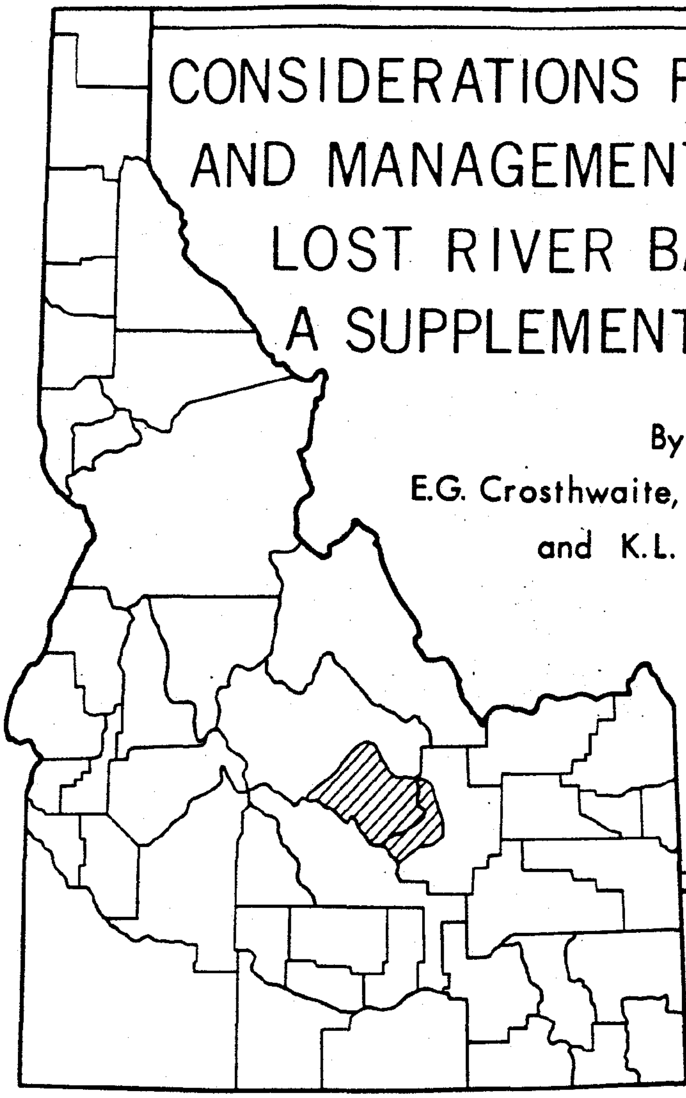

CONSIDERATIONS FOR WATER USE AND MANAGEMENT IN THE BIG LOST RIVER BASIN, IDAHO; A SUPPLEMENTAL REPORT

By

E.G. Crosthwaite, C.A. Thomas,

and K.L. Dyer

OPEN-FILE REPORT

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

Prepared in cooperation with the

IDAHO DEPARTMENT OF RECLAMATION

Boise, Idaho

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CONTENTS

ILLUSTRATIONS

TABLES

CONSIDERATIONS FOR WATER USE AND MANAGEMENT IN THE BIG LOST RIVER BASIN, IDAHO; A SUPPLEMENTAL REPORT

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INTRODUCTION

The water resources of the Big Lost River basin were studied in detail by the U.S. Geological Survey in cooperation with the Idaho Department of Reclamation during the period July 1966 to June 1969. An open-file report entitled "Water resources in the Big Lost River basin, Idaho" by E. G. Crosthwaite, C. A. Thomas, and K. L. Dyer, which describes the results of this study, was released to the public by the U.S. Geological Survey in March 1970. It was originally planned that this report would contain a section discussing various management practices that have been suggested to provide for more efficient utilization of the basin's water resources. Because the section on management practices was not fully completed at the time the report was released, and because the data in the report were needed as soon as possible by persons concerned with the basin's water resources, the section on management was not included in the initial release.

The purpose of this supplemental report is, therefore, to present a discussion on various management practices that may be considered in utilizing the water resources of the Big Lost River basin. It is intended that this supplemental report should be used in conjunction with the open-file report noted above.

