Technical Memorandum 2.6

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Platte River Basin Water Plan

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SUBJECT: Platte River Basin Water Plan
Section 2.6 – Water Use from Storage

PREPARED BY: Trihydro Corporation

DATE: June 14, 2005

PURPOSE: The Platte River Basin Plan is a planning tool developed for the Wyoming Water Development Office. It presents estimated current and estimated future uses of water in Wyoming's Platte River Basin. The Plan is not used to determine compliance with or administration of state law, federal law, court decrees, interstate compacts, or interstate agreements.

2.6 WATER USE FROM STORAGE

2.6.1 Introduction

All reservoirs in Wyoming's Platte River Basin that have been permitted by the Wyoming State Engineer's Office (SEO) have been identified, except, in accordance with the provisions of the Scope of Service for this Basin Plan, for reservoirs with multiple uses including stock uses. The reservoirs are owned by various entities ranging from the U.S. Bureau of Reclamation (USBR) to private individuals. Based on consultations with the Wyoming Water Development Commission (WWDC) and the Wyoming State Engineer's Office (SEO), reservoirs having permitted capacities less than 50 acre-feet were eliminated from this assessment. Information regarding reservoirs with permitted capacities greater than 50 acre-feet but less than 1,000 acre-feet has been tabulated. More in-depth information has been provided for reservoirs having capacities greater than 1,000 acre-feet, for reservoirs having some particular significance to the study regardless of permitted capacity, and for federally owned reservoirs.

Information regarding Basin reservoirs has been gathered from various sources. The USBR provided data and information for the federal reservoirs. For reservoirs with capacities greater than 1,000 acre-feet, available permits and drawings were copied at the Wyoming State Engineer's Office (SEO). Data were also gathered from the district hydrographers in each subbasin.

The Platte River Basin includes seven major federal reservoirs, which are owned and operated by the USBR, within its boundaries. The reservoirs were built during various federal projects. These projects include the North Platte Project in Wyoming and Nebraska, the Kendrick Project in Wyoming, and the Kortes and Glendo Units of the Pick-Sloan Missouri Basin Program (PSMBP) in Wyoming and Nebraska. These reservoirs are operated for irrigation, hydroelectric power production, and municipal and industrial water supply.

2.6.2 Terms and Definitions

Discussion of reservoirs includes use of a variety of terms that may not be familiar to the reader. A list of pertinent terms and definitions is included here to help the reader better understand this discussion. Definitions were obtained from the U.S. Bureau of Reclamation glossary unless otherwise noted.

Abutment – The part of the valley wall against which the dam is constructed; defined in terms of left abutment and right abutment when looking downstream.

Active capacity – The variable reservoir storage capacity normally usable for storage and regulated discharge of reservoir inflows to meet established reservoir operating requirements.

Arch dam – A concrete or masonry dam which is curved upstream in plan in order to transmit the major part of the water load to the abutments and to keep the concrete dam materials in a state of compression.

Arch dam with gravity type section – An arch dam which is only slightly thinner than a gravity dam.

Auxiliary spillway – A “backup” spillway, usually located in a saddle or depression in the reservoir rim at a point not near the dam which leads to a natural or excavated waterway, which permits the release of excess flood flow that exceeds the capacity of the service spillway. A means of controlling the rate of discharge via an auxiliary spillway is seldom furnished. The invert or flow line of an auxiliary spillway is typically set at the maximum water surface elevation for a 100-year flood or some other specific flood frequency. The auxiliary spillway is therefore a safety feature that is utilized infrequently. An auxiliary spillway may also be operated in the event of structural damage or erosion to the service spillway.

Earth dam (earthfill dam) – An embankment dam in which more than 50 percent of the total volume is formed of compacted earth material generally smaller than three-inch size. Seepage through the dam is controlled by the designed use of upstream blankets and/or internal cores constructed using compacted soil of very low permeability.

Emergency gate – A standby or auxiliary gate used when the normal means of controlling reservoir discharge are not available. The emergency gate is the first gate in a series of reservoir outlet flow controls structures and typically remains open while downstream gates or valves are operating.

Fixed wheel gate – A fixed wheel gate consists of a flat, rectangular, structural-steel gate leaf made up of a skin plate, beams, and girders mounted on steel wheels to carry the hydraulic load from the gate leaf to tracks embedded in the concrete on either side of the fluid way. A fixed wheel gate has wheels or rollers mounted on the end posts of the gate. The wheels bear against rails fixed in side grooves or gate guides. The gates are installed in spillways to be used to regulate reservoir releases when reservoir water levels are relatively low and are also used as emergency discharge control gates when reservoir water levels are high.

Flood control capacity – Flood control capacity is reservoir storage capacity that has been assigned for the sole purpose of regulating flood inflows in order to reduce potential downstream flood damage.

Forebay – A forebay is a small reservoir or pond located at the head of a penstock of a hydroelectric powerplant, which is used to store water in relatively small quantities to care for variations in the load which occur over short periods of time usually not exceeding several hours (American Public Health Association et al., 1981).

Freeboard – Freeboard is the vertical distance between a water surface and an adjacent dam or embankment crest.

Fuse plug spillway – A form of auxiliary reservoir spillway consisting of a low embankment designed to be overtopped and washed away during an exceptionally large flood, thereby protecting the dam during such an event.

Gravity dam – A gravity dam is a dam constructed of concrete and/or masonry which relies on its weight and internal strength for stability. Gravity dams are generally used where the available foundation is rock and materials to construct an earthen dam are not available in proper quality and/or quantity.

Head – Head is the differential water pressure that causes flow in a fluid system and is usually expressed in terms of the "feet of head." Water flows from higher head to lower head.

Headwaters – Headwaters are the source waters or upper portions of a stream or the water located upstream of a dam or hydroelectric powerplant.

Intake structure – An intake structure is the upstream or inlet portion of a reservoir outlet works, including trash racks and/or fish screens to keep debris from entering and clogging the outlet works.

Invert elevation – The invert elevation is the base elevation or flow line elevation of a water conveyance channel.

Maximum water surface (maximum pool) – The maximum water surface or pool of a reservoir is the highest acceptable water surface elevation based on all factors affecting the safety of the dam. The maximum water surface or pool is the highest water surface elevation resulting from a computed routing of the reservoir inflow design flood through the reservoir under established operating criteria. This surface elevation is also the top of the reservoir surcharge capacity.

Morning glory spillway – A circular or glory hole form of a drop inlet spillway. Usually free standing in the reservoir and so called because of its resemblance to the morning glory flower.

Needle valve – A needle valve is any of a family of valves which regulate flow through the use of a needle moving into and out of an orifice. Movement of the needle regulates flow through the valve and effects valve closure. Needle movement is accomplished by varying the water pressure in counterbalancing chambers within the valve cylinder and needle or by an electric-motor-driven operator supplying the force to move the needle. Needle valves are intended to operate at the downstream end of a reservoir outlet pipe under free discharge conditions and to regulate high-velocity discharge flows under very high heads or pressures.

Normal water surface – The normal water surface of a reservoir is the highest normal water surface elevation of the reservoir. The normal water surface elevation is usually the water surface elevation to which the reservoir may rise under normal operating conditions, not including reservoir flood control storage capacity.

Ogee crest – An ogee crest is a specially shaped concrete spillway crest that represents the lower profile or curve of a jet of water flowing over a sharp-crested weir.

Outlet works – Reservoir outlet works are a combination of structures and equipment required for the normal, safe operation and control of water released from a reservoir to serve various purposes, i.e. regulate streamflow and quality; release floodwater; and provide irrigation, municipal, and/or industrial water.

Penstock – A penstock is a pipeline or conduit that is designed to convey water under pressure from a forebay or reservoir to power-producing hydroelectric turbines.

Powerhouse – The powerhouse is the main structure of a water-generated or hydroelectric powerplant, housing the generating units and associated control equipment.

Regulating gate – A regulating gate is a gate used to regulate the rate of flow of water through a dam outlet works or spillway.

Ring-follower gate – A ring-follower gate is a water flow regulating gate consisting of a rectangular leaf with a round opening equal in diameter to that of the conduit or pipe to which the ring-follower gate is attached; a ring-follower gate is moved to regulate flow through the adjacent pipe.

Ring seal gate – A ring seal gate is a water flow regulating gate in which sealing is accomplished by a moveable seal.

Service spillway (primary spillway) – The service or primary spillway is a structure located on or adjacent to a dam over or through which surplus or floodwaters which cannot be contained in the allotted storage space are passed. The spillway would include the intake and/or control structure, discharge channel, terminal structure, and entrance and outlet channels. A spillway is designed to provide releases from a reservoir to prevent significant damage to either the dam or its appurtenant structures.

Spillway – A structure that passes normal and/or flood flows in a manner that protects the structural integrity of the dam. If the rate of flow is controlled by mechanical means such as gates, a spillway is considered a controlled spillway. If the geometry of the spillway is the only flow control component of the spillway, it is considered an uncontrolled spillway.

Supplemental irrigation service land – Irrigable land now receiving, or to receive, an additional or reregulated supply of water through facilities constructed by or to be constructed by the U.S. Bureau of Reclamation (USBR).

Surcharge storage capacity – Reservoir surcharge storage capacity is available water storage capacity above the established or normal reservoir water surface elevation; reservoir surcharge storage capacity is typically utilized to store and control release of atypically high inflows, thereby controlling downstream flooding.

Tailwater – Tailwater is the water in the natural stream immediately downstream from a dam. The elevation of tailwater varies with the rate of water discharge from the reservoir. Tailwater is measured as the average depth of water downstream of a dam, expressed in inches or feet.

Wicket gate – In hydropower applications, a wicket gate pivots open around the periphery of an electricity-generating turbine to allow water to enter.

2.6.3 Federal North Platte River Water Projects in Wyoming

Table 2.6.1 contains a summary of information regarding federal North Platte River water projects in Wyoming. Platte River Basin Federal reservoirs are shown on Figure 2.6.1.

Table 2.6.1 Summary - federal water projects in the Platte River Basin of Wyoming

Federal Project	Entity
North Platte Project	Pathfinder Dam and Reservoir
	Guernsey Dam and Powerplant
	Whalen Diversion Dam
Kendrick Project	Seminoe Dam and Reservoir
	Alcova Dam and Reservoir
Kortes Unit of the Pick-Sloan Missouri Basin Program	Kortes Dam, Reservoir and Powerplant
Glendo Unit of the Pick-Sloan Missouri Basin Program	Glendo Dam, Reservoir and Powerplant
	Fremont Canyon Powerplant
	Gray Reef Dam and Reservoir
Source: United States Bureau of Reclamation.	

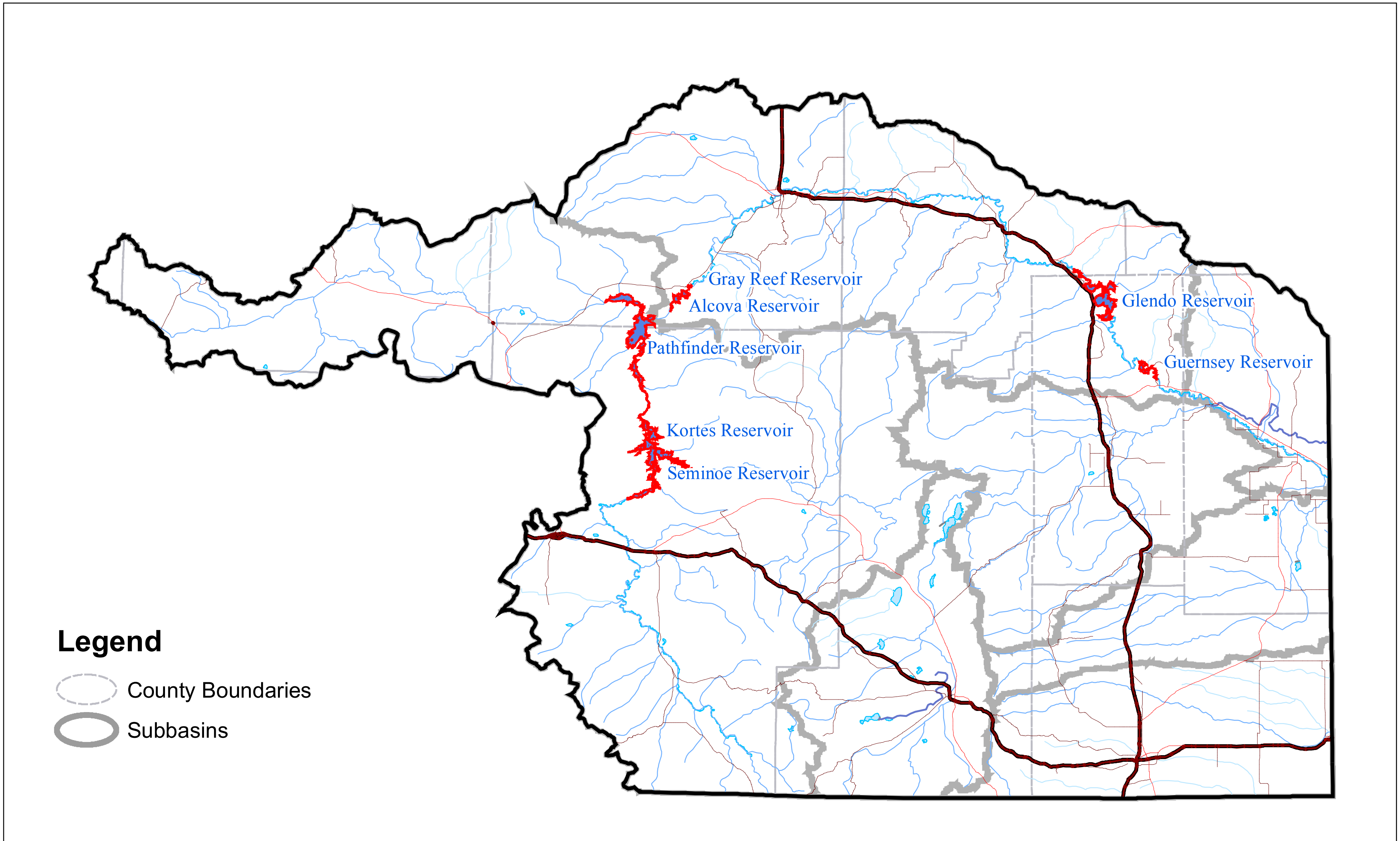

Figure 2.6.1
Locations of Federal Dams and Reservoirs
in the Platte River Basin of Wyoming
Platte River Basin Water Plan

2.6.3.1 North Platte Project

The major purpose of the North Platte Project is storing and providing water for agricultural irrigation. Lands irrigated by water from the North Platte Project extend 111 miles along the North Platte River Valley from Guernsey, Wyoming to Bridgeport, Nebraska. The project provides full service irrigation for approximately 226,000 acres within four irrigation districts: Pathfinder Irrigation District, Goshen Irrigation District, Gering – Fort Laramie Irrigation District, and Northport Irrigation District. The Goshen Irrigation District is located in Wyoming, while the Pathfinder, Gering – Fort Laramie, and Northport Irrigation Districts are located in Nebraska. Supplemental irrigation service is also provided to a combined area of about 109,000 acres within nine water-user entities, including Lingle Water Users, Hill, Rock Ranch, Gering, Farmers, Central, Chimney Rock, Browns Creek, and Beerline Irrigation Districts.

Facilities included within the North Platte Project are Pathfinder Dam and Reservoir; Guernsey Dam, Reservoir, and Powerplant; Whalen Diversion Dam; Fort Laramie Canal; Interstate Canal and Reservoir System; and Northport Canal.

2.6.3.2 Kendrick Project

The Kendrick Project stores the waters of the North Platte River for irrigation use and electric power generation. The project includes storage at Seminoe Reservoir and diversion of irrigation water at Alcova Dam to project agricultural lands via the Casper Canal. The Kendrick Project includes approximately 24,000 acres of irrigable project lands in the North Platte River basin between Alcova and Casper, Wyoming.

2.6.3.3 Kortes Unit of the Pick-Sloan Missouri Basin Program

The Kortes Unit consists of Kortes Dam, Reservoir, and Powerplant and is located in the Black Canyon of the North Platte River. These facilities are located in central Wyoming approximately two miles below Seminoe Dam within the Kendrick Project. The Kortes Unit was the first unit for which construction was initiated by the U.S. Bureau of Reclamation (USBR) in 1946 under the Pick-Sloan Missouri Basin Program. The primary purpose of the Kortes Unit is to provide hydroelectric power. No irrigation benefits are associated with this project (Simonds, 1996).

Water released from Seminoe Dam passes through the Kortes turbines on its way to Pathfinder Reservoir. The Kortes turbines generate 36 megawatts of electrical power, which is distributed by a transmission system owned by the federal government to localities in the Great Plains area.

2.6.3.4 Glendo Unit of the Pick-Sloan Missouri Basin Program

The Glendo Unit is comprised of Glendo Dam, Reservoir, and Powerplant; Fremont Canyon Powerplant; and Gray Reef Dam and Reservoir. The Glendo Unit provides supplemental irrigation water to 37,251 acres in Wyoming and Nebraska. Glendo Reservoir provides 40,000 acre-feet of water annually for beneficial use in Wyoming and Nebraska. The Glendo Unit project was authorized on July 16, 1954. Construction of Gray Reef Dam and Reservoir was authorized separately by Public Law 85-695 (72 Stat.687), approved August 20, 1958. (USBR, glendo1.html).

