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DEPARTMENT OF
WATER RESOURCES

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ATTORNEYS FOR THE CITY OF POCATELLO

BEFORE THE DEPARTMENT OF WATER RESOURCES
OF THE STATE OF IDAHO

IN THE MATTER OF THE PETITION REGARDING STORAGE RESET IN WATER DISTRICT 01 FILED BY MILNER IRRIGATION DISTRICT	Docket No. P-WRA-2017-002 **CITY OF POCATELLO'S OPENING BRIEF**

The City of Pocatello, by and through undersigned counsel, hereby submits this Opening Brief.

INTRODUCTION

On January 3, 2018, the Director of the Idaho Department of Water Resources ("IDWR" or "Department") issued an *Order Re: Statements of Issues and Responses; Order Adopting Deadlines; Amended Notice of Status Conference*. The Director ordered the parties to submit briefing to address a "threshold legal question" before continuing further in this contested case:

> In responding to Milner's petition, the Director must determine whether Water District 01's procedures for resetting the accounting system's reservoir water right accrual volumes for federal onstream reservoirs are consistent with the storage water right partial decrees. The Director's interpretation of water right partial decrees must begin with the plain language of the decrees. *See U.S v. Black Canyon Irr. Dist*, Docket No. 44635, 2017 Idaho (Dec. 21, 2017); *City of Blackfoot v. Spackman*, 162 Idaho 302, 396 P.3d 1184, 1190 (2017); *Rangen, Inc. v. Idaho Dep't of Water Res.*, 159 Idaho 798, 367 P.3d 193, 201 (2016). The threshold legal question the Director must answer in this contested case is whether the plain language of the "period of use" element of the storage water right partial

> decrees for federal onstream reservoirs in Water District 01 that specifies "1/1 to 12/31" as the time period for "irrigation storage" requires that the reset date for those rights be January 1.

Id. at 3. As described in the Staff Memorandum, the Water District 01 ("WD01") "reset" date

> determines the annual period natural flow can be distributed to previously filled reservoir water rights. For example, if the reset date is September 15th, the annual period natural flow can be distributed to reservoir water right volumes is from September 15th of the current year to September 14th of the following year.

Reset Date Staff Memorandum from Tony Olenichak, to Gary Spackman, at 1 (Dec. 1, 2017) ("Staff Memo").

The Staff Memo explains that historically the reset date has been established by WD01 in a manner that maximizes beneficial use of the resources available in the Upper Snake River Basin. This administration is consistent with the partial decrees for the federal onstream reservoirs in WD 01, which are silent regarding reset. As noted by the Idaho Supreme Court, a period of use element of 1/1 to 12/31 for a storage right indicates that the storage water rights are able to divert "year-round"—in other words, on any day of the year. *In re SRBA*, 157 Idaho 385, 389, 336 P.3d 792, 796 (2014). Thus, the Director is not limited by the decrees to a reset date of January 1. Rather, the Director should select an appropriate reset date for WD01 that promotes maximum utilization without waste, as required by the prior appropriation doctrine. Fundamentally, the purpose of the onstream federal reservoirs is to capture water when available year-round, including the fall and winter. Ensuring that this goal is met contributes to maximizing the storage of water, and maximizing the beneficial uses of water in WD01.

BACKGROUND

Federal irrigation projects in the Upper Snake River Basin above Milner Dam are operated together to divert and deliver storage water to over 60 spaceholder entities that serve over 1 million irrigated acres in the Upper Snake River Basin. The Minidoka Project originally consisted of three dams; Jackson Lake Dam, American Falls Dam, and Minidoka Dam (Lake Walcott Reservoir). BUREAU OF RECLAMATION, THE UPPER SNAKE RIVER BASIN: A DESCRIPTION OF BUREAU OF RECLAMATION SYSTEM OPERATIONS ABOVE MILNER DAM at 7, (Jan. 1996, revised Dec. 1997), attached as Exhibit 1. On September 20, 1935, Island Park and Grassy Lake dams were authorized as part of the project. *Id.* at 9. After water shortages during the 1930s, the Palisades Project was authorized on December 9, 1941[1], and reauthorized by the Act of September 30, 1950, Pub. L. No. 81-864, 64 Stat. 1083 (1950) ("1950 Act").

It was the intent of the Palisades Project—like most Bureau of Reclamation projects—to capture water during the fall and winter to provide additional supplies. *See* BUREAU OF RECLAMATION, WATER SUPPLY FOR PALISADES RESERVOIR PROJECT, IDAHO, PROJECT PLANNING REPORT 1-5.17-1, at 114 (Oct. 1946), attached as Exhibit 2 ("Climatic cycles have affected the annual run-off of the Snake River just as much as other western streams, however, and as a result, considerable hold-over storage facilities are needed to make approximately full use of available water."). However, to secure sufficient water supplies to justify the Palisades Project, the Bureau of Reclamation also sought the agreement of senior canal companies to forego their historical practice of diverting water year-round. The water savings associated with ceasing winter deliveries was estimated to be 135,000[2] to 435,000 acre-feet.[3]

[1]*Id.* at 8.

[2]BUREAU OF RECLAMATION PROJECT FEASIBILITIES AND AUTHORIZATIONS, A COMPILATION OF FINDINGS AND FEASIBILITIES AND AUTHORIZATIONS FOR BUREAU OF RECLAMATION PROJECTS OF THE DEPARTMENT OF THE INTERIOR (1957 ed.) at 700, Letter from John C. Page, Commissioner, to the Secretary of the Interior (Nov. 1, 1941), attached as Exhibit 3 ("[Palisades'] success, however, depends on the conservation of 135,000 acre-feet of water now wastefully used . . . .").

[3]Exhibit 2 at PDF p. 2, Memorandum from Michael W. Straus, Commissioner, to Secretary J. A. Krug (Nov. 29, 1946) ("Negotiation of the water savings agreements is of vital importance to the Palisades Reservoir Project because its full benefit can be realized only if average annual savings of water in the amount of 435,000 acre-feet can be effected through stoppage of present wasteful non-irrigation season diversions, and because the authorization of the dam was made contingent on being assured of substantial water savings."); *id.* at 140 ("If the winter water conservation program proposed herein is adopted and the proposed Palisades Reservoir is placed in operation, there will be a substantial increase in the supply of stored water available for irrigation use in the Snake River Valley.").

Simply put, winter water savings were necessary to ensure Palisades Reservoir had sufficient supplies to store water for use during drought years. *See* Exhibit 2 at 115, 144. Section 4 of the 1950 Act to authorize the Palisades Dam recognizes this condition: "(a) The continuation of construction of Palisades Dam . . . is hereby made contingent on there being a finding by the Secretary by the controlling date that contracts have been entered with various water users' organizations of the Upper Snake River Valley in Idaho that, in his opinion, will provide an average annual savings of one hundred and thirty-five thousand acre-feet of winter water." Act of Sept. 30, 1950, 64 Stat. 1084, Pub. L. No. 81-864.

The winter water savings provision was decreed in the Snake River Basin Adjudication District Court ("SRBA") through storage water rights 01-10042 and 01-10043. Storage rights were adjusted to give a special priority to those water users participating in the "winter water savings" storage conservation program. In other words, certain entities gave up the right to divert water in the winter and received in exchange a priority storage water right one day senior to the American Falls Reservoir storage water right as consideration for that agreement. Exhibit 1 at 17–19; *see also* Stipulation, In Re SRBA Case No. 39576, Subcase Nos. 01-219 et. al., (Sept. 25, 2012), attached as Exhibit 4.

Partial decrees were entered for the Upper Snake River federal onstream reservoirs in 2016, with the pertinent decreed periods of use included in the table below, hereinafter referred to as the "Base Rights":

Water Right	Reservoir	Period of Use	Priority
01-219	Walcott	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15	12/14/1909

01-2064	American Falls	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15 Power Storage 01-01 to 12-31 Power from Storage 01-01 to 12-31	3/30/1921
01-10042	American Falls	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15	03/30/1921
01-2068	Palisades	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15 Power Storage 01-01 to 12-31 Power from Storage 01-01 to 12-31	07/28/1939
01-10043	Palisades	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15 Power Storage 01-01 to 12-31 Power from Storage 01-01 to 12-31	07/28/1939
01-4055	Jackson	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15	08/23/1906
01-10044	Jackson	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15	08/18/1910
01-10045	Jackson	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 03-15 to 11-15	05/24/1913
21-2156	Island Park	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 04-01 to 10-31	03/14/1935
21-10560	Island Park	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 04-01 to 10-31	06/12/1940
21-4155	Grassy Lake	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 04-01 to 10-31	02/13/1936
25-7004	Ririe	Irrigation Storage 01-01 to 12-31 Irrigation from Storage 04-01 to 10-31 Wildlife Storage 01-01 to 12-31	06/16/1969

ARGUMENT

I. The Department's variable administration of reset is consistent with the storage water right partial decrees.

"When interpreting a water decree this Court utilizes the same rules of interpretation applicable to contracts. If a decree's terms are unambiguous, this Court will determine the meaning and legal effect of the decree from the plain and ordinary meaning of its words." *City of Blackfoot v. Spackman*, 162 Idaho 302, 396 P.3d 1184, 1188 (2017) (citations omitted). "A decree is ambiguous if it is reasonably subject to conflicting interpretations." *Id.*

The partial decrees for the Base Rights are silent on the matter of reset. The "period of use" element is not a decreed reset date. Instead, pursuant to IDWR's own rules, "period of use" is defined as "[t]he time period during which water under a given right can be beneficially used." Idaho Admin. Rules 37.03.02.010.20 (2017). The Idaho Supreme Court discussed the decreed elements of storage rights in the Basin Wide 17 Decision, and noted that the period of use provision means "year-round use":

> The purpose of use element of a storage water right generally contains at least two authorized purposes of use. The first authorizes the storage of water for a particular purpose (i.e., "irrigation storage," or "power storage"). The second authorizes the subsequent use of that stored water for an associated purpose, which is often referred to as the "end use" (i.e., "irrigation from storage," or "power from storage"). Each purpose of use is assigned its own quantity and period of use, which may or may not differ from one another. With respect to storage rights for irrigation, for example, it is typical for the "irrigation storage" purpose of use to be a **year-round use** (January 1 to December 31), and the "irrigation from storage" purpose of use to be limited to the irrigation season (e.g., March 15 to November 15).

In re SRBA, 157 Idaho at 389, 336 P.3d at 796 (emphasis added); *see also United States v. Black Canyon Irrigation Dist.*, No. 44635, 2017 WL 6521065, at *1 n.2 (Idaho Dec. 21, 2017) (quoting *In re SRBA*, 157 Idaho at 389, 336 P.3d at 796). In the same case, below, the SRBA found that the storage right decrees at issue in Basin 63—which contain the same period of use term as found in the Base Rights—"contain no flow limitations or period of use limitations in regard to storage." Memorandum Decision and Order at 13, Case No. CV-WA-2015-21376 (Sept. 1, 2016).

> **the reservoir water rights lack period of use limitations on storage**. The partial decrees unambiguously provide for **year-round use**. Ex. 2015. That is, the reservoir water rights divert water to storage any day of the year that they are in priority up until the time they are satisfied.

Id. at 10. In other words, the period of use provision of 1/1 to 12/31 indicates that storage can be diverted during any time of the year; there is nothing in either Courts' decision to support the conclusion that January 1 is a reset date.

The continuation of historical administration (including reset) was the basis of a September 25, 2012 Stipulation entered by various entities including IDWR in the Base Right subcases. *See* Exhibit 4. The parties agreed to the standard period of use element, a year-round storage component (1/1 to 12/31) and an irrigation from storage component of 3/15 to 11/15. Except for specifically excluded issues enumerated in paragraph 11, "the Parties agree, and the Department concurs, that this Stipulation and the attached Exhibits is a complete resolution of the water right elements and remarks of the water rights [subcases no. 01-219, 01-02064, 01-10042, 01-02068, 01-10043, 01-4055, 01-10044, 01-10045, 21-2156, 21-10560, 21-4155, 25-7004]". *Id.* ¶ 11. As a term of the Stipulation, for each of the Base Rights, the parties agreed that the stipulated elements in the attached draft partial decrees—which included the year-round period of use element—were agreed to in a manner "[c]**onsistent with . . . . historic administration** of water rights in Water District 01." *Id.* ¶¶ 2–10 (emphasis added).

Historic administration which, as explained by Staff Memo, supports a fall reset date. This Stipulation is binding and the partial decrees for the Base Rights must be administered as consistent with historic administration.

II. Historic administration and the purpose and intent of the onstream federal reservoirs shows that these projects intended to divert in the winter.

The intent and purpose of the development of the Upper Snake Reservoir Projects was to capture fall and winter water to maximize use of the Snake River above Milner Dam. "It is important to note that the Minidoka Project was initiated because irrigated agriculture was already highly developed and experienced shortages in summer months. Project storage was designed and developed to capture excess winter and spring season flows . . . ." Exhibit 1 at 4. Bureau of Reclamation's intent in securing partial decrees for the Base Rights was to affect this intent to capture such flows. Specifically with respect the winter water savings program, senior irrigators bargained for the right to receive the storage of winter water flows that they would otherwise apply for irrigation.[4] This history provides further support for a determination that the partial decrees do not set a reset date of January 1.

III. The Director's discretion in administering storage rights is limited by the prior appropriation doctrine and Idaho Law.

The Director's duties of administration extend to storage water.[5] Idaho Code section 42–602 gives the Director a "clear legal duty" "to direct and control distribution of water from all natural water sources, within water districts." *In re Idaho Dep't of Water Res. Amended Final Order Creating Water Dist. No. 170*, 148 Idaho 200, 211, 220 P.3d 318, 329 (2009); *In re SRBA*, 157 Idaho at 393, 336 P.3d at 800. "The Director also 'shall distribute water in water districts in accordance with the prior appropriation doctrine.'" *In re SRBA*, 157 Idaho at 393, 336 P.3d at 800 (citation omitted). "This means that the Director cannot distribute water however he pleases

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[4] *See* note 3, *supra*.

[5] "Storage water is water held in a reservoir and intended to assist the holders of the water right in meeting their decreed needs." *In re SRBA*, 157 Idaho at 389, 336 P.3d at 796. "A storage water right entitles the appropriator to divert, impound, and control water from a natural watercourse by means of a diversion structure such as a dam." *Id.*

at any time in any way; he must follow the law." *Id.* While administration necessarily starts with a water rights holder's decree, it does not end there:

> Here, the Director's duty to administer water according to technical expertise is governed by water right decrees. The decrees give the Director a quantity he must provide to each water user in priority. In other words, the decree is a property right to a certain amount of water: a number that the Director must fill in priority to that user. However, it is within the Director's discretion to determine when that number has been met for each individual decree. In short, the Director simply counts how much water a person has used and makes sure a prior appropriator gets that water before a junior user. Which accounting method to employ is within the Director's discretion and the Idaho Administrative Procedure Act provides the procedures for challenging the chosen accounting method.

Id. at 394, 336 P.3d at 801.

The Department must administer reset in a manner that promotes maximum utilization of the resource available in the Upper Snake River, without waste, as repeatedly affirmed by Idaho Courts. *Am. Falls Reservoir Dist. No. 2 v. Idaho Dep't of Water Res.* ("*AFRD#2*"), 143 Idaho 862, 880, 154 P.3d 433, 451 (2007). The policy of securing the maximum use and benefit, and least wasteful use, of Idaho's water resources, has long been the policy of Idaho. *Clear Springs Foods, Inc. v. Spackman*, 150 Idaho 790, 808, 252 P.3d 71, 89 (2011). "[T]he Idaho Constitution and statutes do not permit waste," and in Idaho, "the greatest use must be had from every inch of water in the interest of agriculture and home building." *AFRD#2*, 143 Idaho at 880, 154 P.3d at 451; *Van Camp v. Emery*, 13 Idaho 202, 89 P. 752, 754 (1907). *See also* Amended Final Order at 79, *In the Matter of Accounting for Distribution of Water to the Federal On-Stream Reservoirs in Water District 63* (Oct. 20, 2015) ("the current water right accounting method is consistent with the prior appropriation doctrine and is the best method for efficiently accounting and distributing water and maximizing water use without waste."). "It is against the spirit and policy of our constitution and laws, as well as contrary to public policy, to permit the wasting of our waters, which are so badly needed for the development and prosperity of the state . . . ." *Stickney v. Hanrahan*, 7 Idaho 424, 63 P. 189, 192 (1900).

As explained in the Staff Memo, the reset date has historically been set by WD01 in a manner that maximizes beneficial use of the resources available in the Upper Snake River basin, and that a "later" reset date—i.e. a later fall or winter reset date, like January 1—"allows junior water rights to come into priority ahead of senior reservoir rights in the fall and winter could delay (or prevent) the fill of reservoir water rights." Staff Memo at 5. "Variable annual reset dates (instead of using constant annual reset dates) could maximize the beneficial use of water above Milner Dam each year." *Id.* at 6.

> Variable annual reset dates would largely be based on the ability to forecast future conditions. For example, if the reservoir system has an extraordinary amount of carryover storage near the end of the irrigation season, the reset date could be delayed to allow junior water rights to come into priority in the fall, reducing the amount of water spilled past Milner Dam without preventing the complete satisfaction of reservoir water rights and without affecting the distribution of natural flow to junior irrigation water rights in the beginning of the following irrigation season.

Id. Such an administrative approach, on its face, serves the doctrine of maximum utilization.

When a decree does not contain express language, the Director is authorized to impose administrative constraints on water rights that are consistent with decree terms and the intent and purpose of the appropriator. "Somewhere between the absolute right to use a decreed water right and an obligation not to waste it and to protect the public's interest in this valuable commodity, lies an area for the exercise of discretion by the Director." *AFRD#2*, 143 Idaho at 880, 154 P.3d at 451.

For example, the Director's administration of storage rights limits the ability of storage rights to call. *Id.* at 879, 154 P.3d at 450. At issue in *AFRD#2* was a rule promulgated by the Department that permits the Director to consider, when determining material injury:

> The extent to which the requirements of the holder of a senior-priority water right could be met with the user's existing facilities and water supplies by employing reasonable diversion and conveyance efficiency and conservation practices; provided, however, the holder of a surface water storage right shall be entitled to maintain a reasonable amount of carry-over storage to assure water supplies for future dry years. In determining a reasonable amount of carry-over storage water, the Director shall consider the average annual rate of fill of storage reservoirs and the average annual carry-over for prior comparable water conditions and the projected water supply for the system.

Idaho Admin. Rules for Conjunctive Management of Surface and Ground Water Resources 37.03.11.042.01.g. This rule effectively states that the Director can require the use of some carryover water by a senior before cutting off water to a junior. *Id.* Carryover storage is "the unused water in a reservoir at the end of the irrigation year which is retained or stored for future use in years of drought or low-water." *AFRD#2*, 143 Idaho at 878, 154 P.3d at 449. The question presented to the court by the Surface Water Coalition ("SWC"), involving some of the Base Rights at issue in this case, was whether "the holders of storage water rights also entitled to insist on all available water to carryover for future years in order to assure that their full storage water right is met (regardless of need)." *Id.* at 879, 154 P.3d at 450.

The Base Right partial decrees are silent on the issue of carryover storage. The Idaho Supreme Court rejected the SWC's argument that they were entitled to the full amount of their decreed storage right simply because their decree contained that amount as a decreed element.[6] The Court upheld the rule, finding that while a storage right is a property right protected by the law, "that property right is still subject to other requirements of the prior appropriation doctrine." *Id.* at 879, 154 P.3d at 450.

[6] *Id.* at 880, 154 P.3d at 451. ("At oral argument, one of the irrigation district attorneys candidly admitted that their position was that they should be permitted to fill their entire storage water right, regardless of whether there was any indication that it was necessary to fulfill current or future needs and even though the irrigation districts routinely sell or lease the water for uses unrelated to the original rights. This is simply not the law of Idaho.").

Indeed, the Director has relied on the doctrine of maximum utilization as the basis for other Department's administrative practices when a decree is silent on an issue. In defending storage administration in Basin 63, the Director reaffirmed the importance of administering storage water rights in a manner that maximizes beneficial use and minimizes waste. *See* IDWR Appellants' Brief, Docket No. 44746-2017 (Idaho May 26, 2017).[7] There, the SRBA found that the Department's practice of continuing to distribute water to the Basin 63 reservoirs as "unallocated storage" was contrary to law. On appeal, the Department argues that unallocated/unaccounted for storage procedures that the Department has used in the past must be continued so as to prevent waste and to serve the doctrine of maximum utilization.

> The Unaccounted for Storage Methodology is Consistent with the Doctrine of Maximizing Beneficial Use and Minimizing Waste. . . . While there is excess flow early in the season during flood control years, this is a short-lived state of affairs. After the flood flows have ended and summer begins in earnest, stored water is essential to supplement the fully appropriated and steadily diminishing natural flow supply. Allowing the reservoirs to "refill" with excess water as the flood risk subsides prevents wasting storable flood water. This promotes beneficial use . . . .

IDWR Appellants' Reply Brief at 30–31, Docket No. 44746-2017 (Idaho Sept. 8, 2017).[8] The Department's reasoning in the Basin 63 litigation supports the continuation of historic administration of reset in WD01—otherwise, significant flows will go unappropriated and flow past Milner Dam in the fall and winter before "resetting" on January 1.

The State Water Plan recognizes the importance of maintenance of "zero flow" at Milner Dam. Idaho State Water Plan, Idaho Water Resource Board, adopted Nov. 28, 2012, attached as Exhibit 5. "The purpose of allowing a zero river flow at Milner Dam was to maximize the amount of water available for development above the dam . . . ." *Clear Springs Foods*, 150

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[7]*Available at* http://www.idwr.idaho.gov/files/legal/44746-2017/44746-2017-20170526-IDWR-Appellants-Brief.pdf.
[8]*Available at* http://www.idwr.idaho.gov/files/legal/44746-2017/44746-2017-20170908-IDWR-Appellants-Reply-Brief.pdf.

Idaho at 799, 252 P.3d at 80. Section 4 of the Plan addresses the Snake River Basin. Exhibit 5 at 42.

> The Snake River policies in this Plan provide essential guidance for the management of the Snake River in the public interest. When competing demands for Idaho's unappropriated water resources arise, the laws of the State of Idaho and the policies in this Plan establish the blueprint for management of the resource.

Id. "Policy 4B reaffirms the Milner Zero minimum average daily flow policy that guides the optimum development of unappropriated flows of the Snake River Basin above Milner Dam." *Id.* "Because of year-to-year variability of the natural flow passing Milner Dam, the optimum development of the natural flow will be achieved through storage in surface water reservoirs above Milner Dam and in the ESPA." *Id.* at 46.

CONCLUSION

The partial decrees for the Base Rights are silent on reset—the period of use element means that water can be diverted year-round for storage, not that January 1 is the decreed reset date. The Idaho Supreme Court has indicated that questions involving the administration of storage rights require an examination of facts and the law, and not just partial decrees. "[T]he question of when a storage water right is filled presents a mixed question of fact and law." *In re SRBA*, 157 Idaho at 392, 336 P.3d at 799. "Determining when a [storage] water right is filled requires the development of a factual record." *Id.* Indeed, "[a]dministering a water right is not a static business." *A&B Irrigation Dist. v. Idaho Conservation League*, 131 Idaho 411, 414, 958 P.2d 568, 571. Based on the purpose of the onstream federal reservoir projects, the Stipulation, historic administration and the doctrine of maximum utilization, the Department should continue to administer reset as described in the Staff Memo.

Dated this 18th day of January, 2018.

WHITE & JANKOWSKI LLP

By______________________________
Sarah A. Klahn

ATTORNEYS FOR CITY OF POCATELLO

CERTIFICATE OF SERVICE

I hereby certify that on this 19th day of January, 2018, I caused to be served a true and correct copy of the foregoing **CITY OF POCATELLO'S OPENING BRIEF** in **Docket No. P-WRA-2017-002** upon the following by the method indicated below:

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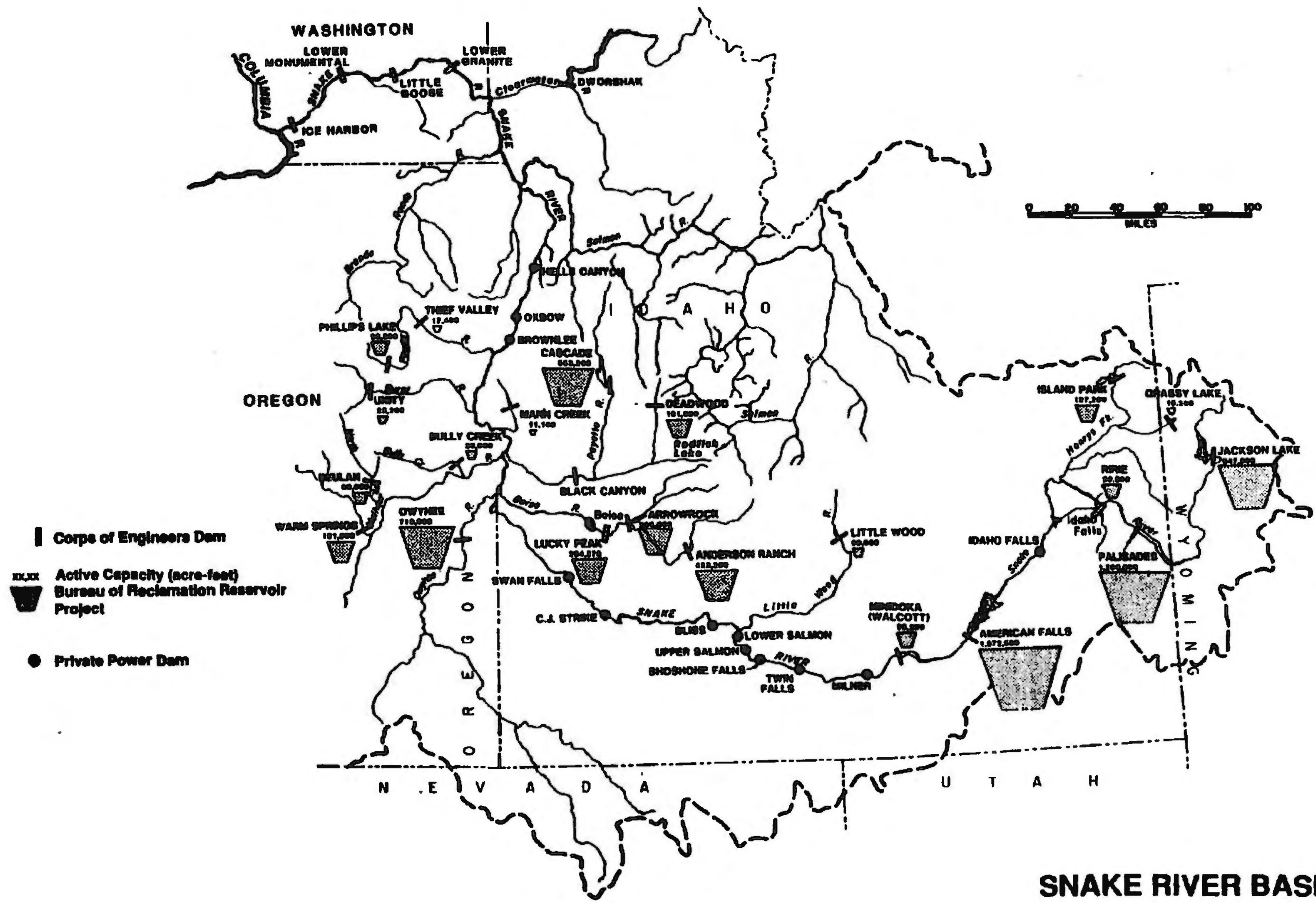
DEPARTMENT OF
WATER RESOURCES

The Upper Snake River Basin

A Description of Bureau of Reclamation System Operations Above Milner Dam

Bureau of Reclamation
Boise Idaho
January 1996
(revised December 1997)

EXHIBIT 1



SNAKE RIVER BASIN

Acronyms and Abbreviations

BPA	Bonneville Power Administration
cfs	Cubic feet per second
Corps	U.S. Army Corps of Engineers
ESA	Endangered Species Act
FCRPS	Federal Columbia River Power System
FERC	Federal Energy Regulatory Commission
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
IPC	Idaho Power Company
IWRB	Idaho Water Resources Board
kW	Kilowatt
NMFS	National Marine Fisheries Service
Reclamation	Bureau of Reclamation
RMP	Resource Management Plan
SOP	Standing Operating Procedures
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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I. Introduction

This report is intended as an overview of the operation of the Snake River/Federal storage system above Milner Dam. Increasing demands and controversy over the use of Snake River resources require an understanding of the history of water development, river hydrology, characteristics of the dams and reservoirs, and the legal and institutional requirements for operation of the current system. Water operations in the past focused on out-of-stream diversions to irrigate land and flood control. In recent years, additional demands on the water resource have focused primarily on instream uses including recreation and recovery of endangered species. Since 1991, the Bureau of Reclamation (Reclamation) has been asked to provide water to augment flows in the lower Snake River for enhancement of endangered salmon. Part of this water is being provided from the upper part of the Snake River basin. Reclamation also has been asked to modify operations to accommodate other species listed under the Endangered Species Act (ESA). Groups representing resident fishery, white water rafting, and water quality interests are asking for system operation changes to better accommodate their concerns.

