportation and Warehousing	6.5%	6.8%	5.0%
Manufacturing	5.6%	5.1%	10.7%
Finance, Insurance and Real Estate	5.0%	4.2%	6.8%
Agriculture	2.8%	12.3%	1.9%
Information	2.4%	1.5%	2.3%
Wholesale Trade	1.1%	2.0%	2.9%

TRENDS AND KEY ISSUES

EMPLOYMENT GROWTH

- The Cheyenne Area's level of employment generally continued to rise notwithstanding regional and national conditions of the past few years. Total employment in most western communities is flat compared to 2000, while in the Cheyenne Area employment is up 16% for the decade, with job growth averaging 1.5% per year.
- The extent to which recent oil play exploration will move into the development/production phase and the timing and number of jobs associated with that possible shift remains uncertain; challenges related to lack of housing diversity, retail supply and infrastructure will be further amplified should these efforts move forward.

Sources:
Economic Indicators for Greater Cheyenne; Center for Economic and Business Data for Laramie County, September 2011; 2010 American Community Survey 3-Year Estimate; Economic and Planning Systems, Population, Employment, and Housing Forecast, 2012.

Income and Earnings Growth

- Median household income in Laramie County in 2010 was $49,065 (2010 American Community Survey), slightly lower than the State of Wyoming ($54,294), and nation ($51,222).

Commuter Trends

- Approximately 80% of Laramie County workers live in Laramie County and 83% of Laramie County residents work in the County.
- There are a greater number of workers that commute into Laramie County for work than Laramie County residents who commute out of the County for work. There is a nearly even split among in-commuters from the north, west, and south.
- The commute flow indicates that the County's economy is relatively independent and has been successful in generating employment and attracting employees from other areas in the region.

Employment Diversity

- The economy is currently reliant on public administration jobs for its stability; this presents a challenge where level of funding in the public sector could change.
- The scale and diversity of employment and intermodal opportunities provided by Swan Ranch and other office/industrial parks provides the Cheyenne Area with a competitive advantage over other communities in the Rocky Mountain west in attracting new jobs. However, the timing of these potential new jobs remains difficult to predict.
- The health care industry has a strong and growing presence in Cheyenne, but faces strong competition from Fort Collins and other communities to the south for specialized treatment facilities. Future expansion of the Cheyenne Medical Center may help address this competition and growing demand for health care services in the Cheyenne Area.

TRENDS AND KEY ISSUES

RETAIL SUPPLY

- The retail inventory in the Cheyenne Area has fallen below equilibrium, indicating opportunity for additional development. As with most communities, capturing retail leakage will be a challenge.

HOUSING INVENTORY AND MIX

- A larger supply and more diverse mix of housing types than that which exists in the Cheyenne Area today is needed to support future employment growth.

PLANCHEYENNE
Reflections and Progress

SNAPSHOT

CHEYENNE AREA HOUSING & NEIGHBORHOODS

March 2012

FACTS AT A GLANCE

The Cheyenne Area offers a range of housing units and types—in the city of Cheyenne and in the more rural Laramie County. Many Cheyenne Area neighborhoods typically contain a mix of sizes, styles, types, prices, and age of homes. In addition to urban housing, the area currently provides opportunities to live in rural areas with a short commute to downtown.

2011 Cheyenne Area Housing Profile

- **Total Units:** In 2011, the Cheyenne Area had 36,320 housing units (up from 29,136 units in 2003, although the planning area was expanded in 2011).
- **Single Family Units:** Of the total housing units, 73% were single family.
- **Multi-Family Units:** 27% of housing units were multi-family.
- The **rental vacancy rate** is approximately 6.7% percent while the **homeowner vacancy** rate is much lower at 1.9%.

Housing Growth and Change

- **Residential Permits:** The city permitted a total of 3,736 residential units between 2000 and 2010, which was 70% of the county total of 5,344 residential units. For the decade, the city permitted an average of 340 units per year and the entire county permitted an average of 485 units per year.
- **Single-Family Permits:** The majority of units permitted between 2000 and 2010 were single-family detached homes (75 to 80%). 2,830 single-family residential units were permitted in the city and 4,438 in the entire county.
- **Multi-Family Permits:** Of the multi-family units permitted within the last decade, 94% (568 units) were in the city.

New Neighborhoods and Residential Areas

The fastest growing neighborhoods in the Cheyenne Area are located at the edges of the city. Some of the newer neighborhoods and residential areas within the Cheyenne Area include:

- **The Pointe**, located on the north side of the city, includes a mix of single-family and attached units, common open space, and trails.
- **Saddle Ridge**, a planned community on the east side of the city, includes a range of single-family and townhomes and common open space, plus a future city park, elementary school, and nearby commercial space.
- **Harmony**, located on the southern edge of the city, includes a diverse mix of single- and multi-family housing, a mixed-use retail area, several school sites, parks, and quality manufactured housing.
- **JL Ranch** is a developing single-family neighborhood located on the southeastern side of the city, near the Cheyenne LEADs Business Park and greenway trail system.

TRENDS AND KEY ISSUES

NEW CONSTRUCTION

- 2004 and 2005 were peak years for housing construction in the Cheyenne Area. New housing construction dropped off considerably in 2007 and 2008, but building permits increased somewhat in 2009 and 2010.

HOUSING INVENTORY

- At 7% vacancy, the Cheyenne Area has a barely sufficient housing inventory to maintain and facilitate an adequate rate of turnover; vacancy rates in Front Range communities to the south are much higher.
- Housing demand is projected to increase along with the Cheyenne Area's continued employment growth. Demand for between 13,637 and 17,516 new housing units is projected by 2035. Between 4,550 and 6,019 of those units will be needed within the next ten years.

Source:
U.S. Census 2010,
Center for Economic and Business Data for Laramie County, Economic Indicators for Greater Cheyenne, September 2011; Economic and Planning Systems, Population, Employment, and Housing Forecast, 2012.

Existing and Historic Neighborhoods

- Cheyenne includes the historic neighborhoods of Capital North, Lakeview; Moore Haven Heights, Rainsford, Rosenberg, and South Side. (See: *Snapshot Historic Preservation*).
- The Cheyenne Area also features an array of existing neighborhoods that range from compact, and walkable established neighborhoods near and east of downtown (with and average density of 3.5 units per acre) to very rural, low-density neighborhoods (typically on lots between 5 and 10 acres) outside of the City.

Housing Market

- **Average Sale Price**: Between 2000 and 2010, the average housing price for homes in the City of Cheyenne increased from $108,590 to $182,630. During this period, the average household income for City households increased from $46,771 to $62,606. The compound average annual growth rate for home prices in the City was 5.3% and 4.5% in the County from 2000 to 2010.
- **Housing Price to Household Income Ratio**: In 2000, the City's ratio of home price to household income was 2.32, which is low compared to other cities. The ratio increased to 2.92 in 2010, which is more consistent with other markets.
- **Regional Comparisons:** Single-family homes in the City of Cheyenne are slightly less than those located Northern Colorado Front Range, with the exception of the Greeley Area. However, the average cost of rural residential properties in the Cheyenne Area is comparable to Northern Colorado single-family homes.

Cheyenne Area Average Sale Price – Housing

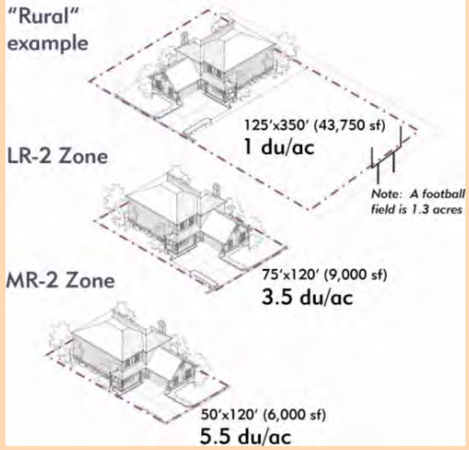
Year	City Residential	Rural Residential
2006	$169,781	$252,300
2007	$174,613	$259,920
2008	$173,476	$253,321
2009	$168,237	$245,000
2010	$182,630	$261,096
Sept 2011	$176,056	$276,287
5-year increase	4%	10%

Source: *Economic Indicators for Greater Cheyenne Annual Trends Edition 2010, and September 2011 Report*.

Northern Colorado Median Sales Prices for Homes

Year	Fort Collins Area	Greeley Area	Loveland Area	Windsor Area
2006	$248,767	$174,859	$257,204	$319,120
2007	$253,578	$165,223	$245,565	$332,155
2008	$251,081	$150,735	$240,610	$311,864
2009	$239,223	$139,410	$226,021	$286,160
2010	$245,908	$142,181	$235,264	$308,208
Nov 2011	$274,169	$168,049	$241,059	$307,824
5-year increase	10%	-4%	-6%	-4%

Source: The Group, Inc. Annual Report 2010, and The Group, Inc. "Insider Newsletter," November 2011.



Example of Density (Adapted from "Community by Design")

TRENDS AND KEY ISSUES

HOUSING INVENTORY

- There is a good deal of uncertainty in the timing and extent to which recent oil play exploration and the buildout of Swan Ranch will translate into a sudden spike in jobs. This has a direct impact of the timing and extent of increased housing demand, and presents additional challenges in an already constrained housing market.