The Glendo Unit includes two powerplants, Glendo Powerplant and Fremont Canyon Powerplant, which have a combined generating capacity of 104.8 megawatts. These two powerplants provide electrical power to Wyoming, Colorado, and Nebraska.

Glendo Reservoir provides capacity to regulate stream flow below Alcova Dam. By providing flow regulation, water releases can be made year-round, and valuable water resources are more fully utilized. Also, more constant North Platte River water levels are maintained in the non-irrigation season (October 1 through April 30), improving the water quality in the river. (USBR, glendo1.html).

2.6.4 Federal North Platte River Reservoirs in Wyoming

Federal reservoirs, in order of occurrence on the North Platte River in Wyoming from upstream to downstream are:

- Seminoe Reservoir,
- Kortes Reservoir,
- Pathfinder Reservoir,
- Alcova Reservoir,
- Gray Reef Reservoir,
- Glendo Reservoir, and
- Guernsey Reservoir.

Table 2.6.2 contains a summary of information regarding the locations of these reservoirs.

Table 2.6.3 contains a summary of information regarding storage capacities of federal reservoirs on the North Platte River in Wyoming.

Table 2.6.2 Summary - locations of federal reservoirs on the North Platte River in Wyoming

Permit number	Reservoir name	Subbasin	Township	Range	Section	Qtr qtr	Nearest city	County
P4552R	Seminoe Reservoir	Above Pathfinder	25N	84W	8	NWNE	Rawlins	Carbon
P5580R	Kortes Reservoir	Above Pathfinder	26N	84W	34	SWSW	Rawlins	Carbon
P609R	Pathfinder Reservoir	Above Pathfinder	29N	84W	24	NWNW	Rawlins	Carbon
P4630R	Alcova Reservoir	Pathfinder to Guernsey	30N	83W	24	SESE	Casper	Natrona
P6489R	Gray Reef Reservoir	Pathfinder to Guernsey	30N	82W	18	NESE	Casper	Natrona
P5998R	Glendo Reservoir	Pathfinder to Guernsey	29N	68W	24	NENE	Glendo	Platte
P3905R	Guernsey Reservoir	Pathfinder to Guernsey	27N	66W	27	NENW	Guernsey	Platte

Source: Wyoming State Engineer's Office, United States Bureau of Reclamation.

Table 2.6.3 Summary - storage capacities of federal reservoirs on the North Platte River in Wyoming

Permit number	Reservoir name	Total capacity SEO tab book (acre-feet)	Outlet capacity (cubic feet per second)	Spillway capacity (cubic feet per second)	Hydro-electric generating plant	Power capacity (megawatts)	Powerplant release SEO tab book (cubic feet per second)
P4552R	Seminoe Reservoir	1,026,360	3,000	48,500	Seminoe Powerplant	45	1,990
P5580R	Kortes Reservoir	4,640	No information available	50,000	Kortes Powerplant	36	2,850
P609R	Pathfinder Reservoir	1,070,000	2,928 (left abutment) + 50-450 (30" flow gate)	33,940	Fremont Canyon Powerplant	48	2,320
P4630R	Alcova Reservoir	184,295	2,950	55,000	Alcova Powerplant	36	3,800
P6489R	Gray Reef Reservoir	Afterbay to re-regulate Alcova Powerplant releases	No information available	20,000	No information available	No information available	No information available
P5998R	Glendo Reservoir	800,000	13,000	No information available	Glendo Powerplant	38	3,340
P3905R	Guernsey Reservoir	71,040	No information available	No information available	Guernsey Powerplant	6.4	1,100

Source: Wyoming State Engineer's Office, United States Bureau of Reclamation.

2.6.4.1 Seminoe Dam and Reservoir

Background and History

The main irrigation water storage facility for the Kendrick Project, Seminoe Dam and Reservoir, is located on the North Platte River upstream of Pathfinder Reservoir. Construction of Seminoe Dam was completed in 1939.

Description

Seminoe Reservoir has a total permitted storage capacity of 1,026,360 acre-feet as shown in the Wyoming State Engineer's tab book. The dam has a structural height of 295 feet and is a concrete-arch structure. The primary spillway at Seminoe Dam consists of "a short trapezoidal approach channel leading from the reservoir to the inlet structure, a transitional chute, and a 30-foot diameter concrete lined tunnel through the right abutment with a cut-and-cover conduit section at the downstream portal" (USBR, 1991). Three electric motor-operated 14-foot by 50-foot fixed wheel gates control discharge through the primary spillway. The maximum discharge rate of the Seminoe Dam primary spillway is 48,500 cubic feet per second (USBR, 1991). A photograph of Seminoe Dam is included on Figure 2.6.2.

Figure 2.6.2
Seminoe Dam

The Seminoe Dam contains two 60-inch jet flow valves that provide a low level river outlet with a flow capacity of 3,420 cubic feet per second (cfs). The outlets are located to “the left of centerline of the dam” (USBR, 2003).

<u>Power Generation</u>

Seminoe Powerplant is located at the downstream base of Seminoe Dam. The powerplant outlets “include three 120-inch diameter steel penstocks passing through the dam” (USBR, 1991). Each penstock also includes a 102-inch ring seal gate. Water flow through the penstocks is generally controlled by turbine wicket gates, while the ring seal gates are fully open. Water is released from the reservoir through penstocks at the Seminoe Powerplant or over a controlled spillway and outlet tunnel. The powerplant has a full release capacity of 4,050 cubic feet per second. Three electrical generating units with a total capacity of 51 megawatts are housed in the powerplant. The plant was up-graded in the mid-1970s to its present capacity of 51 megawatts.

Table 2.6.4 summarizes historic Seminoe Reservoir storage volumes.

Table 2.6.5 summarizes historic Seminoe Reservoir evaporation losses.

Table 2.6.6 summarizes historic Seminoe Reservoir discharges.

Table 2.6.4 Summary - historic Seminoe Reservoir storage volumes (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Mean	Max day	Date of max day
1981	840,357	778,210	703,377	604,066	548,858	501,406	461,661	512,109	600,072	596,365	577,860	549,972	606,193	872,259	1-Oct
1982	522,393	462,741	392,915	320,287	278,168	225,675	185,048	337,603	658,281	854,069	873,698	869,923	498,400	876,158	15-Sep
1983	839,485	794,759	721,790	626,701	555,693	512,109	536,838	736,532	1,039,376	971,419	952,949	904,922	766,048	1,055,564	9-Jul
1984	885,463	863,839	834,089	786,779	786,779	648,323	636,392	919,085	956,234	983,622	954,301	930,392	843,001	988,576	2-Aug
1985	919,648	898,643	868,309	852,299	852,299	817,550	842,098	902,326	905,656	901,402	838,605	808,198	865,937	936,080	13-Jun
1986	780,173	738,877	699,012	634,024	634,024	518,826	489,065	657,561	956,809	869,557	827,851	810,231	713,535	957,196	29-Jun
1987	796,422	782,313	735,274	674,068	674,168	646,906	723,324	832,174	835,993	772,805	702,016	660,139	732,410	858,846	17-Jun
1988	624,361	588,482	545,154	472,885	472,885	398,214	510,583	687,391	872,791	849,999	811,758	773,294	629,824	876,756	3-Jul
1989	736,526	694,077	608,078	518,707	518,707	451,814	465,340	505,106	553,819	543,924	514,220	488,161	543,387	772,152	1-Oct
1990	468,826	455,968	410,459	386,244	386,244	371,875	357,568	355,786	510,349	533,195	460,365	432,886	426,761	539,882	27-Jul
1991	419,547	410,756	396,569	361,059	361,059	347,402	337,599	441,807	645,777	584,186	479,861	439,721	433,973	646,059	29-Jun
1992	419,245	413,041	405,135	388,235	388,235	394,930	411,848	449,271	424,704	351,710	299,745	276,134	384,573	458,430	4-Jun
1993	257,753	247,948	236,117	227,629	227,629	242,015	301,494	548,731	782,642	750,572	697,922	608,884	421,863	796,422	8-Jul
1994	614,007	614,007	597,022	574,138	574,138	563,469	597,022	702,317	657,561	536,227	410,756	346,790	563,566	714,130	5-Jun
1995	332,128	319,288	310,101	297,923	297,923	308,642	295,166	403,274	872,431	976,123	889,832	836,167	511,478	988,570	23-Jul
1996	822,516	822,688	805,325	784,292	784,292	660,139	628,074	781,324	885,638	906,769	864,903	816,525	792,607	909,369	22-Jul
1997	793,583	781,818	745,337	707,902	707,902	640,859	611,576	785,944	967,307	901,218	881,823	895,510	782,096	977,894	25-Jun
1998	902,141	896,796	876,576	855,652	855,652	766,952	690,951	777,710	942,950	941,229	918,517	864,546	856,009	965,356	11-Jul
1999	853,882	802,124	757,281	735,743	735,743	674,314	720,401	843,498	968,869	955,454	835,319	911,230	821,992	969,065	1-Jul
2000	887,277	867,586	846,129	830,616	830,616	743,599	753,601	914,774	980,259	931,333	862,940	829,060	853,828	980,456	28-Jun

Source: United States Bureau of Reclamation

Table 2.6.5 Summary - historic Seminoe Reservoir evaporation losses (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Max day	Date of max day
1981	4,969	2,844	1,697	1,590	1,777	2,638	4,190	3,065	6,935	7,441	6,363	4,798	48,307	677	20-Feb
1982	3,042	2,663	1,975	1,214	788	1,392	1,828	2,098	4,843	8,825	9,008	4,726	42,402	731	7-Dec
1983	6,465	1,857	776	804	1,002	1,739	1,823	3,717	7,554	10,845	9,425	7,126	50,133	676	2-Jul
1984	6,306	2,922	914	1,059	735	1,179	2,514	6,852	8,779	9,474	8,320	5,576	53,630	1,001	14-Nov
1985	3,276	3,035	1,084	881	728	2,578	5,540	8,365	10,039	10,086	9,752	5,569	60,933	805	30-Nov
1986	4,489	1,567	711	1,338	1,292	3,319	3,515	4,620	8,725	10,394	8,666	5,449	54,085	1,073	5-Jul
1987	2,938	1,851	1,186	1,187	1,584	1,619	5,464	5,442	9,126	8,379	7,158	5,128	61,062	681	13-Jun
1988	3,843	1,592	715	562	765	457	3,451	4,477	8,646	9,855	9,219	6,068	49,650	488	20-Oct
1989	4,566	2,218	994	1,436	548	1,859	3,420	4,118	5,098	6,976	5,521	3,577	40,331	980	31-Jan
1990	3,542	1,797	485	1,040	943	1,400	2,140	2,469	4,990	5,433	5,322	3,137	32,698	1,066	30-Nov
1991	3,271	1,433	372	1,078	959	1,460	1,897	2,977	8,256	7,740	5,762	3,324	38,529	1,012	1-Jun
1992	3,118	565	854	689	1,140	1,642	3,739	3,781	4,062	4,396	3,675	2,874	30,535	552	29-Feb
1993	1,788	1,156	642	309	276	918	1,297	3,761	5,135	8,647	6,177	4,950	35,056	753	20-Sep
1994	2,845	985	496	1,239	471	2,174	4,181	6,491	7,793	6,218	4,936	3,104	40,933	668	15-Mar
1995	1,598	1,591	784	497	316	1,138	1,240	1,230	6,295	9,500	9,081	4,867	38,137	1,301	29-Nov
1996	3,478	2,152	1,285	2,413	2,504	1,547	2,759	4,661	7,993	8,283	8,145	5,240	50,460	2,523	31-Oct
1997	2,797	1,388	1,329	980	970	3,533	3,390	4,861	7,956	9,469	7,500	5,811	49,984	2,197	29-Oct
1998	2,318	691	998	943	1,310	1,418	3,801	6,467	6,485	8,985	7,379	6,397	47,192	1,184	23-Apr
1999	3,258	3,771	1,692	1,431	1,205	4,092	3,602	7,179	8,485	12,110	10,309	5,454	61,588	3,566	30-Mar
2000	4,631	3,434	2,661	1,722	1,148	2,088	3,962	6,835	8,887	11,022	10,045	6,314	62,749	2,799	30-Nov

Source: United States Bureau of Reclamation

Table 2.6.6 Summary - historic Seminoe Reservoir discharges (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Max discharge (cfs)	Date of max discharge
1981	51,398	81,439	102,686	123,180	78,220	79,837	76,655	41,088	31,833	36,696	32,386	35,566	770,983	2,897	23-Jan
1982	50,969	79,265	89,629	91,188	68,073	93,051	100,247	46,253	38,166	40,512	42,908	41,643	781,904	2,014	10-Jan
1983	74,454	84,914	107,937	126,460	100,288	107,881	95,585	55,256	419,474	475,946	120,252	66,307	1,834,754	16,173	30-Jun
1984	63,344	61,773	65,395	85,468	108,363	118,247	150,399	366,853	486,960	182,733	117,380	67,539	1,874,454	13,054	7-Jun
1985	61,611	61,208	63,463	48,294	42,732	79,674	134,362	234,742	204,780	72,617	86,106	44,408	1,133,996	5,062	20-May
1986	67,874	76,411	79,817	99,739	117,485	161,270	225,082	145,382	213,064	254,221	84,859	46,019	1,571,225	6,652	10-Jul
1987	68,342	67,601	79,855	84,407	76,296	36,970	29,601	32,192	49,970	84,135	87,148	53,724	750,240	2,192	31-Jan
1988	52,463	60,180	66,224	93,168	72,770	76,885	61,985	72,161	63,495	63,481	49,123	44,521	776,456	2,256	30-Jan
1989	49,123	59,946	110,344	106,171	97,934	65,236	64,961	37,571	33,178	32,104	47,909	37,061	741,539	2,180	29-Dec
1990	31,559	30,169	60,869	42,754	28,177	50,862	90,224	76,877	34,739	38,898	89,718	39,084	613,930	2,047	30-Aug
1991	31,632	31,507	32,573	49,535	38,362	33,439	63,685	63,810	40,080	103,275	125,407	50,291	663,598	2,706	14-Jul
1992	32,188	30,371	30,863	30,492	27,846	29,560	37,144	53,768	103,934	114,829	65,427	31,597	588,018	2,674	28-Jul
1993	32,460	31,573	32,801	32,846	28,869	32,063	31,182	49,170	122,475	142,217	147,378	50,725	733,759	2,751	27-Jul
1994	32,577	31,123	50,333	50,612	46,322	51,511	58,961	90,317	130,846	137,500	135,158	66,561	881,820	2,774	10-Aug
1995	32,021	31,121	32,380	32,089	28,838	32,295	47,804	56,273	77,964	193,133	128,235	71,591	763,744	3,466	26-Jul
1996	46,181	44,580	45,556	46,304	86,700	126,081	189,610	189,818	234,050	58,602	62,045	55,932	1,185,459	5,312	13-Jun
1997	43,244	49,517	64,467	67,638	67,549	134,214	144,976	179,336	309,253	154,116	72,805	47,522	1,334,636	6,725	15-Jun
1998	43,474	47,919	52,264	52,409	47,215	157,819	158,549	100,042	86,414	116,600	64,729	66,986	994,419	3,309	25-Mar
1999	50,015	95,574	68,495	53,187	59,457	97,966	51,223	137,314	289,291	125,453	53,215	41,645	1,122,833	5,215	9-Jun
2000	43,369	41,645	43,095	43,091	61,704	98,384	87,187	50,985	49,529	64,532	70,911	41,125	695,558	2,001	1-Jun

Source: United States Bureau of Reclamation

2.6.4.2 Kortes Dam and Reservoir

Background and History

Kortes Dam, Reservoir, and Powerplant are part of the Kortes Unit of the U.S. Bureau of Reclamation (USBR) Pick-Sloan Missouri Basin Project. The dam, reservoir, and powerplant are located in a 1,000-foot deep gorge, Black Canyon, approximately two miles downstream of Seminoe Dam. Construction of Kortes Dam was initiated in 1946 and finished in 1951.

Congress passed Senate Bill 2553 in the late 1960s which authorized modification of the operation of Kortes Dam and Powerplant. This legislation requires a minimum 500 cubic feet per second flow rate in the North Platte River between Kortes Reservoir and the normal headwaters of Pathfinder Reservoir, which is located downstream of Kortes Reservoir. This minimum flow allows for preservation of a famous sport fishery in a reach of the North Platte River below Kortes Reservoir commonly referred to as the "Miracle Mile."

Description

Kortes Dam is a concrete gravity structure which has a maximum height of 244 feet, a dam length of 193 feet, and a dam crest width of 24 feet. Kortes Reservoir provides a total permitted storage capacity of 4,640 acre-feet as per the Wyoming State Engineer's Office tab book. An uncontrolled emergency spillway tunnel on the right abutment of the reservoir has a discharge capacity of approximately 50,000 cubic feet per second. The spillway tunnel has a diameter of 30 feet, and it is 527 feet long. The site of Kortes Dam was chosen to provide approximately 200 to 300 feet of elevation difference or "head" between the upstream Seminoe Powerplant tailwater and the downstream Pathfinder Reservoir high water surface elevation. A photograph of Kortes Dam and Powerplant is shown on Figure 2.6.3.

