Water Utilization Study

Water District 2

Prepared
for
James D. Geissinger

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SUMMARY AND CONCLUSIONS

1. Water District 2 serves as a strategic link between mountain and front range tributary areas and downstream plains areas of the South Platte Basin. Because of this location, water users within Water District 2 are dependent upon inflow from several sources and at several locations. Thus, they experience quite different water supply situations within the various reaches from year to year. Urbanization is rapidly taking place in the districts above Water District 2, as well as in the upper section of Water District 2.

2. River water supply. The amount of river water available for diversion under direct-flow decrees held by Water District 2 ditches has changed over the years. Some ditches in the upper portion of the Water District have experienced a reduction in diversions of direct-flow water, whereas some ditches in the lower portion have been diverting an increasing amount during recent years.

3. Reservoir water supply. The amount of water remaining in storage within Water District 2 after the close of the irrigation season has been increasing over recent years, although the amount in storage at the beginning of the season does not show this trend.

4. Groundwater supply. A reservoir containing approximately 1.3 million acre-feet of groundwater underlies the main stem of the South Platte River in Water District 2. In addition, an estimated 320,000 acre-feet of groundwater underlies Beebe Draw between Barr Lake and Latham Reservoir, giving a total of some 1.6 million acre-feet of groundwater in Water District 2. During an average year less than 10% (120,000 to 140,000 acre-feet) of this storage capacity is actively used. During years of heavy pumping (such as 1954 and 1956) the amount withdrawn has reached 200,000 to 210,000 acre-feet within Water District 2.

5. Inflow, return flow and outflow characteristics. The relationship of inflow to outflow of surface water for Water District 2 has not changed significantly on an annual basis. However, noticeable changes have occurred during certain parts of the year--particularly late summer and fall--indicating that the return flow pattern has been changing during recent years. This change started in 1953 for November and December, but not until the early 1960's during the summer months. The average annual depletion (inflow-outflow) for the Water District is about 126,000 acre-feet, some of which is transported to the Box Elder and Prospect Valleys.

6. Source and extent of water utilization data. Data and estimates of water used were obtained from a Farm Water Utilization Study prepared by the Bureau of Reclamation for the Narrows Project. The study was for the 15-year period from 1947 to 1961, inclusive. It covered 17 of the canals which divert water for irrigation from the South Platte River in Water District 2.

7. Irrigated acreage. The Bureau estimated a total of 124,635 acres as being irrigated by the 17 canals and/or by pumping from groundwater sources. Estimates from other sources show considerable discrepancy for the irrigated acreage under individual canals.

8. Water diverted. The estimated average annual diversion of water by the 17 canals (direct flow plus reservoir releases) was 302,100 acre-feet. The amount diverted varied greatly from year to year. Most canals experienced a minimum diversion from the South Platte River during 1954 and 1961. Maximum diversions generally occurred during 1947 and 1952.

The estimated average annual canal loss was 84,700 acre-feet or 29 percent of the water diverted. Thus, an annual average of 217,400 acre-feet of surface water was estimated to be available at the farm headgates.

The estimated average annual amount of water pumped from groundwater sources for land under the 17 canals was estimated to be 148,600 acre-feet. Thus, the estimated total average annual supply of water at the farm headgates was 366,000 acre-feet or 2.94 acre-feet per acre. Groundwater provided about 40.6 percent of the total supply at the farm headgat

Only a very minor amount of water was used for irrigation during the months of November, December, January, February and March. The estimated average annual total water supply at the canal river headgates plus reservoir releases and groundwater pumped was estimated to be 450,400 acre-feet. (Some minor discrepancies will be noted in some of the above total due to rounding of figures to the nearest 100 acre-feet).

9. Estimated full or ideal water supply at farm headgates. The ful water supply at the farm headgate was computed by the Bureau of Reclamati using (1) a combination of the Lowry-Johnson and the Thornthwaite methods to determine the consumptive use of water by crops and (2) an assumption of a 60 percent irrigation efficiency in the application of water to supp the consumptive use requirements for each of the 17 canals.