HOME PRICES

- Annual home value growth is 5.3% for the past decade. This figure is much higher than most areas, representing more stability and market pressure on pricing.
- Housing sales prices in 2010 have weathered the recession well as they are nearly the same as the peak in 2007.

HOUSING DIVERSITY

- While some new residential subdivisions with mixed densities and housing types have developed since 2005, additional diversity is needed to attract and retain new employers and employees.

WATER, SEWER, AND STORMWATER

March 2012

FACTS AT A GLANCE

In the Cheyenne Area, water and sanitary sewer services provided by the City of Cheyenne Board of Public Utilities and the South Cheyenne Water and Sewer District. The various water, sewer, and stormwater systems are described below.

Water and Sewer

Board of Public Utilities (BOPU) – Potable/Water Treatment System

- Current capacity is 40 million gallons per day (mgd).
- Current average daily demand is 13.2 mgd.
- Current peak daily demand is 31.2 mgd (July 2007).
- Projected average daily demand (2052) is 20.0 mgd (1% growth).
- Projected peak day demand (2052) is 47.0 mgd (1% growth).
- Current treatment storage capacity is 35 million gallons.
- Areas above 6,150 feet must be served by booster pumping station.

Board of Public Utilities (BOPU) – Water Reclamation System

- Current Plant Treatment capacity is 17 mgd.
- Current average daily demand is 9 mgd.
- Peak month last 5 years demand is 12.0 mgd (May 2010).
- Projected average day demand (2052) is 17 mgd (1% growth).

Board of Public Utilities (BOPU) – Recycled Water System

- New recycle water treatment facilities went on-line in 2007 at the Crow Creek Water Reclamation Plant.
- Recycled water is delivered to cemeteries, parks, athletic fields, and green spaces for irrigation use.
- Current recycle water treatment capacity is 4 mgd.
- Recycled water distribution system currently features 12.2 miles of pipe.

South Cheyenne Water and Sewer District (SCWSD)

- The SCWSD provides potable/treated water and sewer service to the area along the S. Greeley Highway and along College Drive.
- The SCWSD acquires water from the BOPU.
- Currently, some customers in the district experience low water pressure during peak hours.
- This district is currently only about 45% built out. The district cannot expand without permission from the City of Cheyenne.

Public Health – Well and Septic Permits

- The Cheyenne/Laramie Health Department records show that 2,903 rural septic permits have been issued in the county since 2000—an average of 242 per year.
- Growing numbers of septic and wells in the county raise concerns about groundwater and well contamination.

TRENDS AND KEY ISSUES

- *Raw Water Delivery:* In 2007 the BOPU completed construction of a new 14.7 mile, $14.2 million raw water delivery pipeline from Crystal Reservoir to the Sherard Water Treatment Plant.
- *Main Rehabilitation:* The BOPU established a water and sewer main rehabilitation program that replaces or relines several miles of water and sewer mains each year. This is done to keep the water distribution and wastewater collection systems current and in working condition.
- *Water Reclamation Plant:* $39.5 million in improvements to the Dry Creek and Crow Creek Water Reclamation Plants were completed in 2006. In addition to addressing ammonia and chlorine residual removal, the improvements also included construction of a new $12.3 million recycle water system.
- The BOPU *Master Plan* identifies projects that if constructed, would expand wastewater collection lines to the south of the City within the urban development boundary. *See Utilities (Existing and Proposed) Map.*
- Two recent,major BOPU projects included completion of the first phase of the Southern Water Main project and the replacement and cleaning of a 30-inch transmission main that crosses Warren Air Force Base.

Stormwater

- Currently new developments on ground that has never been developed are required to place stormwater detention areas on their site to maintain offsite stormwater releases to historic rates. Redevelopment projects are generally required to detain the difference in impermeable area between what is existing and the new site layout. The city has also begun to take a more proactive approach in regards to stormwater quality as new areas are developed.
- The county has completed parts of the Allison Draw Flood Control Project and is in the final stages of removing areas from the FEMA floodplain. This project also made major improvements to the area on smaller storm events. There are many areas in the urbanized county area that are still prone to flooding.
- Numerous smaller drainage concerns remain unaddressed and existing funding is not adequate to mitigate them. Maintenance funding is likely not adequate to maintain the functionality of the current stormwater system. Moreover, smaller drainage concerns are the source of numerous complaints by the public.
- Implementation of federal Clean Water Act requirements (the city and county are now subject to MS4 water quality permit requirements) will require additional funding and personnel, and will continue to strain existing resources.

TRENDS AND KEY ISSUES, CONT.

- Since the first PlanCheyenne effort, two high-priority flood control projects have been completed. They are the Dry Creek Flood Control Channel and the Henderson Basin Detention Pond. The Capitol Basin, Crow Creek Basin and other smaller basins have not been completed and a funding source has not yet been secured.
- The City recently received a Brownfield grant from the Environmental Protection Agency (EPA) that will be used to help identify future stormwater improvements.
- The Wyoming Department of Environmental Quality (DEQ) is currently evaluating Crow Creek between the western City limit and Morris Avenue for a Total Maximum Daily Loads (TMDL) Development Program for sediment, E. coli, and selenium.

Sources:
Board of Public Utilities Comprehensive Annual Financial Report, 2011. Laramie County Health Department, 2011.

Maps:
Utilities (Existing and Proposed)
Physical Features & Constraints

EDUCATIONAL AND CULTURAL FACILITIES

March 2012

FACTS AT A GLANCE

Schools

The Laramie County School District Number 1 (the largest school district in the State) provides K-12 education in the Cheyenne Area. The district's facilities include:

- 24 Elementary Schools;
- 3 Junior High Schools; and
- 4 Senior High Schools (3 comprehensive and 1 alternative).

Cheyenne Residents enjoy close proximity to various higher education institutions including:

- Laramie County Community College, Cheyenne, WY
- Colorado State University, Fort Collins, CO (46 mi.)
- University of Wyoming, Laramie, WY (50 mi.)
- University of Northern Colorado, Greeley, CO (52 mi.)

Enrollment

- Total school enrollment has increased by 3.1% since 2005.
- Elementary enrollment has increased by 6.1% since 2005.
- Secondary enrollment has decreased by 4.8% since 2005.

School Level	2005-2006 Enrollment	2010-2011 Enrollment
Elementary (K-6)	6,857	7,276
Secondary (7-12)	6,189	5,894
Total	12,776	13,170

Performance

- Average ACT scores for Laramie County have remained on par with Wyoming and the United States for the past 6 years.

Libraries

Cheyenne has three public libraries located in its Downtown:

- Wyoming State Law Library, 2301 Capitol Avenue
- Wyoming State Library, 2800 Central Capitol Avenue
- Laramie County Library, 2200 Pioneer Avenue

Cultural Facilities

Cheyenne residents and visitors enjoy quality arts, entertainment, and historic tourism opportunities at facilities such as:

- Cheyenne Civic Center
- Cheyenne Depot Museum
- Cheyenne Frontier Days Old West Museum
- Nelson Museum of the West
- Wyoming State Museum
- Cheyenne Little Theatre
- Historic Atlas Theatre
- Historic Lincoln Movie Palace
- Art Center in Holiday Park

TRENDS AND KEY ISSUES

- Several new schools recently opened in the Cheyenne Area. Some of these schools replace older facilities, while others are new facilities to serve a growing population.
  - Freedom Elementary (2005)
  - Sunrise Elementary (2008)
  - Saddle Ridge Elementary (2009)
  - South Senior High School (2010)
  - Gowins Elementary (2012)
- The new Prairie Wind elementary school will open in coming years. Other planned school facility improvements include a new building to replace the old Carey Junior High School, and replacement or refurbishing of Davis, Dildine, Hobbs, and Jessup Elementary Schools.
- Capacity issues within the Laramie County School District Number 1 remain a problem because many of the existing elementary schools in the district are undersized, and elementary enrollment continues to rise.

Source:
Laramie County School District #1, "District Profile," November 2011.
Wyoming School Facilities Department, "2010 Approved District Facility Plans."

See Map:
Schools and Elementary School Districts

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CHEYENNE AREA TRANSPORTATION

March 2012

FACTS AT A GLANCE

Many people understand the transportation system as the network of streets and highways that allows for automobile and truck travel within, to, and through the region. In reality, roads make up only one component of the transportation system, albeit an important one. Transit service, bicycle facilities, and pedestrian infrastructure are essential to a well-balanced multi-modal transportation system. The system even includes railroad corridors, airports, and intermodal truck terminals.

Roadways

Roadways make up the backbone of the transportation system. Cars and trucks use the roadway system. Transit buses also use roads for their routes. Bicyclists often travel directly on roads, especially in corridors with delineated bike lanes or designated bike routes. Pedestrians walk on sidewalks that are constructed in roadway rights-of-way. The most effective roads, called *complete streets*, often accommodate all of these travel modes. In addition to the travel lanes that accommodate travel by transit and automobile, complete streets include good sidewalks to facilitate pedestrian travel and bike paths or lanes for bicycle travel.