Figure 2.6.3
Kortes Dam and Powerplant

Power Generation

Kortes Reservoir serves as the forebay to Kortes Powerplant. To maximize hydropower production, reservoir storage is maintained at or near capacity (Simonds, 1996). Kortes Powerplant consists of three electrical generating units. Due to an anticipated shortage within the region, the generators at Kortes Powerplant were put into operation before the dam was complete. Water is supplied to the generators via three 108-inch diameter steel penstocks running through the dam (Simonds, 1996). The powerplant has a water release capability of approximately 3,000 cubic feet per second and a total electricity generating capacity of 36 megawatts. After release from Seminoe Dam, water passes through Kortes Reservoir and Powerplant turbines to generate power on its way to Pathfinder Reservoir. Power produced by the Kortes Powerplant is marketed by the Western Area Power Administration (WAPA) to cities within a 15-state region in the western and central U.S.

Table 2.6.7 summarizes historic Kortes Reservoir storage volumes.

Table 2.6.8 summarizes historic Kortes Reservoir evaporation losses.

Table 2.6.9 summarizes historic Kortes Reservoir discharges.

Table 2.6.7 Summary - historic Kortes Reservoir storage volumes (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Mean	Max day	Date of max day
1981	4,683	4,630	4,626	4,600	4,624	4,636	4,628	4,543	4,335	4,700	4,638	4,416	4,588	4,872	2-Oct
1982	4,504	4,539	4,585	4,557	4,650	4,587	4,524	4,445	4,548	4,512	4,488	4,571	4,543	4,712	14-Dec
1983	4,585	4,650	4,682	4,622	4,483	4,733	4,270	4,563	5,603	4,935	4,663	4,457	4,687	5,708	29-Jun
1984	4,593	4,252	4,630	4,585	4,559	4,306	4,302	5,404	5,243	4,511	4,565	4,600	4,629	5,499	6-Jun
1985	4,579	4,491	4,511	4,551	4,487	4,544	4,569	5,043	4,519	4,605	4,581	4,599	4,590	5,135	18-Jun
1986	4,559	4,536	4,625	4,630	4,673	4,355	5,015	4,523	5,103	4,531	4,504	4,548	4,634	5,173	8-Jul
1987	4,523	4,577	4,540	4,579	4,515	4,634	4,585	4,567	4,595	4,607	4,595	4,457	4,565	4,731	7-Nov
1988	4,531	4,564	4,511	4,569	4,658	4,666	4,605	4,536	4,599	4,630	4,561	4,592	4,585	4,737	25-Feb
1989	4,658	4,666	4,499	4,632	4,678	4,687	4,593	4,694	4,678	4,673	4,590	4,692	4,645	4,712	2-Aug
1990	4,712	4,702	4,663	4,640	4,701	4,684	4,654	4,694	4,664	4,615	4,511	4,697	4,661	4,719	22-Dec
1991	4,670	4,698	4,700	4,699	4,658	4,659	4,663	4,589	4,599	4,696	4,685	4,664	4,657	4,772	10-May
1992	4,638	4,694	4,650	4,693	4,670	4,705	4,691	4,699	4,415	4,633	4,459	4,679	4,636	4,717	15-Oct
1993	4,689	4,675	4,668	4,690	4,662	4,700	4,684	4,650	4,699	4,548	4,616	4,702	4,665	4,729	20-Jun
1994	4,710	4,696	4,694	4,653	4,666	4,625	4,703	4,469	4,618	4,697	4,695	4,671	4,658	4,728	1-Nov
1995	4,699	4,675	4,698	4,669	4,690	4,684	4,675	4,696	4,700	4,574	4,606	4,585	4,671	4,856	8-Jul
1996	4,653	4,690	4,699	4,708	4,699	4,681	4,618	4,985	4,619	4,705	4,701	4,694	4,704	5,066	13-Jun
1997	4,684	4,666	4,703	4,714	4,685	4,694	4,569	4,799	5,014	4,690	4,666	4,458	4,695	5,149	14-Jun
1998	4,468	4,719	4,685	4,699	4,665	4,852	4,704	4,565	4,643	4,673	4,723	4,699	4,682	4,898	22-Mar
1999	4,693	4,661	4,677	4,700	4,694	4,666	4,617	5,018	4,921	4,693	4,699	4,694	4,728	5,091	2-Jun
2000	4,703	4,695	4,680	4,719	4,719	4,704	4,366	4,713	4,699	4,705	4,674	4,708	4,696	4,830	6-Mar

Source: United States Bureau of Reclamation

Table 2.6.8 Summary - historic Kortes Reservoir evaporation losses (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Max day	Date of max day
1981	20	12	5	6	8	20	30	21	41	44	39	30	276	4	31-Jan
1982	21	19	13	9	4	16	24	23	33	42	36	19	259	5	7-Dec
1983	19	6	0	1	3	10	12	21	31	49	41	34	227	3	21-Jun
1984	22	11	0	1	0	2	13	36	44	38	31	25	223	4	14-Nov
1985	15	8	1	0	0	14	24	39	47	45	43	26	262	3	30-Nov
1986	21	7	1	5	6	19	26	30	42	49	38	28	272	5	31-Jan
1987	12	5	3	3	4	7	25	27	38	41	38	31	234	3	31-Jan
1988	22	8	0	0	3	0	26	27	41	46	42	26	241	3	20-Oct
1989	25	10	3	7	1	13	26	31	39	45	39	24	263	7	31-Jan
1990	27	11	1	6	6	10	20	23	40	36	35	25	240	8	30-Nov
1991	23	10	0	7	6	11	16	26	52	47	36	27	261	8	1-Jun
1992	27	2	4	3	7	12	27	28	31	39	34	30	244	5	29-Feb
1993	20	9	5	1	1	8	12	32	29	46	34	30	227	6	25-Mar
1994	14	3	0	5	0	12	19	36	44	35	35	27	230	4	31-Jan
1995	14	13	5	2	1	9	10	7	35	39	38	21	194	13	29-Nov
1996	13	7	3	9	10	6	13	28	36	34	31	27	217	13	29-Apr
1997	11	4	4	2	3	18	17	24	36	40	32	26	217	11	29-Oct
1998	0	0	2	1	4	4	13	32	28	40	28	28	180	6	23-Apr
1999	7	15	6	4	4	20	5	36	39	52	46	25	259	20	30-Mar
2000	24	13	9	5	3	8	12	34	37	48	44	28	265	13	30-Nov

Source: United Stated Bureau of Reclamation

Table 2.6.9 Summary - historic Kortes Reservoir discharges (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Max discharge (cfs)	Date of max discharge
1981	51,564	81,485	102,684	123,211	78,188	79,803	76,631	41,151	31,995	36,288	32,406	35,774	771,182	2,822	23-Jan
1982	50,858	79,210	89,572	91,208	67,978	93,098	100,290	46,304	38,031	40,504	42,893	41,540	781,486	2,036	10-Jan
1983	74,416	84,839	107,911	126,524	100,425	107,623	96,026	54,948	418,399	476,563	120,484	66,480	1,834,637	16,225	30-Jun
1984	63,181	62,100	65,018	85,517	108,385	118,497	150,393	365,935	487,277	183,423	117,283	67,434	1,874,444	13,059	7-Jun
1985	61,613	61,287	63,439	48,256	42,797	79,603	134,317	234,228	205,256	72,486	86,087	44,360	1,133,728	5,061	20-May
1986	67,886	76,423	79,728	99,725	117,437	161,574	224,398	145,843	212,444	254,745	84,843	45,945	1,570,990	6,651	10-Jul
1987	68,356	67,537	79,888	84,365	76,356	36,845	29,627	32,182	49,912	84,083	87,122	53,831	750,105	2,182	31-Jan
1988	52,364	60,135	66,276	93,104	72,668	76,871	62,015	72,206	63,392	63,402	49,144	44,463	776,041	2,314	29-Jan
1989	49,035	59,925	110,507	106,028	97,892	65,209	65,032	37,438	33,156	32,065	47,952	36,934	741,174	2,124	29-Dec
1990	31,507	30,171	60,906	42,768	28,110	50,870	90,240	76,814	34,727	38,914	89,792	38,874	613,692	2,024	30-Aug
1991	31,632	31,573	32,469	49,533	38,404	33,427	63,660	63,856	40,017	103,133	125,375	50,285	663,364	2,662	14-Jul
1992	32,186	30,307	30,904	30,450	27,866	29,510	37,133	53,730	104,186	114,573	65,564	31,347	587,756	2,655	28-Jul
1993	32,426	31,581	32,805	32,828	28,895	32,017	31,184	49,166	122,396	142,324	147,277	50,604	733,504	2,738	2-Aug
1994	32,553	31,137	50,331	50,644	46,308	51,537	58,869	90,516	130,653	137,387	135,126	66,555	881,615	2,731	10-Aug
1995	31,978	31,131	32,352	32,118	28,824	32,297	47,804	56,243	77,925	193,210	128,166	71,488	763,535	3,470	25-Jul
1996	46,199	44,539	45,544	46,280	86,698	126,093	189,663	189,420	234,383	58,487	62,017	55,910	1,185,233	5,304	13-Jun
1997	43,238	49,531	64,431	67,624	67,577	134,188	145,083	179,080	308,995	154,397	72,799	47,700	1,334,644	6,724	15-Jun
1998	43,464	47,671	52,296	52,395	47,242	157,628	158,686	100,052	86,404	116,529	64,647	66,980	993,995	3,308	25-Mar
1999	50,015	95,591	68,475	53,161	59,460	97,978	51,265	136,877	289,347	125,629	53,167	41,621	1,122,587	5,214	9-Jun
2000	43,337	41,637	43,101	43,049	61,702	98,394	87,247	50,872	49,507	64,475	70,901	41,066	695,288	2,002	1-Jun

Source: United States Bureau of Reclamation

2.6.4.3 Pathfinder Dam and Reservoir

Background and History

Located approximately 47 miles southwest of Casper, Pathfinder Dam was built as part of the North Platte Project. The dam was one of the first dams built under the Federal 1902 Reclamation Act. Pathfinder Dam is an arch dam with a gravity-type section and has a maximum height of 214 feet. The Pathfinder Dam is listed as a Wyoming Historic Civil Engineering Landmark as well as in the National Register of Historic Places (USBR, 2003). Pathfinder Reservoir has a total permitted storage capacity of 1,070,000 acre-feet as shown in the Wyoming State Engineer's Office tab book.

Construction of Pathfinder Dam began in 1905. In December 1905, contractors started constructing a temporary dam to divert the North Platte River while the permanent dam was put in place. In January 1906, excavation was initiated for the foundation of the dam. In March 1906, construction was put on hold due the river rising and flooding the dam site, pushing foundation construction to August 15, 1906 (Autobee, 1996). Construction of the dam was completed in 1909.

Pathfinder Dam was erected from 60,210 cubic yards of masonry and 55,000 barrels of cement. The masonry and cement were hauled by freight teams from Casper, a 45-mile trip. Freight teams ranged "from a sheep wagon drawn by two horses and a mule carrying 24 sacks of cement to a 22-horse team drawing five wagons coupled together hauling 327 sacks weighing 31,000 pounds" (Autobee, 1996).

Description

Once Pathfinder Dam was complete, the diversion tunnel used during construction was operated as a service outlet. The finished structure has two main outlets – one on each abutment. The two main outlets consist of a north, or left abutment, outlet that is 480 feet long and a south, or right abutment, outlet that is 360 feet long. The right abutment outlet associated with the original outlet works was plugged in 1958 when the Fremont Canyon power conduit was constructed. The left outlet works includes two 60-inch jet flow gates which provide a total discharge capacity of 2,928 cubic feet per second (cfs) at water surface elevation 5850.1 feet. An additional 30-inch jet flow gate outlet in the left abutment has a controlled discharge capacity that can be varied from 50 to 450 cfs.

Pathfinder's emergency spillway is an uncontrolled, flat-crested weir. If the reservoir water surface elevation at any time exceeds maximum water surface elevation 5850.1, water discharges via the emergency spillway. The spillway is located approximately 400 feet from the north side of the canyon and is 650 feet wide. The principal spillway can convey water at a flow rate of 33,940 cubic feet per second at water surface elevation 5858.1 (USBR, wy01296.htm). The spillway also has 12-foot high guide walls. Water is released at varying and controlled rates from Pathfinder Reservoir during both the irrigation and non-irrigation seasons. During the irrigation season, water is released as required to meet the needs of the North Platte Project. Figure 2.6.4 provides a photograph of Pathfinder Dam.

Figure 2.6.4
Pathfinder Dam

Power Generation

Completed on June 3, 1960, Fremont Canyon Powerplant is located in a North Platte River canyon below Pathfinder Dam. Depending upon the reservoir water surface elevation, as much as 2,900 cubic feet per second (cfs) can be released through the Fremont Canyon power conduit and discharged from the Fremont Canyon turbines at the powerplant three miles downstream of Pathfinder Dam. The powerplant intake conduit is located approximately 35 miles southwest of Casper, Wyoming, and is three miles long and 18 feet wide (Autobee, 1996). The conduit is controlled by a 14-foot by 18-foot fixed wheel gate located downstream of the conduit inlet. The powerplant intake works consists of two penstocks leading to the powerplant in Fremont Canyon, near the upper end of Alcova Reservoir.

Reservoir Operations

In addition to providing storage and release of water for irrigation and hydroelectric power generation, Pathfinder Reservoir is used for recreation and flood control. Recreational activities at the reservoir include fishing and boating. The reservoir contains cutthroat, rainbow, and brown trout. With a surcharge storage capacity of 188,493 acre-feet, the reservoir has prevented $8.7 million in flood damage since its construction (USBR, 2003).

Table 2.6.10 summarizes historic Pathfinder Reservoir storage volumes.

Table 2.6.11 summarizes historic Pathfinder Reservoir evaporation losses.

Table 2.6.12 summarizes historic Pathfinder Reservoir discharges.

Table 2.6.10 Summary - historic Pathfinder Reservoir storage volumes (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Mean	Max day	Date of max day
1981	551,654	584,405	632,006	701,213	733,738	782,776	801,670	762,432	706,963	610,756	473,110	378,778	643,292	803,910	27-Apr
1982	369,890	408,891	456,003	505,765	536,046	582,104	612,409	568,805	581,960	520,202	437,503	387,647	497,269	612,559	1-May
1983	436,950	476,830	546,248	629,547	695,214	776,543	877,651	842,033	1,067,018	1,039,874	898,784	842,420	760,759	1,083,755	7-Jul
1984	859,615	868,669	882,241	920,877	974,873	947,500	900,203	1,055,177	1,062,901	976,378	918,201	881,842	937,373	1,080,740	14-Jun
1985	884,437	880,644	894,932	894,324	886,443	883,838	875,455	930,793	988,632	871,036	720,667	601,677	859,407	996,002	25-Jun
1986	618,539	645,470	672,748	718,097	780,783	839,700	974,821	992,485	1,044,765	1,005,760	905,226	846,291	837,057	1,050,851	15-Jul
1987	856,050	822,623	847,263	880,597	909,514	925,559	938,655	922,665	871,632	799,441	724,969	721,869	851,736	948,505	13-May
1988	736,600	746,614	745,913	786,842	821,100	875,210	902,579	924,938	868,856	725,314	579,224	494,239	767,536	927,422	3-Jun
1989	508,641	509,148	564,597	622,325	687,322	728,598	706,365	625,216	541,389	420,553	301,105	271,635	540,575	734,680	12-Apr
1990	297,681	295,737	328,054	340,501	343,915	365,199	416,276	439,398	396,705	321,912	230,795	227,610	333,649	440,292	30-May
1991	246,843	249,902	250,116	269,973	286,635	289,327	282,241	306,792	336,935	336,491	322,341	281,930	288,294	340,411	18-Aug
1992	306,709	300,859	302,006	305,136	310,879	319,170	311,214	293,080	277,438	251,548	237,524	182,604	283,181	320,196	29-Mar
1993	203,307	204,684	203,620	204,433	208,280	217,763	211,023	225,255	297,356	288,930	294,286	305,549	238,707	307,207	28-Sep
1994	328,403	329,974	355,628	380,829	406,276	436,947	457,135	450,582	420,553	340,054	245,428	221,189	364,417	470,730	11-May
1995	254,208	240,025	244,651	254,497	264,663	285,374	291,719	367,958	477,297	654,607	643,905	640,160	382,422	644,844	16-Aug
1996	678,122	685,012	704,678	723,934	783,349	849,795	928,666	952,718	980,185	869,648	780,966	771,673	809,062	982,551	15-Jun
1997	785,002	808,805	831,802	861,944	889,022	905,023	922,252	956,308	1,007,947	896,289	859,779	857,815	881,832	1,010,137	26-Jun
1998	878,599	895,682	919,983	946,824	971,399	995,739	982,551	971,186	963,303	936,360	842,797	760,494	922,076	996,390	2-Apr
1999	780,966	840,474	869,847	889,022	916,690	973,537	995,305	993,352	1,009,699	978,037	920,396	897,301	922,052	1,011,892	26-Jun
2000	918,130	926,387	928,873	935,943	960,543	994,870	994,653	993,135	923,904	777,676	652,715	610,429	884,772	997,259	3-Jun