This document focuses on the Snake River in the reach upstream from Milner Dam which is located near Burley, Idaho. This region is designated as Water District 01 by the State of Idaho and closely corresponds to the reach of the Snake River where a majority of the diversions from the main stem are for irrigation of lands and where most of the main stem reservoir storage is located. Irrigated lands further downstream in the Snake River basin, except those watered by diversions from the Milner pool, are watered from tributaries and storage development on those tributaries, e.g., the Boise, Little Wood, Owyhee, and Payette Rivers in Idaho and several streams in eastern Oregon. This document does not consider system operation of the Snake River downstream from Milner Dam.

Consumptive use of the Snake River is primarily for agriculture. However, it is important to recognize that less than one-half of the irrigated land in the upper Snake River basin[1] was developed under Federal authorities. The majority of the irrigation development in the upper Snake River basin is private development which relies on natural flow rights and ground water pumping. Federal irrigation development, in contrast, applies to those lands that were mostly privately developed but rely on storage rights for either a supplemental water supply or a full water supply. Several points, which are further developed throughout this document, should be kept in mind in considering Reclamation operation of the upper Snake River system:

- Irrigation water rights are appurtenant to the land, and the Federal Government does not hold most of these. Reclamation does hold storage rights at Reclamation dams.

- Water rights are administered by the State; Reclamation law, beginning with the 1902 Reclamation Act, requires Reclamation to comply with state law with regard to control, appropriation, use, and distribution of waters.

- Use of federally developed storage is closely controlled by three factors:
  - Federal authority for operation of the Federal facilities as enacted by the Congress
  - State water rights
  - Contracts for storage.

[1]Upper Snake River basin and upper Snake River are used throughout this report to indicate the Snake River and basin located upstream from Milner Dam. See chapter VII (Glossary) for additional definitions.

- Of almost 2.5 million acres irrigated upstream from Milner Dam, less than 1.1 million acres receive water from Reclamation storage, and only 210,000 acres receive a full water supply from Reclamation storage.

This paper is organized to provide more detailed information in succeeding chapters. Chapter II provides a description of the area, and chapter III provides a short history of water resource development upstream from Milner Dam. Major Federal and private facilities and water rights are discussed in chapter IV. Chapter V adds a general discussion of river system operations and includes a series of graphs of reservoir levels and river flows to illustrate the effects of water supply. River operations by function are expanded in chapter VI. Chapter VII identifies several issues related to operation of the Snake River/reservoir system. A list of acronyms and abbreviations appears at the front of this document and a glossary of hydrologic and other terms follows chapter VII as an aid to the reader.

II. Description of Area

Geography

The Snake River originates in Yellowstone National Park at an elevation in excess of 9,500 feet, flows south through western Wyoming, turns west and curves north in Idaho, and north of Idaho Falls curves south to make an arc through southern Idaho (see Snake River Basin and Major Storage Facilities above Milner Dam maps). At the Oregon border, the Snake River turns north, forming much of the border between Idaho and Oregon and a short portion of the border between Idaho and Washington. From Lewiston, the river makes an arc to join the Columbia River near the tri-cities of Richland, Pasco, and Kennewick, Washington. The Snake is the largest tributary of the Columbia River.

In Wyoming, the major tributaries to the main stem Snake River (sometimes referred to as the South Fork) are the Buffalo Fork, Gros Ventre, Hoback, Greys, and Salt Rivers. North of Idaho Falls, the main stem is joined by the Henrys Fork (often referred to as the North Fork) which flows from the north. The Henrys Fork originates in the northeast corner of Idaho at Henrys Lake, and flows south through Island Park Reservoir and to the confluence of the Warm River. After this confluence, the flow of the Henrys Fork is generally southwest to the confluence with the main stem. The major tributaries of the Henrys Fork are the Warm, Falls, and Teton Rivers.

Downstream to Milner Dam, most of the surface inflow is from streams that flow northward to join the main stem. These streams include the Blackfoot, Portneuf, and Raft Rivers and Willow Creek.

In addition to streams, springs provide a significant contribution to the Snake River. Many of these springs flow directly into the Snake River and are hidden. The largest contribution to the river is the highly visible Thousand Springs located downstream from Milner Dam.

Water Supply and Historical Change of Flows

Figure 1 shows the estimated annual water supply for the upper Snake River basin for the period from 1928 to 1989; the average supply during this period was about 10 million acre-feet. The estimated natural flow at Milner is the amount of water that would pass Milner Dam if there were no storage reservoirs and no irrigation or other diversion of the basin water supply. These estimates of natural flow were derived using the State of Idaho Monthly Planning Model and require adjusting observed runoff for the effects of of upstream storage, diversions, and return flows. Estimates of natural flow for the years following 1989 are not available at this time. The most difficult part of making this estimate is the determination of return flow and reuse which are affected by a complex relationship between surface flows and ground-water flows. The Snake Plain Aquifer intersects the river and provides significant water. Timing of this ground-water influence is difficult to assess. and data on ground-water movement does not provide exact results.

Natural flow in figure 1 is contrasted with the observed flow past Milner. This contrast shows the effect of operating the river/storage system with storage of water and out-of-stream diversions.

Figure 1.—Annual Discharge of the Snake River at Milner, Idaho.

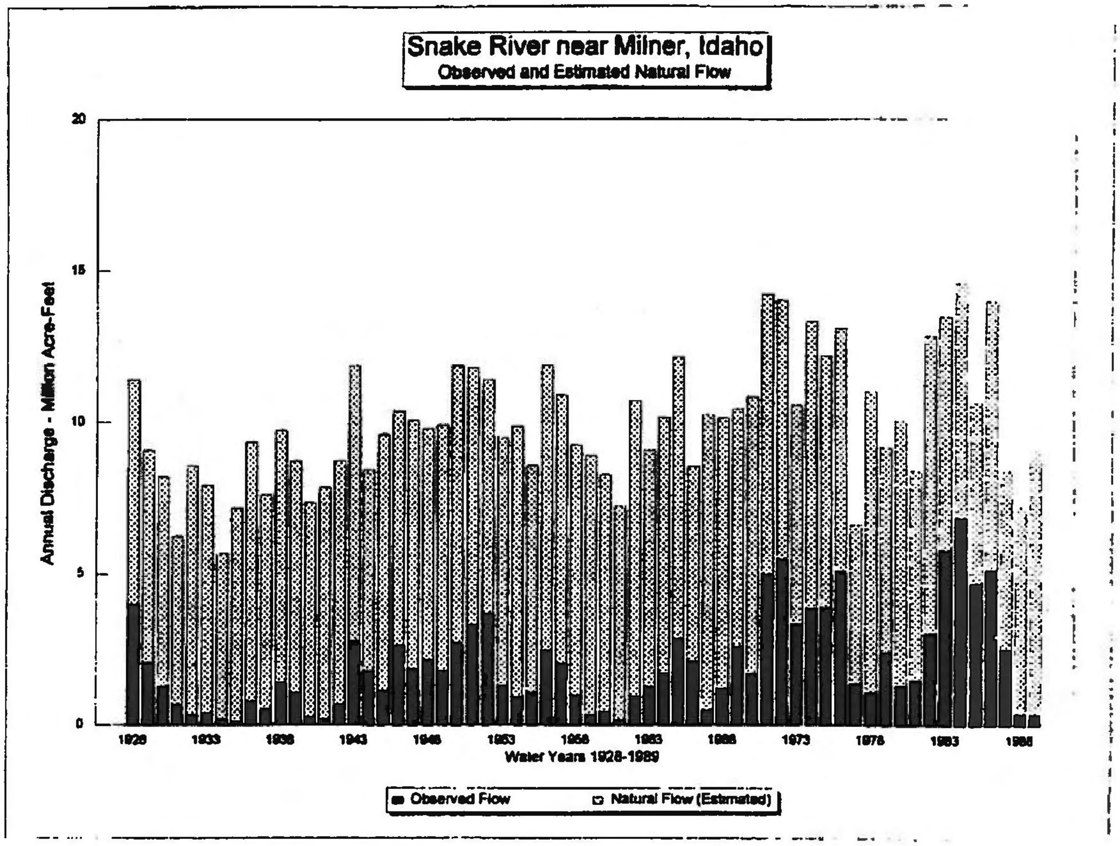
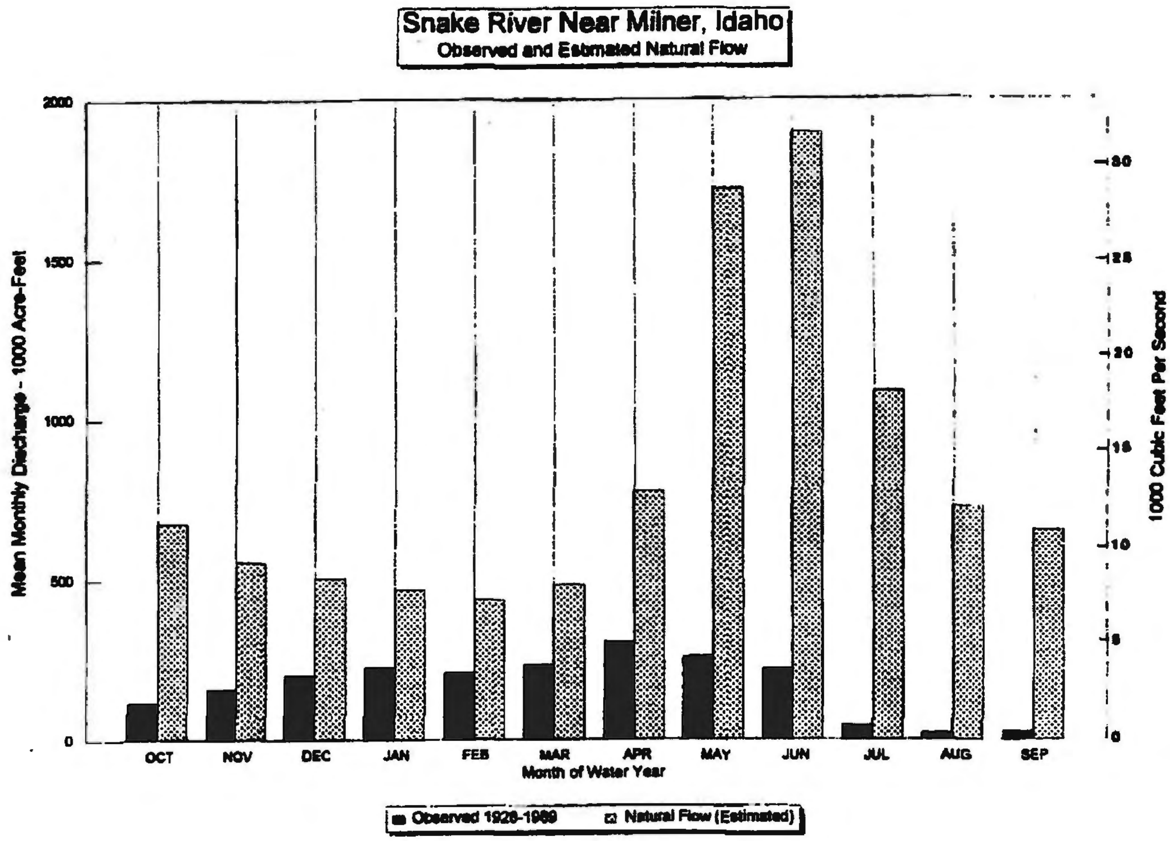


Figure 2 shows the average monthly flow past Milner for natural flow (no water development and no diversions) for the period 1928-1989. Natural flow past Milner would peak in June at a level of nearly four times the natural flow in February. With the current irrigation and reservoir development, flows peak in April and decline to minimums in August and September. Average monthly flows past Milner with system development are lower in all months than the average monthly flow for the lowest flow month without development (natural river flow).

Figure 2.—Average Monthly Discharge of the Snake River at Milner, Idaho



During early development of irrigation, but before major storage was developed, the natural flows during the winter changed very little, whereas, summer flows were substantially diminished by diversions for irrigation. With the current level of storage development, winter flow as well as summer flow are substantially altered.

It is important to note that the Minidoka Project was initiated because irrigated agriculture was already highly developed and experienced shortages in summer months. Project storage was designed and developed to capture excess winter and spring season flows for use in the summer, because the river was being severely depleted. Summer flows at Blackfoot were sometimes reduced to zero. Also, the aquifer was in an early stage of charging, and springflows and other subsurface return flows were smaller than they are today.

Although this report focuses only on the Snake River upstream from Milner Dam, upstream diversions and water use affect the downstream reach of the river. Some of those effects are complex. For instance, a minimum flow of 200 cubic feet per second (cfs) past Milner Dam is quickly augmented by irrigation return flows and to a much larger extent by the discharge of the Snake Plain Aquifer at Thousand Springs. Average discharge at Thousand Springs was around 4,000 cfs in the early 1900's and increased to almost 7,000 cfs in the 1950's. It has since decreased to about 5,000 cfs.

III. History of Water Resource Development

In the late 19th century, Utah farmers were attracted to the Snake River Valley upstream from American Falls, Idaho because of the relative abundance of water. The area where the two forks of the Snake River join (north of Idaho Falls) was especially attractive because of the fertile plain and many natural water channels. This interest led to extensive construction of canal systems around American Falls prior to 1900. Due to arid conditions in the west, the riparian doctrine of water rights that developed in the more humid east was discarded throughout the west as inappropriate, and the prior appropriation doctrine of water rights was developed. Under the prior appropriation doctrine, a person could use water from a stream without ownership of abutting land provided that the use did not interfere with an earlier use. Priority of appropriation became the recognized principle, with the courts ultimately determining the priority sequence and the amount of water of each appropriation. A law regulating the appropriation of water and affirming the prior appropriation doctrine was passed in Idaho in 1881. The Idaho State Constitution affirmed the principle that the stream belonged to the State, and a procedure was established through which future appropriation of water was to be made by application to the State Engineer (currently the Director of the Idaho Department of Water Resources). For administrative purposes, the State of Idaho has divided the Snake River into three sections. Water District 01 extends from Milner Dam to Palisades Reservoir including all of the Snake River drainage in Idaho above Milner Dam.

In Idaho, public land was acquired largely under the Homestead Act (1862), the Desert Land Act (1877), and the Carey Act (1884). The Carey Act was used quite extensively in the development of lands for irrigated agriculture production in the upper Snake River system. Under the Carey Act, each state, where irrigation was feasible, was to select up to 1 million acres of arid Federal lands to secure their reclamation by inducing private capital to construct the works necessary for irrigation. The Secretary of the Interior was authorized to ". . . donate, grant, and patent to the State free of cost for survey or price . . ." desert land for reclamation, cultivation, and settlement. The State Land Board was to approve the plans for development, set a price to be charged by the developing company, and provide supervision for the projects. The promoting company was to acquire a lien upon the lands of the settlers as security for payment of the obligation due for the water rights.

The first project constructed under the Carey Act was the Aberdeen-Springfield Canal completed in 1895 to divert 1,230 cfs from the Snake River at a point 3 miles downstream from the Firth bridge. Further to the west, the Twin Falls Land and Water Company was formed to provide for the development of Milner Dam and for the construction of the Twin Falls Canal to convey water to lands south of the Snake River. Upon completion in 1905, the Twin Falls tract included 202,000 acres.

Although the Desert Land Act and the Carey Act were somewhat effective in promoting irrigation development by private enterprise, development was limited by the financial resources of the individual promoters and the state. As the less complex irrigation projects were completed, the Federal Government was pressured to participate in development of irrigation by providing financing and water through storage development. Early settlers often overestimated the available water supply, not realizing that natural flows in August and September were insufficient to dependably irrigate crops.

At about the same time, the U.S. Geological Survey (USGS) had been formed and was actively classifying public lands and examining the geologic structure, mineral resources, and products of the national domain. The USGS reviewed opportunities for storage of water and irrigation of lands. Included in this evaluation were lands for a proposed Minidoka Project, lying to the north and south of the Snake River and extending up to 35 miles west from Minidoka Rapids (situated 6 miles south of the town of Minidoka) and water storage facilities in the upper basin. In 1902, the Reclamation Act was passed and work on the proposed Minidoka project was assigned to the newly created Reclamation Service. At the time that the Reclamation Service became involved in the investigation of irrigation potentials, Snake River flows were being used to irrigate some 275,000 acres upstream of Minidoka Rapids. Construction of Minidoka Dam and carriage facilities began in 1904, and a rockfilled crib dam was constructed at Jackson Lake in 1907. By 1912, 110,000 acres of the Minidoka Project could be irrigated.

As irrigation development proceeded, it became clear that the water supply was not as abundant as had once been thought. The irrigation season of 1905 was the first time that the Snake River canals experienced a serious water shortage. During the summer, the Snake River was dry for a distance of 10 miles in the vicinity of Blackfoot. Irrigation diversion came under the jurisdiction of the court which mandated the closing and opening of the headgates to only partially fulfill water claims so that a total loss of crops in the Blackfoot area was averted.

Completion of the Twin Falls North Side Project under the Carey Act to irrigate up to 180,000 acres on the north side of the Snake River was delayed until storage could be obtained from an enlarged Jackson Lake. In 1919, Jackson Lake (by then reconstructed to a capacity of 847,000 acre-feet) failed to fill, and a serious water shortage occurred. In 1924, another water shortage occurred, and crops on the North Side Twin Falls tract were in jeopardy.

The dry years and the resulting loss of agricultural production and financial instability provided the impetus for construction of additional Federal storage capacity. Additional storage capacity became available with the completion of American Falls Dam in 1927. While both Jackson Lake Dam and American Falls Dam were constructed by Reclamation, up front funding was secured from the participants to supplement Federal appropriations so that construction could proceed.

Federal irrigation development continued with the Gooding Division of the Minidoka Project in 1927, the Upper Snake River Division in 1935, the North Side Pumping Division in 1950, and other irrigation projects in the upper Snake region.

Reclamation involvement in irrigation development of the region is the response of the Congress to requests for Federal participation. Federal involvement began primarily with the USGS, which began classification of public lands at the request of Congress. The 1902 Reclamation Act provided the broad authority under which the Reclamation Service (later the Bureau of Reclamation) operates to identify and pursue irrigation potentials. The Reclamation Project Act of 1939 provided additional broad authorities particularly in the area of expending funds and recovering construction charges on Federal reclamation projects. The Federal Water Project Recreation Act of 1965 (Public Law 89-72) further broadens authorities by essentially authorizing recreation and fish and wildlife enhancement as a function at all existing reservoirs. More recently, Title XXVIII of Public Law 102-575 provides some additional broad authorities. Other public laws, especially the various flood control acts, provide further authorities for consideration and authorization of other functions. Specific authorizations of projects, divisions, and units or specific facilities are contained in a variety of individual project or facility authorizing acts and in some appropriation acts.

A USGS study in 1990 indicates that there are about 2,470,000 acres of irrigated land upstream of Milner Dam. This includes about 60,000 acres of the Fort Hall Indian Project which is irrigated

with natural flows, ground water, and storage in Blackfoot Reservoir and Grays Lake.
About 1,070,000 acres are part of Reclamation's Minidoka and Michaud Flats Projects with about 210,000 acres receiving a full water supply and about 860,000 acres receiving a supplemental water supply from Reclamation storage. The remaining 1,340,000 acres are outside Federal projects and much of this acreage is irrigated from ground water; none receive storage water developed by Reclamation.

Annual withdrawal of water is about 14,365,000 acre-feet, of which 6,581,000 acre-feet are from ground water and 7,784,000 acre-feet are from surface water. The annual consumptive use of water (net use of water) totals about 4,661,000 acre-feet.

IV. Overview

Federal Projects

There are five major Federal projects associated with development of irrigation and water and land resources in the upper Snake. The Federal projects include the following:

> Fort Hall Indian Project, constructed and operated by the Bureau of Indian Affairs
>
> Minidoka Project, constructed and operated by Reclamation
>
> Michaud Flats Project, constructed and operated by Reclamation
>
> Palisades Project, constructed and operated by Reclamation
>
> Ririe Project[1], constructed by the U.S. Army Corps of Engineers (Corps) and operated by Reclamation

Minidoka Project lands extend discontinuously along the Snake River from the town of Ashton on the Henrys Fork to the town of Bliss in south-central Idaho, about 300 miles downstream. Project lands downstream from Milner Dam are served by diversions from the Milner Pool. Project facilities furnish a full or supplemental water supply to more than 1 million acres of land from five reservoirs that have a combined active storage capacity of about 2.8 million acre-feet (Note: this does not include the storage of the Palisades and Ririe Projects). Major project works consist of Minidoka Dam and Powerplant, Jackson Lake Dam, American Falls Dam, Island Park Dam, and Grassy Lake Dam. In addition, there are thousands of miles of canals, laterals, and drains and many water supply wells.

The Fort Hall Indian Project is an irrigation project constructed primarily on the Fort Hall Indian Reservation. The water supply is provided from Blackfoot Reservoir, which has an active capacity of about 350,000 acre-feet; Grays Lake, which has an active capacity of about 40,000 acre-feet; and the Snake River. Operation of Blackfoot Reservoir and Grays Lake are not integrated into the operation of other Federal reservoirs in the upper basin.

The Michaud Flats Project is an irrigation project developed by Reclamation for irrigation of about 11,000 acres of land adjacent to the town of American Falls. There was no storage facility constructed specifically for the project which gets its water supply from storage space in American Falls and Palisades Reservoirs and from ground water.

[1]Ririe Dam and Reservoir are considered to be Reclamation facilities for the purposes of this document.

The Palisades Project consists of Palisades Dam and Reservoir which were constructed to provide additional storage of 1,200,000 acre-feet in the upper basin. (Palisades Project is often combined in common speech with Minidoka Project, e.g., "the Minidoka-Palisades Project" because the two are so closely related. Often, a speaker includes the operation of the Palisades Project when the stated subject is the Minidoka Project.)

The Ririe Project consists of Ririe Dam and Reservoir and was constructed for flood control and irrigation. The reservoir has an active storage capacity of more than 80,000 acre-feet.

Reclamation Project Authorizations

Most of the Reclamation reservoirs in the upper Snake River basin were authorized as part of the Minidoka Project under the 1902 Reclamation Act with subsequent authorization of specific facilities by the Secretary of the Interior or the President. From 1902 to 1910, the Secretary of the Interior had authority to approve construction after a finding of feasibility. The Act of June 25, 1910 modified the procedure to require the President to approve the authorization. The 1939 Reclamation Act returned authorization authority to the Secretary of the Interior but a finding of feasibility had to be submitted to the President and the Congress. Authorizing legislation sometimes clearly states the authorized purpose of the project or facility but often indicates only that the project is to be constructed in accordance with a cited report.

The authorized purpose is an important consideration because it determines the limits within which a Federal facility can be operated. Flood control, as a project function, was authorized after most facilities were constructed. Recreation, including fish and wildlife enhancement, is an authorized function at projects and reservoirs generally through legislation that was passed after the facilities were constructed. However, the general authorizations for recreation apply to management of water and land surfaces and the development of facilities for recreation or safety purposes; they do not authorize reallocation of water supply for other purposes.

The Minidoka Project was authorized by the Secretary of the Interior on April 23, 1904, under the 1902 Reclamation Act. Investigation and construction funds for the Gooding Division (Gravity Extension Unit) were provided by the Act of January 12, 1927, and the Secretary's finding of feasibility dated July 2, 1928 was approved by the President on July 3, 1928. The Upper Snake River Division was authorized by a finding of feasibility of the Secretary and approved by the President on September 20, 1935. The North Side Pumping Division was authorized for construction by the Act of September 30, 1950. Replacement of American Falls Dam was authorized by the Act of December 28, 1973 (Public Law 93-206).

The Palisades Project was initially authorized by the Secretary of the Interior on December 9, 1941 under the Reclamation Project Act of 1939. It was reauthorized by the Act of September 30, 1950 (Public Law 81-864).

The Michaud Flat Project was authorized by the Act of August 31, 1954 (Public Law 83-741) and the Ririe Dam and Reservoir Project was authorized by the Act of October 23, 1962 (Public Law 87-874).

Table 1 shows the original authorization associated with each reservoir.

Table 1.—Authorization of Reclamation Storage Facilities		
Facility and Construction[1]	**Authorization**	**Original Authorized Purpose**[2]
Minidoka Dam 1904-1906	Secretary of the Interior on April 23, 1904 (under the 1902 Reclamation Act)	Irrigation and power
Jackson Lake Dam, 1907, 1910-11, 1916	Secretary of the Interior on April 23, 1904 (under the 1902 Reclamation Act)	Irrigation
American Falls Dam 1925-27, 1976-78	(under 1902 Reclamation Act[3]). Replacement by Act of December 28, 1973	Irrigation and power
Island Park Dam 1935-38	President on September 20, 1935 (under 1902 Reclamation Act)	Irrigation
Grassy Lake Dam 1932-39	President on September 20, 1935 (under 1902 Reclamation Act)	Irrigation
Palisades Dam 1951-57	Secretary of the Interior on December 9, 1941. Reauthorized by Act of September 30, 1950	Irrigation, power, flood control, and fish and wildlife
Ririe Dam[4] 1970-77	Act of October 23, 1962	Flood control, irrigation, and recreation.

[1]Multiple construction periods indicate reconstruction or additional construction to reach the current storage capacity.
[2]The Act of September 30, 1950, by reference, appears to authorize the upper Snake River Reservoir system to be operated for flood control. In addition, several flood control acts have essentially authorized flood control at all Reclamation reservoirs. Public Law 89-72 along with Public Law 102-575 have essentially authorized recreation (including fish and wildlife enhancement) at all Reclamation projects. However, this authorization is primarily for construction of facilities and management of lands and does not authorize a change in the use of storage space in a reservoir.
[3]Legislation in 1924 addresses purchase of Indian lands and expenditure of monies for construction of the reservoir; however, a specific document authorizing construction has not been identified.
[4]Constructed by the Corps, but operated by Reclamation.

History and Operation of Reclamation Dams

The major Reclamation dams are discussed below in the approximate order in which they were constructed. Table 2 summarizes the capacities of Reclamation reservoirs located upstream of Milner Dam. (Additional information on reservoir space is included in Appendix A.)

Table 2.—Capacities of Federal Reservoirs					
Reservoir	Elevation at Full Pool (feet above sea level)	Capacity (acre-feet)			
		Active[1]	Inactive[2]	Dead[3]	Total
Minidoka	4,245	95,200	115,000	--	210,200
Jackson Lake	6,769	847,000	--	--	847,000
American Falls	4,354.5	1,672,590	--	--	1,672,590
Grassy Lake	7,120	15,200	--	270	15,470
Island Park	6,302	127,265	381	--	127,646
Palisades	5,620	1,200,000	157,000	44,000	1,401,000
Ririe	5,119	80,500	6,000	4,000	[4]90,500
Total	Not Applicable	4,037,755	278,400	48,270	4,364,406

[1]Water that can be released for specific purposes.
[2]Water that can be released from the reservoir but is normally retained for a specific purpose, e.g., Island Park and Ririe--sediment control; Palisades and Minidoka--power or operational head (see also Appendix A).
[3]Water that cannot be released by gravity flow because it is below the elevation of the outlet.
[4]Does not include 10,000 acre-feet of exclusive flood control space.

Minidoka Dam

Construction of Minidoka Dam began in 1904 and was completed in 1906; Minidoka Powerplant was completed in 1909. In 1909, the overflow spillway section was raised 5 feet with the addition of 334 stop-log piers and bays. Development of Minidoka Project lands began with diversion of water from Minidoka Dam to the Minidoka Irrigation District and the Burley Irrigation District. Lands around Lake Walcott (the impoundment formed by Minidoka Land) are withdrawn by Reclamation and managed by the U.S. Fish and Wildlife Service (USFWS) as part of the Minidoka National Wildlife Refuge which was established in 1909.