The roadway network is based on a range of different types of facilities with varying characteristics that, when combined, make up the roadway system. These facilities range from state highways, which serve high speed, longer-distance trips, to local streets that are designed for lower speeds and shorter trip lengths. Figure 1 shows the facilities that make up the roadway network in the MPO planning area.

Roadway Functional Classification

The Cheyenne Area has an excellent transportation system which serves the needs of its citizens and businesses. However, there are several locations within the area that are congesting and need improvement.

ROADWAY FUNCTIONAL CLASSIFICATIONS

- *Interstates*: Roadways that serve high-speed and high volume regional traffic. Access to a Freeway is limited to grade separated interchanges with mainline traffic signals. (e.g. I-25)
- *Principal Arterials*: Roadways that serve high-speed and high-volume traffic over long distances. Access is highly controlled with a limited number of intersections, medians with infrequent openings, and no direct parcel access. Adjacent, existing and future, land uses shall be served by other network roadways, service roads and inter parcel connections. (e.g. Dell Range and College Drive)
- *Minor Arterials*: Roadways that currently serve high speed and high-volume traffic over medium distances. Access is restricted through prescribed distances between intersections, use of medians, and no or limited direct parcel access. (e.g. Storey Boulevard and Campstool Road.)
- *Collectors*: Roadways that serve as links between local access facilities and arterial facilities over medium-to-long distances, outside of or adjacent to subdivision developments. Collectors are managed to maximize the safe operation of through-movements and to distribute traffic to local access. (e.g. Vandehei and Walterscheid.)
- *Locals*: Roadways that provide direct parcel access and deliver parcel generated trips to the collector network. (e.g., many neighborhood streets)

Daily Traffic Volumes and Levels of Congestion

Congestion levels for the Cheyenne Area are depicted in the Daily Level of Service (Congestion) map in Figure 2. As can be seen, the Cheyenne Area experiences very little congestion, which is noteworthy for a medium size city. Locations within the area that are congested or congesting include:

Congested:

- Warren Avenue between Dell Range Blvd and 8th Avenue
- Ridge Road north of Pershing Blvd
- 5th Street west of Morrie Avenue
- Powderhouse Road between Prairie & Melton
- Norris Viaduct between E. 10th Street and Campstool Road
- Central Avenue between 8th Ave and Pershing Boulevard, 24th & 22nd Street

Congesting:

- Pershing Blvd between Snyder Avenue and Pioneer Avenue
- Pershing/Converse/19th Intersection
- Ridge Road between Pershing Blvd & Omaha Rd
- Central Avenue sections between 8th Avenue and 19th Street
- Powderhouse Road between Melton & Carlson
- Dell Range Blvd sections between Bluegrass Circle and Converse Avenue

The issue that needs to be examined as part of the Comprehensive Plan process is how growth in the area will result in increased traffic congestion, and what improvements should be proposed to accommodate this increased growth.

LEVELS OF SERVICE - CONGESTION

Transportation planning assesses congestion based on a relationship between traffic volumes and capacity called Level of Service. These congestion levels fall into one of three ranges:

- *Uncongested*: Roadways that generally operate in free-flow conditions, where the driver tends to be able to travel without undue delay except for typical traffic control operations, such as stop signs or traffic signals. During the peak hour, there might be some delay at a controlled intersection, but generally the driver can get through the intersection within one cycle of the traffic signal.
- *Congesting*: These are roadways where the driver can generally travel in free-flow conditions during the off-peak hours, but might experience having to wait more than one cycle at a signalized intersection during the peak hours. Because these roadways have existing traffic volumes approaching capacity, there can be significant variations in congestion from day to day, fluctuating between acceptable to congested.
- *Congested*: The congested roadways are those roadways where traffic volumes have either reached or exceeded the facilities capacity to accommodate these volumes. These facilities experience daily congestion delays where it is not uncommon that a driver might have to wait two or more signal cycles to get through the intersection during the morning or afternoon peak periods.

Transit

The Cheyenne Area's current transit service, provided by the Cheyenne Transit Program (CTP), offers good coverage throughout the City. Approximately 83% of Cheyenne Area households are within a quarter mile of a transit line. Similarly, over 91% of all businesses, 88% of schools and administrative support, 74% of all places of general employment, and 63% of all places of industrial employment in the region are within a quarter mile of a transit line.

In 2006, total CTP ridership was approximately 221,634. It grew tremendously and peaked at over 291,000 in 2008 but saw a modest drop to 256,000 rides in 2011. Much of this reduction and stagnation is in direct relationship to the economic recession.

The CTP recently received a grant for approximately $900,000 from the Federal Transit Administration through the American Recovery and Reinvestment Act for design and construction of upgraded and improved bus stops in the Cheyenne Area. An estimated 41 stops located through-out the system were improved with the installation of the ADA compliant shelters and pads, with bus bay pull-outs constructed at 9 of those stops.

Buses run hourly on the six routes shown in Figure 3 from 6:00 am to 7:00 pm Monday through Friday and Saturdays 10:00 am to 5:00 pm. The overall system utilizes 16 buses and is run by 13 full-time employees and 18 part-time drivers. All routes consist of one-way loops that all stop at the downtown transfer center where schedules are coordinated to accommodate quick transfers. One way fares are one dollar and allow for free transfers. The CTP also provides curb-to-curb dial-a-ride service. This service runs on Monday through Saturday by advance reservation.

The Cheyenne Transit Program's fixed route system provided about 226,000 rides in 2011. Additionally, CTP provided 7,000 Stride rides to students. The dial-a-ride service provided over 23,000 rides in 2011.

Bicycle and Pedestrian

Increased walking and bicycling in a community has positive effects on air quality, physical health, and when used extensively, traffic congestion. The Cheyenne Area existing ADA-accessible greenway system includes over 30 miles of physically separated trails that accommodate users throughout the year. The original vision of the greenway system was to build a continuous loop trail around the city. To date, nearly three quarters of the original loop trail has been completed and 96% of Cheyenne Area residents are within one mile of a greenway segment. While this has expanded an important resource for the community, it has also created some maintenance concerns. Infrastructure has been expanded while the resources to keep it in good repair have not been similarly expanded. In recent years, City and MPO staff have worked aggressively to expand the existing greenway system. As a result, nearly nine miles of greenway have been included in the 2010 – 2013 Transportation Improvement Plan.

While cyclists are legally allowed to use all roadways in Wyoming, jurisdictions distinguish on-street bikeway as preferential roadways that have facilities to accommodate bicycles. The Cheyenne Area system of on-street bikeways includes approximately six miles of bike lanes and 50 miles of designated shared roadways. In addition, many roadways have wide shoulders that are commonly used by bicyclists, but are not formally designated as part of the bikeway systems. Existing designated bikeways are supported by bicycle parking, bicycle detection at signals, and connections to transit. The *Cheyenne On-Street Bicycle Plan and Greenway Plan Update* provides additional information about the existing Cheyenne Area bike system as well as planned projects that will help create a more robust bikeway system.

Pedestrian facilities vary throughout the city. The pedestrian system takes advantage of open space preserved for drainage and policies that support increased pedestrian safety and comfort (e.g., separation from higher speed roadways through the use of tree lawns). Today, the City continues to develop and enhance the existing walkway system by filling sidewalk gaps, constructing greenways, and improving transit connections and roadway crossings. These improvements will result in a truly friendly pedestrian environment, which enables freedom of mobility, encourages more physical activity, allows children to walk and bike to school, reduces traffic congestion, and makes it possible to create economic growth at the same time. The *Cheyenne Metropolitan Area Pedestrian Plan* provides summary information about the existing conditions throughout the Cheyenne Area and proposes projects that could improve the walking environment. The existing Cheyenne Area bicycle network and pedestrian network are shown in Figure 4 and Figure 5, respectively.

Truck and Freight

The Cheyenne Area is well positioned to capitalize on a growing manufacturing and distribution industry. The Cheyenne Logistics Hub at SWAN Ranch has chosen to locate in southwest Cheyenne due to access to the Union Pacific Railroad and the BNSF Railway as well as I-25 and I-80 with proximity to the Front Range and I-70. As this project develops, more truck traffic will need to be accommodated.

Additionally, the Cheyenne Area is experiencing an expansion in the oil and gas industry. As part of oil extraction, heavy trucks are required to transport materials to and from extraction sites. Heavy trucks can have significant impact the roadways they travel on.

SNAPSHOT

CHEYENNE AREA PARKS & RECREATION

March 2012

FACTS AT A GLANCE

Parks Division

2011 Existing Parkland

- The Cheyenne area has 1,985 acres of public parkland, including the cemeteries and golf courses (compared with 1,012 acres in 2004).
- The City of Cheyenne has 992 acres of developed parks and 1,078 acres devoted to other resources such as cemeteries, natural and open space areas, visual green space, detention ponds, Country Club, and VA parkland.
- Planned future parkland development includes open space at Swan Ranch (400+ acres), expansion at Romero Community Park, and neighborhood parks in JL Ranch subdivision.