Source: United States Bureau of Reclamation

Table 2.6.11 Summary - historic Pathfinder Reservoir evaporation losses (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Max day	Date of max day
1981	3,787	2,304	1,630	1,843	2,421	3,957	7,025	6,446	11,162	9,859	7,475	5,984	63,893	929	20-Feb
1982	2,433	2,276	2,130	1,782	1,356	2,737	4,550	5,242	8,060	9,634	7,379	3,875	51,454	811	4-Jun
1983	2,046	1,265	612	823	1,271	2,511	3,008	5,916	8,699	12,689	11,950	9,207	59,997	755	19-Jul
1984	5,759	3,226	1,038	1,265	968	1,701	3,776	9,222	10,555	12,531	12,191	7,403	69,635	1,110	14-Nov
1985	3,500	3,258	1,207	981	840	2,990	6,408	9,690	11,609	12,216	12,041	6,562	71,302	874	30-Nov
1986	4,023	1,482	753	1,616	1,763	5,097	6,084	9,212	12,391	13,692	11,839	7,040	74,992	1,114	31-Jan
1987	3,523	2,133	1,430	1,586	2,264	2,402	7,717	8,974	12,601	12,230	9,884	7,368	72,112	820	28-Jul
1988	4,888	2,076	996	868	1,396	910	6,683	8,492	13,788	13,257	10,548	5,717	69,619	707	18-Jul
1989	3,589	1,831	958	1,779	808	3,036	5,548	8,847	8,556	9,196	5,897	3,118	53,163	1,326	23-Mar
1990	2,475	1,360	397	987	923	1,407	2,393	4,543	6,859	5,720	4,359	3,029	34,452	806	30-Nov
1991	2,241	1,036	279	841	851	1,358	1,696	3,053	4,920	5,588	5,115	2,902	29,880	608	28-Feb
1992	2,454	469	711	594	1,021	1,467	3,177	3,194	3,524	3,801	3,670	2,529	26,611	494	29-Feb
1993	1,483	1,025	600	281	275	905	1,072	2,385	2,708	4,024	3,750	2,931	21,439	471	25-Mar
1994	1,599	629	341	931	379	1,887	2,908	5,398	6,474	5,861	4,182	2,737	33,326	577	15-Mar
1995	1,423	1,347	659	447	312	1,095	1,243	1,348	4,032	7,320	8,900	6,123	34,249	1,094	29-Nov
1996	3,168	2,061	1,269	2,502	2,891	2,025	4,094	7,135	11,423	11,493	10,250	6,311	64,622	3,364	29-Apr
1997	3,080	1,567	1,597	1,247	1,318	5,113	5,199	7,153	9,804	11,245	8,734	6,535	62,592	2,577	27-Mar
1998	2,490	754	1,122	1,105	1,596	1,869	5,368	10,226	8,789	11,260	9,609	7,990	62,178	1,695	23-Apr
1999	3,109	4,297	2,077	1,821	1,609	5,989	3,752	8,707	11,005	13,894	12,236	6,598	75,094	5,230	30-Mar
2000	5,735	3,961	3,147	2,062	1,416	2,841	5,459	9,288	10,507	11,960	9,416	6,194	71,986	3,236	30-Nov

Source: United States Bureau of Reclamation

Table 2.6.12 Summary - historic Pathfinder Reservoir discharges (acre-feet)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Max discharge (cfs)	Date of max discharge
1981	70,195	54,426	56,977	50,763	45,554	35,911	60,720	85,448	89,395	134,590	176,713	130,661	991,355	3,205	22-Aug
1982	61,759	46,290	46,502	45,082	42,615	53,833	78,284	113,964	51,880	109,309	127,837	91,589	868,945	2,898	25-Jul
1983	32,577	43,864	42,928	42,889	37,289	36,480	52,381	157,797	231,410	496,322	267,570	117,759	1,559,266	8,687	2-Jul
1984	45,195	56,233	57,457	53,355	50,805	155,821	215,514	258,121	494,850	281,213	171,519	100,578	1,940,662	9,504	9-Jun
1985	62,110	68,690	52,056	56,019	55,359	92,269	164,051	191,708	146,358	184,988	231,832	170,130	1,475,572	6,847	30-Apr
1986	57,300	51,584	53,566	54,403	55,442	101,514	99,199	166,467	216,385	295,724	185,010	104,501	1,441,095	5,955	15-Jul
1987	64,637	100,005	54,169	52,620	51,630	33,604	52,596	57,271	106,084	157,135	162,411	52,110	944,269	3,415	21-Jul
1988	63,835	48,597	59,032	55,313	41,290	34,994	51,227	58,677	113,213	200,406	195,773	130,671	1,026,028	3,631	31-Aug
1989	34,374	57,537	53,970	49,797	38,430	31,295	92,932	126,379	121,416	155,379	168,575	66,234	996,317	4,740	29-Aug
1990	6,349	31,745	33,066	33,560	27,824	36,613	52,056	61,603	81,584	115,503	190,094	43,902	713,901	3,948	22-Aug
1991	11,219	32,194	30,908	33,634	28,003	38,561	84,660	68,110	44,126	112,510	146,696	96,419	727,039	3,190	28-Aug
1992	9,584	69,527	34,009	31,839	29,641	33,763	53,205	78,117	128,093	150,583	79,656	85,496	753,511	3,203	23-Jul
1993	11,228	32,061	31,857	32,099	27,251	31,325	52,532	63,039	82,100	155,972	148,846	40,919	709,228	2,862	11-Aug
1994	14,065	34,856	31,898	32,975	26,765	30,720	54,268	113,645	160,245	213,558	234,046	94,764	1,041,804	4,005	13-Aug
1995	2,202	40,840	30,744	30,145	28,272	31,722	53,100	34,947	33,929	58,499	104,559	76,048	525,005	2,453	1-Sep
1996	6,190	41,423	30,105	32,545	28,961	63,215	123,025	180,766	217,993	161,554	146,392	61,636	1,093,805	4,876	14-Jun
1997	29,570	30,073	42,942	44,400	45,965	128,154	140,223	190,372	305,603	266,309	110,116	49,321	1,383,049	5,386	27-Jun
1998	22,235	34,725	35,774	35,034	33,892	148,086	193,178	132,065	111,612	153,374	163,674	151,440	1,215,088	3,615	16-Apr
1999	44,928	40,967	42,768	42,615	41,050	51,267	55,055	196,879	319,571	163,987	112,372	68,848	1,180,306	5,512	26-Jun
2000	28,824	41,944	46,933	45,410	50,807	79,418	102,212	78,540	127,337	209,006	195,624	86,729	1,092,784	3,679	1-Aug

Source: United States Bureau of Reclamation

2.6.4.4 Alcova Dam and Reservoir

Background and History

Alcova Dam and Reservoir are part of the Kendrick Project. The dam, located approximately 10 miles downstream of Pathfinder Dam, serves as a diversion for Casper Canal, which conveys irrigation water to Kendrick Project irrigators. Completed in 1938, the reservoir has a storage capacity of 184,295 acre-feet at a maximum water surface elevation of 5500.0, of which only the top 30,600 acre-feet is active capacity available for Kendrick Project irrigation.

Description

The Alcova Reservoir emergency spillway has a discharge capacity of 55,000 cubic feet per second at a reservoir water surface elevation of 5500.0 feet. The emergency spillway, located in the left abutment, is a concrete-lined open channel regulated by three 25-foot by 40-foot gates. The reservoir is operated within two-foot water surface elevation ranges during summer and winter. The summer operating range is 10 feet above the winter operating range. The high summer operating range is maintained to provide adequate head on the Casper Canal and to assist with recreational use. During the winter, the lower level reduces the potential for ice damage to the Casper Canal gate and to recreational boat docks. Figure 2.6.5 contains a photograph of Alcova Dam.

Power Generation

Alcova Reservoir serves as a forebay for the Alcova Powerplant. Alcova Powerplant was authorized for construction on August 22, 1950, under the Federal Reclamation Act of 1939 and was completed in 1955. The powerplant consists of two electrical generating units with a capacity of 36 megawatts. The powerplant has a full water release capacity estimated at 4,100 cubic feet per second. Water from Alcova Reservoir is released for downstream irrigation use through the powerplant or over a controlled Alcova Dam spillway.

Table 2.6.13 summarizes historic Alcova Reservoir storage volumes.

Table 2.6.14 summarizes historic Alcova Reservoir evaporation losses.

Table 2.6.15 summarizes historic Alcova Reservoir discharges.

Insert Table 2.6.13

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File Name: 0505_TechMemo2-6_TBL 2-6-13thru15

Insert Table 2.6.14

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2.6.4.5 Gray Reef Dam and Reservoir

Background and History

Gray Reef Dam and Reservoir are located approximately 27 miles southwest of Casper and two miles downstream of Alcova Dam. The dam and reservoir are part of the U.S. Bureau of Reclamation (USBR) Glendo Unit, Oregon Trail Division, Pick-Sloan Missouri Basin Program. The reservoir regulates widely fluctuating water releases from Alcova Powerplant.

Description

Gray Reef Reservoir has a surface area of 182 acres at the maximum water surface elevation of 5332.0 feet and a total capacity of 1,798 acre-feet. The reservoir is an afterbay to re-regulate releases from the Alcova Powerplant.

Gray Reef Dam, completed in 1961, is a three-zoned rock and earth fill structure. The structural height of the dam is 36 feet, while the embankment height is 30 feet. The dam crest length is 650 feet. Gray Reef Dam is an earth fill structure with no outlet works. A concrete chute spillway is located near the center of the dam. The spillway is controlled by two radial gates and has a discharge capacity of 20,000 cubic feet per second.

The Congressional authorization for construction of the dam requires a minimum flow of 330 cubic feet per second (cfs) to pass Gray Reef Dam (Purcell, 2000). The mandate was included in the Congressional authorization for construction of the dam. While the required minimum Gray Reef Reservoir release is 300 cfs, the U.S. Bureau of Reclamation's (USBR) target Gray Reef Reservoir minimum release is 500 cfs, subject to hydrological conditions.

To scour the gravel beds by removing sediment and thereby improve fish spawning habitat below Gray Reef Dam, the U.S. Bureau of Reclamation (USBR) and the Wyoming Game and Fish Department (WGF) have been managing reservoir discharge rates to apply flushing flows since 1998. This entails varying flows each day from 500 cubic feet per second to 4,000 cubic feet per second for specified periods during the spring and late fall. Early data indicate that the fishery below the dam has been enhanced as a result of this process (Purcell, 2000). A photograph of Gray Reef Dam is shown on Figure 2.6.6.

Table 2.6.16 summarizes historic Gray Reef Reservoir storage volumes.

Table 2.6.17 summarizes historic Gray Reef Reservoir evaporation losses.

Table 2.6.18 summarizes historic Gray Reef Reservoir discharges.

Insert Figure 2.6.6

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Insert Table 2.6.16

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2.6.4.6 Glendo Dam and Reservoir

Background and History

The Glendo Dam, Reservoir, and Powerplant are a part of the U.S. Bureau of Reclamation (USBR) Glendo Unit of the Pick-Sloan Missouri Basin Project. The reservoir furnishes up to a maximum of 40,000 acre-feet of storage water annually for use in Wyoming and Nebraska. Glendo Powerplant provides electrical power to Wyoming, Colorado, and Nebraska. The Glendo Unit also provides flood control, fish and wildlife enhancement, recreation, sediment retention, and pollution abatement.

Glendo Reservoir is operated in conformance with the 1953 U.S. Supreme Court order modifying and supplementing the North Platte River Decree of 1945. The North Platte River Decree was modified again in 2001 by order of the U. S. Supreme Court. The 2001 Modified Decree provides that:

> The operation of Glendo Reservoir shall not affect the regime of the natural flow of the North Platte River except that not more than 40,000 acre feet of the natural flow of the North Platte River and its tributaries which cannot be stored in upstream reservoirs under the provisions of this Modified Decree may be stored in Glendo Reservoir during any water year for disposition by the United States under contracts, in addition to evaporation losses on such storage, and further, the amount of water that may be held in storage at any one time for disposition by the United States under contracts, including carryover storage, shall never exceed 100,000 acre feet. Such storage water shall be disposed of in accordance with contracts executed or to be hereafter executed, in compliance with federal law, and may be used for any beneficial purpose in Nebraska within the Platte River basin to the extent of 25,000 acre feet annually and for any beneficial purpose in Wyoming within the Platte River Basin to the extent of 15,000 acre feet annually. (Supreme Court of the United States, 2001)

Description

Glendo Dam and Powerplant are the newest of Wyoming's North Platte River federal reservoirs. Construction began in 1954 and was finished in 1958. Three miles of Chicago, Burlington and Quincy Railroad track and four miles of state highway U.S. 87 were relocated to construct Glendo Reservoir. Glendo Dam is a zoned, earth fill structure, 190 feet high, with a crest length of 2,096 feet. When initially constructed, the design of Glendo Dam and Powerplant had no provisions to release water at low flow rates. To address this, the U.S. Bureau of Reclamation (USBR) obtained federal funding in the amount of $1.3 million to construct a three-foot diameter low flow outlet works through the right abutment of the dam. The low flow outlet, completed in 1992, provides a continuous release of approximately 25 cubic feet per second (cfs) in the North Platte River below Glendo Dam. A check dam was also constructed to produce wetlands below Glendo Dam (Purcell, 2000).

Glendo Reservoir has a total storage capacity of 795,196 acre-feet at a maximum water surface elevation of 4653.0. Included in this capacity are 271,917 acre-feet of flood control; 100,000 acre-feet irrigation pool; 20,090 acre-feet evaporation pool; 63,148 acre-feet power pool; and 334,247 acre-feet re-regulation space. Space is also provided in the reservoir for storing 115,000 acre-feet of sediment, which is the estimated 100-year sediment accumulation. Through 2003, Glendo Reservoir has prevented $68 million in flood damage (USBR, 2003).

The reinforced concrete Glendo Dam emergency spillway has an ogee crest. In addition to the spillway, the reservoir has an outlet works system that includes an intake structure with a trash rack, the tunnel and conduit mentioned above, a 21-foot surge tank, and a 16 ½-foot by 21-foot fixed wheel gate. Three regulating gates and three emergency gates control outlet works discharge. Restrictions in place for the outlet works due to potential damage limit the maximum discharge to 6,600 cubic feet per second (cfs) at water surface elevation 4635.0 feet and above. In combination with the turbine releases, a maximum discharge rate of 10,000 cfs is specified at water surface elevations 4635 and above. In 1992, a new low flow outlet works was installed. Figure 2.6.7 provides a photograph of Glendo Dam.

Insert Figure 2.6.7

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Power Generation

Glendo Powerplant consists of two generating units with a combined capacity of 38 megawatts. Water at a flow rate of approximately 3,400 cubic feet per second can be released through the powerplant when all generating units are operating at capacity and the reservoir water surface is at an elevation of 4635 feet. Glendo Powerplant is operated on a seasonal basis during the release of irrigation flows. Available power in the North Platte River Basin has increased by approximately 500 million kilowatt-hours annually since the Glendo Unit power generation facilities (Glendo and Fremont Canyon Powerplants) were constructed.

Table 2.6.19 summarizes historic Glendo Reservoir storage volumes.

Table 2.6.20 summarizes historic Glendo Reservoir evaporation losses.

Table 2.6.21 summarizes historic Glendo Reservoir discharges.

Insert Table 2.6.19

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Insert Table 2.6.20

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2.6.4.7 Guernsey Dam and Reservoir

Background and History

Construction of Guernsey Dam and Powerplant was approved as part of the U.S. Bureau of Reclamation (USBR) North Platte Project on April 30, 1925. The dam is located approximately 25 miles below Glendo Dam and approximately 95 miles southeast of Casper. With a structural height of 135 feet, Guernsey Dam is utilized to meet varying downstream irrigation demands. The original capacity of the reservoir was 73,810 acre-feet. Due to silt deposition over the years, the original capacity has been reduced to roughly 45,612 acre-feet. The north spillway, with a discharge capacity of 50,000 cubic feet per second at a reservoir water surface elevation of 4,420 feet, is utilized to release water for irrigation use and to supplement maximum Guernsey Powerplant releases. A photograph of Guernsey Dam is included on Figure 2.6.8.

Insert Figure 2.6.8

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-8

Power Generation

Guernsey Powerplant is located on the southwest river bank below the dam. Construction of the powerplant began in 1925 and was completed in 1928. The powerplant has two 3.2-megawatt electrical generating units and a total water release capacity of approximately 1,340 cubic feet per second. The electric power generated at the plant is supplied to the North Platte Project area by four substations and about 160 miles of transmission lines. Guernsey Powerplant is operated on a seasonal basis during the release of irrigation flows to satisfy downstream irrigation demand on the North Platte River in Wyoming and Nebraska.

Reservoir Operations

Silt runs have been performed at Guernsey Reservoir since 1936. This is the "Bureau's practice of reducing water releases from Glendo Reservoir to lower the level of Guernsey Reservoir so that deposited sediments are flushed from Guernsey reservoir" (USBR, 1983). The silt-laden water flushed from Guernsey Reservoir is diverted into downstream irrigation canals, resulting in decreased canal seepage loss and increased canal bank stability. This practice also helps maintain Guernsey Reservoir water storage capacity.