The results of the study by Crosthwaite and others (1970) of the water resources in the Big Lost River basin showed that, on the average, about 23 percent of the 650 cfs (cubic feet per second) total water yield of the basin is used consumptively; about 12 percent leaves as surface flow, and 65 percent leaves as ground-water flow. The water leaving the valley is of good quality. If captured, it could be used within the basin to irrigate both the many arable acres that are not yet irrigated, and much of the presently irrigated land that does not receive a full supply in years of low runoff.

An increased supplemental water supply for presently irrigated land and a supply for nonirrigated land can be achieved by making optimum use of all the water resources of the Big Lost River basin. This will, however, require a modification of existing water management practices. Additional quantities of water to meet irrigation requirements during extended periods of low streamflow could be obtained by constructing reservoirs in upstream areas. These reservoirs could be multipurpose reservoirs that would be used to control floods in addition to supplying irrigation needs. Irrigation requirements could also be met by using existing canals and ditches to distribute additional quantities of water pumped from wells. These additional quantities of ground water could be made available by using artifical recharge techniques to raise the water table and thus increase the amount of ground water retained in the aquifers.

Conjunctive use of both surface and ground water provides the most efficient use of the resource. The ground-water reservoir between Mackay Narrows and Arco contains an estimated 2.6 million acre-feet of water in its upper 200 feet plus an unknown amount below this depth (Crosthwaite and others, 1970, p. 84). This ground-water reservoir can be utilized at any time to supplement surface-water supplies, as is now being done by about three-fourths of the existing irrigation wells in the basin. However, increased ground-water withdrawals may interfere with streamflow, thus raising questions concerning water rights. Ideally, conjunctive use of surface and ground water would provide a system that could draw heavily on the ground-water reservoir during dry years when streamflow is deficient, thus providing a full supply. During wet years, the draft on ground water should be minimized and excess streamflow artificially recharged to the ground-water reservoir. Only through this kind of exchange can use of all the water resources of the basin be optimized.

POSSIBILITIES FOR ADDITIONAL MANAGEMENT OF SURFACE WATER

Additional management of the surface-water resources in the Big Lost River basin is needed to (1) supply irrigation requirements during drought years, (2) provide increased flood control, and (3) insure more efficient use of the water supply available in normal years. An indication of the amount of water that could be salvaged from unused outflow by additional management practices is provided by the measurements of flow in the Big Lost River at the gage near Arco (table 1). Annual flow at this gage ranged from 0 to 195,500 acre-feet during the period 1944, 1947-68. Also, although an average of only about 7,000 acre-feet per year (10 cfs) passed the gage during the dry period 1960-64, the annual flow exceeded 100,000 acre-feet (138 cfs) in 5 years of the 23-year period 1944, 1947-68. However, despite these variations, an average annual flow of 55,900 acre-feet (77 cfs) did pass this gage and leave the basin during the 1944, 1947-68 period. Assuming that, on the average, this annual quantity of water continues to be available in future years, much of it could be made available for use by prolonging the use of the storage space available in Mackay Reservoir, by construction of additional reservoirs above Mackay Reservoir, by increased diversion of upstream flows onto the highly rechargeable gravel acres of the Chilly-Barton Flats and thereby increasing the amount of water temporarily retained in the underlying aquifers, and by increasing irrigation efficiencies as discussed in the following pages.

Mackay Reservoir did not fill during 24 of the 50 years of record. To make better use of the reservoir storage space during the low-runoff years, and to make more water available for diversion by way of the reservoir outlet works, some of the leakage past Mackay Dam could be intercepted and pumped back into the reservoir. Also, some winter flow, together with summer flood flows could be intercepted in Lower Cedar Creek and diverted into Mackay Reservoir through a lined channel that could be constructed to provide gravity flow. In addition, some of the surface water now lost to ground water could be salvaged by lining the channel extending from Upper Cedar Creek into Mackay Reservoir.

Surface reservoirs with sufficient storage to alleviate water shortages during long periods of low flow could be built in the upper part of the Big Lost River basin. Construction of such additional reservoirs above Mackay Reservoir would provide more water for irrigation by long-term

Table 1. Annual diversions from Big Lost River and annual mean streamflow in acre-feet (rounded).