Existing Parklands, City of Cheyenne

Park Class	Total Acres	Number of Sites
Community	368	6
Neighborhood	94	7
Pocket	22	14
Sports Complex	158	8
Golf Course	219	2
Cemetery	53	5
Natural Area/Corridor	128	6
Greenway Corridor	4	4
County	107	3
Other Resource	264	3
Open Space Area	554	16
Visual Green Space	25	40
Detention Pond	3	4
Total	1,966	118

Source: City of Cheyenne Parks Department.

Current Level of Service

Standards have been defined in the Parks and Recreation Master Plan to guide the provision of an adequate level of service for parks. These standards are expressed as acres of parkland provided for each 1,000 residents.

- Neighborhood parks are the smaller parks that serve nearby homes and neighborhoods. The target neighborhood park level of service is 2.5 acres for every 1,000 people. The existing neighborhood park level of service is approximately 1.5 acres for every 1,000 people within city limits, based on an estimated 2011 population of approximately 62,000.
- Community parks, such as Lions Park and Holliday Park, are larger parks intended to serve community-wide needs. The existing community park level of service is approximately 5.9 acres per 1,000 people. The target level of service for community parks is 5.8 acres per 1,000 people.

TRENDS AND KEY ISSUES

- Several new parks have been developed since 2006 including Romero Community Park and Saddle Ridge Park.
- According to the Parks and Recreation Master Plan, the current offering of community parks seems to satisfy existing demand, but many people in Cheyenne feel that they do not have adequate access to neighborhood parks, especially in the central and southern areas of the city. As the community grows, additional neighborhood and community parks will be necessary in order to provide a similar or better level of service to the growing population in and around Cheyenne.
- Large lot rural residential growth outside of the city continues to generate additional demands on City services, including parks and recreation.

Greater Cheyenne Greenway

A grassroots group called the Crow Creek Greenway Committee, formed in 1990, was the driving force behind the planning and development of the Greater Cheyenne Greenway. The community has constructed nearly 32 miles of the Greenway pathway with the involvement of government agencies, private businesses, volunteers, and schools. The City also features nearly 13 miles of shared-use pathway that connect schools, neighborhoods, parks, and other destinations. An update of the 1992 Master Plan will be completed in 2012.

Recreation/Aquatics/Ice and Events Division

The City of Cheyenne offers a variety of youth and adult sports, instructional activities, and special events that take place at City-owned, privately-owned, and Laramie County School District #1 facilities. Programs include youth athletics and aquatics, tennis, ice skating, gymnastics, basketball, baseball, softball, soccer, volleyball and martial arts. There are also a number of private sports programs that use City-owned facilities. Popular programs and numbers of participants are listed below.

Activity	No. of Participants (2011)
Recreational Swim	21,000
Lap Swim	7,500
Goblin Walk	1,700
Women's Softball	1,400
Co Ed Softball	1,300
Men's Softball	1,200
Latchkey Program	1,080
Water Exercise	1,020
Swimming Lessons	1,000
Adult Basketball	650
Youth Basketball	400
Youth Gymnastics	350
Youth Swim Team	330
Tae Kwon Do	180
Dance	120
Yoga	110
Superday	25,00

Golf Division

The City manages 219 acres of golf course land. The Golf Division is responsible for all aspects of course maintenance and new construction for the two city-operated courses, Airport and Kingham Prairie View. The Airport Golf Course is an 18-hole course that encompasses nearly 120 acres, and is a certified Audubon Cooperative Sanctuary. The 99-acre Kingham Prairie View Golf Course is a 9-hole course.

The Cheyenne Country Club Golf Course is privately owned and maintained, as are the FE Warran (18-hole) base and Little America (9-hole) courses.

Dry Creek Greenway

Dutcher Field Ballfields

TRENDS AND KEY ISSUES

New Programs and Grant Funding

The number of recreation programs offered by the City continues to increase, and sports such as adult dodgeball and kickball are becoming popular.

The new Outdoor Adventure Program started in 2011. A $2,500 grant from the North Face helped fund equipment for the program. The City anticipates that demand and interest for outdoor activities and offerings, such as the Outdoor Adventure Program, will continue to grow.

Sources:
Cheyenne Parks and Recreation Department

See 2011 Parks Map

Botanic Gardens Division

The Botanic Gardens Division oversees the operation of Cheyenne Botanic Gardens in Lions Park. The gardens exhibit a diverse collection of plants, provide opportunities for senior, at-risk-youth and handicapped volunteers, and provide educational and therapeutic outreach to the community in the form of lectures, demonstrations, and special events. Recent visitation is shown is the list below. Additionally, Botanic Gardens Staff design, plant and maintain about 2 acres of off-site community plantings, and grow approximately 50,000 bedding plants for City parks annually.

The Paul Smith Children's Village is a children's garden intended to teach concepts of sustainability from the past, present, and future. The Children's Village is currently the only children's garden in the country to receive LEED™ Platinum certification from the U.S. Green Building Council.

More than 41,000 people from all over the world visited the gardens in 2010.

Forestry Division

The Forestry Division is responsible for the development and maintenance of over 14,000 trees, plus shrubs, vines, hedges, and ornamental plantings on all public properties and rights-of-way. The Division is responsible for testing, licensing and regulating the work of commercial arborists and pesticide applicators within the City of Cheyenne, and provides educational opportunities to private citizens as well as tree care professionals.

Cemetery Division

The Cemetery Division manages and maintains the City of Cheyenne cemetery complex (59 acres) clustered around East Pershing Boulevard. The cemetery complex consists of the following city-owned and managed cemeteries: Lakeview, Beth El and the International Order of Odd Fellows (I.O.O.F.), as well as the Serenity Gardens Columbarium. In addition to these cemeteries, the Cemetery Division staff provides grounds and operations services and maintains the records via contract for the following privately-owned cemeteries within the complex: Mount Olivet and Mount Sinai (Jewish Cemetery).

Open Space – Belvoir Ranch and The Big Hole

In 2003, the City acquired 18,800 acres of ranchland west of Cheyenne, known as Belvoir Ranch and the Big Hole. The Belvoir Ranch remains a working cattle ranch, and also offers opportunities for recreation and potential solar and wind energy development. The Big Hole is protected by a conservation easement held by the Nature Conservancy. The easement protects the area's natural setting but allows some low-impact recreational activities.

Lakeview Cemetery

Discovery Pond in the Botanic Gardens.

Belvoir Ranch west of Cheyenne

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PLANCHEYENNE
Reflections and Progress

SNAPSHOT

HISTORIC PRESERVATION

March 2012

FACTS AT A GLANCE

Cheyenne Historic Preservation Board

The Preservation Board was created in 1986 to be the City's representative for the Certified Local Government Program created under the U.S. Department of the Interior and the National Park Service and the Wyoming State Historic Preservation Office (SHPO) to preserve local and nationally significant historic properties.

The mission of the Cheyenne Historic Preservation Board is to safeguard the City's historic structures and features. The Board works to foster civic pride in its past and to promote the use, re-use and adaptation of historic structures, districts, and landmarks for the education, pleasure and welfare of the people of the city. They also encourage the preservation of historic integrity in land use and development planning.

Current Historic Assets within Cheyenne

Historic Asset	# of Buildings	Area Involved
Capitol North Historic District	130	12 blocks
Downtown Historic District	143	Apx 7 blocks
Lakeview Historic District	249	Apx 20 blocks
Moore Haven Heights Historic District	360	32 blocks
Rainsford Historic District	409	Apx 32 blocks
South Side Historic District	393	Apx 41 blocks
Historic Schools	10	na
Historic Warehouses	7	na
Individual Historic Structures	28	na

Future Historic Assets to be Surveyed and Preserved

Historic Asset	# of Buildings	Area Involved
Capitol Heights Historic Area	Apx 500	Apx 34 blocks
Pershing Heights Historic Area	Apx 150	24 blocks
Pioneer Park Historic Area	Apx 500	Apx 46 blocks
Belvoir Ranch	na	Apx 18,000 acres

Future Goals and Objectives

- Protect and enhance buildings, structures, and other features that reflect the City's cultural, social, economic, political, and architectural history
- Safeguard the City's historic and cultural heritage
- Stabilize property values in Historic Districts
- Foster civic pride in accomplishments of the past
- Enhance the City's historic attractions for tourist and visitors, thereby stimulating local business
- Promote the use of Historic Districts and landmarks for education, pleasure and welfare of the people of the City.

Significant Historic Cheyenne Buildings Lost to Development

Cheyenne U.S. Post Office, c. 1902

Cheyenne Carnegie Library, c. 1912

Significant Historic Buildings Restored

Cheyenne Union Pacific Depot

The Plains Hotel

Source:
Historic Preservation Board, 2011.

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Appendix 2-B
EPS - Brief Description of Revised Forecast

(Employment and Population Projection Methodology)

MEMORANDUM

To: Ben Herman, Darcie White, and Shelby Sommer, Clarion Associates

From: Andy Knudtsen and David Schwartz, Economic & Planning Systems

Subject: Brief Description of Revised Forecast; EPS#21858

Date: April 23, 2012

The Economics of Land Use

This memorandum summarizes the revisions made to employment and population forecasts for the update to *PlanCheyenne*.

Forecast Methodology

The 50-year population forecasts are grounded in a projection of employment by industry. The Cheyenne area's population has grown parallel with employment over the past 20 years, and given that employment is the primary driver of population in an economy like Cheyenne, an employment-based forecast was most appropriate.

