

APPENDIX D

ACCOUNTING FOR CONSUMPTIVE USE FROM THE YAMPA RIVER AND ITS TRIBUTARIES IN COLORADO AND WYOMING

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FROM THE YAMPA RIVER AND ITS TRIBUTARIES IN
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Background

This appendix describes the accounting system for determining changes in consumptive water use in the Yampa River Basin. This accounting process periodically will estimate consumptive uses of water from the Yampa River and its tributaries in Colorado and Wyoming and identify when “new” depletions approach an average of about 30,000 acre-feet per year (AF/year) in Colorado and 23,000 AF/year in Wyoming. For the purpose of this document, new depletions are any consumptive uses that did not exist as of 1998, the baseline from which current depletions were estimated.

In Colorado, these depletions were estimated with the Colorado River Decision Support System (CRDSS), a State Model that uses historic stream flow gage and water diversion records, concurrent climatological data, and indices of evapo-transpiration, such as Blaney-Criddle. The CRDSS for the Yampa River estimated current depletions from the Yampa Basin by projecting water demands as of 1998 back through a 90-year (1909–1998) record of known climatic and hydrologic conditions. This “backcasting” process allowed for a reasonable estimate of conditions that are likely to exist in the immediate, foreseeable future. A similar procedure was used to estimate new depletions through the year 2045, based on projections of growth in consumptive demand by various sectors. Because there are no direct hydrologic data (i.e., gage data) available prior to the advent of irrigated agriculture in the Yampa Basin, the same process was used to estimate “undepleted” conditions, by removing all anthropogenic water demands from the same set of known hydrologic conditions (Table D-1). States West Water Resources (2000) estimated depletions from the Little Snake River and its tributaries in Wyoming by identifying specific projects and estimating the average annual volume of water each project would consume (Table D-2).

Table D-1. Current and future depletions (AF) from the Yampa Basin in Colorado by sector

Sector	Current	Future	Hydrologic basis
Agriculture (irrigation)	87,765	92,258	1975–1998 average ^a
Municipal & Industrial (M&I)	5,201	15,307	1998 consumption
Thermo-electric generation	16,947	32,350	1985–1998 average
Exports (for or by agriculture)	2,815	2,917	1975–1998 average
Evaporation	12,543	12,543	Includes stock ponds
TOTAL	125,271	155,375	

^a Taken directly from CRDSS calculated data set. Estimated depletions prior to 1975 used 1975–1998 average calculated demands for the same month and hydrologic condition, without constraint of net cumulative decree. Does not include any fallow lands that may be irrigated in the future.

Table D-2. Current and future depletions (AF) from the Yampa Basin in Wyoming by sector

Sector	Current	Future	Comments
Agriculture (irrigation)	26,905	37,451	Includes High Savery Project (UC)
Municipal	76	88	Towns of Baggs & Dixon
Industrial	0	3,000	No current depletions
Exports (for or by municipal)	14,400	22,656	Cheyenne I & II (1995–1997 usage)
Evaporation	1,202	2,816	Diked wetlands & small reservoirs
TOTAL	42,583	66,011	

Current depletions average about 125,000 AF/year in Colorado and 43,000 AF/year in Wyoming. Based on projections of future human water needs, average annual depletions will likely reach 155,000 AF/year in Colorado and 66,000 AF/year in Wyoming by the year 2045. Total current and projected future depletions are the basis for this biological opinion, whereas undepleted conditions serve as the baseline for this biological opinion.

If average annual depletions reach or exceed the estimated depletions considered by the Service in rendering its biological opinion (i.e., 155,000 AF/year in Colorado and/or 66,000 AF/year in Wyoming), the Service would likely reinitiate consultation. Therefore, periodically the Recovery Program will quantify annual water demand from the Yampa River Basin in Colorado and Wyoming, and estimate average annual depletions following a process similar to that used to estimate current (1998) and projected future (2045) depletions.

Methodology

In Colorado, the U.S. Bureau of Reclamation (USBR) prepares a *Consumptive Uses and Losses Report* (CULR) every 5 years, using information provided by the Colorado Water Conservation Board (CWCB). Data from the CULR or State-approved demand estimate will be backcast over the CRDSS period of record for the Yampa River to estimate annual depletions that would have occurred in each of the years of the hydrologic record. The hydrologic record may be expanded to include more recent hydrologic data since 1998. In addition, the CRDSS may utilize a daily time-step in the future (previous modeling with the CRDSS used a monthly time-step) that would allow for a more precise impact analysis. Averaging depletions over a longer period (90+ years) would minimize the influence of exceptional years and produce results more directly comparable to projected future depletions considered in this consultation.

Every 5 years, beginning in water-year (WY) 2010, the States of Colorado and Wyoming will report to the Program estimated average annual volumes of depletions from the Yampa and Little Snake rivers and their tributaries. When estimated average annual depletions reach 155,000 AF in Colorado or 66,000 AF in Wyoming, the Service is expected to reinitiate intra-Service consultation under Section 7 of the Endangered Species Act (ESA) and, depending upon the outcome of that consultation, the *Management Plan for Endangered Fishes in the Yampa River Basin* and/or the cooperative agreement among the states of Colorado and Wyoming and the Service to implement this plan may need to be modified or supplemented.