Water year	Diversions above Mackav Reservoir	Flow at Mackay Narrows	Diversions below Mackay Reservoir	Flow at gage near Arco	Apparent loss or gain Mackay Narrows to Arco
1922	112,000	279,000	200,000	a7,290	-71,700
1923	203,000	235,000	241,000	-	-
1924	55,800	162,000	124,000	-	-
1925	85,500	232,000	222,000	-	-
1926	65,600	144,000	123,000	-	-
1927	71,900	212,000	175,000	-	-
1928	75,700	201,000	173,000	-	-
1929	63,600	143,000	97,600	-	-
1930	79,500	171,000	119,000	-	-
1931	52,600	125,000	69,800	a0	-55,200
1932	68,900	192,000	140,000	-	-
1933	53,400	156,000	82,900	-	-
1934	61,600	94,800	35,200	a0	-59,600
1935	77,700	172,900	103,000	b2,668	-67,200
1936	81,700	145,000	69,700	a0	-75,300
1937	61,900	120,000	52,400	-	-
1938	152,000	264,100	90,300	-	-
1939	29,500	180,200	129,000	-	-
1940	24,200	169,000	216,000	-	-
1941	49,000	176,300	117,000	-	-
1942	55,000	246,100	165,000	-	-
1943	54,100	309,700	204,000	-	-
1944	56,400	290,100	206,000	a119,100	+35,000
1945	57,000	220,400	203,000	-	-
1946	65,400	222,600	212,000	-	-
1947	63,300	232,300	208,000	60,260	+36,000
1948	73,400	228,600	219,000	26,870	+17,300
1949	55,300	195,400	189,000	23,620	+17,200
1950	46,200	185,200	175,000	18,130	+7,930
1951	59,000	243,500	224,000	28,650	+9,150
1952	67,700	310,400	240,000	124,300	+53,900
1953	84,000	244,300	242,000	58,470	+56,200
1954	66,600	208,200	218,000	28,530	+38,300
1955	40,000	175,300	148,000	12,250	-15,000
1956	63,200	282,900	239,000	61,750	+17,800

Table 1. Annual diversions from Big Lost River and annual mean streamflow in acre-feet (rounded)--Continued.

Water year	Diversions above Mackay Reservoir	Flow at Mackay Narrows	Diversions below Mackay Reservoir	Flow at gage near Arco	Apparent loss or gain Mackay Narrows to Arco
1957	61,600	245,500	220,000	66,520	+41,000
1958	57,600	304,900	275,000	131,200	+101,000
1959	32,200	170,800	140,000	47,640	+16,800
1960	36,800	154,000	106,000	5,520	-42,500
1961	29,900	130,600	65,700	0	-64,900
1962	60,700	184,300	128,000	a0	-56,300
1963	52,900	229,500	200,000	c7,960	-21,500
1964	48,100	246,400	256,000	a22,400	+32,000
1965	55,300	405,800	282,000	195,500	+71,700
1966	40,500	194,600	177,000	c44,900	+27,300
1967	66,000	353,200	235,000	138,700	+20,500
1968	52,700	207,000	187,000	64,280	+44,300
47 year average	62,000	212,700	169,000	-	-

a From the annual report of the watermaster, Water District 27, Big Lost River.

b River flow below Arco Canal heading, which is probably greater than flow at gage below Arco.

c Estimated from partial records of U.S. Geological Survey and the watermaster, Water District 27.

holdover storage, water for fishing and boating, and control of floodflows. The reservoirs could store some of the water that now passes the gage near Arco in high-flow years for release and use during low-flow years, and at the same time materially reduce floodflows. Streamflow records indicate that planned release of storage from such reservoirs could also be used to increase recharge to the aquifers underlying the Chilly-Barton Flats area (Chilly Sinks). The bulk of this recharge would gradually seep back into the river channel above Mackay Reservoir and thus would provide a more even rate of flow into the reservoir. Also, recharge to the Chilly Sinks could be timed so that increased amounts of water would be available in Mackay Reservoir when needed for irrigation and recreation uses.