The Team analyzed economic and demographic trends for the previous 20 to 40 years, depending on the data sets available. Factors and relationships were calibrated for the model based on extensive analysis of these data, including: wage and salary jobs by industry; in- and out-commuting patterns; proprietors; unemployment rate; group quarters; and the proportion of population older or younger than the working age (16-65).

To forecast employment, population, and households, the Team also assembled assumptions on the regional and national economic outlook, including interest in oil and gas exploration, and development potentials for Swan Ranch. Employment growth assumptions were then calibrated using: factors from the historic data analysis; analysis of industry volatility/stability; national-level employment projections (10-year); and an assessment of each industry's proportion in the Cheyenne area compared to the state. Major considerations for distinguishing the low and high forecast were:

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www.epsys.com

Demographics by Age:

- The State demographer released 20-year forecasts that projected 0.76 percent growth per year in the County population and 0.21 percent growth per year in the population older or younger than the working age (16-65).
- The Team's forecast (over 20 years) for the working age population is based on employment growth, which ranges from 0.64 percent per year (low) to 1.10 percent per year (high).
- For the population under 16 and over 65, the State demographer forecasts 1.73 percent per year, well in excess of the 0.74 percent annual growth of the previous 40 years. The Team acknowledges an increase in the 65+ population, but forecasts a more moderate range of 0.95 to 1.00 percent annual growth.

Employment by Industry:

- Growth Rates by Industry (2-digit NAICS level):
  - The Team evaluated volatility and stability in each of Cheyenne's major industries.
  - Low and high growth assumptions were determined by a juxtaposition of historic rates, national level growth trends, regional competitive advantage, and location quotients.
- Public Administration:
  - Concern over cuts in federal funding will affect the civilian and military federal jobs.
  - Forecast assumes a reduction in this workforce (low) or no change (high).

Forecast Revisions

The following revisions were made to the employment and population forecasts based on further inquiry and consideration of a variety of assumptions and variables regarding: baseline growth assumptions; Swan Ranch development potentials; and oil and gas industry jobs.

Baseline Growth

Wage and salary job growth in the past decade has averaged 1.5 percent per year. As shown in **Table 1**, baseline growth is forecast to be 1.5 percent, higher than previously, and in line with historic growth. Specific industries have been adjusted (up and down) based on market projections, independent of Swan Ranch (which has been addressed separately).

Table 1
Forecast Growth Rates
PlanCheyenne Update

	County Employment (2010)	Ann. Avg. Growth Rates 1990-2010	1990-2000	2000-2010	BLS 2008-2018-Year Forecast Rates (U.S.)	EPS Factors Low Growth	High Growth
NAICS Category							
Agriculture, forestry, fishing and hunting	299	6.06%	6.73%	5.39%	-0.4%	2.00%	2.00%
Mining	60	-0.67%	2.13%	-3.38%	-1.6%	1.50%	2.00%
Utilities	161	N/A	N/A	3.34%	-1.1%	1.50%	1.50%
Construction	2,810	3.48%	5.35%	1.64%	1.7%	1.50%	1.50%
Manufacturing [1]	1,521	1.80%	5.23%	-1.52%	1.0%	3.50%	4.00%
Wholesale trade [1]	868	2.21%	2.48%	1.93%	0.4%	3.50%	4.50%
Retail trade [1]	5,646	0.59%	1.56%	-0.38%	0.4%	1.50%	2.00%
Transportation and warehousing [1]	2,609	1.85%	-1.40%	5.21%	0.9%	3.50%	4.50%
Information [1]	1,166	0.09%	-0.28%	0.45%	0.4%	3.00%	4.00%
Finance and insurance	1,768	0.58%	-0.85%	2.03%	0.7%	1.25%	1.25%
Real estate and rental and leasing	539	0.08%	-0.86%	1.03%	---	1.50%	1.50%
Professional and technical services	1,678	3.85%	4.58%	3.12%	2.1%	2.50%	3.50%
Management of companies and enterprises	82	-3.68%	5.23%	-11.84%	---	1.50%	2.00%
Administrative and waste services	1,758	2.80%	3.75%	1.87%	---	1.50%	1.50%
Educational services	243	10.81%	12.12%	9.52%	2.4%	1.50%	2.00%
Health care and social assistance	4,808	3.25%	0.80%	5.77%	2.3%	1.50%	2.50%
Arts, entertainment, and recreation	340	-1.22%	-1.09%	-1.35%	---	0.25%	0.50%
Accommodation and food services	4,298	1.54%	1.82%	1.26%	0.8%	1.50%	1.50%
Other services, except public administration	1,317	-0.06%	4.80%	-4.69%	1.2%	1.50%	1.50%
Public administration	7,487	1.55%	1.63%	1.46%	0.3%	-0.50%	0.50%
Other	6,080	1.78%	1.27%	2.30%	---	1.50%	1.50%
Total [2]	**45,536**	**1.69%**	**1.88%**	**1.51%**	**1.0%**	**N/A**	**N/A**

[1] Industries relevant to jobs at Swan Ranch.
[2] The rates shown in this row under the"EPS Factors" columns "Low Growth" and "High Growth" indicate resulting average 50-year annual wage and salary job growth.
Source: Economic & Planning Systems
H:\21858-Cheyenne Comprehensive Plan\Models\[21858-Projections-MODEL-031912.xlsx]TABLE 3 - GROWTH FACTORS

Swan Ranch

Overall, the following are the development and growth estimates for Swan Ranch.

- 1,000 to 1,500 jobs in the next 10 years; approximately 5,400 to 8,300 jobs by build-out over 30 years.
- The industries affected include: Manufacturing, Wholesale Trade, Retail Trade, Transportation and Warehousing, and Information.
- Most oil and gas jobs at Swan Ranch are likely to be reported as Manufacturing.

The employment estimate for development potential of Swan Ranch is based on land use assumptions (FAR) and space to employment ratios (square feet per job). According to Swan Ranch representatives, existing industrial operations have plans to expand onto 145 acres of the first phase (527 acres). Expansion plans would utilize approximately 460,000 square feet of facility and employ more than 500 jobs. At this utilization level, the FAR for the existing phase ranges from 0.02 to 0.09, with an employment ratio ranging from 550 square feet to 2,200 square feet per job. Existing commercial sites are developed at 0.20 to 0.38 FAR with employment ratios ranging from 2,083 square feet to 2,200 square feet per job.

EPS took two approaches to estimate the remainder of Swan Ranch's development capacity:

- **Land Use Capacity**: Using standard industry metrics as a benchmark for these types of land uses and the existing land use intensities as a benchmark, EPS estimates total maximum employment for the 3,800 acres of net developable land at 8,200 jobs, as shown in **Table 1**. In addition to the 4,800 jobs for industrial uses, the development capacity for Swan Ranch includes 2,200 jobs in the highway commercial phases for lodging, retail, and office.

  The remainder of Phase I is assumed to develop at 0.10 FAR and 2,000 square feet per job. This generates 2.3 million square feet of facility space and 2,000 jobs. For the future phases of industrial development, the 0.10 FAR and 2,500 square feet per job generate approximately 12.1 million square feet of space and 4,800 additional industrial jobs, for a total industrial job count of 6,000.

Table 1
Swan Ranch Build Out Potential
PlanCheyenne Update

	@ Build-Out				
	Acres	**Floor Area**	**Jobs**	**Sqft / Job**	**FAR**
Industrial Uses					
Phase I (527 acres)					
Schlumberger (@ build out)	65 ac.	220,000 sqft	400	550	0.08
Midwestern Wyoming	55 ac.	220,000 sqft	100	2,200	0.09
Jebro	25 ac.	20,000 sqft	12	1,667	0.02
Remaining Phase I	382 ac.	1,840,000 sqft	688	2,674	0.10
Subtotal Phase One	527 ac.	2,300,000 sqft	1,200	2,000	0.10
Future Industrial Phases	2,773 ac.	12,080,000 sqft	4,800	2,500	0.10
Subtotal Industrial Uses	**3,300 ac.**	**14,380,000 sqft**	**6,000**	**2,397**	**0.10**
Highway Commercial Uses					
Hotel	3 ac.	50,000 sqft	24	2,083	0.38
Office	3 ac.	22,000 sqft	10	2,200	0.20
Remaining Commercial / Office	495 ac.	4,284,000 sqft	2,166	2,000	0.20
Subtotal Commercial Uses	**500 ac.**	**4,356,000 sqft**	**2,200**	**2,000**	**0.20**
Total Swan Ranch	**3,800 ac.**	**18,736,000 sqft**	**8,200**	**2,285**	**0.11**

Source: Granite Peak Development; Economic & Planning Systems

H:\21858-Cheyenne Comprehensive Plan\Data\[21858-Specific Industry Jobs.xls]TABLE 2 - SR Existing

- **Comparable Development**: EPS researched development patterns at an existing industrial park in Windsor, Colorado (Great Western), as shown in **Table 2**. While significantly smaller than Swan Ranch, development within this industrial park with rail and highway access ranges from 0.07 to 0.46 FAR and between approximately 700 to 3,300 square feet per job.