Several activities have recently taken place at Minidoka Dam. The spillway radial gates were replaced in 1989-90. The original gates were installed in 1913 and were in need of complete replacement. Rehabilitation and construction activities at the powerplant have been initiated and are expected to be completed in 1997. The "old" Minidoka Powerplant is being replaced with a new, two unit powerplant built near the left abutment of the embankment dam. Units 1 through 5 will be retired and preserved as museum pieces in the old powerplant. Existing Unit 6 will be completely replaced and Unit 7 will have modern controls installed. The new powerplant will house Units 8 and 9. With this construction, generation nameplate capacity will be increased from 13,4 kilowatts (kW) to about 28 kW.

Minidoka Dam is primarily a diversion dam and a power generating facility. Lake Walcott is the easiest reservoir to fill because it is relatively small and winter flows in the Snake River at Minidoka are always sufficient to fill it. An early priority storage right means that the storage right must be physically filled somewhere in the system before junior storage rights can be filled (see additional discussion under "Water Rights").

Normal spring/summer operation is to raise the elevation to 4245 feet and to maintain that level to provide adequate flow to the main canals of the Burley and the Minidoka Irrigation Districts. Flows from American Falls Reservoir are diverted to the canals and/or passed through Minidoka Dam downstream to Milner Dam. In late summer, deliveries are made from storage if needed. In the fall, when irrigation deliveries will not be affected, the reservoir is drawn down and maintained at elevation 4240 feet or lower. This protects the concrete overflow spillway stop-logs, piers, and bays from ice damage. Winter inflow includes any releases from American Falls plus reach gains that normally total 250 to 350 cfs.

Jackson Lake Dam

The original Jackson Lake Dam (rockfilled crib) was completed at the outlet of a large existing lake in 1907 but partially failed in 1911; the size of the original lake is unknown but may be as much as 2 million acre-feet . A concrete gravity structure with earth embankment wings was built at the site in 1911 and further raised in 1916. Safety concerns were identified at the dam in the mid-1970's, and from 1977 to 1989 the level of Jackson Lake was maintained at a lower than normal level because of concerns for possible dam failure during an earthquake. In 1989, reconstruction was completed under the authority of the Reclamation Safety of Dams Acts making the full capacity again available. Lands around the lake are withdrawn by Reclamation. Since the lands are inside the boundary of Grand Teton National Park, they are managed by the National Park Service. (See also "Snake River Compact.")

Jackson Lake is operated in conjunction with Palisades Reservoir for flood control. In the late summer or early fall, flood control space is evacuated, lowering the lake to 647,000 acre-feet of storage; normal summer operation sometimes empties the flood control space. Winter inflow, minus outflow, is stored until the 647,000 acre-feet is reached and then passed to maintain that level; however, additional flood control releases may be made in the late winter or early spring. Winter flow releases are generally above 200 cfs. In the spring and summer, inflow is stored until full pool is reached or released as needed to meet irrigation demands.

American Falls Dam

American Falls Dam was completed in 1927 and rebuilt in 1977. Idaho Power Company (IPC) owns and operates a powerplant under a Federal Energy Regulatory Commission (FERC) license at the dam. Lands around American Falls Reservoir were withdrawn and acquired and are managed by Reclamation; lands located on the Fort Hall Indian Reservation are managed by the Shoshone-Bannock Tribes.

A winter minimum release of at least 300 cfs is maintained from November until spring; in recent years the release from December to February has averaged 4,050 cfs. The magnitude of the winter flow depends principally on the amount of carryover storage in American Falls Reservoir and the system upstream. If American Falls is nearly drained at the end of the irrigation season, a flow of about 350 cfs is commonly released to maintain water quality downstream. If carryover storage is good, estimates are made of the amount of unstorable flow expected prior to the irrigation season. This unstorable flow is then released as uniformly as feasible to provide higher flows throughout the winter.

The primary winter operation goal is to fill American Falls by April 1 or the onset of the irrigation season. IPC often moves some of its American Falls storage water (total of 44,276 acre-feet) in December and this may increase the flow for a short time. If inflows to American Falls are much higher than normal or if the carryover storage is substantial, winter releases may range from 1,000 to 5,000 cfs. Some flood control operations may be made at American Falls but are incidental to irrigation operations. Summer releases from American Falls are dictated by downstream irrigation demands and downstream water rental pool leases below Milner Dam.

Island Park Dam

Island Park Dam was completed in 1938, primarily for irrigation of land in the St. Anthony to Rexburg area. Safety of Dams work was completed in the early 1980's. In 1991, the Fall River Rural Electric Cooperative (FRREC) received a FERC license to construct and operate a small powerplant at the dam; generation began in 1994. FRREC also received approval in 1995 to modify the spillway to enhance hydropower generation. This modification will increase the active storage capacity to 135,000 acre-feet and improve water temperature conditions downstream in the Henrys Fork that will benefit its world famous rainbow trout fishery. A combination of withdrawn and acquired lands around Island Park Reservoir are managed by the U.S. Forest Service (USFS).

Winter releases are established in late October and November of each year and are dependent on carryover storage and fall inflows Although there is no requirement for a minimum release, Reclamation has worked with spaceholders and others to try to maintain a release of 300 cfs between irrigation seasons. Recent winter releases have ranged from 100 to 300 cfs. With good carryover and normal to above normal runoff, a release of about 500 cfs is maintained. Close communication is maintained with the Henrys Fork Foundation (a private conservation group) and the Idaho Department of Fish and Game (IDFG) on all release operations, and consideration is given to fish and swan habitat.

Island Park is operated to provide additional flow in the winter months using water that was adversely stored (storage accumulated adverse to a senior storage priority) in the fall after the irrigation season. In the spring and early summer, water is stored with the goal of filling the reservoir in April. Some incidental flood control operation may occur if the forecast dictates. In the past, Island Park Reservoir was managed to maintain a surcharge of one additional foot above the dam's spillway lip to meet contractual irrigation storage obligations. With the spillway modification and resultant increase in active capacity, this water will no longer be in surcharge.

Grassy Lake Dam

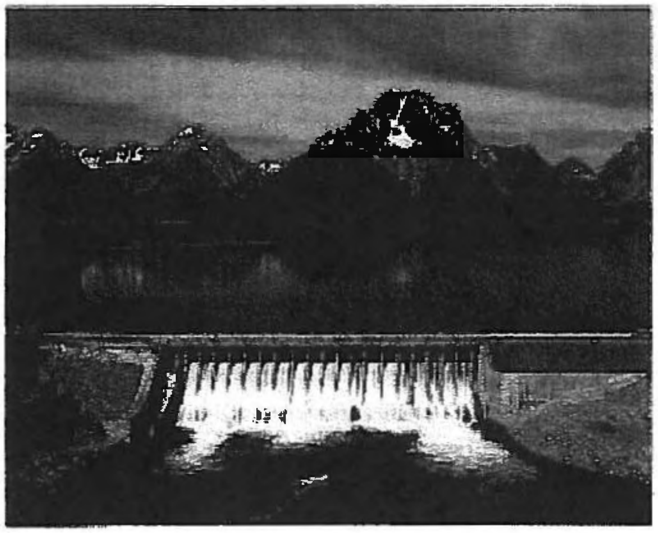
Grassy Lake Dam was completed in 1939. Grassy Lake is a small reservoir located in Wyoming just outside the southwest corner of Yellowstone Park. Lands around Grassy Lake are withdrawn by Reclamation and managed by the USFS.

Water is diverted from Cascade Creek to Grassy Lake in the fall, winter, and early spring. No water is diverted during periods of high inflow, full reservoir conditions, or during the summer months. Grassy Lake does not normally release water in the winter. Diversions into the lake begin in late winter and early spring with the goal of filling Grassy Lake in early summer. Releases are made on demand, normally in July and August. Additional releases are made if necessary to reach the winter operation level. Grassy Lake is difficult to fill the following spring if drawn down to 7,000 acre-feet or lower.

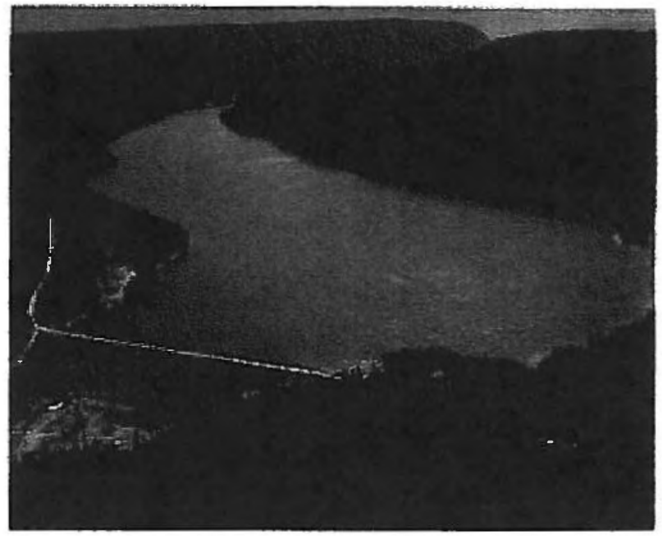
Palisades Dam

Palisades Dam was completed in 1957. The powerplant was uprated in 1994 and all four units were rewound increasing the nameplate rating from the original 118,750 kW to 176,600 kW. As part of the mitigation for the powerplant uprate, a fish screen was constructed on an irrigation diversion on Palisades Creek, a small tributary which joins the Snake River approximately 3 miles downstream from the dam. The acquired and withdrawn lands around Palisades Reservoir are managed by the USFS.

At Palisades, winter minimum releases are established in early November on the basis of fall carryover storage and fall inflow and are maintained throughout the winter. A minimum flow of 550-750 cfs is usually maintained depending on the severity of drought conditions. The usual minimum flow is 1,100-1,200 cfs. If

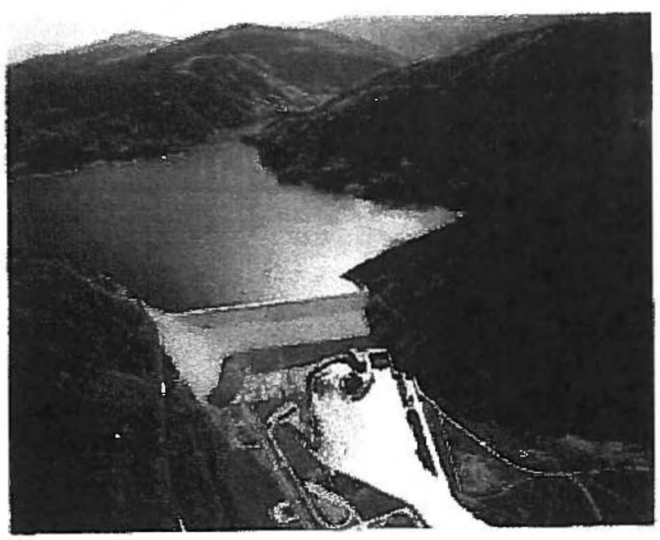


Jackson Lake Dam



Grassy Lake Dam

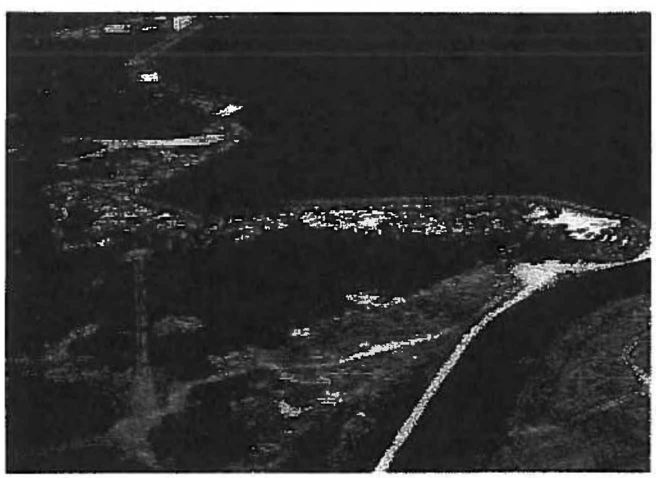
Island Park Dam



Palisades Dam

Ririe Dam

American Falls Dam



Minidoka Dam

carryover storage is good, higher releases may be needed around the end of the calendar year to create or maintain flood control space.

During the spring runoff, Palisades is operated in combination with Jackson Lake under flood control rules which may require increased releases depending on the forecast. The goal is to fill Palisades when flood potential subsides; after the peak spring runoff. Releases are made throughout the summer and fall to meet downstream irrigation demands. To the extent possible, releases are directed through the powerplant but storage is not specifically released for power production.

Ririe Dam

Ririe Dam and flood control channel were completed by the Corps in 1977 and were turned over to Reclamation for operation. The reservoir is operated primarily for flood control. Uncontracted storage in Ririe Dam is part of the 1990 Fort Hall Indian Water Rights Agreement (see chapter VII) which is in the process of being approved. Lands around Ririe Reservoir are managed by the IDFG with recreation facilities managed by Bonneville County.

Water is stored at Ririe throughout the winter, spring, and early summer. There is no winter minimum flow because of possible ice formation in the flood channel. After spring, the reservoir is maintained as high and as stable as possible for recreation with a release of at least 30 cfs to provide water for natural flow right demands. After Labor Day the reservoir is drawn down to the flood control pool for the winter, releasing as much as 45,000 acre-feet by November 1.

Other Major Dams and Reservoirs

There are four other major dams and reservoirs in the upper Snake River basin. Two are operated by the Bureau of Indian Affairs and two are owned and operated by non-Federal entities.

Milner Dam

Milner Dam is owned and operated by the Twin Falls Canal Company and was constructed for irrigation in 1905. Because of safety concerns, the dam was rebuilt in 1991-1992. Although the reservoir has about 50,000 acre-feet of storage, the primary purpose of the dam is to raise the pool to a level adequate to divert water to the several irrigation canals and pumping plants and for operation of the powerplants. Associated with the dam are two powerplants owned and operated by IPC and operated under FERC licenses, under which IPC is required to pass 200 cfs whenever water is available. The smaller powerplant discharges directly to the stream downstream from the dam. Water for the larger powerplant is diverted from the Twin Falls Canal to penstocks for the powerplant located 1 mile downstream from the dam. Discharge is to the Snake River.

Blackfoot Reservoir and Grays Lake

Blackfoot Reservoir and Grays Lake are owned and operated by the Bureau of Indian Affairs as part of the Fort Hall Indian Project. Blackfoot Reservoir, completed about 1913 and raised to its current capacity by an auxiliary dam, has a total capacity of about 413,000 acre-feet and an active capacity of about 350,000 acre-feet. It is the main source of water for irrigation and municipal and industrial water supply on the Fort Hall Indian Reservation. Grays Lake, constructed in 1924, has a total capacity of about 400,000 acre-feet and a surface area of about 22,000 acres, but provides only 40,000 acre-feet of active storage. A canal diverts water from Grays Lake to Blackfoot Reservoir. Because of the small active storage capacity and large wetland area, Grays Lake is operated primarily for wildlife benefits.

Henrys Lake

Henrys Lake Dam is owned and operated by the North Fork Reservoir Company. The dam was completed at the outlet of a natural lake of unknown capacity in 1923 and has an active storage capacity of about 90,000 acre-feet. Storage in the lake is used to irrigate private lands.

Reclamation Spaceholder Contracts

Reclamation Projects are authorized with the intent of recovering the capital and operating costs from the direct beneficiaries. Over time and with experience in developing large projects, the Congress has changed the procedures and rules to achieve this goal. Currently, the capital and operating costs of a project are allocated among the benefiting functions, e.g., irrigation, flood control, power, fish and wildlife, etc. In some cases, the benefiting entities are widespread and cannot easily be identified or there is a national interest in the benefit, e.g., flood control, anadromous fish enhancement, and migratory bird enhancement. These costs are made nonreimbursable meaning that the people of the United States pay these costs through general taxes. Where costs are assigned to functions that benefit specific entities, the costs are made reimbursable, and repayment contracts to recover the reimbursable costs are signed with the benefiting entities. Capital costs assigned to the irrigation function are to be fully repaid without interest over a specific time period (as low as 10 years in the early 1900's to about 50 years at present depending on the type of contract). Reclamation irrigation repayment contracts are generally spaceholder contracts or water service contracts. Annual operating costs (operation, maintenance, replacement, and power costs) are included in the repayment contracts.

Project capital costs are seldom reallocated, a process that requires the Congress to reauthorize the project. However, annual operating costs are adjusted from time to time not only to reflect changing economic conditions but changes in benefits. Changes in the contracts must be approved by all of the signing entities.

All of the repayment contracts for Reclamation storage in the upper Snake River basin are spaceholder contracts that include an annual payment for the reimbursable cost of construction and for operation and maintenance. A spaceholder contract means that Reclamation sold each contractor (spaceholder) a share of the reservoir space, not a specific amount of water to be delivered each year. Carryover rights were also established, meaning that spaceholders could retain unused stored water from one year to the next. Under this system a water user's supply of storage water is a function of the space contracted, carry-over storage from previous years, and accrual to storage in the current year. However, the total amount of water due a spaceholder cannot exceed the volume of the contract space. Spaceholder contracts are held in perpetuity but can be sold to another entity with approval of Reclamation under Idaho State water law.

The Fremont-Madison Irrigation District is the only contracting entity for Island Park Reservoir and Grassy Lake. The District is served primarily by the Henrys Fork and Teton River. Some 64 other contracting entities hold space in one or more of the following reservoirs: Jackson Lake, American Falls Reservoir, and Palisades Reservoir. A total of 31 contractors hold space in only one reservoir, 12 contractors hold space in two reservoirs, and 21 contractors hold space in three reservoirs. A list of spaceholders in these three reservoirs and the capacities and contracted space for all of the Federal reservoirs is included as appendix A.

These spaceholder contracts are in marked contrast to conventional repayment and water service contracts often used at other Reclamation Projects. With water service contracts, Reclamation essentially delivers a specific amount of water or an entitlement and all water that remains in a reservoir after delivery of the specified entitlements is under Reclamation's control. With spaceholder contracts, Reclamation's control is limited to water in the uncontracted space and the inactive space. If all the active reservoir space has been marketed or contracted, all of the water in the active space of the reservoir is under control of spaceholders. That is the case for the Federal reservoirs upstream from Milner Dam. All of the active space has been marketed except for the following: 500 acre-feet in Palisades Reservoir and 10,000 acre-feet of exclusive flood control in Ririe. Reclamation has recently purchased about 22,400 acre-feet of storage space for salmon flow augmentation. Technically, this latter space can be included in uncontracted total, but the space is assigned to a specific use.

Spaceholder contracts make possible another concept—water banking. Under these contracts, the spaceholders can accumulate water in their contracted space and they may rent that water. To avoid problems with possible forfeiture of use (under State law a water right holder retains the right only if the water is used for a beneficial purpose), the State authorized creation of a water bank and defined the water bank as a beneficial use under State law.

In poor water years, when not all of the spaceholder storage is filled, each spaceholder gets his/her carryover from previous years and an amount of the accrued water supply proportionate to the contracted storage space. During normal and above normal years, the spaceholder storage space usually fills and the supply may exceed the amount used by the spaceholder who may carry over the excess or market it to a rental pool.

Spaceholder contracts are an important part of reservoir operations as the contract language, in part, defines the operating limits. For example, the contracts often stipulate that Reclamation will maximize the storage of water for irrigation use.

Reclamation Reservoir Cost Allocations

Construction Costs

As indicated earlier, the facilities of the Project were essentially for single purpose irrigation facilities; power at Minidoka Dam and American Falls Dam was intended primarily for operation of the dams and pumping water for irrigation. As a result almost all of the cost of these dams and reservoirs were to be repaid by irrigation interests. The capital cost of the Palisades Project was allocated to flood control (47 percent), irrigation (20 percent), power (32 percent), recreation (0.2 percent) and fish and wildlife (0.8 percent). The capital cost of Ririe Dam was allocated to flood control (74.30 percent), irrigation (14.33 percent), and recreation and sport fishery (11.37 percent). Costs assigned to flood control are considered nonreimbursable. All of the capital costs assigned to fish, wildlife, and recreation for these facilities are nonreimbursable. The only reimbursable costs of these facilities are the costs allocated to irrigation and power.

The repayment obligation for construction of the Reclamation facilities (dams, canals, etc.) of the Minidoka and Palisades Projects have for the most part been paid except for the obligation incurred for recent safety of dams work at Jackson Lake Dam. The Fremont-Madison Irrigation District has repaid the construction obligation for Island Park Reservoir and Grassy Lake. At present, most of the original contracting entities for the Minidoka and Palisades Projects have little or no repayment obligation remaining. As a result, annual payments to Reclamation are primarily for operation and maintenance.

Annual Operating Costs

Annual operating costs include operation, maintenance, replacement, and power costs needed to operate and maintain the facility over an extended period. Most of the reservoirs were single purpose at the time of construction and annual costs were to be repaid by irrigation interests. Later, other purposes, including flood control, recreation, and fish and wildlife were recognized and in some cases authorized. At present, all of the reservoirs provide multipurpose benefits. This change is recognized by allocating annual operating costs among several functions.

Allocation of annual operating costs for the older reservoirs uses the Lineweaver allocation method which recognizes that all reservoirs provide substantial benefits to recreation and fish and wildlife (e.g., flatwater boating, water skiing, reservoir fishery, wetlands, etc.). The annual operating costs of Palisades and Ririe Dams and Reservoirs are allocated to project functions following standard Reclamation procedures. Table 3 summarizes annual operating cost allocations. None of the annual costs allocated by the Lineweaver method to recreation and to fish and wildlife are reimbursable.

Table 3.—Allocation of Annual Operating Costs for Reclamation Reservoirs (percent of total cost)

Reservoir	Flood Control	Recreation	Fish and Wildlife	Irrigation	Power
American Falls	33.5	4.0	4.0	58.5	0.0
Grassy Lake	0.0	4.0	4.0	92.0	0.0
Island Park	13.0	4.0	4.0	79.0	0.0
Jackson Lake	29.5	4.0	4.0	62.5	0.0
Minidoka Dam	0.0	4.0	4.0	42.0	50.0
Palisades Dam	27.57	4.0	4.0	27.57	36.86
Ririe Dam	77.2	1.7	0.0	21.1	0.0

Water Rights

Hydraulic mining in the west was an early activity that required diversion of a large amount of water for transport to another place of use. As a result, the prior appropriation doctrine of water rights was developed in the west. Because of the arid conditions, this doctrine was also adapted for irrigation, and the riparian doctrine of water rights that developed in the more wet climate of the east was discarded throughout much of the west as inappropriate.

Under the prior appropriation doctrine, a person could use water from a stream without ownership of abutting land provided that the use did not interfere with an earlier use. Priority of appropriation became the recognized principle, with the courts ultimately determining the priority sequence and the amount of water of each appropriation. A law regulating the appropriation of water and affirming the prior appropriation doctrine was passed in 1881 while Idaho was a Territory. The Idaho State Constitution affirmed that streams belong to the State. Legislation has established a procedure through which appropriation of water is made by application to the State Engineer (currently the Director of the Idaho Department of Water Resources).

Water rights are administered by the State and are issued by date of appropriation for specific quantities, diversion points and places of use, and purposes. The 1902 Reclamation Act and subsequent Federal legislation affirm that the states are responsible for administering appropriative water rights within their borders. The earliest water rights for irrigation in the Boise and Payette River basins predate any storage development and are for diversion of flow at a specific rate (often called natural flow rights). Under the prior appropriation doctrine, natural flow rights are satisfied in order of priority based on date. When the water supply is limited, a water right holder with an earlier natural flow right is likely to receive a greater supply than a water right holder with a later date.

Development of storage facilities led to water rights for storage of a quantity of water (storage rights). Storage rights, along with natural flow rights, are satisfied in order of priority based on the date of the appropriation, i.e., the earliest rights must be met first. If earlier rights cannot be met, then water cannot be stored. All of the storage in a reservoir may have one priority date, but if a reservoir was increased in size at a later date, there may be a second priority date associated with the increase. As an example, Jackson Lake has storage priorities with three dates, each associated with an increase in the storage capacity of Jackson Lake. In addition, there are some cases where natural flow rights were exchanged for storage rights that may have a priority that predate the construction of the reservoir.

In the case of storage, the relative priority among spaceholders is established in the repayment contracts. In general, spaceholders have equal access to storage accruals, however, unequal access and priorities may be established in the contracts (see "District 01 Water Rental Pool" in chapter VI).

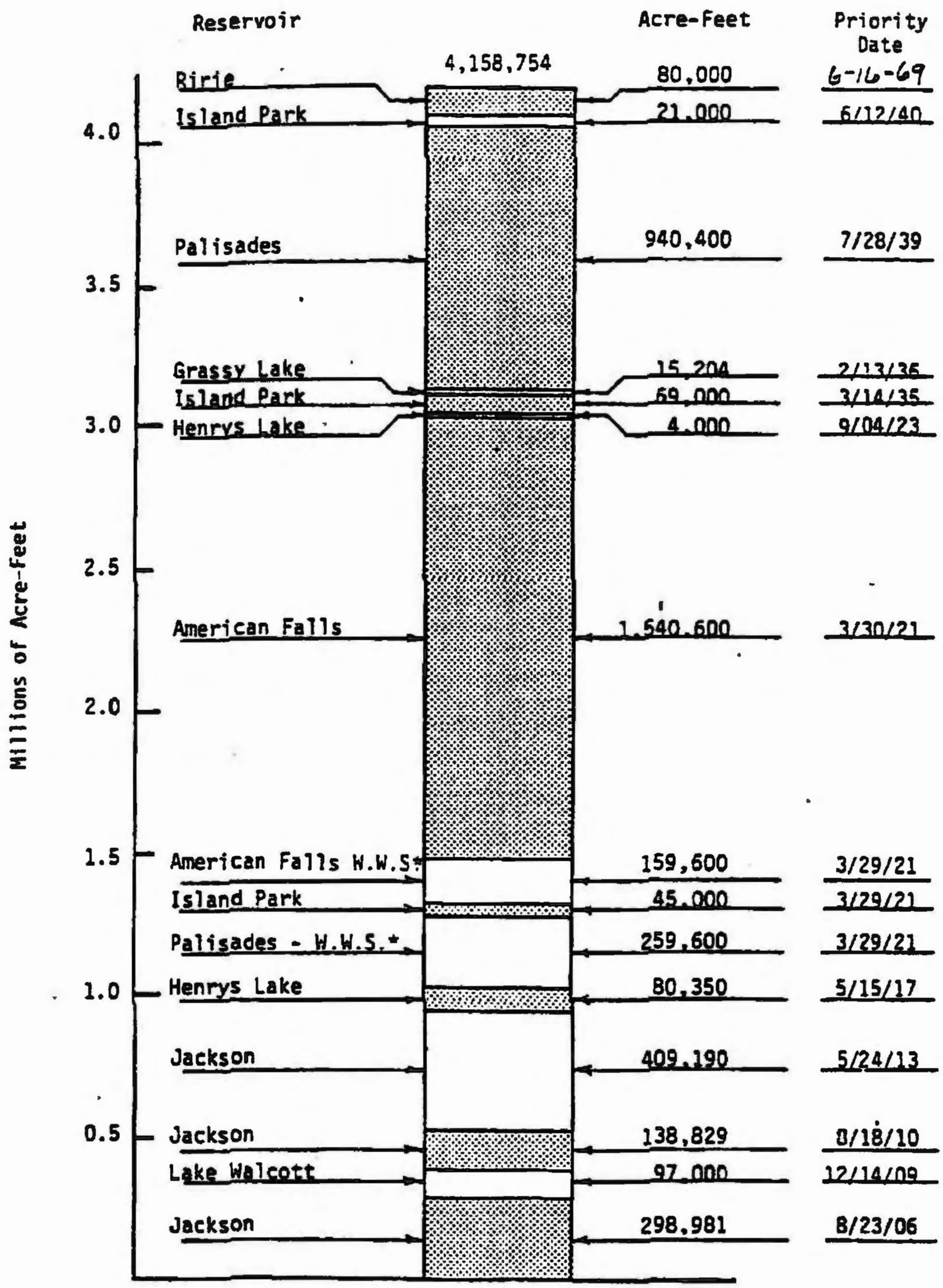
The right to use water for irrigation is an appurtenance to the lands served, whereas water rights for other purposes such as power and municipal and industrial (M&I) water supply are generally not. Water rights for irrigation are often managed collectively by some entity such as an irrigation district.