Six possible surface-water storage sites have been identified above Mackay Reservoir (U.S. Bureau of Reclamation, 1961), but storage capacity at the sites is not known nor have benefit-cost ratios of reservoir construction and operation been determined. In addition to these sites, the feasibility of a storage site on Antelope Creek (below Mackay Reservoir), in the narrows below Grouse, was investigated in 1961. Investigation of this site showed a benefit to cost ratio of considerably less than 1 to 1, however (U.S. Bureau of Reclamation, 1961).

Additional Supply During Drought Years

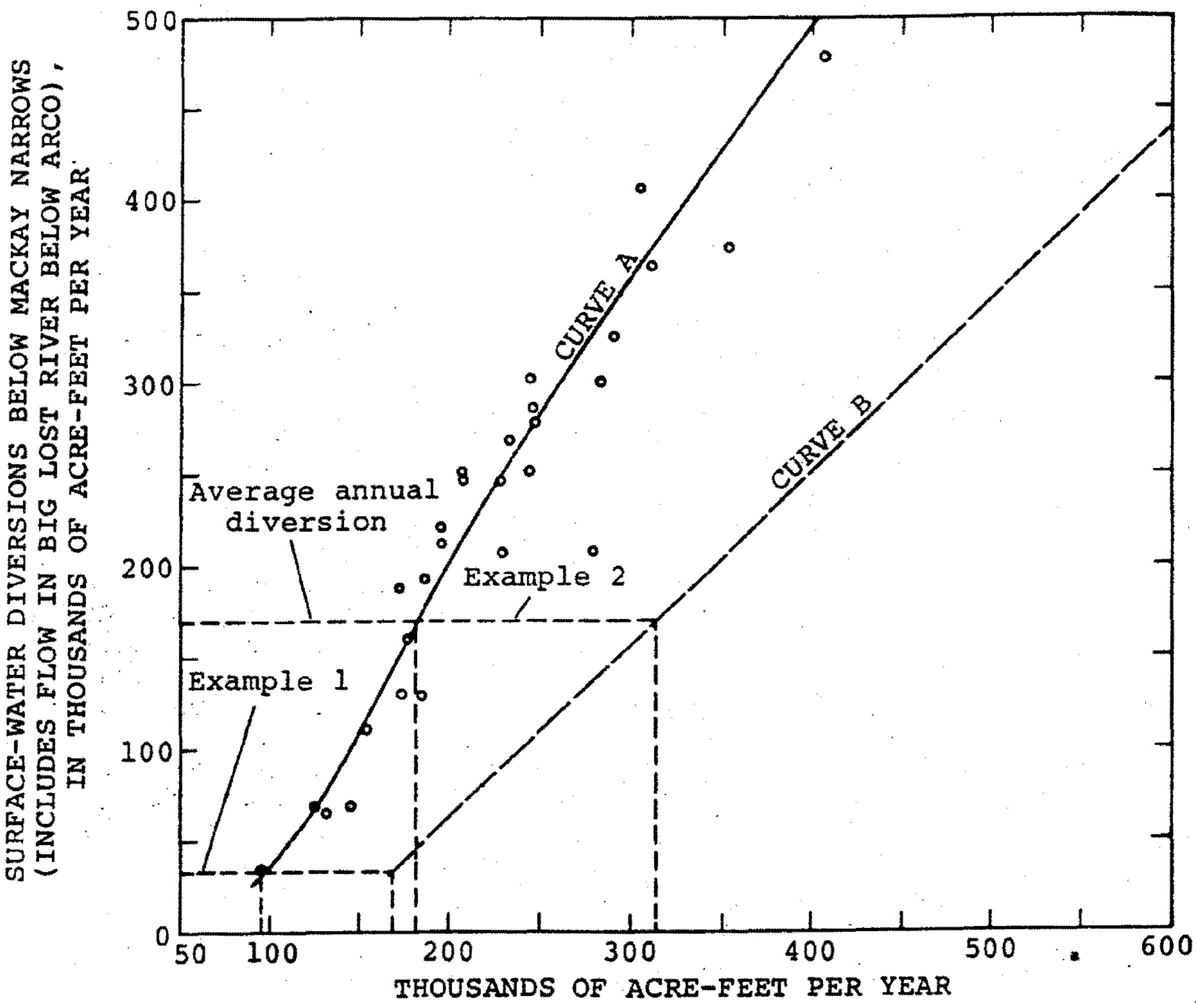
Surface-water reservoirs upstream from Mackay Reservoir would alleviate water shortages occurring during drought years. To estimate the amount of upstream storage needed to provide a full supply during dry years, past records of streamflow, yields from the subbasins contributing water to the river, diversions for irrigation, and the hydrologic characteristics of the river from Mackay Narrows to Arco were considered.