Table 2
Great Western Industrial Park, Windsor, Colorado
PlanCheyenne Update

	Great Western Industrial Park				
	Acres	**Floor Area**	**Jobs**	**Sqft / Job**	**FAR**
Business					
Carestream	400 ac.	1,300,000 sqft	800	1,625	0.07
Front Range Energy	36 ac.	41,000 sqft	32	1,281	0.03
Hexcel	5 ac.	100,000 sqft	47	2,128	0.46
Metal Container Corp.	22 ac.	196,000 sqft	108	1,815	0.20
Vestas	72 ac.	437,000 sqft	600	728	0.14
Owens-Illinois	76 ac.	667,000 sqft	200	3,335	0.20
Subtotal	**611 ac.**	**2,741,000 sqft**	**1,787**	**1,534**	**0.10**

Source: Granite Peak Development; Economic & Planning Systems

H:\21858-Cheyenne Comprehensive Plan\Data\[21858-Specific Industry Jobs.xls]TABLE 3 - Great Western

Oil and Gas Industry

In the state of Wyoming, the total rig count, according to the state's Economic Analysis Division, has fluctuated between 40 and 60 during the last two years. EPS interviewed and researched additional representatives in the industry to understand the exploration activity potential in terms of the maximum rigs that could be positioned in Larimer County at one time and the associated crews and permanent labor. There are generally three phases that relate to oil and gas exploration described below:

- **Land Leasing**: This phase is largely complete, and leases generally run for three to five years.
- **Geology Work**: This phase, involving work by geologists to understand ground conditions and to research best methods and approaches to drilling and exploration, can last approximately one year.
- **Drilling**: This phase generally lasts between five and six years. Because of the limitations of existing number of rigs in the state and around the country, industry representatives indicate that a maximum of 50 rigs might be present for drilling activity in Laramie County. At 16 to 18 jobs per rig, the employment generated would be approximately 900 jobs. This estimate was provided by an industry representative as a high-end maximum. That could only be reached if all market forces align in a concentrated manner. As noted, this amount of drilling represents the average for the whole State of Wyoming for the past two years.

  According to industry representatives, crews follow the rigs, and in the event that rigs aren't already located in a region, they typically travel with the rigs. In this case, workers are often housed in temporary onsite housing, trailer parks, or man camps. Some portion of the jobs, however, can come from the local laborforce.
- **Production**: This phase is highly dependent on the success of drilling activity to yield productive wells. Because exploration has not begun, it is difficult for even industry representatives to estimate the degree to which there will be production. If successful, however, production could continue for 20 to 25 years, though permanent job counts would

be low. Industry representatives indicate that one person can oversee the operation of multiple wells, as much of this stage of oil and gas exploration is automated.

Oil & Gas Employment/Population Estimates

Overall, the industry is skeptical that the Niobrara play will generate the level of activity in Laramie County that was thought possible given the level of interest in land leasing over the past few years. Nevertheless, a boom scenario for Laramie County would generate the following impacts:

- **Employment/Housing**: If 50 rigs are positioned in the County with 18 crew members per rig, approximately 900 jobs would be generated for five to six years at some point in the future. As indicated previously, a portion of workers would be brought along with the rigs and a portion would come from the local workforce. EPS believes that approximately 10 percent of the labor demand could be sourced locally and 90 percent would come with the rigs, as is typical with this industry. Thus, local impacts to infrastructure could be as high as 810 employees.

Total Forecasts

The following is a summary of the revised forecasts for Laramie County.

- **Employment**: EPS estimates that the County's population will grow at an average of 650 to 880 jobs per year for the next 10 years; between 580 and 800 jobs for the next 25 years; and between 550 and 775 jobs per year for the next 50 years. Overall, Laramie County's total wage and salary employment will add between 6,500 and 8,800 jobs over the next 10 years; between 14,500 and 20,100 jobs over the next 25 years; and between 27,500 and 38,700 jobs over the next 50 years. These changes are shown in **Table 3**.
  - These forecasts account for development potentials identified earlier for Swan Ranch employment at build-out. In the near term (5 years), the low and high job forecasts are 1,000 and 1,500 jobs respectively. By buildout, which is estimated to occur over 30 years, the low and high forecasts are approximately 5,400 jobs and 8,300 jobs respectively.
  - Note that Swan Ranch employment has been accounted for as an expansion to basic employment and is in addition to the baseline projections.
- **Population**: The County's population is projected to add between 870 and 1,130 persons per year for the next 10 years; between 990 and 1,270 persons per year for the next 25 years; and between 940 and 1,230 persons per year for the next 50 years. Overall, Laramie County's total population is projected to add between 8,700 and 11,300 persons over the next 10 years; between 24,700 and 31,600 persons over the next 25 years; and between 47,200 and 61,800 persons over the next 50 years.
- **Super-Boom Scenario**: Under this scenario, impacts to the County's population would result from the occurrence of jobs and housing associated with oil and gas in addition to the substantial Swan Ranch development potentials (between 5,400 and 8,300 jobs over the next 30 years). EPS also believes the portion of the workforce that commutes into Laramie

County represents a real and significant aspect of the economy that, if incentivized to live in the County, it could amount to substantial additional population impacts.

- **Oil & Gas Jobs**: As identified above, for a period of five to six years, the County might need to accommodate housing and infrastructure demands associated with an estimated 810 employees, assuming that the balance would come from existing residents.

- **In-Commuting**: Data collected on commuting patterns over the last decade indicate greater rates of in-commuting than out-commuting. As a result, as Laramie County's laborforce expands, the portion of new jobs taken by non-residents has been increasing faster than the portion of new jobs to residents. This forecast projects that in-commuting will continue to increase in the future. Capturing some portion of these in-commuters and converting them to local residents is not outside the realm of possibility.

  Households choose where to live based on a variety of factors—including cost of living (i.e. housing), local amenities, schools, neighborhoods, parks, community fabric, and proximity to employment. If the County allocates investment strategically into any of these community attributes, the likelihood may increase that some portion of workers commuting in for work may decide to live in Cheyenne.

  As estimated in the high growth scenario, in 10 years, there are estimated to be approximately 4,350 in-commuters; by 2035, there are projected to be more than 7,500; and by 2060, there are projected to be nearly 9,400 workers commuting into Laramie County. When evaluating scenarios that include major impacts to local infrastructure and community systems, it is possible that the impact from in-commuters could be greater than the impacts from other economic drivers.

Table 3
Laramie County Forecasts, 2010-2060
PlanCheyenne Update

			10-Yr Growth			25-Yr Growth			50-Yr Growth		
		2010	**Total**	**Ann. #**	**Ann. %**	**Total**	**Ann. #**	**Ann. %**	**Total**	**Ann. #**	**Ann. %**
Low Forecast											
Wage & Salary Jobs		45,536	6,486	649	1.34%	14,578	583	1.12%	27,579	552	0.95%
In-Commuters	-	9,449	3,943	394	3.55%	6,432	257	2.10%	7,513	150	1.18%
Out-Commuters	+	6,800	1,492	149	2.00%	2,787	111	1.38%	3,701	74	0.87%
Employed Local Residents	**=**	**42,888**	**4,036**	**404**	**0.90%**	**10,933**	**437**	**0.91%**	**23,766**	**475**	**0.89%**
Local Laborforce	[1]	47,289	3,333	333	0.68%	8,954	358	0.70%	22,365	447	0.78%
Proprietors	+	12,828	2,254	225	1.63%	4,519	181	1.21%	6,524	130	0.83%
Population (<16 and >65)	+	30,352	3,011	301	0.95%	10,955	438	1.24%	17,682	354	0.92%
Group Quarters (Age 16-65)	+	1,269	118	12	0.89%	284	11	0.81%	610	12	0.79%
Total Population	**=**	**91,738**	**8,716**	**872**	**0.91%**	**24,712**	**988**	**0.96%**	**47,181**	**944**	**0.83%**
Households	[2]	37,576	4,922	492	1.24%	14,271	571	1.30%	30,099	602	1.18%
Housing Units	[3]	40,462	5,300	530	1.24%	15,367	615	1.30%	32,411	648	1.18%
High Forecast											
Wage & Salary Jobs		45,536	8,811	881	1.78%	20,111	804	1.47%	38,773	775	1.24%
In-Commuters	-	9,449	4,349	435	3.86%	7,582	303	2.38%	9,381	188	1.39%
Out-Commuters	+	6,800	1,630	163	2.17%	3,267	131	1.58%	4,717	94	1.06%
Employed Local Residents	**=**	**42,888**	**6,092**	**609**	**1.34%**	**15,797**	**632**	**1.26%**	**34,109**	**682**	**1.18%**
Local Laborforce	[1]	47,289	5,552	555	1.12%	14,037	561	1.05%	33,174	663	1.07%
Proprietors	+	12,828	2,451	245	1.76%	5,283	211	1.39%	8,402	168	1.01%
Population (<16 and >65)	+	30,352	3,164	316	1.00%	12,034	481	1.34%	19,603	392	1.00%
Group Quarters (Age 16-65)	+	1,269	118	12	0.89%	284	11	0.81%	610	12	0.79%
Total Population	**=**	**91,738**	**11,285**	**1,129**	**1.17%**	**31,638**	**1,266**	**1.19%**	**61,789**	**1,236**	**1.04%**
Households	[2]	37,576	6,028	603	1.50%	17,409	696	1.53%	37,342	747	1.39%
Housing Units	[3]	40,462	6,491	649	1.50%	18,746	750	1.53%	40,210	804	1.39%