The silt runs are required by contract with the Goshen, Gering-Fort Laramie, and Pathfinder Irrigation Districts. Under the terms of the current contract, the Districts are provided a continuous seven-day silt run each year without charge and have the option to extend the silt run up to 20 days by payment of a system adjustment charge associated with foregone power generation at the Guernsey Powerplant. During the silt run, power generation at the Guernsey Powerplant is suspended "due to inadequate head and the increased sediment loads drawn through the powerplant turbines" (USBR, 1983).

Table 2.6.22 summarizes historic Guernsey Reservoir storage volumes.

Table 2.6.23 summarizes historic Guernsey Reservoir evaporation losses.

Table 2.6.24 summarizes historic Guernsey Reservoir discharges.

Insert Table 2.6.22

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

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Insert Table 2.6.23

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2.6.4.8 Summary – Federal Reservoir Operations

The USBR System

The seven federal North Platte River reservoirs in Wyoming that are described above and the four off-stream Inland Lakes near Scottsbluff, Nebraska, are monitored and, in most cases, operated as a system by the U.S. Bureau of Reclamation (USBR) office in Mills, Wyoming. This section is intended to provide an overview of how these individual structures are interrelated and are operated as a system. Operation and management of this system is supported by the use of a Programmable Master Supervisory Control, a computerized water accounting process, Hydromet station data, data from control crest measurement weirs at stream flow gauging stations, SNOTEL station data, and a snowmelt runoff forecasting procedure. (USBR, WY2000-2001).

Hydromet stations are automated hydrologic and meteorologic monitoring stations that remotely collect field data and transmit the data via satellite to receiving stations. USBR operates Hydromet stations along the North Platte River in Wyoming at Alcova Reservoir, Glendo Reservoir, Gray Reef Reservoir (two stations), Guernsey Reservoir, Kortes Reservoir, Pathfinder Reservoir, and Seminoe Reservoir. USBR Hydromet data, which are available on the Internet, include current reservoir storage volumes in acre-feet, average historical reservoir storage volumes in acre-feet, daily reservoir evaporation in acre-feet, mean computed reservoir inflows in cubic feet per second, daily mean reservoir discharges in cubic feet per second, and mean daily flows at river gauges located near the reservoirs. This Hydromet information is "integrated with other sources of information to provide streamflow forecasting and current runoff conditions for river and reservoir operations." (USBR, Hydromet)

SNOTEL (SNOwpack TELemetry) data are provided to the USBR by remote sensors that are installed, operated, and maintained by the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture. This system is designed to automatically "collect snowpack and related climatic data in the Western United States and Alaska." SNOTEL "provides reliable and efficiently collected data needed to produce water supply forecasts and to support resource management activities. . . ." Standard SNOTEL sites measure air temperature, precipitation, snow water content, and snow depth. Enhanced SNOTEL sites measure several additional parameters (NRCS, undated). SNOTEL sites are located at various sites in the Snowy Range and Sierra Madre Range mountains above the North Platte River

USBR Annual Operations Plan (AOP)

The U.S. Bureau of Reclamation (USBR) prepares a North Platte River Basin operations summary for each water year, including a projected operating plan for the upcoming water year. These reports are available on the Internet at the address shown in the references section of this technical memorandum. The most recent publicly available annual USBR North Platte River operations report is for water year 2004, with estimated operations for water year 2005. Some key components of the USBR Water Year 2004 Summary of Actual Operations and Water Year 2005 Annual Operating Plans are summarized below.

System Planning and Control:

North Platte River storage, power generation, and water delivery facilities are operated for irrigation, hydroelectric power production, municipal water supply, and industrial water supply. System facilities also provide year-round river flow along specified reaches of the river as well as flood control, recreation, and fish and wildlife preservation. The System is operated as an "integrated system" to "obtain optimum benefits from the individual projects," and system operation is planned and coordinated at the USBR Wyoming Area Office in Mills, Wyoming. System management requires coordination among the USBR, the U.S. Department of Energy, and "many other local, state, and Federal agencies." The USBR contends that proper utilization of System water is "achieved only through careful budgeting of the anticipated water supply," and the end-product of this budgeting process is the Annual Operating Plan (AOP). Each AOP:

- considers water management on a water year basis, October 1 through September 30;
- describes System operations during the current water year and proposes System operations for the following water year;
- is prepared, reviewed, and presented to the public early in each water year;
- includes assessment of "probable," "reasonable maximum," and "reasonable minimum" water supply conditions and requirements for the coming water year; and
- is revised monthly during each water year based on USBR computer modeling.

System Operations – Water Year 2004:

This section of the USBR 2004-2005 AOP assesses and summarizes information regarding major System structures and gains to North Platte River flow along specified reaches of the river. The Water Year 2004 AOP includes descriptions and summaries, beginning upstream and proceeding downstream on the North Platte River, of:

- Seminoe Reservoir inflow;
- Seminoe Reservoir storage and releases;
- Kortes Reservoir storage and releases;
- gains to the North Platte River from Kortes Dam to Pathfinder Dam;
- Pathfinder Dam storage and releases;
- Alcova and Gray Reef Reservoirs storage and releases;
- gains to the North Platte River from Alcova Dam to Glendo Reservoir;
- Glendo Reservoir storage and releases;
- gains to the North Platte River from Glendo Dam to Guernsey Reservoir, and
- Guernsey Reservoir storage and releases.

Photographs of these structures are included in Figures 2.6.2 through 2.6.8 of this technical memorandum. Figure 2.6.1 contains a map showing the locations of these System structures.

This portion of the AOP also includes summaries of current water year precipitation, water allocations, water ownership, flood benefits, and electrical power generation.

Proposed Operations – Water Year 2005:

This section of the USBR 2004-2005 AOP summarizes proposed System operation for water year 2005. Operation of Seminoe Reservoir, Pathfinder Reservoir, Alcova Reservoir, Gray Reef

Reservoir, Glendo and Guernsey Reservoirs, and System water ownership are assessed in terms of "probable 2005 conditions," "reasonable minimum 2005 conditions," and "reasonable maximum 2005 conditions."

In addition to discussion of current water year System operations and proposed System operations for the following water year, each AOP contains a glossary, tables, and figures that summarize and illustrate AOP data.

USBR System Water Accounting

Development of a "system of water accounting" for North Platte River water was required to implement the 1945 North Platte Decree. Beginning in 1946, "Natural Flow and Ownership Meetings" (NFO Meetings), attended by representatives of the States of Nebraska and Wyoming and the U.S. Bureau of Reclamation (USBR), were held on an "approximately" annual basis. The purpose of these meetings has been to provide for "continuous, open dialogue between the parties to the Decree concerning the full range of Decree accounting, administration, and compliance issues." Significant North Platte River water management and accounting concepts that evolved during NFO Meetings have included:

- Storage Ownership Accounting Procedure (Part A), and
- Natural Flow Accounting Procedure (Part B). (Brendecke et al., 2000, pp. 3-1 and 3-11)

NFO Meetings were typically held in March or April and focused on review of previous annual North Platte River Ownership and Natural Flow Accounting Procedures "with a view to making any changes or adjustments that were believed to be desirable or necessary for the upcoming runoff and irrigation season." (Brendecke et al., 2000, p. 3-3). NFO Meetings typically addressed three major topics, including:

- North Platte River Decree (1945) compliance,
- Mainstem reservoirs and North Platte River flow management, and
- other pertinent issues. (Brendecke et al., 2000, p. 3-3)

The principal product of each NFO Meeting was issuance of formal North Platte River Ownership and Natural Flow Accounting Procedures – the water "Accounting Procedures" for the coming irrigation season. Actual river flow accounting is completed "after the fact" and because "stipulated values" are used for some accounting parameters rather than "observed values," North Platte River accounting procedures are "detailed and complex." (Brendecke et al., 2000, p. 3-12)

The Modified Decree formalized the annual process of adopting and negotiating these procedures. The North Platte River Ownership and Natural Flow Accounting Procedures are now discussed and approved by the North Platte Decree Committee at their semiannual spring meeting, which usually occurs in April. An example set of procedures can be found as Exhibit 2 to Appendix G to the Final Settlement Stipulation in Nebraska v. Wyoming, No. 108 Orig., 534 U.S. 40 (2001).

2.6.5 Major Reservoirs with Capacities Greater than or Equal to 1,000 Acre-feet

This section describes Platte River Basin reservoirs which have Wyoming State Engineer's Office (SEO) permitted capacities of 1,000 acre-feet or more, or which are particularly significant water storage structures, regardless of permitted storage capacity. The detail with which each reservoir is described is based on the availability of information regarding that reservoir. Following the descriptions are tables, separated by subbasin, containing reservoir permit information. If available, figures scanned from publicly available SEO permit documents illustrating reservoir, dam, spillway, and outlet details are presented. Area capacity tables from SEO permit documents are also included as shown on SEO permit drawings.

2.6.5.1 Major Reservoirs in the Above Pathfinder Subbasin

The locations of major reservoirs located in the Above Pathfinder Dam subbasin are shown on Figure 2.6.9.

Insert Figure 2.6.9

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-9

Rob Roy Reservoir

Owned and operated by the City of Cheyenne Board of Public Utilities (BOPU), Rob Roy Reservoir is located in the Medicine Bow National Forest west of Laramie, Wyoming, and has a total available capacity of 35,433.92 acre-feet. Permitted for municipal use, industrial use, irrigation, and fish propagation, the reservoir is located in the channel of Douglas Creek. The dam crest elevation is 9,480 feet, and the crest width is 30 feet.

The dam has an overflow emergency spillway crest elevation of 9,420 feet. A morning glory spillway serves as the primary reservoir outlet, with a crest elevation of 9,481 feet. The reservoir has an ogee crest spillway with an invert elevation of 9,470 feet. The spillway width varies from 15 feet, 6 inches to 15 feet, 1¼ inches.

Rob Roy Reservoir is part of the City of Cheyenne's exchange system built to exercise its water right from the Little Snake River. By means of exchange, the City diverts water from the Little Snake River across the Continental Divide through Hog Park Creek and Reservoir and the Encampment River for delivery to the North Platte River as replacement for water diverted by the City from Douglas Creek, which is also a tributary to the North Platte River. The diverted water from Douglas Creek is transported from Rob Roy Reservoir and Lake Owen across the Laramie Valley via the Lake Owen to Middle Crow Creek Pipeline. Once the water is transported across the Laramie Valley, it is stored in Granite Springs and Crystal Lake Reservoirs for municipal use by the City of Cheyenne.

The Cheyenne Board of Public Utilities currently has an agreement with the U.S. Bureau of Reclamation (USBR) to store up to 10,000 acre-feet of water from excess Hog Park Reservoir releases in vacant space in the USBR's Seminoe Reservoir. This stored water can then be exchanged for North Platte River River diversions from Douglas Creek, allowing the City to more fully utilize both its Little Snake River and Douglas Creek water when Hog Park Reservoir releases to the North Platte River are less than the City's use of Douglas Creek water.

Table 2.6.25 summarizes historic Rob Roy Reservoir storage volumes.

Table 2.6.26 provides the Wyoming State Engineer's Office (SEO) permit area capacity table for Rob Roy Reservoir.

Figures 2.6.10 through 2.6.15 show details of Rob Roy Dam.

Insert Table 2.6.25

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-25and27

Insert Table 2.6.26, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Table 2.6.26, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Figure 2.6.10

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-10

Insert Figure 2.6.11

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-11

Insert Figure 2.6.12

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-12

Insert Figure 2.6.13

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-13

Insert Figure 2.6.14

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-14

Insert Figure 2.6.15

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-15

Hog Park Reservoir

Hog Park Reservoir is located in the channel of Hog Park Creek in the Sierra Madre Mountains of south central Wyoming. The reservoir, which is located east of the Continental Divide, is primarily filled by water diverted from the North Fork Little Snake River and tributaries through the Little Snake Diversion Pipeline and Tunnel. Water from this reservoir is appropriated for erosion control, fish culture, flood control, industrial use, municipal use, and irrigation. It is also used as a source of replacement water discharged to the North Platte River in exchange for water diverted below Rob Roy Reservoir on Douglas Creek for the City of Cheyenne Board of Public Utilities municipal, industrial, and irrigation uses.

Hog Park Dam is an earth fill dam with a reinforced concrete pipe outlet and a rock spillway. The available capacity of the reservoir is 22,656.22 acre-feet.

Table 2.6.27 summarizes historic Hog Park Reservoir storage volumes.

Table 2.6.28 provides the Wyoming State Engineer's Office (SEO) permit area capacity table for Hog Park Reservoir.

Figure 2.6.16 provides the Wyoming State Engineer's Office (SEO) permit application Hog Park Reservoir dam cross section.

Figure 2.6.17 provides the Wyoming State Engineer's Office (SEO) permit application Hog Park Reservoir dam profile.

Figure 2.6.18 provides the Wyoming State Engineer's Office (SEO) permit application Hog Park Reservoir spillway detail.

Insert Table 2.6.27

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-25and27

Insert Table 2.6.28, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Table 2.6.28, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Figure 2.6.16

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-16

Insert Figure 2.6.17

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-17

Insert Figure 2.6.18

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-18

Figure 2.6.19 provides the Wyoming State Engineer's Office (SEO) permit application Hog Park Reservoir outlet works detail.

Insert Figure 2.6.19

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-19

Area 2/8 Reclamation Reservoir

Area 2/8 Reclamation Reservoir is used for wildlife and stock purposes. The reservoir is owned by Pathfinder Mines Corporation and has a priority date of 11/21/1991. The sources of supply for the reservoir are provided under Wyoming State Engineer's Office (SEO) Permit No. U.W. 86834, Area 2/8 Reclamation Reservoir Well, and limited surface runoff from Moss Agate Draw and other minor reclamation drainages. The reservoir has a capacity of 13,213.8 acre-feet.

Table 2.6.29 provides the Wyoming State Engineer's Office (SEO) permit area capacity table for the Area 2/8 Reclamation Reservoir.

Insert Table 2.6.29, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Table 2.6.29, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Table 2.6.29, p. 3

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Area 3 Reclamation Reservoir

Area 3 Reclamation Reservoir is located at the Shirley Basin Mine and is owned by Pathfinder Mines Corporation. The reservoir is a large, excavated, and abandoned uranium mine pit that has a capacity of 5,350.93 acre-feet. Water from the reservoir is used for livestock and wildlife watering. Located in the drainage of Spring Creek, the reservoir is filled by groundwater from the Wind River geologic formation under Wyoming State Engineer's Office (SEO) Permit No. U.W. 51774, Final Reclamation Reservoir #1 Well. The reservoir does not have an outlet.

Table 2.6.30 provides the Wyoming State Engineer's Office (SEO) permit area capacity table for the Area 3 Reclamation Reservoir.

Insert Table 2.6.30, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Table 2.6.30, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Table 2.6.30, p. 3

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

No. 4 Evaporation Reservoir

Also located in the Shirley Basin Mine and owned by Pathfinder Mines Corporation, the No. 4 Evaporation Reservoir has a capacity of 3,913.3 acre-feet. The reservoir is permitted for the evaporation of plant effluent (pollution control). The reservoir is located in the channel of Mine Creek and is permitted to be filled through the plant effluent discharge line under Wyoming State Engineer's Office (SEO) Permit No. U.W. 21801.

The plant discharges radioactive effluent, thereby placing the reservoir under the jurisdiction of the U.S. Nuclear Regulatory Commission (NRC). It is assumed this plant is no longer active. The reservoir operates with a required three-foot minimum freeboard. Because of the presence of radioactive material, discharge from the reservoir is prohibited by the NRC. The reservoir has been designed to contain local runoff and does not have an outlet works or spillway.

Table 2.6.31 provides the No. 4 Evaporation Reservoir area capacity table that is shown on the Wyoming State Engineer's (SEO) permit application for this reservoir.

Insert Table 2.6.31

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Figures 2.6.20 and 2.6.21 provide a reservoir cross section and profile, both scanned from the Wyoming State Engineer’s (SEO) permit map for No. 4 Evaporation Reservoir.

Insert Figure 2.6.20

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-20

Insert Figure 2.6.21

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-21

Johnson Reservoir

Johnson Reservoir is located in a natural basin and is filled by discharges from Johnson Ditch No. 1 and Johnson Ditch No. 2. Water from the reservoir is permitted for irrigation use. The reservoir has an available capacity of 3,818.17 acre-feet.

Pierce Reservoir

Constructed in 1912, Pierce Reservoir is used for irrigation, stock, and domestic purposes. The reservoir is located in a natural basin and has a permitted capacity of 3,205.7 acre-feet. The reservoir is permitted to be filled through the Pierce Enlargement of the 7L Ditch.

Upper Rock Creek Reservoir

The Upper Rock Creek Reservoir is located in Fremont County, Wyoming. The reservoir is filled by Rock Creek, which is a tributary of the Sweetwater River tributary North Platte River. Rock Creek that provides water for this reservoir should not be confused with Rock Creek that flows northward through and northeastward from the Medicine Bow National Forest in eastern Carbon County. The water from the reservoir is used for industrial purposes for the beneficiation of iron ore.

As shown on the Wyoming State Engineer's Office (SEO) permit application for this reservoir, the surface area of the reservoir is 67.6 acres at a high-water line of 8320.0 feet, and the total available capacity of the reservoir and its enlargement is 2,799.8 acre-feet. The reservoir dam has a crest length of 20 feet.