The annual diversions listed in table 1 show that droughts have occurred in the Big Lost River basin. A drought is considered to have occurred in years when diversions were average or below average and all surface flow in the basin was utilized, with little or no flow at the gage below Arco during the irrigation season. A severe drought is considered to have occurred when diversions averaged less than 50 percent of the average annual diversion below Mackay Reservoir of approximately 170,000 acre-feet. A moderately severe drought would have occurred when diversions were between 50 and 80 percent of normal. Diversions below the reservoir during the 47-year period of record were less than 50 percent of average in 6 years and less than 80 percent of average in 16 years. Of these 16 years, 10 years were in the period 1929-41.

All of the surface water available for diversion between Mackay Narrows and Arco is derived from the flow passing Mackay Narrows and the yield of subbasins tributary to the Big Lost River below the Narrows. In many years, the combined yield from these sources is not sufficient to satisfy an average annual diversion of approximately 170,000 acre-feet, mainly because much of the water from these sources enters the underlying ground-water aquifer.

Figure 1 was constructed to allow estimation of (1) the amount of surface water lost to the underlying ground-water aquifers in the reach between Mackay Narrows and Arco and (2) the amount of surface water that must be stored above Mackay Narrows to allow an annual diversion of 170,000 acre-feet. As shown in figure 1, annual surface-water diversions below Mackay Narrows plus the flow in the Big Lost River at Arco are related, by curve A, to the annual flow at Mackay Narrows and, by curve B, to the annual flow at the Narrows plus the net annual contribution to surface- and ground-water flow from the subbasins within the reach Mackay Narrows to Arco. In constructing figure 1, the flow at Arco was added to the diversions because it was considered that practically all this flow could have been diverted for use. Within the subbasins below Mackay Narrows, a large part of the yield generated is consumed by irrigated crops and, therefore, this quantity of water was not included in the values used to define curve B. Also, the quantity of subsurface flow passing around Mackay Dam was not considered because this flow is relatively constant from year to year and its inclusion merely shifts both curves some distance to the right.

From example 1 in the figure it can be seen that during a drought year such as 1934, when no water flowed past the gage below Arco (table 1), diversions totaled only about 35,200 acre-feet, the surface flow at Mackay Narrows was about 95,000 acre-feet, and the total contribution to the system (including the net contribution from subbasins downstream) was about 170,000 acre-feet. From this, it is evident that although an amount equivalent to the average annual diversion of approximately 170,000 acre-feet entered the system, about 135,000 acre-feet (170,000 minus 35,200) leaked



CURVE A - SURFACE-WATER FLOW AT MACKAY NARROWS
CURVE B - SURFACE-WATER FLOW AT MACKAY NARROWS PLUS NET CONTRIBUTIONS FROM SUBBASINS DOWNSTREAM

FIGURE 1.--Correlations between annual diversions and (A) the surface-water supply at Mackay Narrows and (B) contributions to the system below Mackay Narrows.

into the underlying ground-water aquifer and was not available for diversion from surface flow. However, to have diverted 170,000 acre-feet in 1934 (fig. 1, example 2), would have required that at least 320,000 acre-feet be contributed to the system. Also, about 150,000 acre-feet (320,000 acre-feet, the quantity necessary to supply the diversion; minus 170,000 acre-feet, the quantity entering the system in 1934) of additional storage would have been needed above Mackay Reservoir. By contrast, Mackay Reservoir has a storage capacity of only 44,370 acre-feet. Similar approximations indicate that to have supplied 170,000 acre-feet each year for diversion during a drought equal to that of 1929-38 would have required about 900,000 acre-feet of storage upstream from Mackay Reservoir. An alternative to upstream storage in such large amounts would be pumpage of stored ground water to supplement streamflow available for diversion. Pumping 900,000 acre-feet over the drought period would have lowered ground-water levels and thereby increased the infiltration of surface flows. This would further reduce the amount of surface flow available for diversion and require additional pumping. Nevertheless, there is such a large quantity stored as ground water, and the ground-water body is so completely recharged during periods of above-normal runoff, that ground-water pumping at carefully-selected locations could adequately meet diversion deficiencies.