[1] Includes unemployed local residents.
[2] Equals the population in households (i.e. total population less all age group quarters) divided by average household size.
[3] Factored up for the existing housing vacancy rate.
Source: Economic & Planning Systems

H:\21858-Cheyenne Comprehensive Plan\Models\[21858-Projections-MODEL-031912.xlsx]TABLE 10 - SUMMARY

Appendix 2-C
AVI - Market Context Summary, Fox Farm Road Corridor and Area Planning Summary

PURPOSE OF MARKET ANALYSIS

- Provides a "reality check" for the planning process
- Ensures that land use programming is grounded in market and economic reality (thereby increasing the likelihood of success)
- Provides an accurate and independent "story" to tell potential private sector audiences

TRADE AREA IDENTIFICATION

- Based on influence of: physical barriers; location of possible competition; proximity to population and/or employment concentrations; zoning; market factors; drive times; spending and commuting patterns, etc.
- For purposes of market demand parameters, the trade area was estimated to be Laramie County.
- As the planning process moves forward, expanded trade areas may exist for certain land uses, e.g., regional retail, employment centers.

POTENTIAL MARKET DEMAND

Residential

- Demand for residential units in Laramie County is a function of projected household growth, estimated at approximately 1.5% annually over the next 10 years.
- Based on this level of growth, Laramie County could accommodate approximately **6,200 new housing units** over the next 10 years – **4,200 ownership units** and **2,000 rental units.** This gross unit demand is further allocated into approximate income-qualified rent and home price groups. (See Table 1).

Table 1
Residential Unit Demand by Income, Rent and Price Range
Fox Farm Road Corridor Trade Area (Laramie County)

Residential Demand Analysis					
Laramie County Trade Area	Households	2010	37,576		
2010-2020 Demand Estimates		2015	40,480	Annual Growth Rate	1.5%
		2020	43,608		
	Household Growth (2010-20)		6,032	Adjust for 2nd homes, demolition, vacancy	2.0%
	Adjusted Unit Requirement		**6,153**	% Rental	32%

					Trade Area Demand from New Households (10-yr)			
Household Income Range (2010 dollars)	**Approximate Rent Range**	**Supportable Home Price Range**	**Current Households in Income Bracket**	**New Households by Income Bracket**	**Total Units**	**Estimated % Rental**	**Total Rental Units**	**Total Ownership Units**
up to $15K	up to $375	up to $75K	16%	15%	**923**	90%	831	92
$15-25K	$375 - $625	$75 to $100K	10%	9%	**554**	70%	388	166
$25-35K	$625 - $875	$100 to $150K	10%	9%	**554**	50%	277	277
$35-50K	$875 - $1,000	$150 to $200K	16%	15%	**923**	25%	231	692
$50-75K	$1,000+	$200 to $250K	18%	19%	**1,169**	10%	117	1,052
$75-100K	$1,000+	$250 to $350K	12%	13%	**800**	10%	80	720
$100-150K	$1,000+	$350 to $500K	12%	13%	**800**	5%	40	760
$150K and up	$1,000+	$500K and up	6%	7%	**431**	5%	22	409
Totals			**100%**	**100%**	**6,153**	**32%**	**1,984**	**4,169**

Source: U.S. Census; Wyoming Dept. of Administration -- Economic Analysis Division; and Ricker+Cunningham.

- Table 2 shows a reasonable attainable capture rate for single family detached units in the Fox Farm Corridor (the Corridor) for households earning at least $15,000 per year. This analysis assumes that detached homes will account for approximately 75 percent of all ownership demand, with the balance coming in the form of attached products (condominiums, townhomes, rowhouses, lofts, etc.). As shown, over the next ten years, approximately **90 new single family detached units** could be accommodated in the Corridor, assuming a relatively modest 3% capture rate.

Table 2
Single Family Detached Demand by Price Point
Fox Farm Road Corridor

Annual Household Income Range	Approximate Home Price Range	Trade Area For-Sale Demand (Incomes $15K+)	Estimated % Single Family Detached	Single Family Detached Demand	Fox Farm Road Corridor Attainable Capture Rate	Fox Farm Road Corridor Attainable Capture (units)
$15-25K	$75 to $100K	166	70%	116	3%	3
$25-35K	$100 to $150K	277	70%	194	3%	6
$35-50K	$150 to $200K	692	70%	485	3%	15
$50-75K	$200 to $250K	1,052	70%	737	3%	22
$75-100K	$250 to $350K	720	70%	504	3%	15
$100-150K	$350 to $500K	760	70%	532	3%	16
$150K and up	$500K and up	409	70%	286	3%	9
Totals		**4,076**	**70%**	**2,854**	**3%**	**86**

Source: U.S. Census; Wyoming Dept. of Administration -- Economic Analysis Division; and Ricker+Cunningham.

- Table 3 shows a reasonable attainable capture rate for single family attached units (condominiums, townhomes, rowhouses, lofts, etc.) in the Corridor for households earning at least $15,000 per year. This analysis assumes that attached homes will account for approximately 25 percent of all ownership demand. As shown, over the next ten years, approximately **245 new single family attached units** could be accommodated in the Corridor, assuming a 20% capture rate.

Table 3
Single Family Attached Demand by Price Point
Fox Farm Road Corridor

Annual Household Income Range	Approximate Home Price Range	Trade Area For-Sale Demand (Incomes $15K+)	Estimated % Single Family Attached	Single Family Attached	Fox Farm Road Corridor Attainable Capture Rate	Fox Farm Road Corridor Attainable Capture (units)
$15-25K	$75 to $100K	166	30%	50	20%	10
$25-35K	$100 to $150K	277	30%	83	20%	17
$35-50K	$150 to $200K	692	30%	208	20%	42
$50-75K	$200 to $250K	1,052	30%	316	20%	63
$75-100K	$250 to $350K	720	30%	216	20%	43
$100-150K	$350 to $500K	760	30%	228	20%	46
$150K and up	$500K and up	409	30%	123	20%	25
Totals		**4,076**	**30%**	**1,223**	**20%**	**245**

Note: Assumes Townhome/Condo development stabilizes at 30% of all ownership demand
Source: U.S. Census; Wyoming Dept. of Administration -- Economic Analysis Division; and Ricker+Cunningham.

- While condominium-type construction has been adversely impacted nationally by the mortgage lending crisis and over-building, the low-maintenance and potentially pedestrian-friendly aspects of attached housing should grow in share as it finds appeal among an aging Baby Boomer population as well as young professionals. This absorption could take the form of loft condominiums within upper floor commercial buildings, as well as in new townhome or rowhouse construction on underutilized parcels scattered throughout the Corridor.
- Table 4 shows a reasonable attainable capture rate for rental apartments in the Corridor for households earning at least $15,000 per year. As shown, over the next ten years, approximately **230 new rental apartment units** could be accommodated in the Corridor, assuming a 20% capture rate.

Table 4
Rental Apartment Demand by Price Point
Fox Farm Road Corridor

Annual Household Income Range	Approximate Rent Range	Trade Area Rental Demand (Incomes $15K+)	Fox Farm Road Corridor Attainable Capture Rate	Fox Farm Road Corridor Attainable Capture (units)
$15-25K	$375 - $625	388	20%	78
$25-35K	$625 - $875	277	20%	55
$35-50K	$875 - $1,000	231	20%	46
$50-75K	$1,000+	117	20%	23
$75-100K	$1,000+	80	20%	16
$100-150K	$1,000+	40	20%	8
$150K and up	$1,000+	22	20%	4
Totals		**1,154**	**20%**	**231**

Source: U.S. Census; Wyoming Dept. of Administration -- Economic Analysis Division; and Ricker+Cunningham.

- As with single family attached ownership housing, new apartments could be created from rehabbing existing commercial space, built on smaller scattered-site underutilized lots, or developed on larger underutilized tracts as part of a residential mix.

Retail

- Demand for new retail space is determined by future retail spending potential of projected new households, as well as by some recapturing of retail spending that is currently lost to nearby communities or areas (referred to as “leakage” or “retail void”).
- Based on these factors, Laramie County could accommodate approximately **850,000 square feet of new retail space** over the next 10 years (See Table 5).