The Upper Rock Creek Reservoir has a spillway and an overflow ditch. The reservoir overflow ditch is permitted to carry the overflow from the spillway of the reservoir around the plant to Slate Creek to prevent flooding of the mine and avoid pumping of the bypassed flow into a tailings basin.

Table 2.6.32 provides the Upper Rock Creek Reservoir area capacity table that is shown on the Wyoming State Engineer's (SEO) permit application for this reservoir.

Insert Table 2.6.32

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Figure 2.6.22 shows the Wyoming State Engineer's Office (SEO) permit application Upper Rock Creek Reservoir cross section.

Figure 2.6.23 shows the Wyoming State Engineer's Office (SEO) permit application Upper Rock Creek Reservoir profile.

Figure 2.6.24 shows the Wyoming State Engineer's Office (SEO) permit application Bosler Reservoir cross section and profile.

Insert Figure 2.6.22

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-22

Insert Figure 2.6.23

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-23

Bosler Reservoir

Bosler Reservoir has a permitted available capacity of 1,964.52 acre-feet. The reservoir is used for fish propagation, stock watering, and recreation purposes. The reservoir is located in the channel of Bosler Slough and receives runoff from a drainage area of 3,200 acres.

Table 2.6.33 provides the Bosler Reservoir area capacity table that is shown on the Wyoming State Engineer's (SEO) permit application for this reservoir.

Insert Table 2.6.33

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Figure 2.6.24

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-24

Saratoga Reservoir

Water stored in the Saratoga Reservoir is permitted by the Wyoming State Engineer's Office (SEO) for municipal, recreational, stock watering, and fish culture uses. The permitted capacity of the reservoir is 1,559.40 acre-feet. The reservoir is filled through the Enlargement of the Saratoga Supply Ditch, which receives water from the North Platte River.

SEO permit application documents show a 16-foot crest width for the Saratoga Reservoir dam. The outlet is shown to consist of a 24-inch diameter corrugated metal pipe, and the spillway is shown to consist of a 36-inch by 48-inch corrugated metal pipe.

Table 2.6.34 provides the Saratoga Reservoir area capacity table that is shown on the Wyoming State Engineer's (SEO) permit application for this reservoir.

Insert Table 2.6.34

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Insert Figure 2.6.25

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-25

Figure 2.6.26 shows the Wyoming State Engineer's Office (SEO) permit application Saratoga Reservoir spillway cross section.

Insert Figure 2.6.26

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-26

Green Mountain Mine Reservoir

Green Mountain Mine Reservoir has a total permitted capacity of 1,382 acre-feet. The water in the reservoir is permitted for wildlife preservation and is an off-channel reservoir located in the McDraw drainage. The reservoir is located in Fremont County.

Table 2.6.35 provides the Green Mountain Mine Reservoir area capacity table that is shown on the Wyoming State Engineer's (SEO) permit application for this reservoir.

Insert Table 2.6.35

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Turpin Park Reservoir

Turpin Park Reservoir is located in the channel of Turpin Creek. Permitted by the Wyoming State Engineer's Office (SEO) for irrigation and stock purposes, Turpin Park Reservoir has an available permitted capacity of 1,316.94 acre-feet and a permitted surface area at the reservoir high-water line of 99.28 acres.

Teton Reservoir

Teton Reservoir is permitted for erosion control, recreation, and flood detention. The reservoir has a permitted capacity of 1,298.70 acre-feet. Located in the channel of Little Sage Creek, the reservoir has a dam crest elevation of 7,028 feet. The reservoir outlet pipe is a 36-inch diameter welded steel pipe. The spillway has a width of 150 feet and a permitted discharge capacity of 1,986.6 cubic feet per second.

Table 2.6.36 provides the Teton Reservoir area capacity table that is shown on the Wyoming State Engineer's (SEO) permit application for this reservoir.

Insert Table 2.6.36

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-26and28thru36

Figure 2.6.27 provides the Wyoming State Engineer's Office (SEO) permit application Teton Reservoir cross section.

Figure 2.6.28 provides the Wyoming State Engineer's Office (SEO) permit application Teton Reservoir dam profile.

Figure 2.6.29 provides the Wyoming State Engineer's Office (SEO) permit application Teton Reservoir spillway cross section.

Insert Figure 2.6.27

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-27

Insert Figure 2.6.28

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-28

Insert Figure 2.6.29

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-29

Sand Lake Reservoir

Sand Lake Reservoir is located in the Medicine Bow National Forest on the channel of Deep Creek. The reservoir is permitted for irrigation, stock, domestic, and industrial uses. The permitted capacity of the reservoir is 1,105.1 acre-feet.

Tables 2.6.37 through 2.6.41 provide an overview of the Wyoming State Engineer's Office (SEO) permit application information for major reservoirs in the Above Pathfinder subbasin.

Insert Table 2.6.37

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-37thru41

Insert Table 2.6.38

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-37thru41

Insert Table 2.6.39

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-37thru41

Insert Table 2.6.40

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-37thru41

Insert Table 2.6.41

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-37thru41

<u>2.6.5.2 Major Reservoirs in the Pathfinder to Guernsey Subbasin</u>

The locations of major reservoirs in the Pathfinder to Guernsey Reservoir are shown on Figure 2.6.30.

Insert Figure 2.6.30

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-30

LaPrele Reservoir

LaPrele Reservoir is owned by the LaPrele Irrigation District. The reservoir is located in the channel of LaPrele Creek and has an adjudicated capacity of 20,000 acre-feet. The permitted uses of the reservoir are irrigation, domestic, and industrial. The reservoir outlet consists of three 3-foot diameter pipes. The spillway is 50 feet wide.

Table 2.6.42 provides a summary of LaPrele Reservoir monthly releases obtained from annual hydrographer's reports.

Insert Table 2.6.42

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-42

Johnson No. 1 Reservoir

Permitted for stock, domestic, and engine purposes, Johnson No. 1 Reservoir has an adjudicated capacity of 11,865 acre-feet. The reservoir is filled via Middle Fork Casper Creek and Supply No. 2 Ditch and via Tie Bridge Gulch through Supply No. 1 Ditch.

Figure 2.6.31 provides the Wyoming State Engineer's Office (SEO) permit application Johnson No. 1 Reservoir dam cross section.

Figure 2.6.32 provides the Wyoming State Engineer's Office (SEO) permit application Johnson No. 1 Reservoir dam profile.

Insert Figure 2.6.31

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-31

Insert Figure 2.6.32

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-32

Soda Lake Reservoir

Soda Lake is located in Natrona County and is owned by Amoco Oil Company. The reservoir is adjudicated for industrial pollution control and remediation and has an adjudicated capacity of 8,815 acre-feet. The reservoir holds waste process water containing chemicals and/or oil to prevent pollution of the North Platte River. The structure is used as a retention structure, so no water leaves the reservoir.

Table 2.6.43 provides the Wyoming State Engineer's Office (SEO) permit application Soda Lake Reservoir area capacity table.

Insert Table 2.6.43

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-43thru45

Figure 2.6.33 provides the Wyoming State Engineer's Office (SEO) permit application Soda Lake Reservoir dam cross section.

Insert Figure 2.6.33

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-33

Bates Creek Reservoir

Permitted for irrigation use, Bates Creek Reservoir has a permitted capacity of 4,717 acre-feet. The reservoir is located in the channel of the Dry Fork Bates Creek, which is an ephemeral stream. The reservoir also receives a supply from Bates Creek through the Bates Creek Reservoir Co. Inlet Ditch. The dam outlet consists of a 24-inch diameter concrete pipe, and the spillway is 200 feet wide.

Table 2.6.44 provides the Wyoming State Engineer's Office (SEO) permit application Bates Creek Reservoir area capacity table.

Insert Table 2.6.44

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-43thru45

Figure 2.6.34 provides the Wyoming State Engineer's Office (SEO) permit application Bates Creek Reservoir dam cross section.

Insert Figure 2.6.34

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-34

J. and J. Reservoir

J. and J. Reservoir is located in Natrona County and is permitted for irrigation. This reservoir has a permitted capacity of 1,423.1 acre-feet. The reservoir is filled through the J. and J. Supply Ditch Canal. The reservoir spillway is 152 feet wide.

Table 2.6.45 provides the Wyoming State Engineer's Office (SEO) permit application J. and J. Reservoir area capacity table.

Insert Table 2.6.45

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-43thru45

Figure 2.6.35 provides the Wyoming State Engineer's Office (SEO) permit application J. and J. Reservoir dam cross section and profile.

Figure 2.6.36 provides the Wyoming State Engineer's Office (SEO) permit application J. and J. Reservoir spillway cross section.

Insert Figure 2.6.35

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-35

Insert Figure 2.6.36

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-36

Reynolds No. 2 Reservoir

Reynolds No. 2 Reservoir is permitted for irrigation and stock water. The total permitted reservoir capacity is 1,008 acre-feet, and the reservoir surface area is 168 acres. The dam has two 6-inch diameter iron pipe outlets. Two spillways are located at the reservoir, one at each end of the dam, and each is 50 feet wide.

Tables 2.6.46 through 2.6.50 provide an overview of the Wyoming State Engineer's Office (SEO) permit application information for major reservoirs in the Above Pathfinder subbasin.

Insert Table 2.6.46

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-46thru50

Insert Table 2.6.47

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-46thru50

Insert Table 2.6.48

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-46thru50

Insert Table 2.6.49

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-46thru50

Insert Table 2.6.50

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-46thru50

2.6.5.3 Major Reservoirs in the Guernsey to State Line Subbasin

The locations of major reservoirs in the Guernsey to State Line subbasin are shown on Figure 2.6.37.

Insert Figure 2.6.37

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-37

Detention Reservoir Pine Ridge – 1

The Detention Reservoir Pine Ridge – 1 is permitted for flood control purposes only. The reservoir is located in the channel of Eaton Draw and has a permitted capacity of 2,207.72 acre-feet. The reservoir has an emergency spillway at invert elevation 4,325 feet.

Table 2.6.51 provides the Wyoming State Engineer's Office (SEO) permit application Detention Reservoir Pine Ridge – 1 Reservoir area capacity table.

Insert Table 2.6.51

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-51thru53

Figure 2.6.38 provides the Wyoming State Engineer's Office (SEO) permit application Detention Reservoir Pine Ridge – 1 dam cross section.

Figure 2.6.39 provides the Wyoming State Engineer's Office (SEO) permit application Detention Reservoir Pine Ridge – 1 Reservoir spillway profile.

Insert Figure 2.6.38

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-38

Insert Figure 2.6.39

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-39

Detention Reservoir Case Bier – 1

Flood control is the only use permitted for the Detention Reservoir Case Bier – 1. Located in Goshen County, the reservoir is north of Fort Laramie, Wyoming. The earthfill dam has a permitted capacity of 1,458.88 acre-feet and is filled by the Case Bier Draw. The emergency spillway has a crest width of 350 feet and an invert elevation of 4,342 feet.

Table 2.6.52 provides the Wyoming State Engineer's Office (SEO) permit application Detention Case Bier – 1 Reservoir area capacity table.

Insert Table 2.6.52

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-51thru53

Figure 2.6.40 provides the Wyoming State Engineer’s Office (SEO) permit application Detention Reservoir Case Bier – 1 dam cross section.

Figure 2.6.41 provides the Wyoming State Engineer’s Office (SEO) permit application Detention Reservoir Case Bier – 1 dam profile.

Figure 2.6.42 provides the Wyoming State Engineer’s Office (SEO) permit application Detention Reservoir Case Bier – 1 Reservoir spillway profile.

Insert Figure 2.6.40

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-40

Insert Figure 2.6.41

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-41

Insert Figure 2.6.42

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-42

Harris Reservoir

Harris Reservoir is an earthfill dam permitted for irrigation, power, and stock uses. The reservoir is located in the channel of J M Creek and has a permitted capacity of 1,305.85 acre-feet. The J M Creek source of supply for Harris Reservoir is supplemented by water from Rawhide Creek through the Harris No. 2 Ditch. Harris Reservoir has an area of 93.8 acres with a maximum depth of 30 feet. The outlet consists of a 14-inch pipe. The reservoir has two spillways, one of which is 200 feet wide and the other of which is 100 feet wide.

Figure 2.6.43 provides the Wyoming State Engineer's Office (SEO) permit application Harris Reservoir dam cross section and profile.

Insert Figure 2.6.43

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-43

Arnold Reservoir

Arnold Reservoir is located in the channel of Arnold Drain and is permitted for flood control. The area of the reservoir at its high-water line is 226.9 acres, and the permitted capacity is 1,134.45 acre-feet. The dam is an earthfill dam, and the slopes of the dam have vegetation planted to prevent erosion. The invert of the emergency spillway is located at elevation 4,174 feet, and the emergency spillway is 300 feet in width. The emergency spillway has a permitted discharge capacity of 884 cubic feet per second.

Table 2.6.53 provides the Wyoming State Engineer's Office (SEO) permit application Arnold Reservoir area capacity table.

Insert Table 2.6.53

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-51thru53

Figure 2.6.44 provides the Wyoming State Engineer's Office (SEO) permit application Arnold Reservoir dam cross section.

Figure 2.6.45 provides the Wyoming State Engineer's Office (SEO) permit application Arnold Reservoir dam profile and emergency spillway cross section.

Tables 2.6.54 through 2.6.58 provide an overview of the Wyoming State Engineer's Office (SEO) permit application information for major reservoirs in the Guernsey to State Line subbasin.

Insert Figure 2.6.44

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-44

Insert Figure 2.6.45

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-45

Insert Table 2.6.54

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-54thru58

Insert Table 2.6.55

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-54thru58

Insert Table 2.6.56

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-54thru58

Insert Table 2.6.57

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-54thru58

Insert Table 2.6.58

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-54thru58

<u>2.7.5.4 Major Reservoirs in the Upper Laramie Subbasin</u>

The locations of major reservoirs in the Upper Laramie subbasin are shown on Figure 2.6.46.

Insert Figure 2.6.46

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-46

Wyoming Development Co. No. 2 Reservoir (Wheatland Irrigation District No. 2 Reservoir)
Wyoming Development Company No. 2 Reservoir is more commonly referred to as Wheatland Irrigation District No. 2 Reservoir. This large irrigation reservoir has a permitted storage capacity of 98,934.00 acre-feet and a January 29, 1898 priority date. The dam has a 3H:1V upstream face slope and a 2H:1V downstream face slope. The upstream dam face is armored with 18 inches of riprap and gravel. About 1,200 linear feet of steel sheet piling has been installed along the upstream toe of the dam along the highest portion of the dam. The dam outlet works consists of a masonry drop inlet near the upstream toe of the dam and a masonry discharge tunnel through the dam.

Table 2.6.59 provides a summary of Wheatland Irrigation District No. 2 Reservoir monthly releases obtained from annual hydrographer's reports.

Insert Table 2.6.59

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-59and60and62and63and68

Figures 2.6.47 and 2.6.48 show the dam section and outlet works and a partial dam profile of Wyoming Development Company No. 2 Reservoir (Wheatland No. 2 Reservoir).

Insert Figure 2.6.47

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-47

Insert Figure 2.6.48

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-48

Wheatland Irrigation District No. 3 Reservoir

Wheatland Irrigation District No. 3 Reservoir is located in Albany County, Wyoming. The reservoir is permitted for irrigation and stock uses. The reservoir is located in the basin adjoining the Laramie River, west of Wyoming Development Company No. 2 Reservoir (Wheatland Irrigation District No. 2 Reservoir). The reservoir has a permitted capacity of 71,318.80 acre-feet.

Water is taken from the Wheatland Irrigation District No. 2 Reservoir via the Reservoir Canal and Intake-Outlet Canal to fill the Wheatland Irrigation District No. 3 Reservoir. The water flow from Wheatland Irrigation District No. 2 Reservoir to Wheatland Irrigation District No. 3 Reservoir has a maximum rate of 2,118 cubic feet per second, which reduces as the Wheatland Irrigation District No. 3 Reservoir inflow rate reaches 100 cubic feet per second. Water can be released from the No. 3 Reservoir at a maximum discharge rate of 600 cubic feet per second via the Outlet Canal. After the water flows through the No. 2 Reservoir Outlet Canal, it discharges into the Laramie River and then into the Wheatland Irrigation District distribution system.

Table 2.6.60 provides a summary of Wheatland Irrigation District No. 3 Reservoir monthly releases obtained from annual hydrographer's reports.

Insert Table 2.6.60

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-59and60and62and63and68

Table 2.6.61 provides the Wyoming State Engineer's Office (SEO) permit application Wheatland Irrigation District No. 3 Reservoir area capacity table.

Figures 2.6.49 through 2.6.51 provide the Wyoming State Engineer's Office (SEO) permit application Wheatland Irrigation District No. 3 Reservoir cross sections and profiles.

Insert Table 2.6.61

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-61and64thru67and69

Insert Figure 2.6.49

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-49

Insert Figure 2.6.50

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-50

Insert Figure 2.6.51

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-51

Lake Hattie Reservoir

Located in Albany County, Lake Hattie Reservoir is about 15 miles west of Laramie. The original purpose of the reservoir was to provide irrigation storage for water drawn from both the Big and Little Laramie Rivers. Water is released from Lake Hattie Reservoir into Hattie Canal No. 1 through large control gates and outlet pipes (WWC, 2003).