Flood Control

Generally, Mackay Reservoir is too small to adequately store prolonged floodflows even though large amounts of water seep into the aquifers underlying the river channel and canals in the Chilly Sinks area. For example, the peak flow observed at Howell Ranch in 1967 was reduced more than 2,000 cfs at Mackay Narrows by leakage into the Chilly Sinks area and by storage in the reservoir. However, because the high flows persisted for a long period, infiltration rates into the Chilly Sinks area reached the maximum attainable with the existing diversion system and all available storage space in Mackay Reservoir filled. As a result, riverflow below the reservoir could not be controlled and considerable damage was done to roads, irrigation structures, farmland, and other improvements. Reservoirs in the upper basins would provide not only additional storage, but also could be operated to control floodflows. More extensive and carefully planned artificial recharge to ground water in the Chilly-Barton Flats area during high river stages could also help control floods by delaying inflow to Mackay Reservoir. An additional measure to control floods below Darlington would be to use the old Utah Construction Co. canal to divert flood water from the river. To accomplish this, the canal would have to be extended so as to discharge the diverted water to the basalt lava plain south of Arco beyond the flood area.

Additional Supply During Normal Years

A significant part of the water diverted from the Big Lost River in normal years for irrigation could be made available for use to irrigate additional land by improving existing irrigation efficiencies. Diversions from Big Lost River into canals have averaged 5.7 acre-feet per irrigated acre per year for the period 1922-68, while net consumptive use is estimated to have been only about 1.2 acre-feet per acre when a full supply is applied to the land. It appears, therefore, that considerably more water is being applied to the crops than is needed and that, if irrigation efficiencies could be improved, significant quantities of water would be saved. The use of sprinklers, lining of canals, land leveling, better control of the length of time water is applied, and control of length of furrows are examples of techniques that would improve irrigation efficiencies by reducing both percolation losses from canals, ditches, and irrigated lands and the consumptive use of water by nonbeneficial vegetation growing along ditches and canals.

Such decrease in percolation losses would, however, result in a similar but lesser decrease in ground-water recharge, and a very small decrease in return flow to the river. Because the ground-water storage capacity is very large, the recharge from percolation loss is small compared to total annual recharge, and, as the ground-water return to the river represents the overflow of the ground-water reservoir, there would be little effect on ground-water return flow. Any effect that might develop would tend to be removed by the excessive recharge during normal and above-normal years of runoff.

POSSIBILITIES FOR INCREASED USE OF GROUND WATER

About 435 cfs or 65 percent of the total water yield of the basin leaves as underground flow past Arco (Crosthwaite and others, 1970, p. 98). Therefore, use of surface water alone will not permit full development of all the basin's water resources. Interception of ground-water flow seems to offer the best means for optimum development of the water resources and is the only means by which some of the water can be captured. Pumping from wells anywhere in the Big Lost River valley above Arco, in addition to those already in use, would serve to decrease the quantity of water leaving the basin. Large quantities of water suitable for irrigation can be obtained from additional wells screened in the unconsolidated alluvial deposits that occur throughout most of the valley. Commonly, wells open to these deposits have yields of several thousand gallons per minute. In stretches where river levels are contiguous with or below the water table, however, wells located near the stream will have some affect upon streamflow. Where stream levels are above the water table, as in the Chilly Sinks and Darlington Sinks areas, pumping will not affect nearby streams.

Wells yielding supplies of water in amounts adequate for irrigation probably are not obtainable in areas underlain by the older cemented alluvial deposits. Examination of their surface outcrops and results of test drilling in Mackay Narrows imply that these deposits are well consolidated and have a low permeability. Low yields obtained from wells located high on alluvial fans, such as those of Alder and Antelope Creeks, indicate that poorly-sorted material deposited at the heads of fans such as these also has a low permeability.