Accounting Protocol

- 1) Beginning in WY 2005, Colorado and Wyoming will collect consumptive use data and other data necessary to update either Colorado’s CRDSS Consumptive Use Model or Colorado’s CRDSS Colorado River Mainstem Water Right Planning Model. Data collected would include irrigated acres, diversion records, climatic data needed to run the “Modified Blaney-Criddle” consumptive use model, as well as data on evaporation, municipal and industrial uses, and other consumptive uses identified in the CULR. Irrigation consumption in Wyoming will be estimated by multiplying the number of acres devoted to each type of crop by a crop-specific Consumptive Irrigation Requirement (CIR). The CIR is the amount of irrigation needed in excess of rainfall to produce a specific crop (Table D-3). However, the maximum consumptive use of any crop is realized only with an adequate water supply (States West Water Resources 2000).

Table D-3. Calculation of current CIR, Little Snake River Basin, Wyoming

		Grass/Meadow	Alfalfa	Totals
Above Baggs	Irrigated acres	10,298	1,273	11,571
	CIR (feet/year)	1.63	1.90	–
	CIR (AF/year)	16,786	2,419	19,205
Below Baggs	Irrigated acres	3,879	479	4,358
	CIR (feet/year)	1.75	1.90	–
	CIR (AF/year)	6,788	910	7,698
Total irrigated acres		14,194	1,755	15,929
Total CIR (AF/year)		23,574	3,329	26,903

In-basin municipal uses in Wyoming are not expected to increase significantly. Out-of-basin municipal uses will be determined by the trans-basin diversion records for the City of Cheyenne. Future industrial consumptive uses in Wyoming of up to 3,000 AF/year have been estimated (Roehm 2004). However, specific industrial uses and locations of use have not been identified. At such time as these industrial uses are identified and developed, site-specific diversion records in real time will be used to estimate their average annual depletions by backcasting demand over an historic hydrologic record.

The Service would also maintain a list of the associated depletions and consumptive uses of any new projects the Service consulted on during each 5-year period. The updated information will be submitted to a technical workgroup for peer review. Once the technical group has verified the depletions and consumptive uses, they will be submitted to the Recovery Program for final review.

- 2) Every 5 years, beginning in WY 2010, Colorado’s CRDSS Consumptive Use Model will be run, using data collected by Colorado and Wyoming during the preceding 5-year period, and a CULR will be developed. The CULR would verify the present level of consumptive uses.

With respect to the water conservation and reuse by any water user, the desire is to develop the allowable increment of new depletions up to 30,000 AF/year in Colorado and 23,000 AF/year in Wyoming without providing further incentives for water conservation or vesting by any water user for undertaking conservation measures. Furthermore, the desire is to allow water users to maintain their current (1998) level of demand and not to penalize them for implementing conservation measures. Therefore, the 30,000 AF/year in Colorado and 23,000 AF/year in Wyoming of new depletions will remain unchanged. Voluntary implementation of any water conservation or reuse measures likely would either delay full development of new depletions or reduce/delay their full impact on the endangered fishes.

- 3) To avoid potential problems associated with annual fluctuations due to variable climatic and hydrologic factors, as well as model and data changes, all determinations of increases in consumptive use will be made using the 90-year (1909–1998) or longer period CRDSS period of record, as appropriate. The CRDSS Colorado River Mainstem Water Right Planning Model will be used, and two model runs will be required.

RUN 1.

The scenario (C_1) will be run for the updated study period (e.g., 1909 through year n , where year n would be WY 2010, 2015, 2020, etc.) at the 1998 level of demand for the entire study period.

RUN 2.

A second model run (C_2) would be made for the same updated study period using year n demand levels over the entire period. Comparing the difference between the long-term averages of the two model runs ($C_2 - C_1$) will identify the increase in consumptive use over that time period (1998 through n). Model calibration and verification will be done with each update. There are no “cap” amounts identified in this process; the trigger is whether or not the difference between the two model runs exceeds 30,000 AF/year in Colorado and 23,000 AF/year in Wyoming as identified in this Biological Opinion.

- 4) A report will be prepared documenting the assumptions used and changes in consumptive use and other model results. The report will be prepared on a water-year basis October 1 to September 30. The report will also document any changes made to the model such as updated demand information.
- 5) The reports will be completed by July 1 every 5 years beginning in 2010.
- 6) This process as currently envisioned has the potential to become labor-intensive depending on the number of model changes and degree of backcasting involved. Costs will be allocated or appropriate cost-share arrangements will be made during the development of the Recovery Program’s annual work plan. A scope of work will be prepared for the FY 2010 Recovery Program’s work planning process to fund model runs and development of the 5-year report. Furthermore, because of cost considerations, the process identified above is subject to change by mutual agreement of the Recovery Program’s participants through its adaptive management process.