The estimated full water requirement at the farm headgate varied fro 1.59 to 3.19 acre-feet per acre with an average annual headgate water requirement of 2.44 acre-feet per acre or a total of 304,200 acre-feet fo the 17 canals. Monthly requirements averaged 0.08 acre-foot per acre for april, 0.14 for May, 0.47 for June, 0.66 for July, 0.60 for August, 0.36 for September, and 0.13 for October.

An assumed average of 60 percent irrigation efficiency for the combi 17 canals appears to be reasonable; however, because of different soil co dition, kind of crops produced and methods of irrigation for each canal, is not reasonable to expect the irrigation efficiency would be identical for each canal.

10. Estimated full requirement at canal headgate. The canal headgat requirement includes the full requirement at the farm headgate plus canal losses. The estimated average annual requirement at the canal headgates was estimated by the Bureau of Reclamation to be 388,900 acre-feet.

11. Estimated surplus or shortage at the canal headgates. An estim annual average surplus of 61,500 acre-feet for the 17 canals was found as the difference between the total headgate supply and the total headgate requirement. However, 4 of the 17 canals experienced an average shortage during the 15 years and also had a shortage 50 percent of the 15-year tim period. Also many ditches experience shortages during critical months, but show an annual surplus because of excessive water use during other months.

The surplus would be greater than that estimated if the actual acreage irrigated were found to be less than that estimated.

If the assumed irrigation efficiency is actually less than 60 percent, the water requirements would be greater than estimated and the surplus would be less (or shortages would be greater).

12. Integrated management. As already determined for Water Districts 1 and 64, the potential for alleviating shortages, stabilizing supplies, and reducing conflicts between surface water and groundwater users is also promising in Water District 2 through planned integrated management. Not only can the distribution of water be improved in Water District 2, but through exchanges and other operating agreements water users above Water District 2 can benefit through relief of calls during critical times. The amount of benefits possible, and the optimum scheme of operation in conjunction with other water districts, will need to be determined from operation studies which are beyond the scope of this study.

INTRODUCTION

Purpose

The study reported herein is a continuation of work initiated under the authorization of Senate Bill 407 enacted by the Colorado 46th General Assembly in 1967. An earlier report by the writers "Progress Report on Senate Bill No. 407 Study" sets forth the purposes of the study and the basic premises on which they are founded, so these are not repeated here. Suffice it to say that the work is to provide the necessary physical and engineering information to develop realistic and practical legislation directed at harmonious administriation and use of both surface water and groundwater where the two supplies are closely interrelated.

Description of Area

Water District 2 lies along the main stem of the South Platte River between the gaging stations at Denver and near Kersey. The District also encompasses most of Big Dry Creek, however this study has been limited to those ditches diverting water from the South Platte River.

Water District 2 is largely agricultural, although rapid urbanization has been taking place in the upper portion of the District. A sizeable acreage of land is irrigated by diversions from the South Platte which is not located in the main river valley. This acreage is located in the parallel valleys to the east: Beebe Draw, Box Elder Creek Valley and Prospect Valley. Each of these valleys are tributary to the main stem of the South Platte, but only Beebe Draw lies within and joins the South Platte River within Water District 2. Therefore, return flow from water conveyed into the Box Elder and Prospect Valleys does not augment the surface flow in Water District 2.

Water District 2 differs from the other Water Districts of the South Platte Basin in that its surface water supply enters at a number of points. Besides the inflow in the main stem of the South Platte, four major perennial tributaries enter the South Platte within the District: Clear Creek, St. Vrain Creek, Big Thompson River, and Cache la Poudre River. The Cache la Poudre River, however, enters Water District 2 below the headgates of all ditches within the District.

Acknowledgements

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Organization of Report

This report contains text material which summarizes and discusses the results of analyses performed on data available for Water District 2. All basic data and graphical analyses used are contained in several volumes of Appendices as described in the Table of Contents. Only a limited number of the Appendices were printed. Those wishing to look at these may do so in the Office of the State Engineer.