South of Arco the wells that have the best yields are about 100 feet deep and produce from gravel near Big Lost River. These wells are in secs. 11, 12, and 13, T. 3 N., R. 26 E., and are several miles downstream from the major irrigation diversions on the river. Because several of the wells are closely spaced, pumping from one well lowers the water level in others, but no significant overall depletion of the ground-water supply is apparent. Experience in test well 4N-26E-21abb1 northwest of Arco suggests that a basalt layer at this location will yield at least moderate quantities of irrigation water.

The best undeveloped land in the basin lies west, southwest, and south of Arco in the Era Flats. Development of this land has been only partly accomplished because no dependable surface-water supply is available and few large-capacity irrigation wells have been successful. About 10,000 acres in this area is presently dry-farmed or used for grazing. Assuming that this 10,000 acres is suitable for irrigation, about 3 acre-feet of water per acre of land irrigated would provide an adequate water supply under the most efficient conditions of water use (pipe lines and sprinkler irrigation). Thus, 30,000 acre-feet of water or about 40 cfs would be the minimum annual requirement. If this water were obtained from wells located between Arco and Moore, a part of the ground-water outflow now moving unused from the basin would be intercepted.

Ground-water pumped from the alluvial deposits between Arco and Moore could provide not only a dependable irrigation supply for the Era Flats but also could supply other nearby arable land. In this area, heavy pumping from about the upper 400 feet of saturated alluvial deposits would reduce flow in the river. To alleviate this effect, provision could be made to augment the surface-water supply with additional ground water pumped from these deposits when streamflow is inadequate. Pumping from a deep basalt and alluvial deposits underlying the basalt northwest of Arco would have a lesser effect on river flow than pumping from about the upper 400 feet of deposits. Little is known, however, about the water-yielding capacity of these deeper zones, and pumping lifts would be considerably higher than in the shallower zone. Regardless of the complications resulting from the effects on streamflow, this is the farthest downstream place in the basin at which ground water can be intercepted and used before it enters and is lost to the Snake River Plain.

There are available large tracts of unirrigated arable land upstream from Arco, particularly on the alluvial fans along the east side of the basin from Arco to north of Leslie and in the Chilly-Barton Flats area above Mackay Reservoir. Most of these areas are underlain by coarse-textured alluvial fans or gravelly alluvial deposits having soils of low moisture-holding capacity. Even though these soils would require large amounts of water for irrigation, net depletion of the water resource would be only that used by crops (1.2 acre-feet per acre) plus that lost by evaporation from free-water surfaces such as canals and laterals. The remainder of the water applied for irrigation would return to the river or aquifer and thus be available for reuse. Each acre irrigated would deplete the average water supply by slightly less than 0.0017 cfs, plus that lost by evaporation from canals and ditches. Development of 30,000 new acres would deplete the average supply by a little more than 50 cfs or about 10 percent of the estimated average surface and underground outflow from the basin at Arco.

In the Chilly-Barton Flats area, the large seepage losses occurring in canals and in some of the upstream reaches of the river indicate that if, by using artificial recharge techniques, additional amounts of water were temporarily stored underground so as to raise the underlying water table, return flow to downstream reaches of the river would be increased. The depth to water below land surface at the old Chilly Store ranged between 24 and 65 feet during 1967 and 1968 and, farther downstream at Barton School, the depth to water ranged between 4 and 16 feet. The part of the Chilly-Barton Flats area southwest of the Big Lost River averages about 3 miles wide and 6 miles long and covers about 11,500 acres. Thus, if it is assumed the rechargeable unsaturated alluvial deposits average 20 feet in thickness and have a specific yield of 20 percent (Crosthwaite and others, 1970, p. 84), about 46,000 acre-feet of water could, theoretically, be recharged. Practically, a somewhat smaller amount would be recharged into these deposits, because it would not be either feasible or desirable to raise the water table everywhere to the land surface. However, several consecutive dry years would allow more water to enter these deposits because the water table would be somewhat lower than during the 1967-68 period. Any water artificially recharged in the Chilly-Barton Flats area would discharge, after a delay in transit through the alluvial materials, to the river and reservoir and thus be available for storage in reservoirs or for immediate use. Hydrographs of the flow at Howell Ranch, water levels in well 9N-22E-32dccl, and inflow to Mackay Reservoir (Crosthwaite and others, 1970, figs. 19 and 26) indicate that the increase of inflow to the reservoir would occur within 3 months after recharge began and the effect would persist for about 18 months after recharge ends.