The total of the natural flow rights above Milner Dam is considerably greater than the estimated natural flow (no storage and no diversions) at Milner Dam. This is one reason that storage development in the upper Snake River basin became necessary to adequately support irrigation that was developed primarily on the basis of natural flows. Resolution of this problem is of concern to the State and to water users and is part of the impetus for the Snake River basin water rights adjudication (se chapter VII).

In the water rights process in Idaho, a permit is issued as a temporary right during development and a license is issued later. When a court takes action to settle water rights, the resulting decision on water rights converts the earlier permits and licenses to decreed water rights.

Reclamation holds title to the storage rights for all Reclamation storage facilities in the Snake River basin above Milner Dam. These rights were acquired in accordance with the laws of Idaho and Wyoming. A compact between the State of Wyoming and the State of Idaho allows water stored in Jackson Lake and Grassy Lake to be used as though the reservoirs were located in Idaho. The earliest storage rights are at Jackson Lake and the latest are at Ririe Reservoir. Some 98 water right claims have been filed by the Minidoka Project in the ongoing Snake River Basin Adjudication. Most of these claims are consistent with presently held water rights. These water rights are for uses or purposes including

Figure 3.—Upper Snake River Reservoir Storage Rights



* Winter Water Savings Contracts

recreation, and fish and wildlife and for direct diversion for irrigation and power. In addition, as part of the legislation and planning for the Palisades Project and to make that project feasible, a concept known as "winter water savings" was introduced. In brief, water users ceased diverting water in the winter (thus the name) in exchange for an earlier storage priority in a reservoir. There are "winter water savings " storage priorities in American Falls and Palisades Reservoirs. Figure 3 illustrates the storage rights by priority date for Reclamation storage rights and the storage rights in Henrys Lake.

Changes in water rights, such as diversion point or use, require an application to and approval by the Idaho Department of Water Resources (IDWR). If the change exceeds 50 cfs or 5,000 acre-feet, the change must also be approved by the Idaho State Legislature.

Snake River Compact

The Snake River Compact between Wyoming and Idaho was signed October 10, 1949, and approved by Congress on March 21, 1950. It allocates the waters of the Snake River to each state (96 percent to Idaho, and 4 percent to Wyoming) for storage or direct diversion exclusive of Wyoming water rights established prior to July 1, 1949. The 4 percent has been quantified to be about 200,000 acre-feet per year based on average annual runoff at the Wyoming/Idaho State line.

The Compact allows for future direct diversion or storage development in Wyoming. Idaho is to be compensated with storage by Wyoming if certain "trigger" criteria are exceeded. The Compact allows one-half of the 200,000 acre-feet to be used without restriction. However, use in Wyoming of the remaining 100,000 acre-feet requires replacement storage in the amount of one-third of such use for the benefit of existing Idaho water users. Therefore, 33,000 acre-feet of space in Palisades Reservoir has historically been identified for that purpose. This space, called Wyoming Compact Space, has now been contracted to Wyoming by Reclamation. It is to be used to meet Wyoming's obligations under the Compact. By exchange, Wyoming may use the space to maintain higher lake levels in Jackson Lake or increases releases from Jackson Lake to supplement low fall and winter streamflows.

V. General System Operation

This chapter provides an overview of operation of the upper Snake River/reservoir system. More detailed description by function is provided in chapter VI.

Climatic conditions of the area produce low precipitation in the summer and early fall, and higher precipitation during the late fall, winter, and spring. Much of the winter precipitation accumulates as snowpack. This produces natural riverflows that can peak at very high levels as snow melts in the spring and early summer, decline throughout the summer to a minimum, and remain low during the fall and winter.

Storage reservoirs are constructed and operated to change the flow regime for some purpose. Based on project authorities, the reservoir system of the upper Snake River is operated for two primary purposes—irrigation water supply and flood control. Hydroelectric power generation, recreation, and fish and wildlife functions (such as maintaining trumpeter swan habitat) are secondary or incidental to the primary operating considerations, i.e., generally, water is not specifically released from storage except for irrigation and flood control purposes.

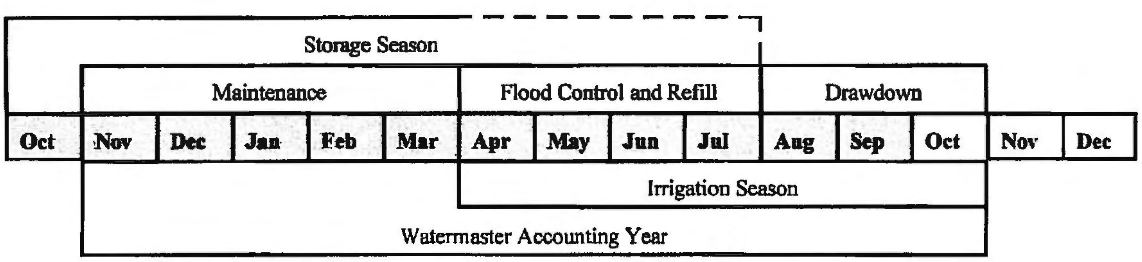
The upper Snake River reservoirs are operated as a unified storage system where water is stored and released in a manner to maximize the capability of the storage reservoirs. This means that water is physically stored in those reservoir that are most difficult to fill and is released from the reservoirs that are most likely to refill in the following year. There are two major operating principles: (1) in general, water is stored as far upstream as possible regardless of storage right priorities and (2) water is released first from the reservoirs that are easiest to refill. A water rights accounting is maintained to assure that, regardless of where water is stored or from where releases are made, the storage and use of water is properly accounted to the appropriate rights and spaceholders. This allows the system to be operated more efficiently than strictly following individual storage right priorities and functions, provides a much greater chance that reservoirs will fill, and allows releases that would otherwise violate water rights.

Water operations are not defined on a calendar year and there are several "seasons" or "years" of reference. For most purposes, a water year is used and is defined as running beginning on October 1 and ending the following September 30, e.g., the 1994 water year began on October 1, 1993 and ended on September 30 of 1994.

Spaceholder contracts for upper Snake River basin specify that the storage season begins on October 1 and extends until there is no more water to be stored and that the irrigation season begins on April 1 and extends to October 31. In keeping with the end of the contract irrigation season, the water accounting system used by the Watermaster runs from November 1 to October 31.

There are three general operating seasons based on climatological pattern and irrigation demand: (1) Maintenance from November through March, (2) Flood Control and Refill from April through July, and (3) Drawdown from August through October. This general pattern coincides with the Watermaster's accounting period. Drawdown for flood control, storage release for irrigation demand, and reservoir refill may occur in the same time frame for different reservoirs because of elevation difference and the demand for irrigation at lower elevations. Also, it is important to recognize that the beginning and ending of the three operating seasons can vary widely with climate and the water supply. The various operating seasons and the accounting period are shown in figure 4.

Figure 4.—Operating Periods and Seasons
(Water year shown by shaded blocks)



Maintenance Period

The primary function of reservoir operation during the Maintenance period of November through March is to carryover and store water to the extent allowed by flood control requirements. By the beginning of November, the reservoirs have been drawn down as the result of meeting summer irrigation needs and/or to meet a maximum elevation that provides the required flood control space. Inflow is stored, if there is more space than needed for flood control, or released as needed to maintain the general winter flood control space. Accrual of water is normally very slow as streamflows are low because of the cold temperatures at the elevation of the reservoirs. Water is released from some reservoirs to meet minimum streamflows for protection or enhancement of fish and other wildlife. After January 1, anticipated spring flooding becomes a factor. Depending on the size of the snowpack the flood control space will be decreased, maintained, or increased.

Flood Control and Refill Period

Spring snowmelt and irrigation demand at lower elevations may begin in April. During the Flood Control and Refill period of April through July, reservoir storage is continuously adjusted on the basis of runoff forecast to provide space for flood control as needed and to assure refill of the reservoirs. Irrigation demands during the early part of this season are usually met from streamflows but may require some release of storage from lower reservoirs. As snowmelt increases, irrigation demands may be met entirely from natural flows, and unstorable flows in excess of irrigation demand may pass Milner Dam. During the latter part of this period, irrigation demands may again be met by a combination of natural streamflow and release of storage. In recent years, some water has also been released downstream to meet requirements for augmentation flows in the lower Snake for ESA-listed salmon (see chapter VI for more detail).

Drawdown Period

During the Drawdown period of August through October, storage is released to meet irrigation demands or to reach a reservoir elevation that provides the required flood control space in November. Irrigation demands must be met in varying degrees from storage releases, and there is constant adjustment of reservoir releases to maintain water as high in the system as possible and to use water from reservoirs with the greatest refill capability. In very poor water years the Drawdown period may begin as early as April.

An important consideration in all of the phases of operation of the reservoirs is travel time. The travel time for water released from Jackson Lake to reach Minidoka Dam is about seven days. As a result, system operators must constantly anticipate irrigation demands and often release water up to 2 days before anticipated use. Ending the irrigation season with water stored as high in the system as possible increases the ability to maintain streamflows throughout the winter. During the flood control season, releases for flood control must also anticipate possible local weather events downstream.

Standing Operating Procedures

Standing Operating Procedures (SOP's) are documents that contain instructions and all of the necessary information for a damtender to correctly operate the dam and reservoir. Reclamation prepares an SOP for each Reclamation dam and reservoir primarily for the use of the damtender and the immediate supervisor. The SOP usually includes (1) an emergency preparedness plan that provides instructions to follow in the event of various emergencies, (2) a directory of personnel including those of emergency services and cooperators for communications purposes, (3) general information on the facility, (4) technical data on structural, mechanical and electrical details, and (5) information on reservoir operations including filling and release of water, inflow forecasting, and specific operating criteria.

These documents are controlled and numbered, which allows additions, corrections, and updates to be tracked carefully. Deviation from the SOP is a serious matter which requires concurrence of upper management.

General Operating Activities

Table 4 shows general operating activities for Reclamation reservoirs located upstream from Milner Dam. Jackson Lake, Palisades Reservoir, American Falls Reservoir and Lake Walcott (Minidoka Dam) are operated in a closely integrated manner.

Ririe Reservoir is operated for flood control and recreation as there are no contracts for storage at present. However, the uncontracted storage is part of the Fort Hall Indian Water Rights Agreement (see chapter VII). The operations of Island Park Reservoir, Grassy Lake, and Henrys Lake are somewhat coordinated among the three and with downstream reservoirs, but not to the degree of coordination among the main stem reservoirs.

Table 4.—Summary of Reservoir Operating Activities

Activity	American Falls Reservoir	Grassy Lake	Island Park Reservoir	Jackson Lake
Refill target	April 1	None	April 1	Mid-May to July 1
Flood control operation	Informal	None	Informal rule curve	Yes. Rule curve with Palisades Reservoir
Minimum flood control space[1]	None	None	None	200,000 acre-feet October 1 to May 1
Average winter release (Dec-Feb 1966-1995)	4,050 cfs	0 cfs	350 cfs	415 cfs
Minimum winter release (unofficial)	300 cfs	None	100 cfs	Smaller of inflow or 280 cfs
Minimum or conservation pool	0 acre-feet	270 acre-feet	380 acre-feet	Large natural lake[2]

[1]Until spring forecasts are available
[2]Larger than the active storage capacity

Table 4.—Summary of Reservoir Operating Activities (Continued)			
Activity	**Minidoka (Lake Walcott)**	**Palisades Reservoir**	**Ririe Reservoir**
Refill target	April 1	Mid-June to early July	None
Flood control operation	None	Yes. Rule curve with Jackson Lake	Yes. Rule curve
Minimum flood control space[1]	None	None	50,000 acre-feet
Average winter release (Dec-Feb 1966-1995)	4,350 cfs	2,260 cfs	0 cfs since 1987
Minimum winter release	300 cfs plus reach gain	550 cfs	0 cfs
Minimum or conservation pool	115,000 acre-feet	201,000 acre-feet	10,000 acre-feet

Typical Reservoir Contents and Riverflows

At any given time, the contents of the upper Snake River reservoirs and the flows in various reaches of the river will vary depending on a large number of factors. These factors, include the amount of precipitation in the previous year as well as in the past few weeks or days, the contents of the reservoirs at the end of the storage season, the temperature, the amount of irrigation demand, etc. The content of reservoirs and the amount of streamflow at any instant provide limited information on the system operation as reservoir contents and riverflows could markedly differ in a few weeks or even a few days. In addition, riverflows may change greatly in a few hours and reservoir contents and riverflows can very greatly with the water supply. However, charts of riverflows and reservoir contents can provide a general overview of the range of operations.

The contents of five reservoirs and the outflow at six dams were selected for a good, average, and poor water supply year. The 1992 water year was selected as a recent, very poor water supply year. However there is no year since 1989 that would show a typical average water supply and a good water supply, and Jackson Lake content was restricted from 1977 to 1989. As a result, the 1970 water year was selected for an average supply, and the 1971 water year was selected to illustrate a good water supply. Figure 5 illustrates typical reservoir content and outflows for good, average, and poor water years.

The reader is cautioned that several significant developments have occurred since the early 1970's. American Falls Dam was under reconstruction from 1976 to 1978 and Ririe Dam was not completed until 1977. In addition, significant conservation measures in irrigation have been implemented since the early 1970's. None of these changes are reflected in the average water year (1970) and good water year (1971) data. The most significant change—conservation effects during a poor water supply—are reflected in the poor water year (1992) data.

The reader is also cautioned that riverflow may be composed of many elements. During the irrigation season, these are primarily (1) natural flows to meet demands for natural flow rights, and (2) storage releases to meet spaceholder demands for a full or supplemental water supply. Early in the spring, riverflow may also include releases from storage for flood control operation. In the summer and fall, part of the flow may be releases from storage to reach the minimum flood control level for fall and winter operation.

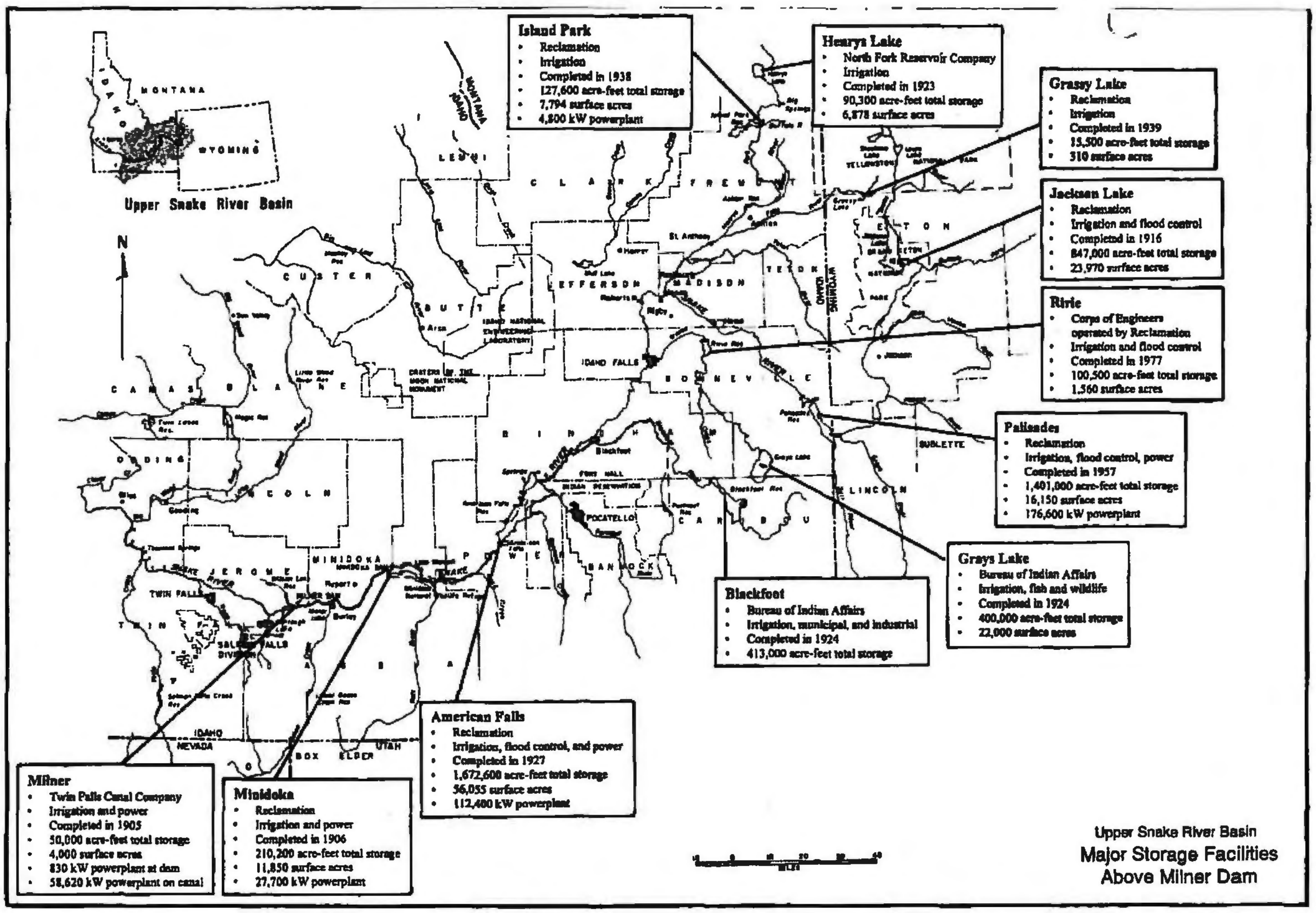

Upper Snake River Basin
Island Park
• Reclamation
• Irrigation
• Completed in 1938
• 127,600 acre-feet total storage
• 7,794 surface acres
• 4,800 kW powerplant
Henrys Lake
• North Fork Reservoir Company
• Irrigation
• Completed in 1923
• 90,300 acre-feet total storage
• 6,878 surface acres
Grassy Lake
• Reclamation
• Irrigation
• Completed in 1939
• 15,500 acre-feet total storage
• 310 surface acres
Jackson Lake
• Reclamation
• Irrigation and flood control
• Completed in 1916
• 847,000 acre-feet total storage
• 23,970 surface acres
Ririe
• Corps of Engineers operated by Reclamation
• Irrigation and flood control
• Completed in 1977
• 100,500 acre-feet total storage
• 1,560 surface acres
Palisades
• Reclamation
• Irrigation, flood control, power
• Completed in 1957
• 1,401,000 acre-feet total storage
• 16,150 surface acres
• 176,600 kW powerplant
Grays Lake
• Bureau of Indian Affairs
• Irrigation, fish and wildlife
• Completed in 1924
• 400,000 acre-feet total storage
• 22,000 surface acres
Blackfoot
• Bureau of Indian Affairs
• Irrigation, municipal, and industrial
• Completed in 1924
• 413,000 acre-feet total storage
American Falls
• Reclamation
• Irrigation, flood control, and power
• Completed in 1927
• 1,672,600 acre-feet total storage
• 56,055 surface acres
• 112,400 kW powerplant
Milner
• Twin Falls Canal Company
• Irrigation and power
• Completed in 1905
• 50,000 acre-feet total storage
• 4,000 surface acres
• 830 kW powerplant at dam
• 58,620 kW powerplant on canal
Minidoka
• Reclamation
• Irrigation and power
• Completed in 1906
• 210,200 acre-feet total storage
• 11,850 surface acres
• 27,700 kW powerplant
Upper Snake River Basin
Major Storage Facilities
Above Milner Dam

Figure 5.—Typical Content and Outflow of Upper Snake River Reservoirs

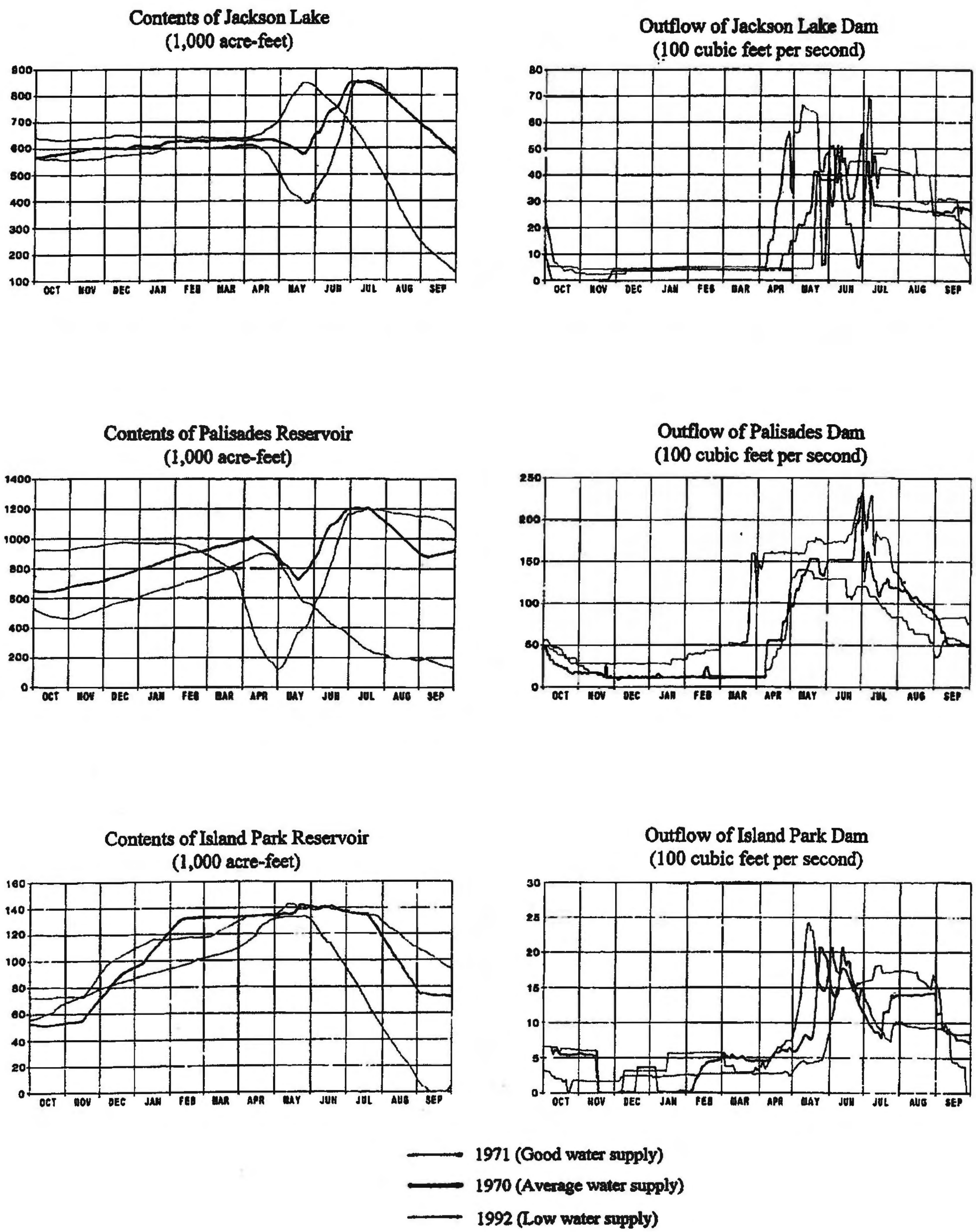
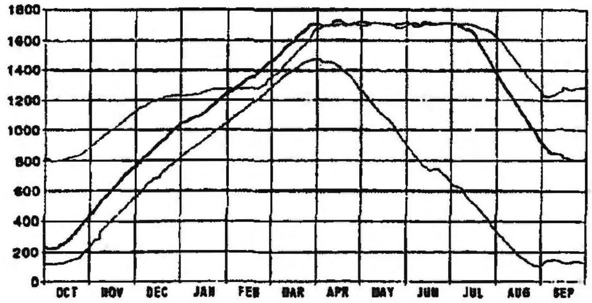
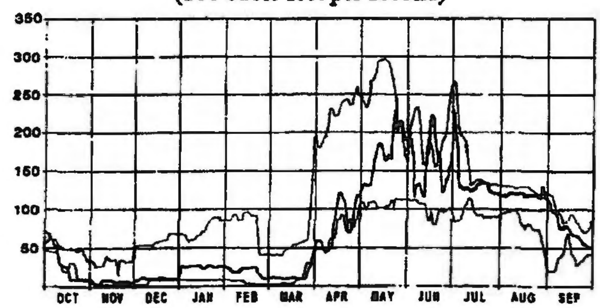


Figure 5.—Typical Content and Outflow of Upper Snake River Reservoirs (continued)

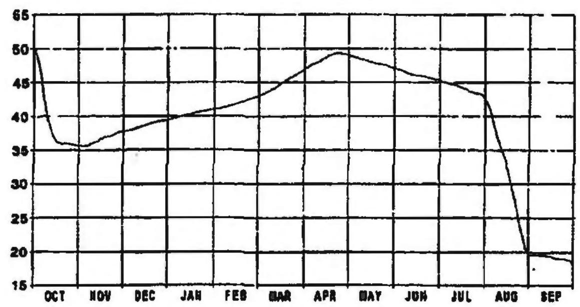
Contents of American Falls Reservoir
(1,000 acre-feet)



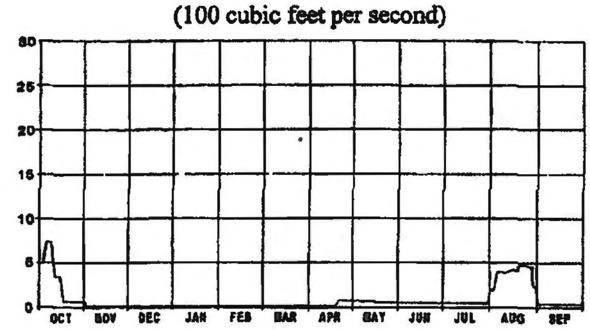
Outflow of American Falls Dam
(100 cubic feet per second)



Contents of Ririe Reservoir
(1,000 acre-feet)

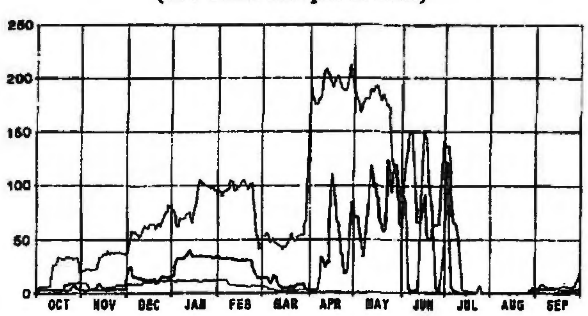


Outflow of Ririe Dam
(100 cubic feet per second)



(Note: No data available before 1978; Ririe Dam and Reservoir were completed in 1977)

Outflow of Milner Dam
(100 cubic feet per second)



1971 (Good water supply)
1970 (Average water supply)
1992 (Low water supply)

VI. Detailed Operation By Function

Early Reclamation storage facilities were developed for a single purpose—irrigation—or for dual purposes—irrigation and power. As additional storage was added, flood control became a potential operating function and was authorized. The passage of laws that required consideration of other functions at existing facilities and new facilities also helped change the character of Reclamation project development in the upper Snake River basin. Passage of a variety of Federal and State laws that require greater consideration of environmental and other factors combined with a general change toward more consideration for fish and wildlife protection has helped mold the operation of the present system.

The upper Snake system has evolved into a true multipurpose operating system; however, irrigation and flood control remain the dominant operating functions. Water rights administered by the State, project authorizations defined by the Congress, and storage contracts with the water users define the operating boundaries. It is important to recognize that although storage space and the use of water are dedicated to specific purposes, the way the water is moved among reservoirs can accommodate other purposes. To the extent possible, reservoir releases are passed through hydroelectric powerplants for the generation of electricity. Within Federal and State statutes and contract law and with the consent of water users, reservoir and river operations are implemented to protect fish and wildlife populations and to provide recreation benefits.

There is a marked contrast in the operation of the Snake River at Milner Dam. Except for salmon flow augmentation water, Reclamation does not release storable water that can be controlled above Milner Dam. In addition, Reclamation has no storage on the main stem downstream from Milner Dam. Below Milner, IPC uses riverflows to generate electricity at numerous powerplants. Another contrast is that there is careful accounting of irrigation water upstream from Milner, and almost no accounting of irrigation water downstsream.

Flood Control

Two types of flooding can occur above Milner Dam—spring snowmelt and winter rain on snow. At higher elevations, such as above Palisades, the major threat of flooding is from the spring snowmelt. At lower elevations, such as the Willow Creek basin upstream from Idaho Falls, there is a major threat from floods caused by winter rain on snow.