Table 5
Retail Demand
Fox Farm Road Corridor Trade Area (Laramie County)

Retail Category	Estimated 2012 Household Retail Demand	Estimated 2012 Retail Sales (Supply)	Estimated 2012 Retail Void (Leakage)	Estimated Retail Sales/s.f.	New Retail Space Needed to Recapture Void/Leakage	Annual Household Growth Rate (2012-2022)	Net New Household Retail Demand	New Retail Space Needed for Household Growth	Total 10-Year New Trade Area Retail Demand (s.f.)
Furniture & Home Furnishings	$27,145,456	$28,542,248	$0	$200	0	1.5%	$4,357,954	21,790	21,790
Electronics & Appliance	$30,928,601	$23,521,896	$7,406,705	$250	29,627	1.5%	$4,965,303	19,861	49,488
Bldg Materials, Garden Equipment	$127,578,451	$155,183,857	$0	$300	0	1.5%	$20,481,550	68,272	68,272
Food & Beverage (Grocery)	$181,751,159	$141,259,956	$40,491,203	$375	107,977	1.5%	$29,178,481	77,809	185,786
Health & Personal Care	$74,533,509	$39,732,294	$34,801,215	$350	99,432	1.5%	$11,965,671	34,188	133,620
Clothing and Accessories	$61,089,473	$33,089,476	$27,999,997	$225	124,444	1.5%	$9,807,354	43,588	168,033
Sporting Goods,Hobby, Book, Music	$28,968,732	$25,044,375	$3,924,357	$225	17,442	1.5%	$4,650,664	20,670	38,111
General Merchandise	$179,498,547	$277,402,985	$0	$300	0	1.5%	$28,816,845	96,056	96,056
Miscellaneous Stores	$36,601,558	$151,444,743	$0	$200	0	1.5%	$5,876,044	29,380	29,380
Foodservice & Drinking Places	$134,509,517	$169,487,763	$0	$350	0	1.5%	$21,594,269	61,698	61,698
Total	**$882,605,003**	**$1,044,709,593**	**$114,623,477**		**378,921**		**$141,694,135**	**473,312**	**852,233**

Source: Claritas, Inc.; Urban Land Institute; and Ricker+Cunningham.

- Assuming a market capture rate of 15%, the Corridor could accommodate approximately **127,500 square feet of new retail space** over the next 10 years.

Employment

- Demand for new employment space is derived from two primary sources: expansion of existing industry; and the relocation of new companies into the market. Laramie County employment growth is estimated at 1.5% annually over the next 10 years.
- Based on these factors, Laramie County could accommodate approximately **1.8 million square feet of new employment (office, industrial, flex) space** over the next 10 years (See Table 6).

Table 6
Employment Demand
Fox Farm Road Corridor Trade Area (Laramie County)

Industry Category	Estimated 2012 Employees	Estimated Growth Rate 2012-2022	Estimated 2022 Employees	Estimated Net New Employees	Estimated % in Office and Industrial Space	Estimated Net New Employees	Sq Ft per Employee	Estimated 10-Yr New Employment Demand
Agriculture/Forestry/Fishing/Extraction	923	1.5%	1,071	148	60%	89	300	26,672
Utilities and Construction	4,204	1.5%	4,879	675	60%	405	300	121,484
Manufacturing	1,656	1.5%	1,922	266	60%	160	300	47,854
Wholesale Trade, Transportation and Warehousing	4,571	1.5%	5,305	734	60%	440	300	132,090
Retail Trade	6,935	1.5%	8,048	1,113	60%	668	300	200,403
Finance/Insurance/Real Estate	6,421	1.5%	7,452	1,031	60%	618	300	185,550
Professional/Scientific/Education Services	2,743	1.5%	3,183	440	60%	264	300	79,265
Accommodations and Food Service	4,429	1.5%	5,140	711	60%	427	300	127,986
Health Care and Social Assistance	4,910	1.5%	5,698	788	60%	473	300	141,886
Administration, Support, Waste Management, Remediation	2,591	1.5%	3,007	416	60%	250	300	74,873
Educational Services	536	1.5%	622	86	60%	52	300	15,489
Arts, Entertainment, Recreation	831	1.5%	964	133	60%	80	300	24,014
Public Administration	17,633	1.5%	20,464	2,831	60%	1,698	300	509,547
Other	4,673	1.5%	5,423	750	60%	450	300	135,037
Totals	**63,056**	**1.5%**	**73,179**	**10,123**	**60%**	**6,074**	**300**	**1,822,151**

Source: Wyoming Department of Workforce Services and Ricker+Cunningham.

- Assuming a market capture rate of 20%, the Corridor could accommodate approximately **360,000 square feet of new employment space** over the next 10 years.

Market Demand Summary

Table 7 summarizes potential Corridor land use absorption over the next 10 years.

Table 7
Summary of Market Demand
Fox Farm Road Corridor

Land Use Type	Trade Area Demand (10 Year)	Fox Farm Road Corridor: Market Share Low	Market Share High	10-Year Absorption (Units/SF) Low	10-Year Absorption (Units/SF) High
Residential (Units):					
Single Family Detached (Ownership)	2,854	2%	4%	57	114
Single Family Attached (Ownership)	1,223	18%	22%	220	269
Multi-Family (Rental)	1,154	18%	22%	208	254
Residential Total	**5,231**			**485**	**637**
Non-Residential (SF):					
Retail	850,000	13%	17%	110,500	144,500
Employment (Office/Industrial)	1,800,000	18%	22%	324,000	396,000
Non-Residential Total	**2,650,000**			**434,500**	**540,500**

Source: Ricker+Cunningham.

- Based on the expected 10-year housing and employment growth rates shown herein, the Corridor could expect to reach build-out in approximately 30 to 35 years.

IMPLICATIONS FOR FOX FARM CORRIDOR LAND USE PLAN

- The current anticipated land use mix appears to have good balance of residential and non-residential uses. It will be critical to maintain this balance over the long-term.
- A unified vision for the Corridor will help to encourage potential market niche opportunities that might arise in the short-term.
- Near-term opportunities are more likely for higher-density housing (apartments) and small-scale service employment uses.
- Flexibility in land use categories will be necessary to accommodate unanticipated market opportunities. A greater emphasis on quality of development/redevelopment, rather than type and quantity of development/redevelopment, will ensure that the Corridor vision is protected and enhanced over time.

		Fox Farm Road Corridor					
	Trade Area Demand	**Market Share**		**10-Year Absorption (Units/SF)**		**10-Year Absorption (Acres)***	
Land Use Type	**(10 Year)**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Residential (Units):							
Single Family Detached (Ownership)	2,854	2%	4%	57	114	14	29
Single Family Attached (Ownership)	1,223	18%	22%	220	269	28	34
Multi-Family (Rental)	1,154	18%	22%	208	254	17	21
Residential Total	**5,231**			**485**	**637**	**59**	**83**
Non-Residential (SF):							
Retail	850,000	13%	17%	110,500	144,500	10	13
Employment (Office/Industrial)	1,800,000	18%	22%	324,000	396,000	30	36
Non-Residential Total	**2,650,000**			**434,500**	**540,500**	**40**	**50**

Source: Ricker+Cunningham.

* Absorption of Acres based on following densities and floor area ratios (FARs):

Single Family Detached: 4 units/acre

Single Family Attached: 8 units/acre

Multi-Family: 12 units/acre

Retail: 25%

Employment (Office/Industrial): 25%

AREA	ACRES				Estimated Net Developed Acres
A	3.66	100% Developed			
B	16.54		4 units per acre	25% already developed	**4.1**
C	16.32	100% Commercial		built out except for one restaurant pad	**14.7**
D	7.75	100% Commercial		strip commercial and office	
E	21.50	100% Commercial		small redevelopment area of general retail areas	
F1	8.25	15% Commercial	8 units per acre	redevelopment	
F2	5.00	100% Commercial		One small spot left for maybe office	
G1	24.71		6 units per acre	15% developed with apartments	**3.7**
G2	17.54	100% Commercial		general retail	
H	65.14		5 units per acre	pretty much fully developed already	**58.6**
I	12.45	15% Commercial	6 units per acre	developed will have to redevelop	**11.2**
J	11.77	100% Commercial		Storage or office use	
K	6.48	30% commercial	6 units per acre	75% developed will have to redevelop to add residential	**4.9**
L	53.87		6 Units per acre	60% already developed	**32.3**
M	7.81	100% Commercial		Service business, office, warhouse	
N	12.30	25% Commercial	6 units per acre		
O	41.49	50% Commercial	6 units per acre	activity center means places for people to gather, shopping center, park, public space	
P	4.36	100% Commercial		Service business, office, warhouse	
Q	13.54		6 Units per acre	60% already developed	**8.1**
R	66.49	10% Commercial	8 units per acre	undeveloped	
S	25.24	100% Commercial		Service business, office, warhouse	
T	80.80	100% Commercial		distribution, warehousing, outdoor equipment storage	
U	10.07		4 units per acre	100% developed	**10.1**
V	105.00	10% Commercial	7 units per acre	50% developed	**52.5**
W	15.50	100% Commercial		Service business, office, warhouse	
X	15.36	100% Commercial		Service business, office, warhouse	
Y	35.91	100% Commercial		distribution, warehousing, outdoor equipment storage	
Z	15.36	90% Commercial	8 units per acre	redevelopment	
AA	24.52	100% Commercial	8 units per acre	undeveloped	
AB	11.39	100% Developed			
AC	7.25	100% Commercial	developed		
AD	42.98	100% Commercial		general retail undeveloped	
AE	19.40		5 units per acre	undeveloped	
AF	47.99			Park space/greenway/floodplain/public wetlands	
AG	20.89	100% Commercial		general retail undeveloped	
TOTAL	***894.64***				**200.2**
	694.40	developable			
	0.35				
	451.3603526	truly developable			