Water for recharge in the Chilly-Barton Flats could be obtained by diverting the river through a series of canals into large ponds. Some of the diverted water would be lost by evaporation during the recharge period. Estimated evaporation, based on Rowher's equation (Crosthwaite and others, 1970, p. 19), would be about 10 inches for the

3-month period April to June, the principal period when water would be available for recharge. However, another possibly more important factor to consider is that raising the water table beneath and upgradient from the bottom lands in the lower reaches of Warm Springs Creek, and other creeks that are 2 or 3 miles upstream from the reservoir, would impede or delay the harvest of crops. This factor should be weighed against the advantages of an improved irrigation supply downstream during dry years.

Geophysical data imply that the alluvial fill of the valley from Chilly Buttes to the upper end of Mackay Reservoir ranges in thickness from a few hundred to more than 2,000 feet. Assuming that the specific yield of these deposits is 20 percent, the upper hundred feet of saturated valley fill in an area of 40 square miles would contain about 500,000 acre-feet of ground water. This is almost enough water to supply the irrigation demand below Mackay Reservoir for three irrigation seasons, assuming that 181,000 acre-feet (see fig. 1, example 2) at Mackay Narrows provides an adequate annual supply (170,000 acre-feet) for presently irrigated lands. Also, the water in storage in the upper 100 feet of the aquifer is equivalent to more than half the amount of supplemental water that was needed for irrigation during the drought that lasted from 1929 through 1939. To provide 181,000 acre-feet to Mackay Reservoir during a year similar to the driest year of record, 1934, would require about 86,200 acre-feet of supplemental ground water, which is equivalent to 65 wells pumping 3,000 gpm (gallons per minute) each during a 100-day irrigation season. This assumes that the water would be conveyed to the reservoir in pipelines or lined ditches so that none would be lost by seepage.

Pumping at these rates in the Chilly-Barton Flats area for several consecutive irrigation seasons would lower the water table and reduce the natural ground-water discharge to Mackay Reservoir. Lowered water levels would reduce the size of the swamp area in Thousand Springs valley and in the area just upstream from Mackay Reservoir, but crop production in these areas could be maintained by ground-water pumping and by using water from Warm Springs Creek.

The estimated average surface-water yield of the basin upstream from Mackay Narrows is about 235,000 acre-feet (Crosthwaite and others, 1970, p. 90). This is about 38 percent larger than the present water needs (170,000 acre-feet) downstream from the Narrows. Artificial recharge in the Chilly-Barton Flats area during wet years and pumping from the valley fill during dry years could provide a more balanced water supply for irrigation, but to recharge all the streamflow in very wet years would require very extensive facilities.

Downstream from Mackay Reservoir, artificial recharge would have to be accomplished almost entirely by seepage from canals and small ponds along the margins of the valley and high up on the alluvial fans where relatively thick sections of unsaturated deposits occur. This is necessary because along the axis of the valley the water table is near the surface and, therefore, the aquifers are virtually full. The old Utah Construction Co. canal along the west side of the valley from Darlington to Era Flats could be repaired and the bottom cleaned of silt and clay so that a maximum amount of water would seep into the ground. A similar canal on the east side of the valley would be twice as long and would, therefore, probably have at least double the recharge potential of the existing canal.

The disadvantages of artificial recharge in these areas are that the recharge water would have a relatively short distance to move underground before it would reappear as streamflow, and, therefore, a short transit time. For these reasons, a considerable amount of the recharged water might not be available at the time it is needed. Also, the recharge water might raise water levels in the lowlands to the extent that the production of crops in the lowlands would be adversely affected.

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