Jackson Lake, Palisades Reservoir, and Ririe Reservoir provide the major flood control above Milner Dam. Jackson Lake and Palisades Reservoir are operated as a system to limit the maximum flow at the Heise stream gauge (about 48 miles below Palisades Dam) to 20,000 cfs. Ririe Reservoir is operated to limit Willow Creek flows to a maximum of 1,200 cfs. Island Park Reservoir is operated informally for flood control. Other reservoirs above Milner are operated for irrigation and incidentally provide space for flood control. In addition, there are channel restrictions of 20,000 cfs at Burley, Idaho. (A list of stream gauges is included as appendix B.)

Rain on Snow

A rain-on-snow on frozen ground event occurs when a saturated basin is subjected to cold, snowfall, and warm rain, in that order. An extremely damaging flood occurred in February 1962 in the Willow Creek basin above Idaho Falls. Ririe Dam was built to prevent a recurrence of this type of flood, as well as to control spring snowmelt floods.

It is generally not possible to anticipate a rain-on-snow event far enough in advance to provide an appropriate amount of flood control space. Therefore, reservoir pools are lowered to a predetermined elevation in the fall and maintained throughout the winter months to provide adequate storage space for possible rain-on-snow events. The reservoir space provided by this action is often referred to as the winter minimum flood control space and is based on studies of historical runoff.

Spring Snowmelt

After January, space is maintained in the reservoirs (i.e., the water surface is held at a lower elevation) according to the amount of inflow anticipated. This requires forecasts of runoff at Heise and Ririe Dam. As forecasts of spring runoff become available, the reservoir pool is adjusted to provide the appropriate amount of flood control space based on criteria for that reservoir—the larger the runoff forecast, the more space required.

The present statistical technique used for forecasting runoff above Milner Dam is a step-wise multiple regression analysis. Forecasts are based on a comparison of the current basin conditions (including observed precipitation and runoff and snowpack moisture) with historical conditions and the resulting runoff. Forecasts are made which assume subsequent precipitation amounts below normal, at normal, and above normal. Reclamation and the Corps independently make runoff forecasts and coordinate to produce one operating forecast. (A sample of a Reclamation forecast for Heise is included as appendix C)

Reservoir operators try to balance flood control and refill needs, since providing too much flood control space jeopardizes reservoir refill, and providing too high a refill probability jeopardizes flood control. Ordinarily, it is possible to maintain a high probability of controlling flooding while also maintaining a high probability of reservoir refill. A large forecast error, however, can occasionally result in flows in excess of the goals or a reservoir failing to refill. Large errors are generally caused only when a low-probability condition occurs that, with hindsight, would have required operating entirely for either flood control or refill. Examples of low probability conditions include exceptionally large or small amounts of precipitation over a long period, exceptionally large amounts of precipitation over a short period, lengthy periods when temperatures are above or below normal, and rapid or extreme shifts in temperature. Forecasts are made as needed, but at least once a month, beginning on January 1 and extending to the end of the spring runoff.

Flood control rule curves are used to determine the amount of storage space required to adequately control runoff. Formal flood control rule curves have been developed for Palisades Reservoir (combined operation with Jackson Lake) and Ririe Reservoir, while informal flood control rule curves have been developed for Island Park Reservoir. A formal flood control curve is jointly developed by the Corps and Reclamation according to Congressional directives, and the Corps has ultimate authority to implement a formal flood curve operation. An informal flood control curve is developed by Reclamation to serve as a guideline in providing flood control benefits below a Reclamation reservoir. Generally, an informal curve will provide a higher chance of reservoir refill than a formal curve.

These rule curves are included as appendix D, and indicate how much space must be maintained by date based on the forecast of runoff. The formal rule curves must be followed and operations agreed to by the Corps which has authority under the Flood Control Act of 1949 to direct some Reclamation reservoir operation to reduce flooding. In actual operation, there is a high level of cooperation and mutual concern for both flood control and reservoir refill.

Irrigation

Most of the Reclamation storage above Milner Dam is used as a supplemental water supply for irrigation; only 210,000 acres depends on Reclamation for a full water supply. As a result, most irrigators are using a combination of water supplies that includes storage, natural flows, and ground water. To provide a sufficient amount of water in the river for out-of-stream diversion without spilling at Milner Dam requires a high degree of coordination among irrigators, storage operators, and the State Watermaster.

Irrigation and flood control operations overlap during much of the reservoir filling season. Spaceholder contracts specify that the storage season begins on October 1 and ends when no more water is available for storage. That point is reached when the riverflow equals or falls below the total amount of natural flow demand for irrigation water. The end of the storage season depends on irrigation demand and the amount and rapidity of snowmelt, varies from April 6 to July 24, and occurs most often in June.

Henrys Lake and the two northern Reclamation reservoirs—Island Park and Grassy Lake—serve only the Fremont-Madison Irrigation District. Jackson Lake, American Falls, and Palisades serve the southern part of the basin. Minidoka has some storage that is used for diversion and powerhead and to enhance storage in American Falls, Island Park, and Palisades Reservoirs. At present, Ririe has no storage contracts for irrigation and is used exclusively for flood control and recreation (but see chapter VII, "The 1990 Fort Hall Indian Water Rights Agreement").

Throughout the irrigation season, water is released from the reservoirs as needed to meet irrigation demands. Reservoir releases in the segment of the Snake River from Palisades Dam downstream to the Blackfoot gauge are determined by diversion demands of some 50 canals, the need to maintain a sufficient flow in the river at Blackfoot, and the desire to move stored water from Palisades Reservoir to American Falls Reservoir so that an adequate amount of water will be available to complete the irrigation season. Frequent consultations with the Watermaster (see "Watermaster" in this section) are necessary to determine the flow requirements and the amount of stored water that needs to be released.

Irrigation demands in the reach from American Falls Dam to Milner Dam are met by releasing water from American Falls Dam through the IPC powerplant. Through most of the irrigation season, the water surface at Lake Walcott is maintained at or near maximum elevation to ensure water deliveries to the Minidoka Irrigation District and the Burley Irrigation District and to provide maximum hydraulic head for hydropower generation at Minidoka Powerplant.

Irrigation demand is determined by weather, crop consumptive use requirements, and cropping patterns. In daily operations, individual irrigators request water from local "ditch riders" who report needs to irrigation district managers. The irrigation districts accumulate the totals and request water from the District 01 Watermaster or Reclamation's Burley office. The Watermaster then requests that water be released from the reservoirs to satisfy the accumulated requests. Operating personnel in Reclamation's Burley office determine how much water to release from each reservoir and the timing of the releases and provide specific instructions to each damtender.

Reclamation coordinates and works with water users throughout the basin including the Committee of Nine and some 64 irrigation districts and canal companies that contract for storage space in the Reclamation facilities. Reclamation personnel in the Burley office work with the Watermaster of Water District 01 in Idaho Falls to meet daily demands for irrigation and instream flows. The Watermaster of Water District 01 is responsible for the natural flow determination and accounting, and Reclamation is responsible for the storage water accounting and allocation. The Watermaster and Reclamation's Burley office operating personnel work very closely to account for all water use and to meet the demands.

Committee of Nine

The Committee of Nine was created in 1919 by the Governor of Idaho to address and help solve water problems in the Snake River basin above Milner. That year, a serious water shortage developed. Upstream diverters of natural flow contested with downstream owners of storage over the flows in the river. As a result, the Committee of Nine was tasked to devise a plan for distribution of water in the Snake River.

The Committee is comprised of representatives elected by canal companies and irrigation districts in that area. Reclamation's Snake River Area Manager and the District 01 Watermaster are advisors to the Committee. Officially recognized by the State of Idaho, the Committee is also recognized in all Minidoka and Palisades Project reservoir spaceholder contracts as an advisory body. The Committee of Nine provides a forum for discussion, consultation, and advice on reservoir and river operation and administration. Reclamation considers the advice of the Committee in making reservoir operation decisions. In addition, the Committee is a decisionmaking body in its function as the local committee for the District 01 Water Rental Pool (also know as the upper Snake River Rental Pool).

District 01 Water Rental Pool

Spaceholder contracts and Idaho State law allow operation of rental pools. These pools allow spaceholders to offer water for rent to other entities that are in short supply.

Water rental pools (as they are now called) operate under State of Idaho law and at the direction and under the rules of the Idaho Water Resources Board (IWRB). Prior to 1991, the rental pools were often called water banks, but that term is now used as the official umbrella name for all water rental pools in the State. The water rental pool concept has been unofficially in existence since 1937 in the upper Snake. In 1979, the State Legislature authorized the establishment of water banks and rental pools statewide as a means to share water. Reclamation's Snake River Area Manager is a member of the Committee of Nine water rental pool subcommittee. Local water rental pool rules and leasing prices are determined by the local water rental pool organization and then subsequently approved or denied by the IWRB. In Water District 01, the Committee of Nine is the local water user committee and proposes rules for approval by the IWRB. The Watermaster administers the rental pool under guidance of the committee. Reclamation as the storage facility owner and contractor is also involved and must approve the rules and rates for Federal storage as well.

Spaceholders who offer water for rent before July 1 receive a proportionate share of proceeds from any such water that sells. Spaceholders who offer water for rent after July 1 receive proceeds from any sales on a "first come" basis after all water offered before July 1 is sold.

District 01 Water Rental Pool procedures stipulate a priority basis for acquiring water from the rental pool. The first priority is for irrigators with storage space in Reclamation reservoirs and the second priority is for irrigators who use the water in the Reclamation project area. The third priority is for other beneficial uses.

In order to protect spaceholders who do not sell storage water, a "last-to-fill" rule was adopted. This rule says that any water sold for use below Milner Dam will be the last to fill the next year. This was imposed to prevent spaceholders who have good overall water supplies from profiting at the expense of overall refill the following year (each spaceholder accrues water proportionately to his owned space). If water is sold through the rental pool, the reservoir space drafted must be refilled the next year. Without the "last-to-fill" rule, all spaceholders would have to contribute to the refill of the rented water.

The price for rented water is set by the Committee of Nine. In 1997, irrigation water for use above Milner Dam sold for $2.95 an acre-foot which included $0.75 for District 01 administration and $0.20 for the IWRB surcharge. Non-irrigation water for use below Milner Dam includes the same administration and surcharge fees and sold for a base price of $7.00 an acre-foot plus per acre-foot charges of $0.75 for District 01 administration, $0.70 for the Water Resources Council, and $2.05 to be held to secure water for Reclamation through 1999 for a total of $10.50 per acre-foot. If this last-to-fill water is filled in the following year the contingency fee will be refunded to the buyer.

Table 5 summarizes District 01 Water Rental Pool contributions and sales for the period 1979-1997. In most years, there was much more water consigned than sold. Prior to 1991, most of the non-irrigation purchases were made by IPC for power generation. Since 1991, Reclamation has purchased most of the non-irrigation water for salmon flow.

Table 5.—District 01 Water Rental Pool Activity, 1979-1997 (acre-feet)

Year	Consigned	Total Purchases[1]	Irrigation Purchases	Not Sold
1979	88,870	73,960	23,960	14,910
1980	72,190	14,575	14,575	57,615
1981	170,107	149,039	24,039	21,068
1982	290,426	203,515	3,515	86,911
1983	540,606	353,084	3,084	187,522
1984	809,400	277,433	2,433	531,967
1985	497,302	362,169	12,169	135,133
1986	895,642	159,735	9,735	735,907
1987	365,006	192,506	42,506	172,500
1988	235,325	159,215	109,215	76,110
1989	416,994	115,736	15,736	301,258
1990	306,463	124,525	68,000	181,938
1991	205,113	184,677	85,677	20,436
1992	9,954	9,954	9,954	0
1993	408,240	287,974	38,974	120,266
1994	432,171	432,171	75,889	0
1995	605,658	303,944	37,828	301,714
1996	637,134	303,369	20,055	333,765
1997	0[2]	0[2]	0[2]	0[2]

[1]Prior to 1991, purchases other than for irrigation were for power, beginning in 1991, Reclamation purchased this water for lower Snake River flow augmentation to enhance salmon migration.
[2]Not available

Watermaster

The State of Idaho issues and administers water rights in the State. The Watermaster of District 01 is elected each year by the water users, is a State Government employee and the State representative for administering water rights throughout the year, and is currently also the Manager of the Eastern Office of the IDWR. He supervises an office of about 15 part-time and full-time employees in Idaho Falls. The Watermaster tracks and reports water use, and notifies water right holders when they do not have a right to use water, e.g., the water supply is insufficient to provide water for their water right. This is a difficult task requiring monitoring of a great deal of water data and extensive computations especially since many water right holders have both natural flow and storage rights. During the course of a year, the natural river runoff declines to the point that flow becomes insufficient to supply all natural flow rights. Holders of later date priority then must switch to storage rights and the Watermaster must also track the storage used. The Watermaster also provides day-to-day operation of the rental pool on behalf of the Committee of Nine.

Water Accounting

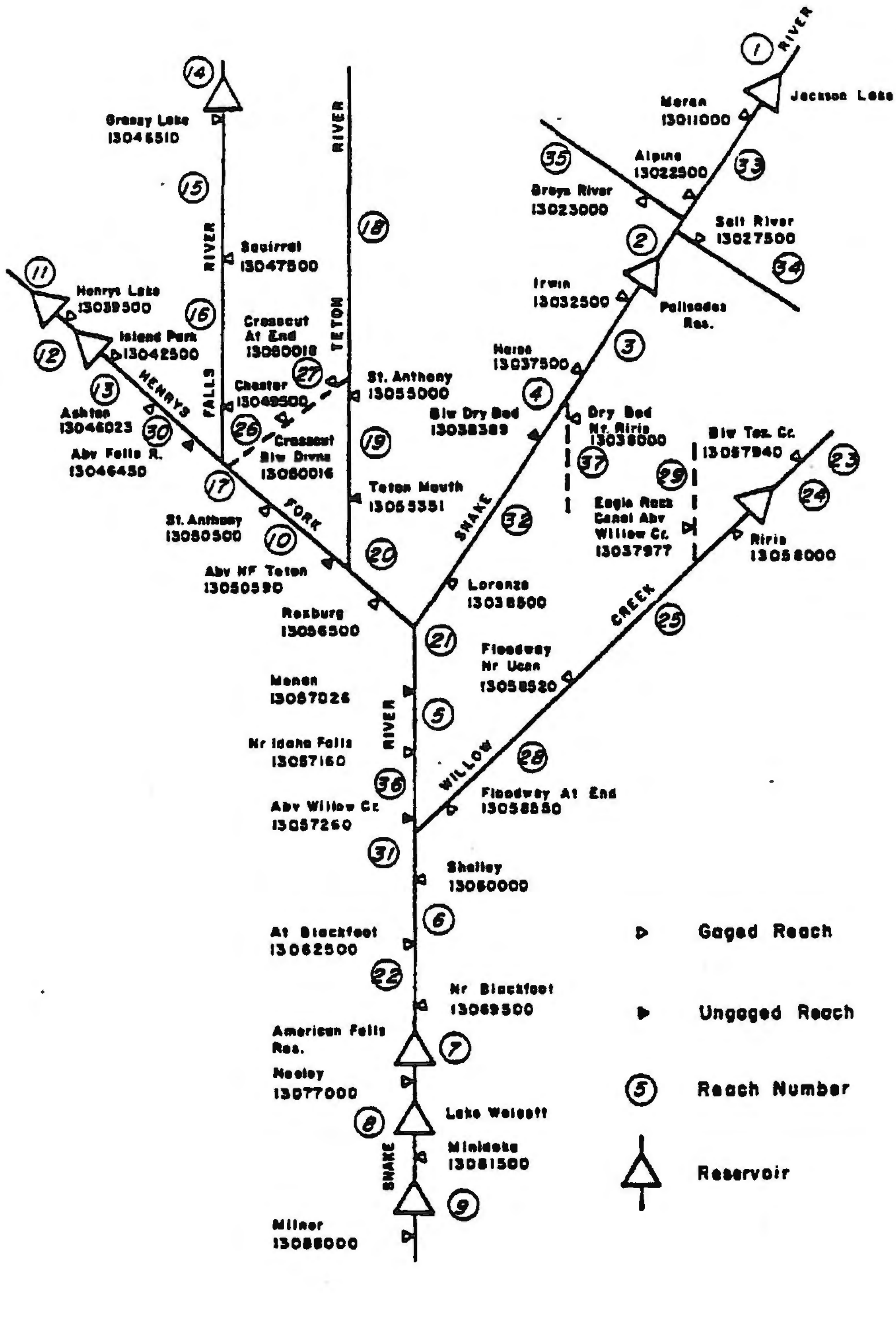
Water data collection and accounting is administered by Water District 01 pursuant to an agreement with the IDWR and in cooperation with Reclamation. The majority of the data is collected by automated data collection platforms that are part of a satellite based telemetry system, referred to as HYDROMET, operated by Reclamation for the collection of hydrologic and meteorologic data on a real-time basis. All important river gauges and the majority of the canal diversions are monitored by the HYDROMET system. Data from canal diversions which are not on this system are obtained by telephone from the canal managers and water district river riders.

The major role of Water District 01 activities under the direction of the Watermaster is to account for the diversions of natural flows, ensure that water right holders are complying with their rights, both in quantity and priority, and determine the amount of stored water used by each spaceholder. On a daily basis, the Watermaster computes the amount of natural flows available in the system and the total diversions by calculating reach gains or losses in 37 reaches of the Snake River and tributaries upstream of Milner Dam (figure 6). These reaches are segments of river lying between two stream gauging stations. Gains are due to inflow from tributaries, springs, and irrigation return flows. Losses are caused by surface flow entering the ground water, evaporation and transpiration of riparian vegetation, and out-of-stream diversions. From this, and the diversion data, the Watermaster determines which water rights are being filled on each day and accounts, on a daily basis, for the amount of stored water that is being used by each of the diverters and from which reservoir account it is being taken. This provides the basis for determining each spaceholder's water storage account of stored water accumulated, used, and carried over. To the extent possible, the debiting for stored water use takes into consideration (1) the need to lower Jackson Lake by October 1 to provide 200,000 acre-feet of flood control space and (2) the location of the diversion demands and the refill potential of American Falls Reservoir, Palisades Reservoir, and Jackson Lake. The accounting year for Water District 01 is November 1 through October 31. A final accounting is made after the end of the accounting period and documented in the Watermaster's annual report.

Power

There are Federal powerplants and non-Federal powerplants located at Federal Dams and there are non-Federal powerplants at several non-Federal dams. Power generation is secondary or

Figure 6.—Upper Snake System for Water Right Accounting



incidental to flood control and irrigation water supply at Federal dams and no water is released from Reclamation facilities specifically for power generation except for water held under spaceholder contracts (IPC is the only electric utility that has a spaceholder contract and that contract amount is 44,275 acre-feet in American Falls Reservoir).

Federal Powerplants

Power generation was included as an authorized function at Minidoka and Palisades Dams. Currently there are Federal power generation facilities at Minidoka Dam and Palisades Dam. Some of the power generated at the Reclamation facilities is used directly for facility operation and irrigation pumping and the remainder is marketed in the Federal Southern Idaho Power System administered by the Bonneville Power Administration (BPA). Minidoka Powerplant, the oldest powerplant in the region is currently being rehabilitated and expanded to a capacity of 27,000 kW. Palisades Powerplant has recently undergone major rehabilitation with an increase in capacity to 176,600 kW.

Idaho Power Company

In the Snake River basin above Milner Dam, IPC owns and operates powerplants at American Falls Dam and Milner Dam; a third IPC powerplant uses water from the Milner pool and is located on the Twin Falls Canal just downstream from Milner Dam.

IPC powerplants at Milner are operated as run-of-the river plants, i.e., available reservoir inflow is passed through the powerplants up to the capacity of the powerplants and riverflows are not controlled for power generation. The only control that IPC can use to regulate river flows is to release water from the 44,275 acre-feet of its contract space in American Falls Reservoir. IPC would normally release this water only when it could be released through the American Falls Powerplant (i.e., Reclamation releases are less than the powerplant capacity) and this water would also produce power at the Milner powerplants.

The American Falls Powerplant, owned and operated by IPC, recently underwent a rewind/uprate to a capacity of 112,400 kW. At American Falls, Reclamation directs the IPC powerplant operator to release the water necessary for flood control or irrigation operations. If the required release is in excess of powerplant capacity (about 13,500 cfs), Reclamation uses the low level outlet gates to supplement powerplant flow. At Milner Dam, IPC releases water to the extent possible through the small powerplant which discharges water to the stream immediately downstream from the dam. About 200 cfs are released directly to the river for minimum streamflow maintenance. When the flow entering Milner pool exceeds irrigation diversion requirements and exceeds the capacity of the small powerplant, flow is directed to the larger powerplant. The larger powerplant takes flows from Twin Falls Canal and discharges flows to the river about 1 mile downstream from the dam.

IPC has provided help in shaping salmon augmentation flows at its downstream dams (see ESA section).

Other Powerplants

In addition to the Federal powerplants and the IPC powerplants, there are other powerplants owned by public agencies and private utilities. All are run-of-the-river powerplants, i.e., flow of the river up to the capacity of the powerplant is passed through the generating units.

In 1991, approval was granted by the FERC for the Fall River Rural Electric Cooperative (FRREC) to construct powerplant with a capacity of 4,800 kW at Island Park Dam. Power generation began in June of 1994. The powerplant operates between a minimum of 190 cfs and a maximum of 960 cfs and utilizes only water that is released to meet irrigation demands or during flood control operations. During late 1995, FRREC also secured approval to modify the spillway with an adjustable lip to allow water that was previously spilled during irrigation surcharge to be passed through the powerplant to provide additional power generation. The FRREC also has a license for a powerplant with a capacity of 1,900 kW located on the Teton River near Felt. This powerplant was leased to Bonneville Pacific Corporation which filed for bankruptcy in the early 1990's.

Marysville Hydro Associates owns and operates a powerplant with a capacity of 9,100 kW located on the Falls River near Marysville. Utah Power and Light Company owns and operates two powerplants on the Henrys Fork. Its powerplant near Ashton has a capacity of about 5,000 kW and its powerplant near St. Anthony has a capacity of 500 kW. The city of Idaho Falls has three powerplants with a total capacity of about 24,000 kW located upstream from American Falls Reservoir. Lower Valley Power and Light Incorporated owns and operates a 1,500-kW powerplant on Strawberry Creek, a tributary of the Salt River which flows into Palisades Reservoir.

Powerplant Summary

There are two federally owned and operated powerplants and 12 non-federally owned and operated powerplants located upstream from Milner Dam. The total nameplate capacity of these facilities is about 423,000 kW. The nameplate rating of the two Reclamation powerplants is nearly half of the total. IPC is the major non-Federal power producer and owns and operates one powerplant located at a Reclamation dam in addition to two powerplants associated with Milner Dam. FRREC is the only other electric utility that owns and operates a powerplant at a Reclamation dam. Powerplants at Federal Dams and at Milner Dam are summarized in table 6.

Table 6.—Powerplants Located at Milner and Reclamation Dams in the Upper Snake River Basin

Site	Nameplate Rating	Owner/Operator
American Falls Dam	112,400 kW	Idaho Power Company
Island Park Dam	4,800 kW	Fall River Rural Electric Cooperative
Milner Dam	At dam: 830 kW On canal: 58,620 kW	Idaho Power Company
Minidoka Dam	[1]27,700 kW	Bureau of Reclamation
Palisades Dam	176,600 kW	Bureau of Reclamation

[1]When new powerplant is completed in 1997.

Appendix A

Spaceholder Contracts

Current Spaceholder Contracts[1] (November 1995) (acre-feet)				
Spaceholder	**American Falls**	**Jackson Lake**	**Palisades**	**Total**
Lower Valley Organizations with American Falls Space				
A&B Irrigation District	46,826		90,800	137,626
American Falls Reservoir District[2]	445,577	13,042		458,619
American Falls Reservoir District No. 2	393,550			393,550
Burley Irrigation District	155,395		39,200	194,595
Hillsdale Irrigation District	40,482			40,482
Idaho Power Company (nonirrigation)	44,275			44,275
Milner Irrigation District	44,951		44,500	89,451
Minidoka Irrigation District	82,216	186,030	35,000	303,246
North Side Canal Company, Ltd.[3]	116,471	312,007	116,600	545,078
Upper Valley Organizations				
Aberdeen-Springfield Canal Company[3]	29,771	57,661	143,278	230,710
Andrus, Ray	187	110		297
Artesian Irrigation, Inc.	2,794			2,794
Blackfoot Irrigating Company	12,558	7,370	4,050	23,978
Burgess Canal & Irrigating Company	9,343	10,603	31,400	51,346
Butte & Market Lake Canal Company	4,591	2,695	44,000	51,286
Clement Brothers, a partnership	70	196		266
Corbett Slough Ditch Company	3,342	1,961	6,300	11,603
Dilts Irrigation Company, Ltd.	871	511	1,200	2,582
Enterprise Canal Company, Ltd.	8,779	11,252	19,600	39,631
Enterprise Irrigation District	10,024	5,883		15,907
Falls Irrigation District	22,925		40,900	63,825
Harrison Canal & Irrigation District	11,832	11,943	23,500	47,275
Idaho Irrigation District	22,541	13,230	58,800	94,571
Lenroot Canal Company	3,805	5,234	7,850	16,889
Michaud Div, Fort Hall Indian Reservation	46,931		83,900	130,831
New Sweden Irrigation District	27,290	22,516	37,000	86,806
Osgood Canal Company, Ltd.	3,930	7,771		11,701
Peoples Canal & Irrigation Company	21,070	20,365	35,000	76,435
Poplar Irrigation District	662	1,589	1,550	3,801
Progressive Irrigation District	12,284	7,209	28,500	47,993

Current Spaceholder Contracts[1] (November 1995) (acre-feet)				
Spaceholder	**American Falls**	**Jackson Lake**	**Palisades**	**Total**
Reid Canal Company	2,507	1,472	3,150	7,129
Rudy Canal Company, Ltd.	2,606	3,530	15,700	21,836
Snake River Valley Irrigation District	25,942	30,225	35,300	91,467
Trego Ditch Company	1,293	758	3,200	5,251
Woodville Canal Company	5,949	3,491	6,000	15,440
Organizations Without American Falls Space				
Butler Island Canal Company, Ltd.			250	250
City of Pocatello			50,000	50,000
Clark & Edwards Canal or Irrigation Company			800	800
Craig-Mattson Canal Company			1,440	1,400
Danskin Ditch Company			2,350	2,350
F.M.C. Corporation			5,000	5,000
Farmers Friend Canal Company, Ltd.		2,000	9,400	11,400
Island Irrigation Company			4,700	4,700
J.R. Simplot Company			2,500	2,500
Labelle Irrigation Company			800	800
Liberty Park Irrigation Company			2,350	2,350
Long Island Irrigation Company			5,000	5,000
Lower Slough Canal Company, Ltd.		1,040	1,600	2,640
Mitigation, Inc.[4]			18,980	18,980
New Lava Side Ditch Company			11,750	11,750
North Rigby Irrigation & Canal Company			1,200	1,200
Owners Mutual Irrigation District		200		200
Palisades Water Users, Inc.			53,630	53,630
Parks & Lewisville Canal Irrigation Company			5,500	5,500
Parsons Ditch Company, Ltd.			994	994
Rigby Canal & Irrigation Company			6,300	6,300
Riverside Ditch Company			1,500	1,500
Sunnydell Irrigation District		4,000	6,300	10,300
Texas Slough Irrigation Canal Company			2,350	2,350

Current Spaceholder Contracts[1] (November 1995) (acre-feet)				
Spaceholder	**American Falls**	**Jackson Lake**	**Palisades**	**Total**
Twin Falls Canal Company[3]		97,183		97,183
Watson Slough Irrigation Company, Ltd & Watson Slough Ditch Company, Ltd			2,056	2,056
Wearyrick Ditch Company			600	600
West Labelle Irrigation Company			1,000	1,000
West Side Mutual Canal Company			2,350	2,350
Wyoming, State of			33,000	33,000
Contract Space Totals	1,663,640	843,077	1,189,978	3,696,695
Uncontracted Space Totals[5]	8,951	3,923	10,022	22,896
TOTAL ACTIVE CAPACITY[1]	1,672,590	847,000	1,200,000	3,719,590

[1] Lake Walcott, Minidoka Dam impoundment, Island Park Reservoir, Grassy Lake, and Ririe Reservoir are not accounted in this table. Minidoka Dam is operated primarily for irrigation diversions and power. Winter power releases may be curtailed by Reclamation and stored in its active storage capacity of 95,200 acre-feet to make additional water available for storage purposes in American Falls, Island Park, and Palisades Reservoirs in any year when these reservoirs fail to fill. The first 45,000 acre-feet of such curtailed saved water is credited to Island Park Reservoir, contingent upon spaceholders paying for power replacement. Fremont-Madison Irrigation District holds all 142,400 acre-feet of the active storage capacity of Island Park Reservoir (127,200 acre-feet) and Grassy Lake (15,200 acre-feet) which are not accounted in this table and make up the Upper Snake River Storage Division of the Minidoka Project.
Mitigation, Inc. holds 80,500 acre-feet in Ririe Reservoir in the 1994 contract (see footnote 4)

[2] American Falls Reservoir District holds: 22,492 acre-feet in American Falls Reservoir and 13,042 acre-feet in Jackson Lake for Aberdeen-Springfield Canal Company; 274,338 acre-feet in American Falls for North Side Canal Company; and 148,747 acre-feet in American Falls for Twin Falls Canal Company.