Lake Hattie has a permitted capacity of 65,260 acre-feet. The reservoir is permitted for irrigation, municipal use, industrial use, fish propagation, flood control, power, and domestic use. Lake Hattie is supplied by the Lake Hattie Supply Canals Nos. 1 and 2, which have a carrying capacity of 1,500 and 700 cubic feet per second, respectively. Lake Hattie Supply Canal No. 1 water comes from the Laramie River, while Supply Canal No. 2 comes from the Little Laramie River. Lake Hattie is used for hold-over irrigation water storage, and the quantity of water held over in the reservoir varies from year to year.

Significant sediment deposition has occurred in the southeastern corner of the lake, where reservoir outlet pipes and control gates are located. Due to this sediment buildup, the outlet control gates cannot currently be opened (WWC, 2003).

Inflow from the Laramie River into Lake Hattie varies from year to year. Senior water rights result in very little inflow into Lake Hattie during dry years. This reservoir also loses about three vertical feet per year of storage water to evaporation (WWC, 2003).

Table 2.6.62 provides a summary of Lake Hattie monthly storage data obtained from annual hydrographer's reports.

Insert Table 2.6.62

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-59and60and62and63and68

James Lake Reservoir

James Lake is permitted for irrigation use. The reservoir is located in the channel of Seven Mile Creek and also receives water from Mill Creek through the James Lake Supply Canal-Mill Creek Diversion. This reservoir also receives water from the Little Laramie River through the Bellamy Ditch at a rate not to exceed 95.0 cubic feet per second (cfs). There is no dam associated with this reservoir.

Table 2.6.63 provides a summary of James Lake Reservoir monthly storage data obtained from annual hydrographer's reports.

Insert Table 2.6.63

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-59and60and62and63and68

Twin Buttes Reservoir

Twin Buttes Reservoir is located in Albany County, Wyoming. The reservoir is permitted for both fish propagation and recreation uses. A portion of the water stored in Twin Buttes Reservoir is a result of a change in point of storage of 300 acre-feet annually from Lake Hattie Reservoir. Located in the channel of Mortensen Draw, Twin Buttes Reservoir has a total permitted capacity of 3,912.3 acre-feet, of which 936.9 acre-feet is live storage and 2,975.4 acre-feet is dead storage. The maximum high-water surface elevation for the reservoir is 7,250 feet.

Table 2.6.64 provides the Wyoming State Engineer's Office (SEO) permit application Twin Buttes Reservoir area capacity table.

Insert Table 2.6.64

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-61and64thru67and69

Figure 2.6.52 provides the Wyoming State Engineer's Office (SEO) permit application Twin Buttes Reservoir dam and spillway cross section.

Figure 2.6.53 provides the Wyoming State Engineer's Office (SEO) permit application Twin Buttes Reservoir dam profile.

Insert Figure 2.6.52

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-52

Insert Figure 2.6.53

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-53

Twelve Mile Reservoir

Twelve Mile Reservoir is permitted for irrigation, domestic use, transportation, power, mechanic, manufacturing, mining, milling, quarrying, and for any and all beneficial uses. The reservoir is filled through the enlargement of the Pioneer Canal and the enlargement of the Lake Hattie Supply Canals No. 1 and No. 2. The permitted capacity of the reservoir is 3,420.5 acre-feet, and the reservoir surface area at the high-water line is 206 acres. The dam is an earthfill structure with brush riprap to prevent erosion.

Table 2.6.65 provides the Wyoming State Engineer's Office (SEO) permit application Twelve Mile Reservoir area capacity table.

Insert Table 2.6.65

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-61and64thru67and69

Figure 2.6.54 provides the Wyoming State Engineer's Office (SEO) permit application Twelve Mile Reservoir dam cross section.

Insert Figure 2.6.54

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-54

Dutton Creek Reservoir

Dutton Creek Reservoir is located near Rock River, Wyoming, in Albany County. The reservoir is used for irrigation and stock watering and also receives water from Rock Creek through the Enlargement of the Canon Ditch. Dutton Creek Reservoir has a permitted capacity of 2,566 acre-feet and a surface area at the reservoir high-water line of 290 acres. The outlet is an 18-inch cast iron pipe, and a shut-off valve is located at the downstream end of the outlet pipe. The reservoir spillway is 200 feet wide.

King No. 1 Reservoir

King No. 1 Reservoir has a surface area of 230.2 acres at the reservoir high-water line and a permitted capacity of 2,216 acre-feet. This reservoir also receives water from Rock Creek through the Enlargement of the Canon Ditch and from One Mile Creek through the Enlargement of the Canon Ditch. The dam crest width is 20 feet. In 1977, plans for renovation of the dam outlet works were approved. A 30-inch corrugated metal pipe (CMP) outlet replaced an existing 24-inch outlet pipe.

Sportsman Lake Reservoir

Sportsman Lake is a natural reservoir with a permitted capacity of 1,459 acre-feet. The reservoir is supplied through the Sportsman Lake supply ditch, which has a carrying capacity of 86 cubic feet per second. Sportsman Lake discharges water through an open cut ditch.

Table 2.6.66 provides the Wyoming State Engineer's Office (SEO) permit application Sportsman Lake Reservoir area capacity table.

Insert Table 2.6.66

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-61and64thru67and69

Figure 2.6.55 provides the Wyoming State Engineer's Office (SEO) permit application Sportsman Lake Reservoir outlet design.

Insert Figure 2.6.55

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-55

Willow Creek Reservoir

Willow Creek Reservoir is located on the channel of Willow Creek. The permitted uses for the Willow Creek Reservoir are irrigation, stock use, and domestic use. The permitted capacity of the reservoir is 473.71 acre-feet, and the dam has a crest width of 12 feet. Total reservoir capacity at the emergency spillway invert elevation is 1,505.24 acre-feet.

Table 2.6.67 provides the Wyoming State Engineer's Office (SEO) permit application Willow Creek Reservoir area capacity table.

Insert Table 2.6.67

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-61and64thru67and69

Figures 2.6.56 and 2.6.57 provide the Wyoming State Engineer's Office (SEO) permit application Willow Creek No. 2 Reservoir cross sections of the main dam and Dike No. 1, the larger of two secondary dams.

Insert Figure 2.6.56

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-56

Insert Figure 2.6.57

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-57

Berg Reservoir (Lake Owen)

Berg Reservoir, also known as Lake Owen, has a permitted storage capacity of 750.68 acre-feet. This reservoir is included in this section due to the fact that it is an essential component of the City of Cheyenne municipal water supply system. Berg Reservoir is filled through the Douglas Creek Diversion Pipeline and is used for municipal, industrial, and irrigation purposes.

Table 2.6.68 provides a summary of Berg Reservoir (Lake Owen) monthly inflow from Rob Roy Reservoir data obtained from annual hydrographer’s reports.

Insert Table 2.6.68

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-61and64thru67and69

Table 2.6.69 provides the Wyoming State Engineer’s Office (SEO) permit application Berg Reservoir (Lake Owen) area capacity table.

Figure 2.6.58 provides the Wyoming State Engineer’s Office (SEO) permit application Berg Reservoir (Lake Owen) dam cross section.

Figure 2.6.59 provides the Wyoming State Engineer’s Office (SEO) permit application Berg Reservoir (Lake Owen) dam profile.

Figure 2.6.60 provides the Wyoming State Engineer’s Office (SEO) permit application Berg Reservoir (Lake Owen) spillway cross section.

Tables 2.6.70 through 2.6.74 provide an overview of the Wyoming State Engineer’s Office (SEO) permit application information for major reservoirs in the Upper Laramie subbasin.

Insert Table 2.6.69

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-61and64thru67and69

Insert Figure 2.6.58

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-58

Insert Figure 2.6.59

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-59

Insert Figure 2.6.60

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-60

Insert Table 2.6.70

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-70thru74

Insert Table 2.6.71

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-70thru74

Insert Table 2.6.72

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-70thru74

Insert Table 2.6.73

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-70thru74

Insert Table 2.6.74

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-70thru74

2.6.5.5 Major Reservoirs in the Lower Laramie Subbasin

The locations of major reservoirs in the Lower Laramie subbasin are shown on Figure 2.6.61.

Insert Figure 2.6.61

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-61

Grayrocks Reservoir

Located near Wheatland, Wyoming, in Platte County, Grayrocks Reservoir is a zoned earthfill structure with a permitted capacity of 104,109.6 acre-feet. The reservoir is located on the channel of the Laramie River and is permitted for fish propagation, irrigation, wildlife, industrial, and recreational uses. The dam is 94 feet high with a crest length of 2,555 feet. The upstream embankment slope is 3:1, and the downstream embankment slope is 2.5:1. The upstream slope is also protected by riprap.

Grayrocks Reservoir has both a principal spillway or outlet works and an emergency spillway. The principal spillway is constructed of reinforced concrete and has a discharge capacity of 13,500 cubic feet per second at the maximum high-water surface elevation of 4,415 feet. The principal spillway or outlet works is located close to the right abutment of the dam. This principal spillway's location was chosen to reduce foundation subsidence under the spillway. From the principal spillway, water discharges directly into the Laramie River (J.T. Banner & Associates, 1975). The emergency spillway is an unlined fuse plug structure with a discharge capacity of 131,000 cubic feet per second at the maximum reservoir high-water line.

Table 2.6.75 provides a summary of Grayrocks Reservoir end-of-month storage and monthly inflow from annual hydrographer's reports.

Insert Table 2.6.75

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-75and77and78and81

Table 2.6.76 provides the Wyoming State Engineer’s Office (SEO) permit application Grayrocks Reservoir area capacity table.

Figure 2.6.62 provides the Wyoming State Engineer’s Office (SEO) permit application Grayrocks Reservoir dam cross section.

Figure 2.6.63 provides the Wyoming State Engineer’s Office (SEO) permit application Grayrocks Reservoir dam profile.

Insert Table 2.6.76

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-76and79and80and82

Insert Figure 2.6.62

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-62

Insert Figure 2.6.63

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-63

Wyoming Development Company No. 1 Reservoir

Permitted for irrigation, stock, and domestic use, the Wyoming Development Company No. 1 Reservoir and its enlargements have a permitted capacity of 9,369.75 acre-feet. The reservoir is filled through the Enlargement of the Wyoming Development Company No. 1 and No. 3 Canals, which have a carrying capacity of 500 and 1,500 cubic feet per second, respectively.

North Laramie Land Company No. 3 Reservoir

The North Laramie Land Company No. 3 Reservoir is used for recreation and fish propagation. The reservoir is located in a natural basin. The No. 3 Reservoir is filled by the North Laramie Land Company Canal. The No. 3 Reservoir outlet is through an 18-inch cast iron pipe. The spillway crest width ranges from 600 feet to 1,000 feet.

Table 2.6.77 provides a summary of North Laramie Land Company No. 3 Reservoir monthly storage volumes obtained from annual hydrographer's reports.

Insert Table 2.6.77

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-75and77and78and81

Toltec Reservoir

Toltec Reservoir is located on the channel of the North Laramie River. This reservoir is permitted for irrigation, recreation, and stock water. The total permitted capacity of the reservoir is 2,945 acre-feet, and the surface area of the reservoir at the high-water elevation is 227.68 acres. The dam is an earthfill structure with a concrete core, with the upstream face of the dam protected by rock riprap.

Table 2.6.78 provides a summary of Toltec Reservoir monthly storage volumes obtained from annual hydrographer's reports.

Insert Table 2.6.78

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-75and77and78and81

Table 2.6.79 provides the Wyoming State Engineer's Office (SEO) permit application Toltec Reservoir area capacity table.

Figure 2.6.64 provides the Wyoming State Engineer's Office (SEO) permit application Toltec Reservoir dam cross section.

Figure 2.6.65 provides the Wyoming State Engineer's Office (SEO) permit application Toltec Reservoir dam profile and maximum dam cross section

Insert Table 2.6.79

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-76and79and80and82

Insert Figure 2.6.64

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-64

Insert Figure 2.6.65

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-65

MBPP Ash Pond

The MBPP Ash Pond is permitted solely for pollution control purposes by the Basin Electric Power Cooperative in Platte County. The reservoir consists of three cells, in which the total permitted capacity is 2,111.1 acre-feet. Located in the Seepage Water Hole Draw, the reservoir is filled through a pipeline from the Laramie River Power Station.

Table 2.6.80 provides the Wyoming State Engineer's Office (SEO) permit application MBPP Ash Pond Reservoir area capacity table.

Insert Table 2.6.80

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-76and79and80and82

Figure 2.6.66 provides the Wyoming State Engineer’s Office (SEO) permit application MBPP Ash Pond Reservoir outlet works drawing.

Insert Figure 2.6.66

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-66

North Laramie Land Company No. 1 Reservoir

The North Laramie Land Company No. 1 Reservoir is permitted for irrigation, stock, and domestic purposes. The reservoir is located in a draw and a swale that are connected by an open channel. The reservoir is filled through the North Laramie Land Company Canal and discharges to the North Laramie Land Company No. 2 Reservoir. The dam outlet is a 24-inch cast iron pipe.

Table 2.6.81 provides a summary of North Laramie Land Company No. 1 Reservoir monthly storage volumes obtained from annual hydrographer's reports.

Insert Table 2.6.81

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-75and77and78and81

Glomill Reservoir

Located in a natural basin, Glomill Reservoir is permitted for irrigation purposes. The total permitted capacity of the reservoir is 1,296.4 acre-feet. Filled by the Glomill Ditch, the reservoir has a surface area at the high-water elevation of 259.6 acres. Glomill Reservoir has both an east and a west spillway, each of which is 200 feet wide. The physical characteristics of the east and west spillways are identical, and combined spillway discharge capacity is 3,962 cubic feet per second.

Table 2.6.82 provides the Wyoming State Engineer's Office (SEO) permit application Glomill Reservoir area capacity table.

Insert Table 2.6.82

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-76and79and80and82

Figure 2.6.67 provides the Wyoming State Engineer’s Office (SEO) permit application Glomill Reservoir dam and outlet works cross sections.

Figure 2.6.68 provides the Wyoming State Engineer’s Office (SEO) permit application Glomill Reservoir dam profile.

Tables 2.6.83 through 2.6.87 provide an overview of the Wyoming State Engineer’s Office (SEO) permit application information for major reservoirs in the Lower Laramie subbasin.

Insert Figure 2.6.67

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-67

Insert Figure 2.6.68

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-68

Insert Table 2.6.83

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-83thru87

Insert Table 2.6.84

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-83thru87

Insert Table 2.6.85

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-83thru87

Insert Table 2.6.86

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-83thru87

Insert Table 2.6.87

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-83thru87

2.6.5.6. Major Reservoirs in the Horse Creek Subbasin

The locations of major reservoirs in the Horse Creek subbasin are shown on Figure 2.6.69.

Insert Figure 2.6.69

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-69

Hawk Springs Reservoir

Hawk Springs Reservoir is the primary storage reservoir for the Horse Creek Conservation District. Located southeast of the town of Hawk Springs, storage water is released from Hawk Springs Reservoir into the Hawk Springs Canal and travels approximately 13 miles to the Sinnard Reservoir. In 1985, improvements were made to the Hawk Springs Reservoir and canal.

The Hawk Springs Reservoir consists of one main earthfill dam and three small dikes. The reservoir is an off-stream reservoir with a drainage area of approximately 15 square miles. The Hawk Springs Reservoir does not have a spillway. The main dam contains two separate outlet works. One outlet has a discharge capacity of 210 cubic feet per second and releases to the Hawk Springs Ditch for distribution throughout the irrigation district, and the second outlet has a capacity of 8.57 cubic feet per second and is a water right held by Lincoln Land Company.

Table 2.6.88 provides a summary of Hawk Springs Reservoir end-of-year storage volumes obtained from annual hydrographer's reports.

Insert Table 2.6.88

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-88thru90

Goshen Hole Reservoir (Springer Reservoir)

Permitted for irrigation purposes, Goshen Hole Reservoir, which is also known as Springer Reservoir, has a permitted capacity of 4,961.19 acre-feet. Heavy rock riprap and hay bales protect the upstream face of the dam from erosion. The reservoir is filled through the Enlargement of the Goshen Hole Supply Canal.

Table 2.6.89 provides a summary of Goshen Hole Reservoir end-of-year storage volumes obtained from annual hydrographer's reports.

Insert Table 2.6.89

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-88thru90

J. H. D. No. 1 Reservoir

The J. H. D. No. 1 Reservoir has a permitted capacity of 2,040.85 acre-feet. The reservoir is filled by a supply ditch. The dam outlet works consist of one 10-inch diameter cast iron pipe that discharges into the "Overflow Pond" and a second 10-inch diameter cast iron pipe that discharges into the "irrigation ditch".

Figure 2.6.70 provides the Wyoming State Engineer's Office (SEO) permit application J. H. D. No. 1 Reservoir dam cross section and profile.

Insert Figure 2.6.70

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-70

Goshen Reservoir

The Goshen Reservoir is permitted for irrigation purposes. The reservoir is filled through a supply canal and has a permitted capacity of 765.60 acre-feet. The dam outlet is a 24-inch diameter iron pipe. The reservoir also has a natural spillway, which is 100 feet wide.

