Appendix A

East Canyon Reservoir Hydrology Analysis

I. Introduction

East Canyon Reservoir is retained by East Canyon Dam and is one of the principal features of the Weber Basin Project, located in Northern Utah. As a multi-purpose storage reservoir, East Canyon provides irrigation, municipal and industrial water for areas on East Canyon Creek, the Weber River, and through the Gateway Canal to the Weber and Davis Aqueducts, and for land and communities in Weber and Davis Counties in the Great Salt Lake Valley.

In combination with Lost Creek, Rockport, and A.V. Watkins Reservoirs, and Echo Reservoir of the Weber River Project; the flow of the Weber River System is regulated. Additionally, Causey and Pineview Reservoirs located in the Ogden River Basin, the principle tributary of the Weber River, contribute water to the Weber Basin Project. Cooperative releases from each of these facilities provide irrigation and domestic water to lands along the Upper Weber and Ogden River Valleys and eastern slopes and lower valley lands of Weber and Davis Counties.

Although the Weber Basin Project incorporates East Canyon and 6 other reservoirs, it was decided for simplicity that only hydrology from the East Canyon watershed basin would be used to develop a working model for East Canyon Reservoir operations with and without the proposed action alternative. A 30-year history of reservoir storage levels, elevations and releases was compiled, and inflows were calculated. Models were then run of the full 30-year period and 5-year cycles of average, dry, and wet conditions to determine if the pipeline project is manageable given maximum water usage subject to hydrologic limitations.

II. Data Descriptions

East Canyon Reservoir storage records for WY 1978- WY 2007, were obtained from the State of Utah Office of State Engineer (’78-’89) and the Utah Division of Water Rights Commissioner Reports (’89-’07). Reservoir release data for the same period was taken from USGS stream gauge No. 10134000, located on East Canyon Creek ¼ mile downstream of East Canyon Dam.

Reservoir surface elevations from the same period were obtained from the Bureau of Reclamation’s Hydromet Database system. Both storage and elevation had

several missing days which were filled in with an Excel interpolation tool. Based on storage and release data, a 30-year inflow record was then calculated.

A Park City Demand Study submitted by the Park City Water Manager was used to determine daily pipeline releases for the proposed action scenario. This study supplied a 5-year average of each month's percentage of yearly water use. These percentages were then used to translate the yearly 12,500 acre-feet usage to average daily cfs each month. Since the 12,500 acre-feet amount is to be allotted to the entire Snyderville Basin, a service area map from the Summit Water Distribution Company was used to determine the percentage delivered to the East Canyon Basin.

Maximum available acre-feet data for snowmaking was obtained from the Snyderville Basin Water Reclamation District.

III Model Assumptions

For both no action and action alternative scenarios, full use of water rights during non-storage season is assumed, limited only by reservoir hydrology. Reservoir levels are maintained at or above top of inactive storage at 5577 ft. This scenario is at the extreme end of water usage; it is only employed to obtain the maximum yearly yield given hydrologic limitations. Actual full-use operations will likely witness much less storage fluctuation and higher overall elevations. Storage season is defined as October 15 through April 14; non-storage is April 15 through October 14.

The 30-year historic inflows were studied to extract 5-year periods of average, dry, and wet conditions. Total April to July volumes were calculated to determine which years fell in these categories. While it is recognized that future hydrology may offer drier and wetter periods, model limitations assumes the extracted 5-year cycles to be representative of the extremes.

For the no action alternative scenario, these historical inflows remain unchanged for the model input. For the action alternative scenario, historical inflows are adjusted by the following: a 60/80% return flow (non-storage/storage) was added on; a multiplier of .9 was assigned to this return flow to represent the portion of the 12,500 acre-feet returning to the East Canyon Basin; and a snowmaking time-lag reduces return flow during snowmaking months and augments it during spring runoff.

Park City water demand monthly percentages are added to historical releases for the action alternative scenarios.

The return flow percentage is a figure adopted from area consumptive use tables calculated in a recent Utah State Engineer study[1]. The East Canyon basin multiplier was determined from the percentage of service area to East Canyon vs.

Silver Creek drainage basins. A conservative 20% consumptive/evaporation loss is used as determined from a 1988 study on Colorado Snowmaking[2].

Due to these assumptions and the limited tools of the models, actual reservoir operations may differ from those shown in the resulting graphs.

I. Methodology

Microsoft Excel tools and spreadsheets were employed to create the reservoir operational model. Template models used for current East Canyon Reservoir operations were modified to allow the prediction of future storage and elevation, given inflow and release data for both no action and action alternative scenarios.

To maximize reservoir usage, historical releases are increased as much as possible to bring elevation down to the top of inactive, at 5577 ft, or as low as possible such that the following years are able to recover and remain above this level.

No action scenarios employ monthly multipliers to historical releases during the non-storage season to achieve an elevation of 5577 feet at the end of the water year. These "hindsight" reservoir operations are only possible with a view of future years; an upcoming dry cycle would preclude maintaining the reservoir at a level above 5577 feet, such that the reservoir could recover. Releases during wet years are thus likely much greater than needed by water users.

Releases for action alternative scenarios also use this multiplier, and are further increased by the monthly cfs pipeline addition, determined by the Park City demand study. Both scenarios reduce releases during storage season to maintain 5 cfs minimum required downstream flow (plus pipeline release for action scenario).