[3] Also has space through American Falls Reservoir District.

[4] Held in a 1994 contract which becomes operative upon the announcement by the Secretary of the Interior that the 1990 Fort Hall Indian Water Rights Agreement is in effect. Mitigation, Inc. also holds 80,500 acre-feet in Ririe Reservoir in the 1994 contract.

[5] Totals for American Falls and Total Space do not add due to rounding.

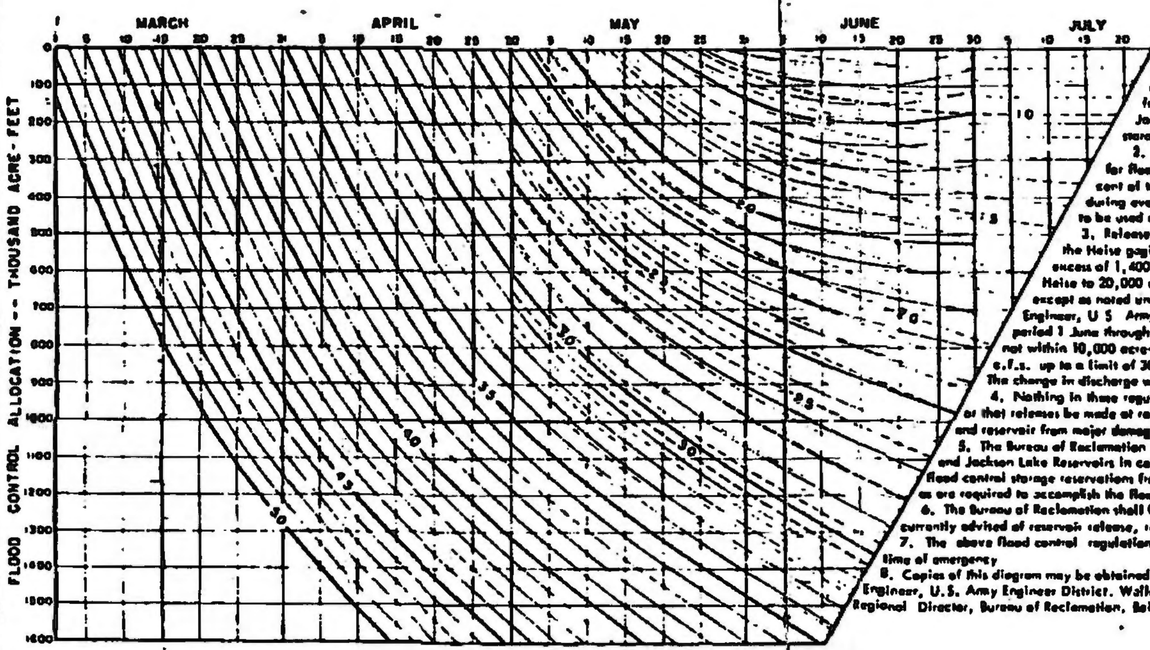
Reservoir Space in Bureau of Reclamation Reservoirs Above Milner Dam (acre-feet)

Reservoir	Total Capacity	Active Capacity				Inactive	Flood Surcharge[1]	Dead
		Total	Contracted[2]	Formally Assigned To Other Uses	Formally Assigned to Flow Augmentation			
STATE OF WYOMING								
Grassy Lake	15,500	15,200	15,200				740	300
Jackson Lake	847,000	847,000	843,077		[3]3,923		94,740	([4])
STATE OF IDAHO								
American Falls	1,672,590	1,672,590	1,663,640		[5]8,951			
Island Park	127,600	127,200	127,200			[6]400	42,000	
Minidoka (Walcott)	210,200	95,200	95,200			[7]115,000	10,000	
Palisades	1,401,000	1,200,000	1,189,978		[8]10,022	[9]157,000	16,000	44,000
Ririe	100,500	90,500	80,500	[10]10,000		[11]6,000		4,000
TOTALS	4,374,390	4,047,690	4,014,795	10,000	22,896	278,400	163,480	48,300

1. Above the spillway and not storable.
2. Except for Minidoka, all contracts are spaceholder (share of reservoir capacity) repayment contracts. Minidoka storage is included in the original Minidoka Project and addressed in conventional repayment contracts.
3. Purchased by Reclamation for salmon augmentation flow
4. Dead storage is a natural lake, the volume of which has not been determined but is estimated at about 2 million acre-feet.
5. Purchased by Reclamation for salmon augmentation flow. American Falls numbers do not add due to rounding.
6. Reserved for sediment control.
7. Provides head for north side and south side Minidoka canals and Minidoka Power Plant.
8. All but 500 acre-feet repurchased by Reclamation for salmon flow augmentation.
9. Reserved for power head.
10. Exclusive flood control.
11. Reserved for sediment control.

Appendix D

Flood Control Rule Curves



NOTES

1. The minimum flood control storage reservation required on any day of the flood season is as indicated by the diagram. Parameter values are forecasted natural flood run-off of Snake River at Heise in millions of acre-feet for the remainder of the season from any given date to 31 July. A minimum of 200,000 acre-feet of storage space in Jackson Lake will be held vacant until 1 May every year unless the forecast indicates that storage should begin earlier to insure filling that space.

2. Storage space in Palisades Reservoir and Jackson Lake combined shall be kept available for flood control purposes in accordance with this diagram. However, not less than 75 per cent of total storage space will be made available in Palisades Reservoir. Solid lines to be used during evacuation and until natural inflow to Palisades first exceeds 20,000 c.f.s. Dashed lines to be used after natural inflow exceeds 20,000 c.f.s.

3. Releases from Palisades Reservoir shall be restricted to 20,000 c.f.s. or less as measured at the Heise gaging station except: (A) when the forecasted run-off indicates that storage capacity in excess of 1,400 000 acre-feet in Palisades and Jackson Lake combined is required to control flows at Heise to 20,000 c.f.s., releases in excess of 20,000 c.f.s. will be made but not to exceed 30 000 c.f.s. except as noted under item 7 or as may be agreed upon by the Bureau of Reclamation and the District Engineer, U S Army Engineer District, during extremely large floods and; (B) when the forecasted run-off for the period 1 June through 31 July exceeds 2,500 000 acre-feet, and when after 1 June the available space is not within 10,000 acre-feet of the space required by this diagram, the release may be increased above 20 000 c.f.s. up to a limit of 30,000 c.f.s. to the extent of 1,000 c.f.s. for each 5,000 acre-feet of deficient storage. The change in discharge will be made in such manner as to minimize the adverse downstream effects.

4. Nothing in these regulations shall be construed to require dangerously rapid changes in magnitudes of releases, or that releases be made at rates or in a manner that would be inconsistent with requirements for protecting the dam and reservoir from major damage.

5. The Bureau of Reclamation shall procure current basic hydrologic data necessary for forecasting inflows to Palisades and Jackson Lake Reservoirs in conformance with procedures mutually agreed to, make current determinations of required flood control storage reservations from the diagram and make current calculations of permissible releases from the reservoirs as are required to accomplish the flood control objectives.

6. The Bureau of Reclamation shall keep the District Engineer, U S. Army Engineer District, in charge of the locality currently advised of reservoir release, reservoir storage and such other operating data as the District Engineer may request.

7. The above flood control regulations are subject to temporary modification by the District Engineer, if found necessary in time of emergency.

8. Copies of this diagram may be obtained from the offices of the District Engineer, U.S. Army Engineer District, Walla Walla, Washington, and the Regional Director, Bureau of Reclamation, Boise, Idaho.

PALISADES DAM AND RESERVOIR

Snake River, Idaho

FLOOD CONTROL STORAGE RESERVATION DIAGRAM

Prepared Pursuant to Flood Control Regulations

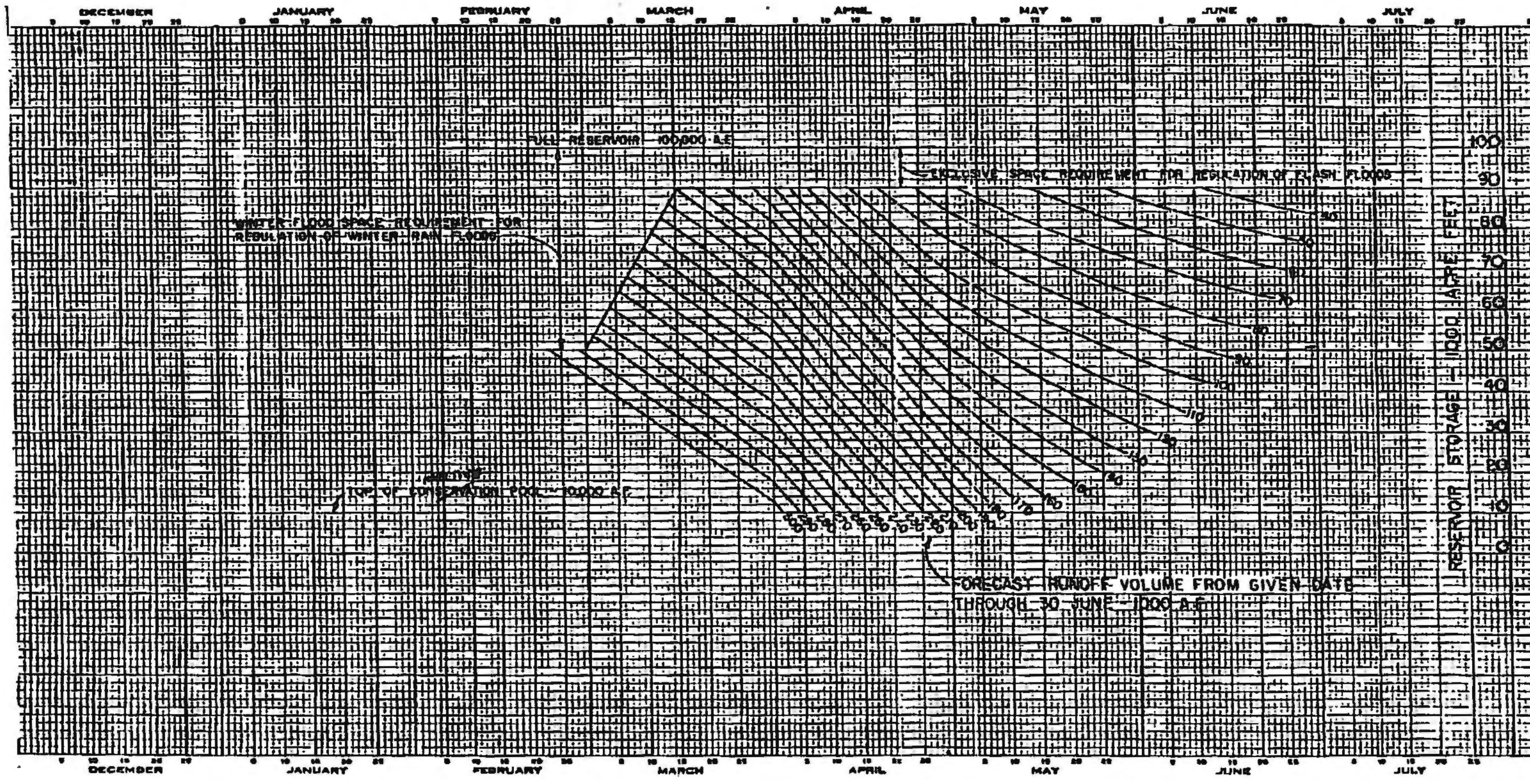
APPROVED H.A. Dexheimer

Commissioner of Reclamation

APPROVED E.C. Itschner

Major General, Chief of Engineers

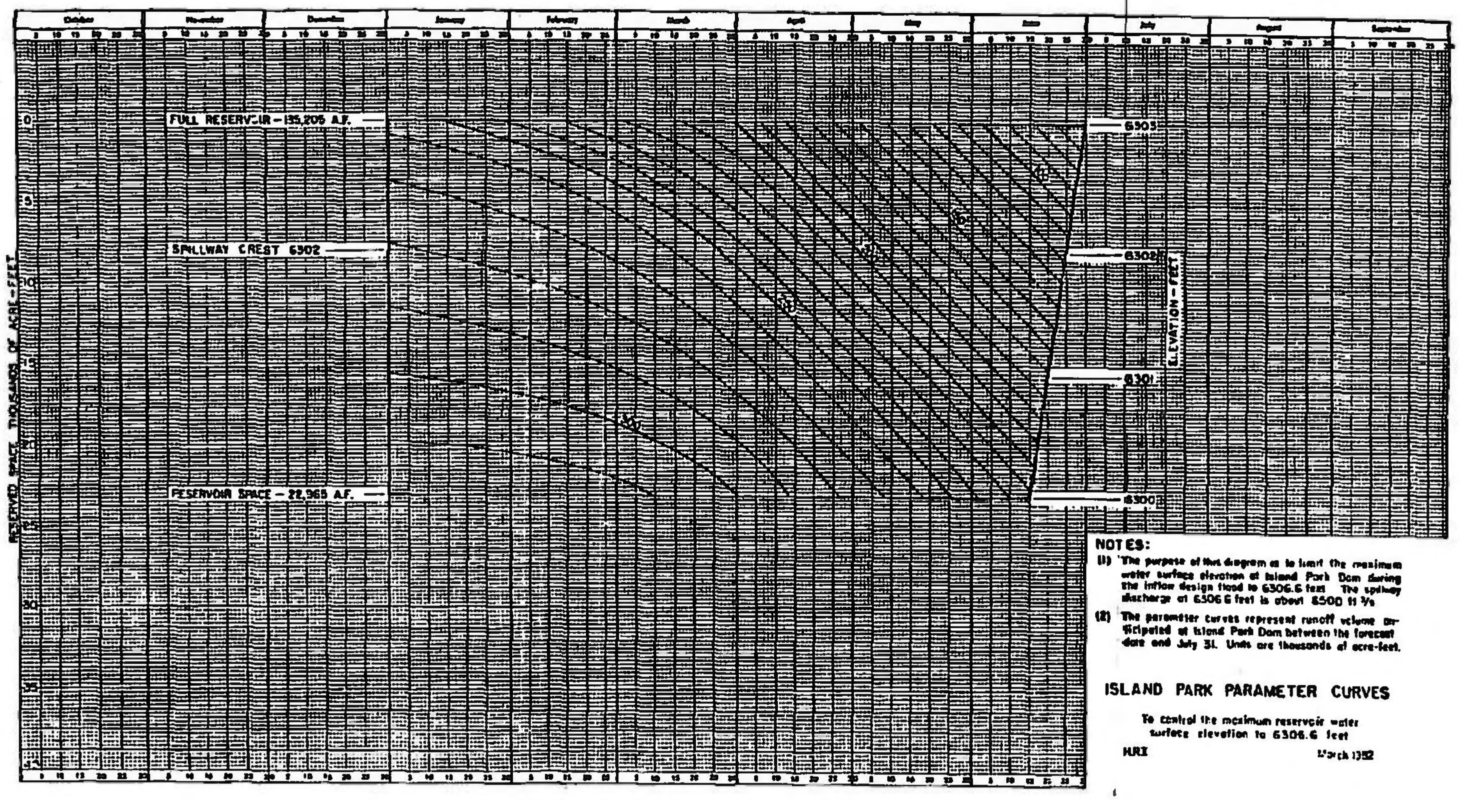
Effective Date May 12, 1958 File No SN-302-1/1



AIRIE LAKE
WILLOW CREEK, IDAHO
OPERATING CURVES
FOR FLOOD CONTROL

U. S. Army Engineer District, Walla Walla
Hydrology
Prepared: V.O.T. Sept. 1976

Res. Reg. Man. CHART 5



NOTES:

(1) The purpose of this diagram is to limit the maximum water surface elevation at Island Park Dam during the inflow design flood to 6306.6 feet. The spillway discharge at 6306.6 feet is about 8500 ft³/s

(2) The parameter curves represent runoff volume anticipated at Island Park Dam between the forecast date and July 31. Units are thousands of acre-feet.

ISLAND PARK PARAMETER CURVES

To control the maximum reservoir water surface elevation to 6306.6 feet

HRI March 1952

H. T. Nelson

UNITED STATES DEPARTMENT OF THE INTERIOR

Julius A. Krug, Secretary

BUREAU OF RECLAMATION

Michael W. Straus, Commissioner

R. J. Newell, Regional Director

WATER SUPPLY
FOR
PALISADES RESERVOIR PROJECT
Idaho

PROJECT PLANNING REPORT
1-5.17-1

A
GENERAL PLAN
For The
Elimination Of Winter Diversions,
Coordinated Operation Of Reservoirs,
And Development Of New Land.

SNAKE RIVER VALLEY

Region 1 | Boise, Idaho | October, 1946

EXHIBIT 2

UNITED STATES DEPARTMENT OF THE INTERIOR

JULIUS A. KRUG, Secretary

WATER SUPPLY

for

PALISADES RESERVOIR PROJECT

IDAHO

BUREAU OF RECLAMATION

MICHAEL W. STRAUS, Commissioner

Region I

R. J. Newell, Regional Director

Project Planning Report No. 1-5.17-1

Boise, Idaho
October 1946

ADDRESS ALL COMMUNICATIONS TO THE COMMISSIONER

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
WASHINGTON 25, D. C.

OFFICE OF THE COMMISSIONER

Nov. 29, 1946

MEMORANDUM

To: Secretary J. A. Krug

From: Michael W. Straus, Commissioner

Subject: Water supply for Palisades Reservoir Project, Idaho.

I present herewith, in connection with the authorized Palisades Reservoir Project, the report of the Regional Director, Region 1, with respect to conservation of water for irrigation use in the Upper Snake River Valley of Idaho.

The report and the underlying material, which present a comprehensive analysis of water supply problems in the Upper Snake River Valley, were prepared to provide a basis for these matters:

(a) Negotiation of water savings agreements with the existing users in the area;

(b) Negotiation of repayment contracts with prospective users of storage space in Palisades Reservoir; and

(c) Selection of the most satisfactory plan for the ultimate use of the 433,000 acre-feet of reserved space in American Falls Reservoir.

Negotiation of the water savings agreements is of vital importance to the Palisades Reservoir Project because its full benefit can be realized only if average annual savings of water in the amount of 435,000 acre-feet can be effected through stoppage of present wasteful non-irrigation season diversions, and because the authorization of the dam was made contingent on being assured of substantial water savings. We have set at present as our goal to be met prior to commencement of construction an assured annual average saving of 283,000 acre-feet.

The several specific recommendations for carrying out the major purposes above discussed are set out in paragraph 41 of the Regional Director's report. These cover: (a) the goals as to average annual water savings; (b) the proposed operating plan for Palisades Reservoir, including a proposal as to joint use of the top 900,000 acre-feet of space for flood control and irrigation; (c) the use of unsold space in American Falls Reservoir for development of not less than 37,000 acres of new land in the North Side Pumping Division of the Minidoka Project, a Bureau of Reclamation project, and not more than 30,000 acres of new land in the Michaud Unit of the Fort Hall

Project, an Indian irrigation project; and (d) the plan to begin negotiations with water users immediately even though the giving of a cost estimate for irrigation space must be deferred. Criticism of the proposals here stated is expected from several groups, but we are convinced that our position is in the interest of the best use of the water supply in the area.

Actual authorization of the proposals for irrigation of new land depends on studies yet to be made and reports yet to be submitted, but it is necessary at this time to indicate the intended disposition of this reserved space. The proposal with respect to the Michaud Unit is concurred in by the Commissioner of Indian Affairs, as indicated by his endorsement below.

I concur in the recommendations of the Regional Director and recommend that you approve them.

/s/ Michael W. Straus

Commissioner.

Enclosure 798

I concur Dec. 5, 1946

/s/ John H. Provinse

ASSISTANT Commissioner of Indian Affairs.

Approved: Dec. 6, 1946

/s/ Oscar L. Chapman

Acting Secretary of the Interior.

10576

REPORT OF THE REGIONAL DIRECTOR

and

SUBSTANTIATING REPORT

REPORT OF THE REGIONAL DIRECTOR

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION I
Boise, Idaho

October 1, 1946

To: The Commissioner, Bureau of Reclamation

From: Regional Director, Region I, Boise, Idaho

Subject: Water Supply for Palisades Reservoir Project, Idaho.

Transmittal

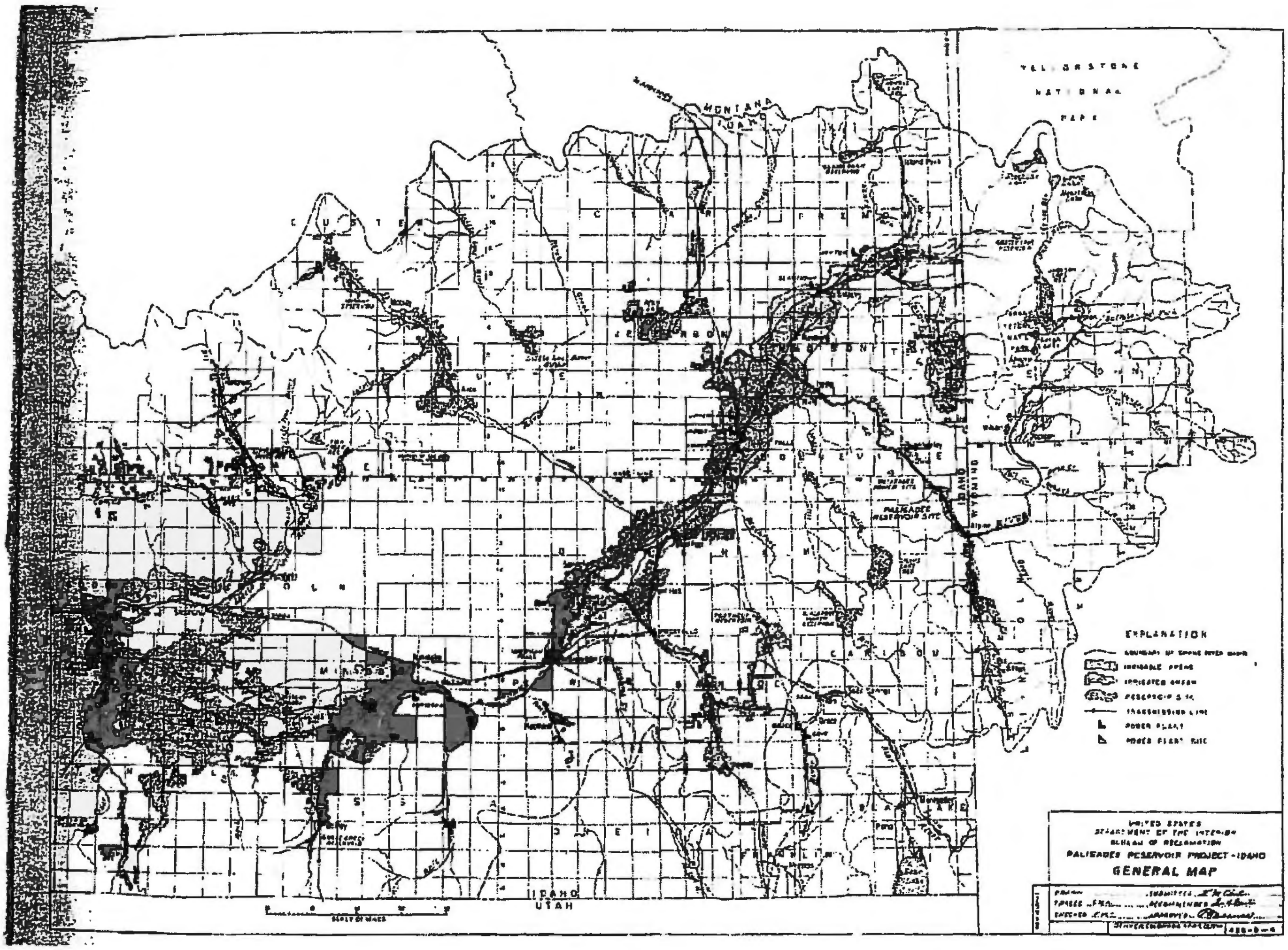
1. Herein is transmitted my report on means of conserving water for irrigation use in the Snake River Valley of Idaho. The conservation measures presented, together with operation of the Palisades Reservoir, previously authorized for construction, will materially increase the water supply available for existing irrigation projects and will permit the development of new land.

2. This summary report presents a digest of a detailed appended report and makes specific recommendations on actions that should be taken prior to the construction of Palisades Reservoir.

3. The primary purpose of both reports is to furnish factual information which will serve as a basis: (a) for negotiation of water-savings agreements with present water users; (b) for negotiations of repayment contracts with prospective users of storage water from Palisades Reservoir; and (c) for selection of the most satisfactory plan for future utilization of the 433,000 acre-feet of reserved space in American Falls Reservoir. I recommend that you approve the report and transmit it to the Secretary of the Interior for his approval in order that it may be presented to the water users in the Snake River Valley.

Authority for the Report

4. This report is authorized to be made by virtue of the Act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto, known as the Federal Reclamation Laws. The securing of water saving agreements with present water users in the Snake River Valley is a prerequisite to construction of Palisades Reservoir specifically recognized in representations made by the Department of the Interior to the 77th Congress, 1st Session, in House Document No. 457. In his letter of November 1, 1941, submitting the "Report on the Palisades Dam Project" to the


YELLOWSTONE NATIONAL PARK
MONTANA
IDAHO
WYOMING
PALISADES RESERVOIR SITE
IDAHO
UTAH
EXPLANATION
POWER PLANT
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PALISADES RESERVOIR PROJECT - IDAHO
GENERAL MAP

Secretary of the Interior, the then Commissioner of Reclamation stated in part:

> ". . . The project is desirable in the public interest. Its success, however, depends on the conservation of 135,000 acre-feet of water now wastefully used, and on the willingness of the irrigators to pay $1 per acre-foot per annum for stored water which they will use. These matters can be adjusted in future negotiations, and construction should not be initiated until appropriate assurances have been received. . . ."

In transmitting the same report to the Congress on December 9, 1941, the Secretary of the Interior stated in part:

> ". . . The Director of the Bureau of the Budget has informed me that there would be no objection to the submission of this report to the Congress. He added, however, 'that. . . it. . . would be contrary to the program of the President to submit any. . . estimate [of appropriation for construction of the project] until local interests have given satisfactory assurance to the Secretary of the Interior that they will eliminate the wasteful use of water in the area to be affected by the project. . .'"

<u>Cooperation and Acknowledgement</u>

5. The investigative work upon which this report is based was undertaken by the Bureau of Reclamation at the request of the water users in the project area. A resolution requesting the study was unamimously adopted by their representatives at a meeting at Burley, Idaho, on November 21, 1941. During the course of the investigation, the officers of the various canal companies and irrigation districts serving the project area furnished data from their office files and provided general information needed to carry on the studies. The personnel of the District Office of the Geological Survey at Idaho Falls, Idaho, assisted materially in collecting all available records of stream flow and canal diversions in the project area. These records and the information given in the annual reports by the Snake River Watermaster were utilized in the water supply and river operation studies made during the investigation. Many useful data were also obtained from the Geological Survey's Water Supply Paper 774.

<u>Description of the Area</u>

6. The report deals with the control and use of water in the entire watershed of the Snake River above Milner Dam. The area that

can be served directly from Palisades Reservoir is limited to the presently developed projects and potentially irrigable lands along the Snake River between Heise and Milner Dam. It was necessary, however, to conduct a basin-wide water-supply study in order to arrive at a basis for coordination of the operation of the new reservoir with the operation of the several existing reservoirs. A further objective of the studies was to determine the possibility and effect of eliminating winter operation of canals in all areas where this practice is now current. The investigation of present water use and of possible water conservation measures was confined to the irrigated portion of the Henrys Fork Valley below Ashton and the irrigated area in the Snake River Valley which is served by canals diverting from the main stream between Heise and Milner Dam. In the study of possibilities for elimination of winter diversions and reduction of summer diversions in the Henrys Fork Valley it was necessary to consider the present irrigation development in the Mud Lake area, where the water supply is influenced by the heavy use of water in the Henrys Fork Valley.