Goshen No. 1 and No. 2 Reservoirs (Bump-Sullivan Reservoir)

Also known as Bump-Sullivan Reservoir, Goshen No. 1 and No. 2 Reservoirs are two earthfill dams with a drainage area of approximately six square miles. The reservoirs are filled via the Goshen Ditch, which has a discharge capacity of 50 cubic feet per second. The reservoirs have a permitted capacity of 1,929 acre-feet. Permitted uses for the reservoir include irrigation, stock, and domestic uses.

A grassed fuse-type emergency spillway approximately 30 feet wide is located between the two dams. The outlet works has a discharge capacity of 10 cubic feet per second and discharges water into the Bump-Sullivan Ditch.

Table 2.6.90 provides a summary of Goshen No. 1 and No. 2 Reservoirs (Bump-Sullivan Reservoir) end-of-year storage volumes obtained from annual hydrographer's reports.

Insert Table 2.6.90

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-88thru90

Figure 2.6.71 provides the Wyoming State Engineer’s Office (SEO) permit application Enl. Goshen Reservoirs No. One and Two dam profiles and cross section.

Insert Figure 2.6.71

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-71

Sinnard Reservoir

Constructed in the 1920's and located on Sinnard Draw tributary Horse Creek, Sinnard Reservoir is located roughly 7.6 miles upstream of the confluence of Sinnard Draw and Horse Creek. The reservoir is located in Goshen County and is approximately one mile north and four miles west of the town of Hawk Springs. The Horse Creek Conservation District (HCCD) both owns and operates the reservoir and dam. Sinnard Reservoir is considered an off-channel reservoir since the Hawk Springs Canal is the main source of reservoir water supply (Banner, 1993).

Sinnard Dam is an earthfill structure with a drainage area of approximately eight square miles. The dam has a crest width of 12 feet and a crest length of 1,350 feet. An open channel emergency spillway approximately 300 feet wide is located around the left abutment of the dam. Hawk Springs Reservoir provides a major portion of the storage inflow to Sinnard Reservoir. The permitted capacity of Sinnard Reservoir is 1,358.31 acre-feet.

Sinnard Reservoir's primary use is as a re-regulation facility. During times when irrigation demand is very high, the Hawk Springs Canal does not have enough capacity to support irrigation demand. Sinnard Reservoir stores water and then releases the water to "satisfy the shortfall from the Canal" (Banner, 1993). Lands within the HCCD along the north side of Lone Tree Creek are served by water released from Sinnard Reservoir into Sinnard Ditch. Throughout most of the irrigation season, "Sinnard Reservoir provides a buffer in the HCCD canal system which allows relatively constant releases to be maintained from Hawk Springs Reservoir" (Banner, 1993).

Table 2.6.91 provides the Wyoming State Engineer's Office (SEO) permit application Sinnard Reservoir area capacity table.

Insert Table 2.6.91

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-91

Figure 2.6.72 provides the Wyoming State Engineer's Office (SEO) permit application Sinnard Reservoir dam cross section and profile.

Tables 2.6.92 through 2.6.96 provide an overview of the Wyoming State Engineer's Office (SEO) permit application information for major reservoirs in the Horse Creek subbasin.

Insert Figure 2.6.72

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-72

Insert Table 2.6.92

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-92thru96

Insert Table 2.6.93

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-92thru96

Insert Table 2.6.94

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-92thru96

Insert Table 2.6.95

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-92thru96

Insert Table 2.6.96

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-92thru96

2.6.5.7 Major Reservoirs in the South Platte Subbasin

The locations of major reservoirs in the South Platte subbasin are shown on Figure 2.6.73.

Insert Figure 2.6.73

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-73

Granite Springs Reservoir

Granite Springs Reservoir is located at elevation 7,210 on Middle Crow Creek in Laramie County. This reservoir has an ajudicated capacity of 7,367 acre-feet, or about 12 percent of total City of Cheyenne municipal surface water storage capacity. Granite Springs Reservoir is one of four reservoirs, including Rob Roy Reservoir, Lake Owen, and Crystal Lake Reservoir, that comprise the raw, or untreated, surface water storage system for the City of Cheyenne municipal water supply. The reservoir stores surface water received by both Stage I and Stage II pipelines from Douglas Creek via Lake Owen in the Medicine Bow Range west of Laramie. In addition to serving as a municipal water storage reservoir, Granite Springs Reservoir is an “active recreational site, with boating, fishing, and camping” (Ogle et al., 1999).

Figures 2.6.74 and 2.6.75 show the Wyoming State Engineer’s Office (SEO) permit application for Granite Springs Reservoir including the dam plan, profile, and cross section.

Insert Figure 2.6.74

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-74

Insert Figure 2.6.75

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-75

Crystal Lake Reservoir

Crystal Lake Reservoir is also located on Middle Crow Creek in Laramie County. The adjudicated capacity of this reservoir is 3,618 acre-feet, or about 8 percent of total City of Cheyenne municipal surface water storage capacity. Crystal Lake Reservoir is located at elevation 6,969 a short distance downstream of Cheyenne No. 2 Reservoir and receives water by pipeline and channel flow from Cheyenne No. 2 Reservoir. From Crystal Lake Reservoir, water is conveyed eastward to the City of Cheyenne municipal water treatment facility located west of Cheyenne. Like Cheyenne No. 2 Reservoir, Crystal Lake Reservoir is a popular recreational destination for boating, fishing, and camping (Ogle et al., 1999).

Table 2.6.97 provides the Wyoming State Engineer's Office (SEO) permit application Crystal Lake Reservoir area capacity table.

Insert Table 2.6.97

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-97thru100

Figures 2.6.76, 2.6.77, and 2.6.78 provide Wyoming State Engineer's Office (SEO) permit application Crystal Lake Reservoir dam plan, profile, and cross section.

Insert Figure 2.6.76

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-76

Insert Figure 2.6.77

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-77

Insert Figure 2.6.78

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-78

One Mile Reservoir

One Mile Reservoir receives its water through the North Lodge Pole Ditch. The reservoir is permitted for irrigation use. One Mile Reservoir has a permitted capacity of 2,247.16 acre-feet. The dam outlets consist of four valved cast iron pipes. Three of the pipes are 8 inches in diameter, and one is 10 inches in diameter. The reservoir does not have a spillway.

Upper Van Tassell Reservoir

Upper Van Tassell Reservoir is located on the channel of North Crow Creek. The reservoir is filled through the North and South Forks of North Crow Creek and has a permitted capacity of 1,867.90 acre-feet. The spillway crest is 200 feet wide and has an invert elevation of 7577.33 feet.

Table 2.6.98 provides the Wyoming State Engineer's Office (SEO) permit application Upper Van Tassell Reservoir area capacity table.

Insert Table 2.6.98

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-97thru100

Figure 2.6.79 provides the Wyoming State Engineer's Office (SEO) permit application Upper Van Tassell Reservoir dam cross section.

Insert Figure 2.6.79

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-79

W. H. R. No. 2 Reservoir

W. H. R. No. 2 Reservoir has a permitted capacity of 877.35 acre-feet. The reservoir is located on the channel of Crow Creek. The reservoir has both an emergency spillway and a principal spillway. The principal spillway has a discharge capacity of 1,021 cubic feet per second, and the emergency spillway has a discharge capacity of 9,918 cubic feet per second.

Table 2.6.99 provides the Wyoming State Engineer's Office (SEO) permit application W.H.R. No. 2 Reservoir area capacity table.

Insert Table 2.6.99

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-97thru100

W. H. R. Reservoir

Permitted for irrigation and stock uses, W. H. R. Reservoir has an available capacity of 878.04 acre-feet. The dam is an earthfill structure. The reservoir is located on the channel of Crow Creek in Laramie County. The crest of the dam is at elevation 5,025 feet, and the spillway is at invert elevation 5,019 feet.

Table 2.6.100 provides the Wyoming State Engineer's Office (SEO) permit application W. H. R. Reservoir area capacity table.

Insert Table 2.6.100

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-97thru100

Figure 2.6.80 provides the Wyoming State Engineer's Office (SEO) permit application W. H. R. Reservoir dam cross section.

Figure 2.6.81 provides the Wyoming State Engineer's Office (SEO) permit application W. H. R. Reservoir dam profile.

Insert Figure 2.6.80

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-80

Insert Figure 2.6.81

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-81

Polaris Reservoir

Polaris Reservoir has a permitted capacity of 1,047.62 acre-feet and is used for irrigation purposes. The reservoir is filled by the Lone Tree “I” ditch. The dam outlet consists of an 8-inch diameter cast iron pipe.

Figure 2.6.82 provides the Wyoming State Engineer’s Office (SEO) permit application Polaris Reservoir dam profile.

Insert Figure 2.6.82

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_FIG 2-6-82

Tables 2.6.101 through 2.6.105 provide an overview of the Wyoming State Engineer's Office (SEO) permit application information for major reservoirs in the South Platte subbasin.

Insert Table 2.6.101

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-101thru105

Insert Table 2.6.102

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-101thru105

Insert Table 2.6.103

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-101thru105

Insert Table 2.6.104

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-101thru105

Insert Table 2.6.105

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-101thru105

2.6.6 Reservoirs with Permitted Capacities between 50 Acre-feet and 999 Acre-feet

The following tables provide tabulated data collected from the Wyoming State Engineer's Office regarding reservoirs with permitted capacities between 50 and 999 acre-feet. These reservoirs are considered "small reservoirs" for the purposes of this report. The tables are organized by subbasin.

Table 2.6.106 contains a summary of information regarding small reservoirs in the Above Pathfinder subbasin.

Insert Table 2.6.106, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-106

Insert Table 2.6.106, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-106

Insert Table 2.6.106, p. 3

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-106

Insert Table 2.6.106, p. 4

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-106

Table 2.6.107 contains a summary of information regarding small reservoirs in the Pathfinder to Guernsey subbasin.

Table 2.6.108 contains a summary of information regarding small reservoirs in the Guernsey to State Line subbasin.

Table 2.6.109 contains a summary of information regarding small reservoirs in the Upper Laramie subbasin.

Table 2.6.110 contains a summary of information regarding small reservoirs in the Lower Laramie subbasin.

Insert Table 2.6.107, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-107

Insert Table 2.6.107, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-107

Insert Table 2.6.107, p. 3

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-107

Insert Table 2.6.107, p. 4

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-107

Insert Table 2.6.108

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-108

Insert Table 2.6.109, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-109

Insert Table 2.6.109, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-109

Insert Table 2.6.110, p. 1

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-110

Insert Table 2.6.110, p. 2

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-110

Insert Table 2.6.110, p. 3

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-110

Table 2.6.111 contains a summary of information regarding small reservoirs in the Horse Creek subbasin.

Table 2.6.112 contains a summary of information regarding small reservoirs in the South Platte subbasin.

Insert Table 2.6.111

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-111

Insert Table 2.6.112

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-112

2.6.7 Reservoir Evaporation

Evaporation from reservoirs is considered a consumptive use of water. Evaporation losses were calculated for all reservoirs with permitted capacities greater than or equal to 1,000 acre-feet, and for which adequate information was available. Evaporation loss data for the federal reservoirs were obtained from the U.S. Bureau of Reclamation (USBR) as shown in the above tables and will not be included in this section. To compute evaporation losses, an annual lake evaporation map in *Development of an Evaporation Map for the State of Wyoming for Purposes of Estimating Evaporation and Evapotranspiration* (Lewis, 1978) was used along with annual precipitation data obtained from the High Plains Regional Climate Center (HPRCC) in Lincoln, Nebraska. Precipitation data were averaged by month for the years 1972-2002. Reservoir surface areas that served as the basis for calculating evaporation are those shown on Wyoming State Engineer's Office (SEO) permit documents as the surface areas at reservoir high-water lines or elevations.

Once evaporation depth for each reservoir was calculated, in units of inches, using the annual lake evaporation map, evaporation depth was multiplied by the factors in *Development of an Evaporation Map for the State of Wyoming for Purposes of Estimating Evaporation and Evapotranspiration* (Lewis, 1978). Monthly precipitation for each reservoir was estimated by determining the nearest weather station to the reservoir and using precipitation data for the selected weather station as obtained from the High Plains Regional Climate Center. To determine net evaporation, evaporation minus precipitation was multiplied by the high-water line surface area of each reservoir.

The following tables provide evaporation estimates for reservoirs within each of the Platte River Basin subbasins.

2.6.7.1. Above Pathfinder Subbasin

Tables 2.6.113 through 2.6.126 provide evaporation estimates for the Rob Roy, Hog Park, Area 2/8 Reclamation, Area 3 Reclamation, No. 4 Evaporation, Johnson, Pierce, Upper Rock Creek, Bosler, Saratoga, Green Mountain Mine, Turpin Park, Teton, and Sand Lake Reservoirs (respectively).

Insert Table 2.6.113

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.114

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.115

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.116

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.117

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.118

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.119

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.120

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.121

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.122

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.123

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.124

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.125

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Insert Table 2.6.126

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

Table 2.6.127 provides a summary of evaporation estimates for major Above Pathfinder subbasin reservoirs.

Insert Table 2.6.127

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-113thru127

2.6.7.2 Pathfinder to Guernsey Subbasin

Tables 2.6.128 through 2.6.133 provide evaporation estimates for the LaPrele, Johnson No. 1, Soda Lake, Bates Creek, J. and J., and Reynolds No. 2 Reservoirs (respectively).

Insert Table 2.6.128

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-128thru134

Insert Table 2.6.129

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-128thru134

Insert Table 2.6.130

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-128thru134

Insert Table 2.6.131

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-128thru134

Insert Table 2.6.132

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-128thru134

Insert Table 2.6.133

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-128thru134

Table 2.6.134 provides a summary of evaporation estimates for major Pathfinder to Guernsey subbasin reservoirs.

Insert Table 2.6.134

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-128thru134

2.6.7.3 Guernsey to State Line Subbasin

Tables 2.6.135 through 2.6.138 provide evaporation estimates for the Detention Reservoir Pine Ridge – 1, Detention Reservoir Case Bier – 1, Harris Reservoir, and Arnold Reservoir (respectively).

Insert Table 2.6.135

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-135thru139

Insert Table 2.6.136

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-135thru139

Insert Table 2.6.137

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-135thru139

Insert Table 2.6.138

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-135thru139

Table 2.6.139 provides a summary of evaporation estimates for major Guernsey to State Line subbasin reservoirs.

Insert Table 2.6.139

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-135thru139

2.6.7.4 Upper Laramie Subbasin

Tables 2.6.140 through 2.6.149 provide evaporation estimates for the Lake Hattie, James Lake, Twin Buttes, Twelve Mile, Dutton Creek, King No. 1, Willow Creek No. 2, and Berg Reservoirs (respectively).

Insert Table 2.6.140

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.141

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.142

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.143

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.144

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.145

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.146

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.147

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.148

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Insert Table 2.6.149

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

Table 2.6.150 provides a summary of evaporation estimates for major Upper Laramie subbasin reservoirs.

Insert Table 2.6.150

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-140thru150

2.6.7.5 Lower Laramie Subbasin

Tables 2.6.151 through 2.6.158 provide evaporation estimates for the Grayrocks Reservoir; Reservoir No. 1, 2nd Enl.; North Laramie Land Co. No. 3 Reservoir; Toltec Reservoir; MBPP Ash Pond; North Laramie Land Co. No. 1 Reservoir; North Laramie Land Co. No. 2 Reservoir; and Glomill Reservoir (respectively).

Insert Table 2.6.151

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Insert Table 2.6.152

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Insert Table 2.6.153

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Insert Table 2.6.154

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Insert Table 2.6.155

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Insert Table 2.6.156

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Insert Table 2.6.157

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Insert Table 2.6.158

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

Table 2.6.159 provides a summary of evaporation estimates for major Lower Laramie subbasin reservoirs.

Insert Table 2.6.159

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-151thru159

<u>2.6.7.6 Horse Creek Subbasin</u>

Tables 2.6.160 through 2.6.164 provide evaporation estimates for the Hawk Springs Reservoir, Goshen Hole Reservoir, J. H. D. #1 Reservoir, Goshen Nos. 1 and 2 Reservoir (Enlargement), and Sinnard Reservoir (respectively).

Insert Table 2.6.160

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-160thru165

Insert Table 2.6.161

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-160thru165

Insert Table 2.6.162

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-160thru165

Insert Table 2.6.163

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-160thru165

Insert Table 2.6.164

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-160thru165

Table 2.6.165 provides a summary of evaporation estimates for major Horse Creek subbasin reservoirs.

Insert Table 2.6.165

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-160thru165

2.6.7.7 South Platte Subbasin

Tables 2.6.166 through 2.6.172 provide evaporation estimates for the Cheyenne No. 1 (Granite Springs), Crystal Lake, One Mile, Upper Van Tassell, W. H. R. No. 2, W. H. R., and Polaris Reservoirs (respectively).

Insert Table 2.6.166

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

Insert Table 2.6.167

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

Insert Table 2.6.168

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

Insert Table 2.6.169

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

Insert Table 2.6.170

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

Insert Table 2.6.171

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

Insert Table 2.6.172

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

Table 2.6.173 provides a summary of evaporation estimates for major South Platte subbasin reservoirs.

Insert Table 2.6.173

File Location: H:\Projects\WWDC\Platte-Waterplan\Final\Tech Memo 2.6

File Name: 0505_TechMemo2-6_TBL 2-6-166thru173

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