Historical inflows for action alternative scenarios are augmented by a 60% return flow during non-storage season and 80% during storage. Snowmaking acre-feet were translated into average cfs; this amount is deducted from December and January return flows and added to May inflow. Inflow for no action is unaltered historical inflow data. Both scenarios employ the .9 multiplier to the return flow to reflect the 10% loss of the 12,500 acre-feet to the Silver Creek watershed basin.

II. Analysis

The 12,500 acre-feet of water per year to be diverted to Park City and Snyderville Basin, represents 3% of WBWCD total project storage right. Due to the number of storage facilities and the flexibility of operations within the

project to meet demand, annually redirecting 12,500 acre-feet to the basin above the East Canyon Reservoir, would not generate significant shortages for WBWCD and its water users on a project wide basis. With the proposed action alternative, immediate downstream releases may be reduced during dry periods (Figure 3.7 in EA). Reservoir elevations may periodically exceed the no action scenario elevations due to return flows (Figure 3.8 in EA).

References:

[1] Utah Department of Natural Resources, Division of Water Resources and Division of Water Rights. (1994). *Consumptive use of irrigated crops in Utah* (Research Report 145). Salt Lake City, UT.

[2] Eisel, L., Mills, K., and Leaf, C. (1988). Estimated consumptive loss from man-made snow. *JAWRA Journal of the American Water Resources Association. 24*, 815 – 820.

PC Water Demand Appendix

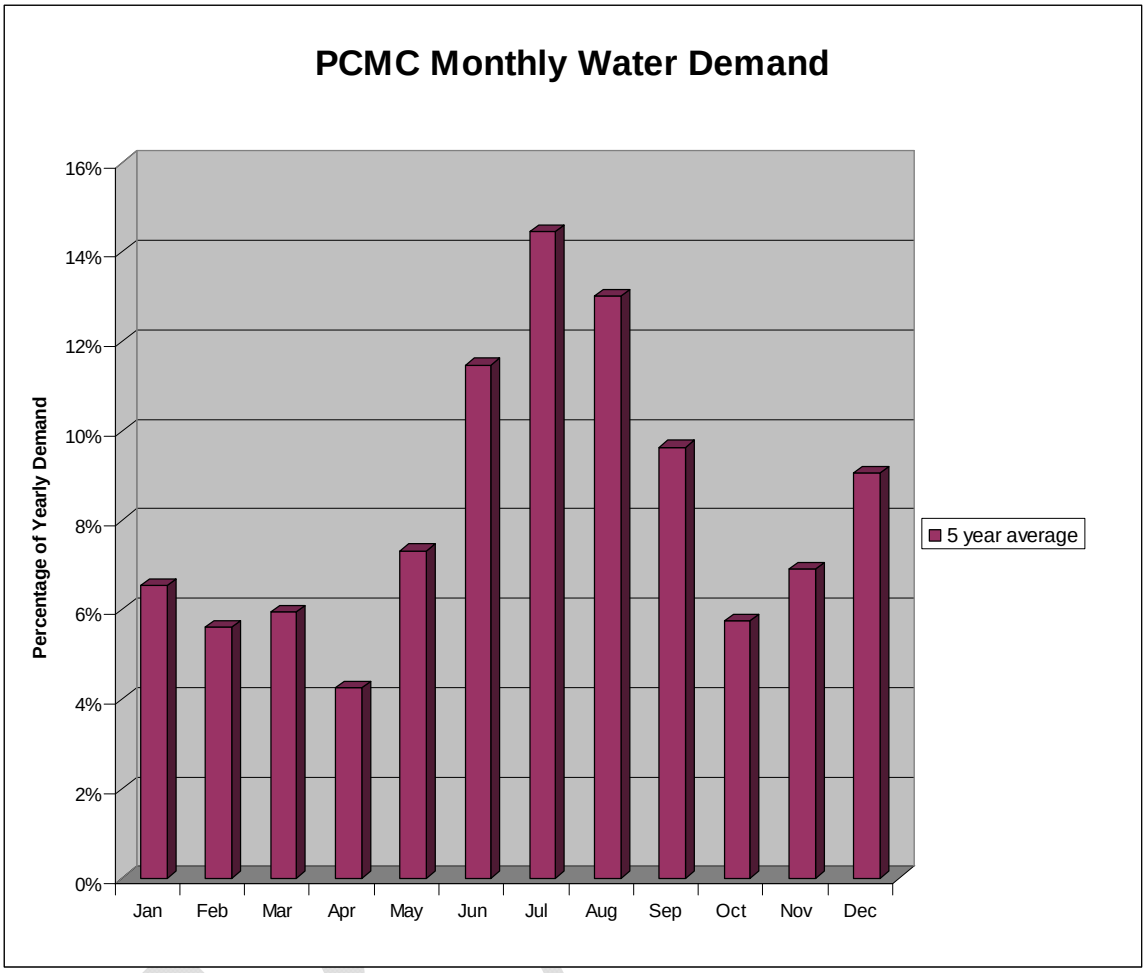

Table of Park City Monthly Water Demand Conversion to cfs/Day

	% of total	**% of 12,500 acre-feet**	**Avg cfs/day**
Oct	5.75%	718	12
Nov	6.90%	863	15
Dec	9.07%	1133	18
Jan	6.55%	818	13
Feb	5.62%	702	13
Mar	5.96%	744	12
Apr	4.25%	532	9
May	7.32%	915	15
Jun	11.48%	1435	24
Jul	14.45%	1807	29
Aug	13.02%	1627	26
Sep	9.64%	1205	20