7. The Snake River rises on the west side of the Continental Divide, in the southern part of Yellowstone National Park, and flows southward through Wyoming for about 130 miles between the Teton and Wind River mountain ranges. Upon entering Idaho, it turns westward through the Caribou and Snake River mountains and emerges onto the Snake River Plain at Heise, Idaho. Downstream from the mouth of the tributary Henrys Fork River, about 17 miles below Heise, the main stream of the Snake heads southwest and crosses southern Idaho in a broad arc. The Henrys Fork River, the largest tributary above Milner Dam, rises along the west side of the Yellowstone National Park; and its two main tributaries--Fall and Teton rivers--drain the west slope of the Teton Mountain Range. The heavy snows which blanket the watersheds of the Snake and Henrys Fork rivers during winter give rise to heavy run-off during the spring and summer. The annual inflow to the Henrys Fork and Snake River valleys from the two watersheds averaged 6,500,000 acre-feet during the 1919--42 period, or about 800 acre-feet from each square mile of drainage area. Climatic cycles, however, have caused a variation of as much as 40 percent from this annual average run-off. As a result, a considerable amount of hold-over reservoir storage space is needed to permit even an approach to full use of the average annual run-off for irrigation purposes.

8. The peculiar geology of the Snake River Plain, across which the river flows after leaving the mountains, is a deterrent to making full use of the water resources above Milner Dam. The plain occupies a structural depression in the impermeable basement rock and was built up to its present level by repeated lava flows. The intermittent lava flows, originating mostly from volcanic eruptions along the northern foothills, obliterated the original drainage

pattern and gradually shifted the main stream channel toward the southeast, leaving a series of buried channels in their wake. The porous fill material underlying the surface of the plain acts like a mighty sponge which absorbs natural precipitation and takes water from surface streams to maintain an immense underground reservoir and subterranean stream flow. The many buried river channels intercept the present river channels above American Falls, and some water flowing in the rivers drains into them. The buried channels form the main arteries of a subterranean stream network which discharges a steady flow of about 8,000 cubic feet per second through spring outlets in the north wall of the Snake River Canyon below Milner Dam. Losses into these subterranean channels from the channel of the Snake River and deep percolation of irrigation water from most of the cultivated land on the Snake River Plain have prevented the full utilization of the large stream flow entering the upper reaches of the Henrys Fork and Snake River valleys.

9. Waters of the Snake River have held a key position in the economic development of the area. From a small beginning in the early eighties, the irrigated area has been extended to include about 1,200,000 acres of land at the present time. Of this total, 110,000 acres are irrigated in the Henrys Fork Valley, and 950,000 acres are irrigated in the Snake River Valley by canals diverting from the main stream between Heise and Milner Dam. The construction of storage reservoirs has accompanied the expansion of the irrigated area. At the present time there are three reservoirs with a combined active capacity of 221,000 acre-feet in the Henrys Fork Watershed and three reservoirs on the main stem of the Snake River with an aggregate, active capacity of 2,582,000 acre-feet usable for irrigation. Hence, about 2.6 acre-feet of storage space are available for each acre of irrigated land dependent on these reservoirs. American Falls Reservoir is the key unit in the storage system because of its large capacity (1,700,000 acre-feet) and its strategic location in the center of the irrigated area where it can capture return flows.

10. Practically all of the population and most of the wealth of the area are concentrated in the irrigated portions of the Henrys Fork and Snake River valleys. The outstanding cash crops produced on the irrigated lands are potatoes, sugar beets, and dry beans. The valley is justly famous for its production of the high quality Idaho Russet potato. Approximately 90 percent of Idaho's potatoes are grown on about 110,000 acres in this area. About one third of the irrigated area is devoted to the growing of hay, primarily alfalfa. Grown in rotation with cash crops, it provides feed for farm livestock and winter feed for the important range livestock industry of the area. The valley as a whole is one of the richer agricultural communites in the entire West.

11. Eleven hydroelectric power plants with a combined capacity of 99,675 kilowatts have been established on the Snake and Henrys Fork rivers in the area covered by this report. Five, with an aggregate capacity of 12,200 kilowatts, are run-of-the-river plants above American Falls. The operation of these plants does not interfere with irrigation water supply. The remaining six plants, with the much greater combined capacity of 87,475 kilowatts, are located below American Falls and utilize some storage space in American Falls Reservoir. Power production at these six plants has been decreased in recent years in order to conserve water for irrigation. Moreover, further, larger decreases are in prospect under the water-conservation measures proposed in this report.

Water Supply Problems

12. The most rapid expansion of the irrigated area occurred during the first two decades of this century when the North Side Twin Falls and South Side Twin Falls projects were developed under the Carey Act, and the Minidoka Project was brought in under the Reclamation Laws. Development of the 570,000 acres in these three projects more than doubled the area irrigated from Snake River between Heise and Milner Dam. The need for storage reservoirs to regulate the flow of the Snake River was recognized at an early date; and Jackson Lake Reservoir, the first major storage facility on Snake River, was constructed to a capacity of 847,000 acre-feet in 1916. When this reservoir failed to fill and a serious water shortage occurred on almost every project in 1919, it was realized that far more storage regulation was needed, and an immediate drive was initiated to obtain it.

13. The drought in 1919 and the ensuing concerted action by the water users resulted in the construction of American Falls Reservoir in 1927. Stream flow records up to that date indicated that the reservoir would fill during every year; and that, in combination with storage already available in Jackson Lake, three fourths of the capacity of the American Falls Reservoir would meet all needs of existing projects. Accordingly, only three fourths of the American Falls storage space was assigned to existing irrigation projects. The remaining capacity was reserved for development of new land.

14. An unprecedented drought which began in 1929 caused serious water shortages on the existing projects and gave rise to the fear that even the augmented water supply was not adequate. All plans for development of new land were temporarily laid aside, and the reserved space in American Falls Reservoir was leased to the existing projects in 1931. Even with full use of American Falls Reservoir, most of the existing projects still suffered serious water shortages in 1931, 1934, and 1935. The present lease of the reserved space

remains in effect through October 31, 1946. It is expected that arrangements will be made to assure that a substantial portion of the reserved space will continue to be available for the use of existing projects until another reservoir is constructed for their use.

15. In part because of the unpredictably low run-off, American Falls Reservoir failed to fill during any year from 1929 to 1935. In part, however, failure to fill was the result of heavy drafts made on inflow to the reservoir during the winter for purposes of producing power downstream and of supplying through the canal systems domestic and stock water to cities and farms. An insignificant proportion of the water diverted through the canals during the non-irrigation season can be utilized for the latter purposes. Hence, about 500,000 acre-feet of water which could otherwise have been stored for irrigation use, were drawn from the river every winter for power and domestic purposes. These practices, established long before the reservoir was built, are deep-rooted and difficult to alter.

16. Thus the problem confronting the valley today is finding ways and means of increasing the water supply to assure that irrigation needs can be met during periods of abnormally low run-off such as occurred during the years 1929--1937. Elimination of justifiable fears of water shortage on existing projects should precede any additional development of new land. The firm supply of irrigation water can be increased at least cost by a combination of additional storage space on the Snake River above Heise and elimination of the present wasteful diversions from the river during the non-irrigation season. Palisades Reservoir, which has multiple purposes among which costs can be allocated, offers the most promising opportunity for securing additional irrigation storage space at reasonable cost.

Proposed Water Conservation Program

17. At the request of the water users, the Bureau of Reclamation made a detailed investigation of the present use of water in the Henrys Fork and Snake River valleys. The field investigation was started in 1942 and completed in 1944. The principal objectives of the study were (a) to determine the extent of all possible water conservation measures which can be adopted without serious injury to existing irrigation projects and (b) to determine the amount of water which can be saved by these measures. The study revealed that elimination of winter diversions for domestic and stock-watering purposes is the only measure which is economically feasible at the present time. Large, additional amounts of water may be saved by lining of canals if and when a lining is developed which is sufficiently inexpensive to permit its widespread adoption.

18. The present heavy use of water in the Henrys Fork Valley results from subirrigation of about 70,000 acres of land in that area. This practice was established during the early stages of development, after irrigation by customary surface methods proved a failure. A wide variety of crops is grown by maintaining the water table within reach of the plant roots during the summer instead of by spreading water on the surface of the ground in the usual manner. The hydraulic properties of the underground reservoir permit the raising and lowering of the water table by varying the flow of water in the canals. The canals must be operated at partial capacity during winter to hold the water table at a level from which it can be raised to the plant roots in the spring after the ice and snow in the canals have melted. Present schedules of annual diversion to the subirrigated lands have been evolved through the experience of 40 years in manipulating the water table to give maximum crop production during the relatively short growing season in that area. Hydrographic studies have shown that relatively large quantities of ground water move westward toward Mud Lake as a result of maintaining high water tables in the Henrys Fork Valley. This ground-water movement has caused a phenomenal increase in the inflow to Mud Lake since 1900 and has made possible the development of a dependable water supply for 28,000 acres now irrigated in that area. In view of these facts, it has been concluded that the present use of water in the Henrys Fork Valley cannot be curtailed without adversely affecting crop production in that valley as well as in the Mud Lake area and that, taking all factors into account, there is no adequate justification for seeking to disrupt these established communities.

19. The proposed water conservation program in the Snake River Valley differs somewhat between the areas above and below American Falls Reservoir. Above American Falls Reservoir, the program involves elimination of winter diversions for domestic and stock watering purposes in all areas where the ground-water movement is not tributary to the river above Milner Dam. These areas include the portion of the irrigated land on the east side of the river between the Great Feeder and the town of Firth and all of the irrigated area on the west side of the river, except that served by the Aberdeen Canal. The water table under most of the land served by this canal is tributary to the Snake River above Milner Dam. The canals serving these non-tributary areas could be shut off during winter if all farmsteads were equipped with wells. Free movement of ground water through the broken lava formation and the filtering of surface waters through the soil mantle and alluvial deposits insure an ample yield and a satisfactory quality of water in all wells. The fact that all of the cities and somewhat more than 80 percent of the farmsteads now obtain domestic water from wells indicates the desirability of well water for

domestic use. The depths of wells on these farms range from 40 to 200 feet. Additional wells which it would be necessary to drill would have similar depths. Water drawn from wells is far less subject to pollution than that now obtained from open canals. The fact that farm owners in the area have drilled wells and have equipped them with adequate pumping facilities indicates that the cost of the required wells is within the means of individual farm owners.

20. The water conservation program in that portion of the Snake River Valley below American Falls Reservoir involves the elimination of winter operation of canals for domestic and stock-watering purposes in the Minidoka Project, the North Side Twin Falls Project, and the South Side Twin Falls Project. The canal systems serving the latter two projects have been operated throughout the winter since their construction in order to provide domestic and stock water. As in the upper valley, an alternative supply of domestic and stock water must be provided before these canals can be shut off in winter.

21. All of the farmsteads in the Minidoka Project are fully equipped with wells, and the canals serving that project have not been operated in January, February, or March for several years. Some water has been diverted in November and December in recent years, however, for convenience in watering livestock in the fields during the harvest season. The fact that no diversions were made in those months during 1942 indicates that the practice could be eliminated without undue hardship. Hence, under the proposed water saving program it is expected that no water will be diverted in the future by this project after the end of the irrigation season.

22. Equipping all farmsteads on the North Side Twin Falls Project with wells is the most practicable method of providing an alternate source of domestic water so that canals of the project may be shut off during winter. All of the cities, towns, and industrial establishments in the project area now obtain their water supplies from wells. Moreover, a field inventory in 1942 showed that 905 farmsteads, or 60 percent of the total in the project, had adequate well facilities and were not dependent on the canals for domestic and stock water. The remaining 592 farmsteads would have to be equipped with wells before the canals could be shut off during the winter. The depth of the required wells averages 280 feet and ranges from 80 to 480 feet. Although the cost of the deepest wells required would be relatively high, many wells of comparable depth have been developed by the farm owners in the same vicinity in order to obtain a better quality of water than that available from the canals. The large volume of ground water flowing freely beneath the project insures an adequate yield from all wells without excessive drawdown. Chemical analyses of several representative

samples of the ground water indicate that it is suitable for domestic use. It is far less subject to pollution than canal water. The present widespread development of farm wells and the fact that all of the cities obtain their water supplies from such sources adequately demonstrate that well water is superior to canal water for domestic use. The ultimate goal, therefore, should be to equip all farmsteads with adequate well facilities in order that the large quantity of water now diverted during the winter may be stored in reservoirs and used for irrigation.

23. Procurement of water of satisfactory quality for domestic use has been an acute problem in the South Side Twin Falls Project since it was first settled. Many wells have been drilled in the project, but with very few exceptions the water obtained is unsuitable for domestic use. Twin Falls and Buhl, the two largest towns in the project, depend upon the canal for municipal water. The canal water is filtered and chlorinated before delivery to the Twin Falls residents, but at Buhl it is only chlorinated. Chemical analyses of the water from 43 representative wells distributed at 3-mile intervals show an average total hardness of 424 parts per million and a concentration of total dissolved solids ranging from 468 to 1340 parts per million. In all samples except one both the hardness and concentration of dissolved solids were in excess of the upper limits prescribed by the United States Public Health Service for drinking water of good chemical quality. Water-softening equipment will reduce the total hardness to acceptable limits; but such equipment is costly and it will not reduce the concentration of dissolved solids. Because of the stagnant nature of the ground water, it has an undesirable taste and is subject to pollution in many areas. It has been concluded, therefore, that the ground water in the project area is not suitable for domestic use.

24. Inasmuch as a well program cannot be recommended for the South Side Twin Falls Project, a satisfactory supply of water for domestic use must be provided by some other means before the Twin Falls Canal can be shut off during winter. A thorough study of all possible ways and means of providing an alternative source of domestic water showed that the most practical and economical plan is to draw water from Murtaugh Lake (a small regulating reservoir on the main canal seven miles southwest of Milner Dam), purify and soften it in a central treating plant, and deliver it under pressure to all farm homes and cities through an underground pipe system. An extensive distribution system, involving somewhat more than 600 miles of 2-inch to 48-inch pipe, would be required to deliver the treated water to all farms and cities. The cost of constructing the entire water system, designed with sufficient capacity to serve the anticipated population 40 years hence, is estimated at

about $14,000,000, based on prices prevailing in 1946. The cost of operating and maintaining the system for 40 years will average about $240,000 per year. Water-rate studies have shown that the construction costs must be financed without interest over a period of at least 40 years in order to provide the treated water at a cost which the prospective consumers can afford. Because the operation of such a domestic water system would result in the saving of a large quantity of water for irrigation use, the Government would be justified in financing the construction cost without interest under the Reclamation Laws. With the construction cost financed over a 40-year period without interest, treated water could be delivered to city reservoirs at a cost of 16 cents per 1,000 gallons and to farm homes at an average cost of 20 cents per 1,000 gallons. These rates compare favorably with those prevailing in many large cities in the United States and in the cities and towns of southern Idaho. The many advantages which the pure, soft water piped to each farm home would have over the present supply of domestic water from canals should amply justify the additional expenditure which would be involved for some farm families. Town dwellers would benefit from a superior domestic water supply at little or no increased cost, and the softness of the water from the proposed system would be attractive to established and to new industries.

25. In summation, the proposed water conservation program calls for elimination of all winter diversions from the main stream of the Snake River to areas above American Falls with non-tributary ground water. Below American Falls, the program involves cessation of winter diversions to the Minidoka and the two Twin Falls projects. Measurements of the diversions to and surface return flow from the non-tributary areas above American Falls during the winters of 1942--43 and 1943--44 showed that the inflow to American Falls Reservoir would be increased about 135,000 acre-feet annually if all canals serving areas with non-tributary water tables between Heise and American Falls Dam were shut off from November 1 to April 1. Shutting off all canals below American Falls during the same period would result in a net storable saving of about 300,000 acre-feet of water annually. Somewhat more than half of this saving (152,000 acre-feet) would be realized by shutting off the South Side Twin Falls Canal. The estimate of water savings below American Falls is based on the average recorded winter diversions since 1936, allowing (a) for the water required to operate the Twin Falls Domestic Water System and the continued two-week autumn run of the Gooding Canal to fill cisterns and (b) for the increase in power releases from American Falls Reservoir that would be needed to offset the reduction of inflow to the river between Minidoka Dam and Shoshone Falls. Thus, a total of 435,000 acre-feet of water could be saved annually if the full winter water-conservation program were carried out. In dry years this amount of water could be stored in reservoirs and made available for irrigation of land during the summer.

26. The water saved by elimination of winter diversions would be considered, from the standpoint of irrigation use, in the same manner as any other natural flow in Snake River and would accrue to the reservoirs in accordance with the priority of their respective storage rights. During extremely dry years, such as 1934 and 1935, all of the saved water would accrue to American Falls Reservoir, thereby greatly firming the yield of that reservoir. Consideration has been given to the possibility of securing a special right to store all of the water saved by elimination of winter diversions in Palisades Reservoir. To do so, however, would require determinations of the amount of water saved. Such determinations would raise controversies and uncertainties which would make administration difficult and which probably could be resolved only after costly and time-consuming litigation.

Use of Reserved Space in American Falls Reservoir

27. The manner in which the 433,000 acre-feet of reserved space in American Falls Reservoir is used in the future will vitally affect the ultimate extent and stability of irrigation development in the Snake River Valley. Local desires with respect to the use of the reserved space are conflicting. Present water users wish to utilize it in conjunction with Palisades Reservoir to reduce water shortages on presently irrigated lands in extremely dry years. Other large groups of public-spirited citizens desire that this reserved space be used to develop new land. The Bureau of Reclamation has made a thorough study of both proposals in order to determine the merits of each and to select and recommend a plan which would insure the greatest benefit to the greatest number of people. The two alternatives, which have been designated as Plan A and Plan B, are described in the following paragraphs.

28. Under Plan A the reserved space in American Falls Reservoir would be used to provide a supplemental supply of stored water for the existing projects. In order to extend advantages of the low-cost and firm yield of American Falls storage to a greater area than at present, the cost and yield of the American Falls reserved space would be pooled with the cost and yield of Palisades space. Although the combined space would be sold as a unit, as if it were all in one reservoir, the amount of stored water accruing to the pool each year would be computed on the basis of the priority of the storage right of each reservoir. No development of new land would be in prospect under this plan inasmuch as existing projects would probably acquire all of the pooled space.

29. Under Plan B the reserved space in American Falls Reservoir would be used for development of new land, and Palisades Reservoir would be used to provide a supplemental supply of stored water for the existing projects. In order to make the most efficient

use of the water supply, the American Falls reserved space would be used to store water for the irrigation of new land in the North Side Pumping Division of the Minidoka Project and in the Michaud Unit of the Fort Hall Project. New land in the Michaud Unit is included in this plan because it is the only large area of good irrigable land from which the deep percolation losses and surface waste will return to American Falls Reservoir where they can be regulated and re-used for irrigation of other lands downstream. The location and approximate extent of these two projects of new lands are shown on the general map following page 1. Detailed investigations of these projects will be needed to determine the exact acreage that can be irrigated in each.

River Operation Studies

30. Elimination of winter diversions from the main stream and operation of Palisades Reservoir will substantially increase the supply of stored water available for irrigation use in the Snake River Valley. A series of operation studies of the river system under these changed conditions was made to determine whether the total available water supply will be adequate to meet the irrigation requirements with and without development of new land. The operation studies covered the 24-year period from 1919 to 1942. This includes the lowest run-off during the period of record, which extends back to 1896. Starting with the Henrys Fork system of reservoirs and irrigation projects, the operation studies were conducted progressively downstream by applying diversion requirements to the water supplies available at selected control points. The diversion requirements for existing projects were estimated by adjusting recorded monthly diversions to reflect the irrigation practices and cropping programs anticipated in the future. River losses and gains under future operating conditions were estimated by means of a correlation of recorded losses and gains with recorded diversions during the period of study. These derived irrigation requirements, river losses, and river gains were applied to the recorded stream flows to determine surplus flows available for storage and deficiencies that would have been met by releases of stored water. In order to have conserved the maximum amount of stored water for use in dry years, it was assumed that irrigation storage would have been released first from the farthest downstream reservoir that could serve the irrigated lands. Since it was assumed that water users in the Henrys Fork Valley would not utilize space in the Palisades Reservoir, no storage water would have been released from that reservoir for their use. Sufficient water would have been released from Palisades Reservoir every winter to maintain a firm output of 15,000 kilowatts at the Palisades power plant. It would have been necessary to release water from Jackson Lake Reservoir during winter in critical dry years in order to maintain this

firm output, but such releases could have been captured in American Falls Reservoir and delivered subsequently to the rightful owners. The criteria adhered to in conducting the river operation studies are in accordance with Idaho water laws and are in general conformity with present operating practices.

Water Supply for Existing Projects - Plan A

31. The results of the operation study of the river system with the proposed winter water-savings program in effect and with American Falls and Palisades reservoirs operated in accordance with Plan A show that the existing projects in the Henrys Fork and Snake River valleys would have had practically a full water supply every year under those conditions. The only shortages which would have occurred during the 24-year period of study are shown in the table below:

Irrigation Water Shortages Under Plan A

Irrigation Season	Henrys Fork Valley		Snake River Valley	
	Shortage in Acre-Feet	Percent of Requirement	Shortage in Acre-Feet	Percent of Requirement
1924	74,000	7	0	0
1926	14,000	1	0	0
1931	143,000	15	0	0
1934	363,000	36	825,000	12
1935	131,000	14	271,000	4

The moderate and infrequent shortages indicated for the Henrys Fork Valley justify the conclusion that existing storage facilities are adequate to meet the needs of that valley and that participation in Palisades Reservoir is unnecessary. For all practical purposes it may be stated that, under Plan A, the irrigation projects in the Snake River Valley would have had a full water supply in every year since 1896. The shortages shown for 1934 and 1935, the lowest and next to lowest years of run-off on record, would have caused negligible crop losses.

32. The increase in deliveries of stored water and the decrease in irrigation shortages that would result from elimination of winter diversions and placing Palisades Reservoir in operation were determined by comparing the results of operation studies of the river system under present conditions and under the future operating

conditions described above. These studies showed that the deliveries of stored water would be increased by an average of 179,000 acre-feet annually. The average annual shortage would be decreased by 218,000 acre-feet, however, because of the increase in usable return flow that would result from application of additional storage water to lands above American Falls.

Water Supply for Existing Projects and New Land - Plan B

33. An operation study of the river system with Palisades Reservoir used entirely to provide a supplemental water supply for existing projects, and with the reserved space in American Falls Reservoir utilized for development of new land in accordance with Plan B, showed the following water shortages during the 1919--42 period:

Irrigation Water Shortages Under Plan B

Irrigation Season	Existing Projects in the Henrys Fork Valley		Existing Projects in the Snake River Valley		New Land in the Snake River Valley	
	Shortage in: Acre-feet	Percent	Shortage in: Acre-feet	Percent	Shortage in: Acre-feet	Percent
1924	74,000	7	0	0	0	0
1926	14,000	1	0	0	0	0
1931	143,000	15	0	0	0	0
1934	364,000	36	2,182,000	32	66,000	15
1935	131,000	14	659,000	11	124,000	29

In all other years of the study period a full water supply would have been available. Furthermore, a comparison of stream flow records prior to 1919 with those during the period of study indicates that the existing projects in the Snake River Valley would have had a full water supply under Plan B in every year except 1934 and 1935 since 1896. The shortage in the Snake River Valley (32 percent) in a year such as 1934 would have been less than that shown for the Henrys Fork Valley (36 percent) and would not have warranted the additional storage facilities needed to reduce it. Shortages in the Henrys Fork Valley would have remained the same as under Plan A because it is assumed that projects there would not participate in Palisades Reservoir. The new lands dependent on the American Falls reserved space also would have had a full water supply in every year since 1896, except 1934 and 1935.

34. Operation studies of the river system under Plan B showed that the average delivery of stored water during the 24-year period would have been increased by 288,000 acre-feet annually as a result of eliminating winter diversions and placing Palisades Reservoir in operation. The corresponding reduction in shortages would have averaged 360,000 acre-feet annually. The deliveries of stored water and irrigation shortages are based on a demand of 433,000 acre-feet annually for new lands in the Minidoka and Fort Hall projects. This is in addition to the full irrigation requirement for the existing projects. The usable return flow from irrigation of new lands in the Michaud Unit of the Fort Hall Project was taken into account in the operation studies.

Conclusions

35. The effectiveness of the authorized Palisades Reservoir in making dependable the water supply for the highly productive irrigated lands of the Snake River Valley is contingent upon eliminating wasteful use of water in the area. The most serious loss of storable irrigation water is occasioned by diversion of water during the non-irrigation season for domestic and stock-watering uses.

36. Domestic and livestock water can and should be provided by wells in all parts of the area except the South Side Twin Falls Project, where the quality of the ground-water supply is entirely unsatisfactory for these purposes. The feasibility of wells elsewhere in the area already has been demonstrated by a large majority of residents. The remaining farmsteads not equipped with wells should be provided with them through the efforts of individual farm owners or groups of owners.

37. In the South Side Twin Falls Project a system for the delivery of domestic water through underground pipes to every farm and town should be built by the Bureau of Reclamation. If financed with interest-free funds under the Reclamation Laws, the cost of the system could be repaid by domestic water users during a 40-year repayment period. Domestic water rates sufficient to cover costs would compare favorably with those of representative municipalities throughout the Nation.

38. Construction of Palisades Reservoir and elimination of wasteful winter diversions would provide an adequate water supply for existing irrigation projects without use by these projects of any of the reserved space in American Falls Reservoir. The existing projects can obtain an adequate supply of supplemental storage water from Palisades Reservoir by capturing surplus flows there in years of average and above-average run-off and retaining such stored

water for use during dry years. If the American Falls reserved space were utilized in conjunction with Palisades Reservoir to provide supplemental storage water for the existing projects in accordance with Plan A, the present water users would incur the cost of an additional 433,000 acre-feet of storage which they might not use oftener than once in every 100 years. The economic justification for such protection is questionable.

39. The maximum benefits from the firm yield of the reserved space in American Falls Reservoir can be realized by using it for the irrigation of new land. Continued use of this space by existing projects would preclude the development of new land, a result contrary to the purpose for which this space was originally provided. Further, the benefit from use of the reserved space for new land development will be increased by applying part of the yield to lands in the Fort Hall Project, from which return flow will be available to other projects served by canals diverting at and above Milner Dam.

40. Negotiations with water users for water-savings agreements will necessarily involve discussions of the terms on which Palisades space will be made available. The water users may be expected to be willing to agree to abandon winter diversions only on being assured of such space and at a cost that they would regard as satisfactory. It is not possible at this time, however, to provide reliable cost data. Before this can be done, the following information will be needed: (a) a current estimate of construction costs, (b) agreement with the Secretary of War as to the amount of space to be used for flood control in keeping with the assumptions made in the reservoir operation studies and a redetermination of flood control benefits on that basis, and (c) reallocations of the revised estimate of costs among irrigation, power, and flood control.

Recommendations

41. It is recommended:

a. That agreements be secured with water users to eliminate the winter diversion of water with the objectives of achieving ultimately an annual saving of 435,000 acre-feet and, as a condition precedent to a commencement of construction of Palisades, an annual saving of 283,000 acre-feet, these objectives to be achieved through the following programs:

(1) Securing agreements providing for shutting off, during the non-irrigation seasons commencing when Palisades Reservoir is placed in operation,

all canals in the areas above American Falls Reservoir where water tables are not tributary to the Snake River above Milner Dam (excluding Henrys Fork Valley), and those diverting between American Falls and Milner dams, except to the minor extent indicated in the underlying report;

(2) Preparing a project planning report, in the nature of a supplement to the Palisades Report of 1941 (House Document 457, 77th Congress) on a domestic water system for the South Side Twin Falls Project providing for a maximum repayment period of 40 years, without interest, for review by the Department looking toward submission to the Congress, if the prospective water consumers indicate a willingness to accept the water-savings program for that project and the obligations in connection with the proposed domestic water system;

(3) Requesting individuals concerned to provide, at their own expense, wells for domestic and stock water in areas to be deprived of present sources when winter water-savings agreements become effective, except in the case of the South Side Twin Falls Project.

In aid of securing water savings agreements it would be the policy in dealing with organizations now diverting winter water to offer space in Palisades Reservoir only to such organizations as are willing to agree to the water-savings program outlined in this report.

b. That the following be adopted as major features of the plan for the operation of Palisades Reservoir:

(1) Water saved by elimination of winter diversions shall accrue to existing reservoirs and to Palisades Reservoir in accordance with the priority of the storage right of each;

(2) American Falls Reservoir water may be stored in Palisades Reservoir whenever space therefor is available in the latter;

(3) An owner of Palisades space may hold over stored water from one season to the next, but may not accumulate more Palisades storage water than can be retained in the space he owns in that reservoir;

(4) Palisades storage water may be exchanged for American Falls stored water in order to permit delivery of American Falls storage water to lands above American Falls Reservoir;

(5) Water which could otherwise be stored in Jackson Lake Reservoir may be released to maintain firm power production at the Palisades power plant in critical years, such releases to be without loss to the owners thereof;

(6) Subject to the making of satisfactory arrangements with the War Department, the top 900,000 acre-feet of storage space in Palisades Reservoir will be used jointly for flood control and irrigation, the operation of this space for flood control purposes to be predicated on forecasts of run-off each year;

c. That the presently unsold American Falls space (approximately 433,000 acre-feet) be used, in accordance with its original purpose, for the development of new lands to comprise not less than 37,000 acres in the North Side Pumping Division of the Minidoka Project and not more than 30,000 acres in the Michaud Unit of the Fort Hall Project, subject to the following conditions:

(1) That, in accordance with a program now in progress, the Bureau complete at an early date detailed investigations of these proposed undertakings to ascertain as to each irrigable acreage classified according to current Reclamation standards, the storage requirements under various plans;

(2) That development of the North Side Pumping Division be authorized by the preparation and submission to the Congress of a report and findings in accordance with the requirements of the Reclamation Laws;

(3) That the Michaud Unit be authorized for construction by the Office of Indian Affairs subject to the same limitations on land speculation and permitted size of individual holdings of irrigable land as control in the case of projects developed under the Reclamation Laws; and

d. That the negotiations with water users on the basis of the plans and policies herein stated for water savings and the sale of Palisades space proceed immediately, but that final announcement of the cost of space be deferred until estimated costs have been redetermined and reallocations thereof among irrigation, power, and flood control have been approved by the Secretary.

R J Newell

Regional Director

UNITED STATES DEPARTMENT OF THE INTERIOR

JULIUS A. KRUG, Secretary

BUREAU OF RECLAMATION
MICHAEL W. STRAUS, Commissioner

SUBSTANTIATING REPORT

WATER SUPPLY

for

PALISADES RESERVOIR PROJECT

IDAHO

SUBSTANTIATING REPORT

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CHAPTER I

THE AREA, PROBLEM, AND INVESTIGATIONS

Costly shortages of water which plague the highly productive irrigated lands of eastern Idaho can be virtually eliminated by construction of the authorized Palisades Reservoir providing wasteful use of water in the area is stopped. Judicious water use together with coordinated operation of Palisades and the existing reservoirs in the Upper Snake River Basin not only will reduce the hazard of water shortage and flood damage but also will permit the irrigation of many thousands of acres of fertile land now dry and unproductive.

THE AREA

The area which will be affected by construction of Palisades Reservoir, hereafter called the project area, embraces all land irrigated from the Snake River above Milner Dam, including land irrigated by diversion at the dam. Also included are irrigated lands adjacent to Mud Lake, which have no surface drainage connection with the Snake Basin but which are influenced by irrigation in the Snake River Basin. These irrigated areas are the hub of economic development in the entire Upper Snake Watershed, with which this report is primarily concerned.

Milner Dam, on the Snake River 400 miles downstream from the river's source in Yellowstone Park, is somewhat more than 150 miles west of the Idaho--Wyoming boundary and about 35 miles north of the Idaho--Utah line. Upstream from Milner Dam the waters of the Snake River are usable for irrigation by relatively simple diversions. Below Milner Dam, the river flows in a deep canyon, and either an extremely high pumping lift or costly high dams would be required to utilize its water for irrigation. Moreover, the flow of the river is augmented a few miles downstream from Milner Dam by a substantial inflow from springs tapping a huge underground reservoir. For these reasons, all parts of the Snake River Basin above Milner Dam have common water supply problems which differ from those of areas below the dam.

Mud Lake lies about 70 miles west of the Idaho--Wyoming boundary and 35 miles south of the Idaho--Montana line. The lake, approximately

3 miles in length, is just west of the surface watershed of the Upper Snake River Valley. Although it has no surface outlet, the lake and adjacent ground water, both used as sources of irrigation water, are affected by water use in the Snake Valley proper. Hence, the Mud Lake area is an integral part of the Upper Snake River Basin insofar as present and potential water supply is concerned.

The Upper Snake Watershed is about 22,000 square miles in size and occupies the eastern part of Idaho and adjacent lands in western Wyoming. The airline distance to Portland, Oregon, from the center of the project area is somewhat more than 500 miles. Salt Lake City, Utah, is about 150 miles to the south.

The eastern half of the Snake River Plain, a broad, desert plateau, and its flanking mountains are the major land features of the project area. On the north and east the mountains form the continental divide and include peaks as high as 13,800 feet above sea level. The lower mountains on the south form the divide between the Snake River and the tributaries of Great Salt Lake. The Snake River Plain slopes from east to west and has a general elevation of 5,000 to 3,000 feet above sea level.

Desert climatic conditions prevail on the Snake River Plain. Annual precipitation there is less than 10 inches. In the higher elevation of the mountains, however, rainfall is much greater. The average precipitation in these mountainous areas is 18 to 20 inches annually, and in a few places it is as much as 46 inches. Temperatures in the lower portions of the project area are mild during winter, and hot summers are characteristic.

Soils in the area consist of residual materials developed in place by weathering of bedrock, those transported and sorted by action of water, and those laid down by wind. Residual soils cover the mountains and foothills, while wind-laid materials blanket much the greater part of the Snake River Plain. Water-borne materials have been deposited along the courses of all streams above and below their entrances to the plain.

Surface Waters

The stream pattern of the basin is extraordinary. The main stem of the Snake heads in the southwestern part of Yellowstone Park at an elevation of nearly 10,000 feet. It flows south for 130 miles in Wyoming and then turns sharply to the northwest in passing through a deep canyon to Idaho and the Snake River Plain. Its major tributary in the project area, the Henrys Fork River, joins the main stream from the north a few miles below its emergence onto the Plain. Then for 180 miles--from the mouth of the

Henry's Fork to Milner Dam--no tributary joins the Snake from the north. As discussed at length subsequently, the streams which drain the mountains to the north disappear in the porous underground materials of the Snake River Plain. The major tributaries joining the main stem from the south in this reach are the Blackfoot, Porteneuf, and Raft rivers.

These surface waters are the critical resource in the basin. The volume, cyclic variations, and seasonal distribution of stream flow set the outer limits of agricultural development. Many thousands of acres of land, otherwise suitable for irrigation, lie idle because dependable surface-water supplies are not available for their development. The high proportion of water resources now lost or consumptively used in the project area is reflected in the runoff statistics of the Snake and Henry's Fork. The two rivers and their tributaries discharged onto the eastern edge of the Snake River Plain an average of about 6.3 million acre-feet of water annually during the 1931--1940 period. By contrast, only 575,000 acre-feet passed Milner Dam and left the project area. About 37 percent of this difference can be accounted for by consumptive use in irrigated areas, and the remainder 54 percent of the total inflow) was lost through evaporation and non-tributary seepage.

Ground Waters

Ground waters in the basin are of limited utility because of the great depth at which they lie under most of the plain. North of the Snake, ground waters constitute an enormous underground reservoir which absorbs precipitation falling on the surface of the plain, surface flows of streams which discharge from the higher lands to the north, and lateral ground-water movements from the eastern part of the plain. This huge subterranean reservoir spills its excess water into the present channel of the Snake through springs a few miles below Milner Dam, where it cannot be used in the project area. Despite the depth at which ground water lies, wells with yields satisfactory for domestic and livestock requirements can be developed economically in all parts of the project area except the South Side Twin Falls district, immediately west of Milner Dam. There the poor quality of ground water makes its use infeasible.

Present Water Resource Development

The Upper Snake Valley is one of the most productive irrigated areas in the Nation. Irrigation development there began about 1879 when water was supplied to hay lands at several cattle ranches by simple diversions at or near points where the streams discharge onto the Snake River Plain. During the last 10 years of the 19th century irrigation development proceeded rapidly; and, by 1900, more than half a million acres were under ditch. This rapid progress continued during the first years of the present century, and by 1920 several hundred thousand additional acres had been irrigated. Very little development of new irrigated land has been made in Upper Snake Basin proper since 1920. In the Mud Lake Area, however, new lands have been brought in as increasing supplies of ground water made such development possible. By 1942, 28,300 acres in that area were irrigated and an additional 6,000 acres were irrigated in the basin of Camas Creek, the major source of surface inflow to Mud Lake. In the project area as a whole, about 1,200,000 acres are now irrigated.

The entire natural flows of all streams in the project area for many years have been diverted for irrigation use during July, August, and September. Since 1920, expansion of storage facilities has been the chief irrigation development. The key reservoir in project area is that at American Falls, 75 miles upstream from Milner Dam. Completed in 1927, American Falls Reservoir provides an active storage capacity of 1,700,000 acre-feet. All of this storage space with the exception of 433,000 acre-feet reserved for the development of new land has been sold to canal companies and other interests. Nineteen other reservoirs in the project area have a combined active storage capacity of 2,144,000 acre-feet. This storage system fails to provide sufficient irrigation water in dry years even though it fully regulates the flow of the Snake River during such years.

Eleven hydroelectric power plants with a combined capacity of about 100,000 kilowatts have been established in the project area. Under present conditions of water use, the operation of these power plants does not seriously interfere with irrigation. Water conservation measures subsequently proposed, however, will cause a reduction in the amount of water available for production of firm power at the plants at American Falls and at Minidoka Dam, 40 miles downstream. Seven of the plants in the project area are owned by the Utah Power and Light Company and the Idaho Power Company. One is owned by the Federal Government and three by a municipality.

Heavy run-off causes considerable flood damage between Heise, Idaho, where the Snake emerges from its canyon onto the plain, and Roberts, 30 miles downstream. When the river flow exceeds 20,000 cubic feet per second, the channel banks in this reach are overtopped and flood damage results. Flows in excess of that amount occurred in 38 of 49 years from 1890 to 1938, inclusive. The estimated average annual flood damage amounts to $410,000.

The critical water supply in the project area has demanded the establishment of efficient water administration in order to avoid disputes and inequities resulting from the complicated water rights and relative priorities. Since 1919 the water users have elected the District Engineer of the Geological Survey, United States Department of the Interior, as watermaster for the distribution of natural flow. The same individual also has been appointed by the Idaho Commissioner of Reclamation as special deputy to supervise the distribution of stored waters. All allocations and deliveries of water in the Upper Snake Valley are made under the supervision of the watermaster, and this system has been proved satisfactory to all concerned.

Economy

Irrigation agriculture is the keystone in the economy of the project area. At least 85 percent of the employment in the area is provided by irrigated farms. Specialty cash crops and livestock enterprises characterize the agricultural economy. One of the most important cash crops of the irrigated lands is potatoes; approximately 90 percent of Idaho's potatoes are grown in the project area. Dry edible beans and sugar beets are other important cash crops. Hay, primarily alfalfa, occupies about one-third of the cropped area. Grown in rotation with cash crops, it provides winter feed for range livestock and for animals retained on irrigated farms throughout the year. Farms 80 acres in size are most numerous in the project area. In the mountain valleys, however, and on the dry lands of the plain, there are many livestock and wheat ranches exceeding 1,000 acres.

Manufacturing in the project area, of minor importance in comparison with agriculture, is characterized by a preponderance of food processing plants. Sugar beet refineries, creameries, canneries, and meat packing establishments constitute the principal types of plants. Forestry, mining, and recreation are other industries of the area, but they, too, are unimportant in relation to agriculture.

The project area is well situated to reach a number of large market centers. The main line of the Union Pacific Railroad from Omaha to the north Pacific Coast crosses the area and, together with the numerous branch lines, offers direct connections to points north, south, east, and west. Three primary highways cross the area, one following an east-west route and two following north-south routes. A well developed road network offers good circulation within the valley.

The leading exports of the project area are livestock, potatoes, sugar, beans, wool, grain, onions, and dairy products. Livestock is shipped to markets in the middle west and on the Pacific Coast. Wool moves to eastern markets, principally Boston and Philadelphia, and a considerable quantity of dairy products is marketed in California. Specialized crops, such as the Idaho Russet potato, are distributed throughout the Nation.

Population

Settlement in the project area began in 1810 with the establishment of a trading post on the Henrys Fork River. Thousands of migrants passed through the area in later years enroute to the north Pacific Coast, but few settled in eastern Idaho. Not until the vigorous expansion of irrigation in the late 1880's did the project area obtain significant numbers of inhabitants. Population grew rapidly during the ensuing 30 years and reached its present proportions in 1920. In 1940, the project area had about 205,000 residents. Of this number about 69,000 live in towns and cities of 1,000 or more population, and the remainder (66 percent) live on farms or in towns of less than 1,000. Practically all of the population is concentrated in irrigated portions of the Snake River Plain. The principal towns, all in Idaho and all trading centers surrounded by irrigated lands, are Pocatello, with a 1940 population of 18,133; Idaho Falls, with 15,024; Twin Falls, with 11,851; and Burley, with 5,329.

THE PROBLEM

With the completion of American Falls Reservoir in 1927, the hazard of irrigation water shortage was believed to have been removed. Subsequent to 1928, however, during an unprecedented series of dry years, American Falls Reservoir failed to fill. It immediately became apparent that the 433,000 acre-feet of space in the reservoir reserved for development of new land would be needed by existing irrigated land. Accordingly, the reserved space was leased to water users on existing projects, and this arrangement has continued ever since. Even use of this reserved reservoir space failed to provide the water needed. As a result, serious crop losses were experienced. In 1931, the losses were approximately $3,000,000; in 1934 they were about $7,000,000, and in 1935, $1,000,000.

Such serious losses revealed the urgent need for additional storage in order to hold over the excess waters of wet years for use during years of low precipitation and for the elimination of wasteful water-use practices which are prevalent in the area.

The most injurious of these practices is the diversion of water during winter. In much of the project area, the irrigation canals are not shut off at the end of the irrigation season. Instead they flow at partial capacity during the entire winter in order to provide water supplies for domestic and livestock use. With the exception of the South Side Twin Falls district, however, a minority of the residents in the areas where canals are operated during the winter depends on canal water for domestic and livestock needs. A majority has constructed farm wells from which they secure a more satisfactory water supply. As noted earlier, ground-water conditions in the South Side Twin Falls district are so unfavorable that even the two largest towns there are dependent for domestic water on the irrigation canals. Every winter over half a million acre-feet are diverted into canal systems and thus, for the most part, lost to storage. It is obvious that if this water could be retained in a hold-over reservoir, the crop losses which result from water shortage during the irrigation seasons could be eliminated entirely or substantially reduced. It follows that construction of a hold-over reservoir such as Palisades cannot be justified unless winter diversions are stopped.

A second practice which loses water for the project area is heavy irrigation of lands underlain by ground water not tributary to the Snake River above Milner Dam. Under much of the project area subterranean channels which by-pass the river carry ground water to the huge reservoir under the Snake River Plain. Water which seeps downward into those channels, therefore, is lost to irrigation use.

INVESTIGATIONS

Previous Studies

In 1932, the Bureau of Reclamation initiated surveys of 27 reservoir sites on the Upper Snake River. In conjunction with these surveys, extensive water supply studies were made. In a report on the studies and surveys dated June 1935, Engineers E. B. Debler and J. R. Riter noted that 13 of the sites were unsuited, geologically, for construction of reservoirs. Many of the remaining sites were found to be unsuitable for hold-over reservoirs of large capacity because of the excessive height of dams required or possible reservoir leakage. It was concluded that the Johnny Counts site near Jackson, Wyoming, and the Palisades site near Irwin, Idaho, were the most favorable of the sites surveyed. The water supply studies summarized in the report indicated the need for water conservation measures in order to obtain the needed benefits from a hold-over reservoir.

A more detailed investigation of the Palisades site was made by the Bureau of Reclamation subsequent to 1935 and a report was issued in 1940. This report presented detailed cost estimates together with allocation of costs to irrigation, power, and flood control. Benefits exceeding costs in the ratios of 1.99 to 1.00 for irrigation; 1.16 to 1.00 for power; and 1.15 to 1.00 for flood control were shown. Eleven areas of potential new irrigated lands aggregating 470,000 acres were itemized although it was emphasized that possibilities for the development of these lands were severely limited by lack of fully adequate water supply even for existing irrigated land despite construction of a new storage reservoir. The conclusion of the earlier report that elimination of wasteful water use is prerequisite to realization of reasonable benefits of reservoir construction was strongly reiterated.

The 1940 report was summarized in House Document No. 457, 77th United States Congress, 1st Session. This document formed the basis for authorization of the Palisades Reservoir Project. Construction of the dam, however, was clearly made contingent upon elimination of wasteful water-use practices.

The site of the Palisades Dam, authorized for construction as a result of these previous investigations, is eight miles due west of the Idaho--Wyoming boundary and about 40 miles upstream from Heise, Idaho, where the Snake River emerges onto the Snake River Plain. The dam will be of earth and rock-fill construction with a height sufficient to create a reservoir of 1,400,000 acre-feet. The tentative design of the structure calls for a height of 260 feet, a crest width of 40 feet, and a length of 2,200 feet. A power plant with an installed capacity of 30,000 kilowatts and appropriate transmission lines will be included. Dead storage for power head will occupy the bottom 120,000 acre-feet. The total capacity available for flood control, when needed, will be 900,000 acre-feet. This will be sufficient to eliminate flood damage in the project area except in rare instances of extremely high run-off.

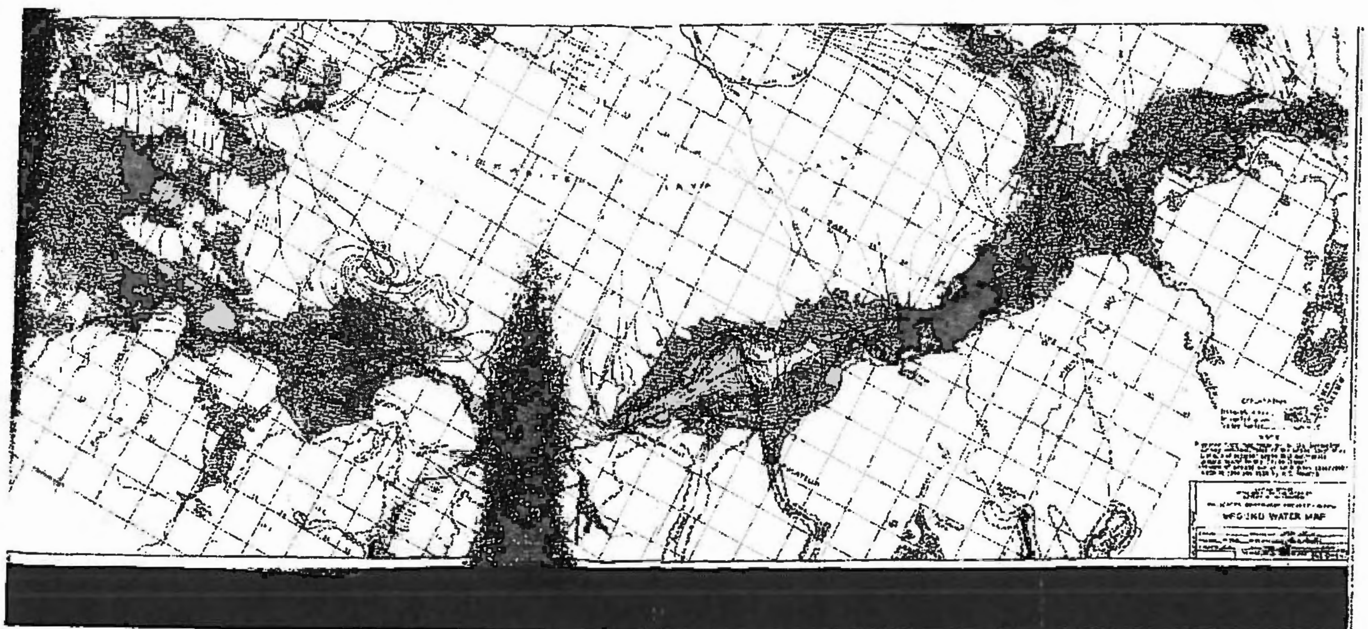
Present Investigation

Construction of Palisades Reservoir, it has been noted, cannot be initiated until wasteful water-use practices have been eliminated or appropriate assurances have been received that they will be stopped. The wasteful practices unfortunately have become well established by many years of usage. The problem cannot be solved equitably without thorough consideration of the many complex and interrelated factors involved. Accordingly, the investigation upon which this report is based was undertaken in 1942 at the request of present water users. The objectives of the investigation were to determine, first, where winter diversions could be economically eliminated, second, the most feasible means of eliminating winter diversions, and, third, the amount of water which could be conserved.

The area covered by the investigation was limited to the Henrys Fork Valley below Ashton, the irrigated area served by diversions from the Snake River between Heise and Milner Dam, and the Mud Lake area, the water supply of which is believed to be influenced by irrigation in the Henrys Fork Valley. Practically all of the water resources in dry years are utilized by diversions from the Snake River below Heise and from the Henrys Fork River and its major tributaries, the Fall and Teton rivers after they enter the Henrys Fork Valley. Relatively small amounts of water are diverted from the Snake River above Heise and from the Teton River in a small basin above the Henrys Fork Valley. All unused waters return to the streams in these areas and are re-used in the main valleys below Ashton and Heise. All areas from which the deep percolation losses and surface waste do not return to the main stream above Milner Dam are situated below Ashton and Heise, and it is only in these areas that water conservation measures will be effective toward increasing the supply of irrigation water. It also follows that the Mud Lake area is the only adjoining irrigated area that can be adversely affected by the adoption of water conservation measures in the Henrys Fork and Snake River valleys.

For the purpose of the investigation and studies of water use, the Henrys Fork Valley was divided into three areas and the Snake River Valley was divided into fourteen areas, five of which are below American Falls. These areas are shown on two fold-in maps entitled "Irrigated Lands, Snake River Valley" at the end of Chapter III, following page 83. The Henrys Fork Valley and that portion of the Snake River Valley above American Falls were divided insofar as possible into areas under which the ground-water movement is all tributary or all non-tributary to Snake River above Milner Dam. The streams from which diversions are made were used as the boundaries of areas wherever possible in order to facilitate the segregation of records of diversions into and return flow from each area. The accompanying ground-water map of the Snake River Plain, made by the Geological Survey, United States Department of the Interior, from observations during the 1928--1930 period, was of invaluable assistance in segregating the upper part of the valley into areas with tributary and non-tributary ground-water movements. The lower segment of the valley--below American Falls--was divided into five areas, each of which includes an entire project. In the upper part of the valley each selected area, however, is served by from six to seventeen canal diversions. The boundaries of the areas are given subsequently in the description and discussion of each area.

The Geological Survey has obtained complete records since 1919 of all diversions above American Falls during the summer period from


WATER MAP

the first of May to the end of September each year, and of the diversions throughout the year below American Falls. That agency also has maintained river-gaging stations throughout each year since 1919 at all critical points in the stream network. All of these records were used in the studies of past water use. Most of the canal systems above American Falls are operated throughout the winter for domestic and stock-watering purposes, but there are no records of this use in the past. In order to determine the amount of stream depletion that is caused by this practice, the Bureau of Reclamation obtained complete records of all diversions into and visible return flow from nine areas above American Falls during the winter period from October 1, 1942, to April 30, 1943. The same program of hydrographic work was continued during the winter of 1943--1944 in two of the areas having non-tributary water tables in order to have a check on the previous records. All daily records of canal diversions obtained by the Bureau of Reclamation have been published in the watermaster's reports for the water years of 1943 and 1944. The changes in ground-water levels were observed throughout the winter of 1942--1943 in some of the areas in the upper valley.

An inventory was made of the developed water supply and irrigated acreage in the Mud Lake area during the summer of 1942, and a general map of the area was prepared from aerial photographs. An appraisal of the present irrigation development in this area was needed for a study of the relation of its water supply to the use of water and irrigation practices in the Henrys Fork Valley.

This report on the investigation provides factual information which will serve as the basis (A) for negotiation of water-saving agreements with the present water users, (B) for negotiation of repayment contracts with prospective users of storage water from the authorized Palisades Reservoir, and (C) for the selection of the most satisfactory plan for ultimate use of the reserved space in American Falls Reservoir. The field investigations and office studies were carried on under the general supervision of Engineer George N. Carter and were directed by Engineer F. M. Clinton. The report was prepared by Mr. Clinton. The preliminary designs and estimates for the Twin Falls domestic water system were prepared by the Branch of Design and Construction in the Denver Office of the Bureau of Reclamation under the general direction of Walker R. Young, Chief Engineer, and under the immediate supervision of Engineer P. J. Bier.

The recommendations of the report call, first, for a program of well-drilling to supply domestic and livestock water for all parts of the project area except the South Side Twin Falls district. The feasibility of wells in these areas has already been demonstrated by the majority of residents. The well drilling would be undertaken and financed by individual farmers or groups of farmers. Estimated costs would range from $260 to $1,300 per well.

In the South Side Twin Falls Project, where, as noted, wells are not feasible, a domestic water supply system would be constructed by the Bureau of Reclamation. Three plans for this system have been developed. The pipe distribution system, to deliver water to every farm and town in the district, is the same under each of the three plans. The source of water under the recommended plan would be Murtaugh Lake, seven miles southwest of Milner Dam. The lake, which is about three miles long and somewhat more than half a mile wide, is fed by the South Side Twin Falls canal diverting at Milner Dam. Sufficient water would be stored in the top ten feet of the lake at the end of the irrigation season to meet the anticipated requirement for domestic water during the winter months. A treating plant would be constructed at Lake Murtaugh to soften and purify the water. The construction cost at 1946 price levels of the Twin Falls domestic water system would be somewhat more than $14,000,000. This amount would be repaid in full over a 40-year, interest-free repayment period by the farmers and townspeople served by the system. Moreover, the water rates necessary to be charged the consumers in order to repay the construction costs as well as operation and maintenance costs would compare favorably with rates charged by representative municipal water systems.

Conservation of water through retirement of irrigated lands which have ground-water movements not tributary to the Snake River above Milner Dam was found not to be feasible. These lands support established farm communities which could not be abandoned without incurring excessive social and monetary losses. The monetary losses alone would be far greater than the value of water which might be conserved.

Water supply and river operation studies made in connection with the report indicate that the elimination of winter diversions, the construction of Palisades Reservoir, and the coordinated operation of Palisades and the existing reservoirs in the project area will make available, during years of average precipitation and run-off, a volume of water far in excess of that required by presently irrigated lands. In years of run-off as low as 1931--1934, however, small shortages would still occur on existing irrigated land.

It will be apparent that the conserved and stored water may be used advantageously either wholly to supplement the supply available for existing irrigated land or partially for that purpose and partially for the development of new lands. In view of the fact that a span of years as dry as those of 1931--1935 is likely to occur only once in a 50-year period, it is the conclusion of the report that the augmented water supply available for irrigation should be used in part for the development of new lands. Otherwise, surplus water will in nearly all years be wasted. It is recommended, therefore, that the 433,000 acre-feet of reserved space in American Falls

Reservoir be utilized for the irrigation of new lands on the North Side Pumping Division of the Minidoka Project and on the Michaud Flats Unit of the Fort Hall Project. The yield of the reserved space would be adequate to irrigate at least 67,000 acres of new land in those projects.

CHAPTER II

PRESENT WATER USE

The Snake River Plain is a structural depression which has been filled by repeated lava flows. It seems likely that, prior to the volcanic eruptions, the Snake and Henrys Fork rivers flowed west for some distance beyond Roberts and Ashton and joined in the vicinity of Mud Lake. Below this junction the main stream meandered southwesterly across the bottom of the original depression until it reached the present Snake River channel in the vicinity of King Hill. The tributary streams flowing down from the mountains on both sides of the depression probably all joined the main stream at that time and contributed a surface flow throughout the year. The many ensuing lava flows, which originated mostly from volcanic eruptions along the northern foothills, gradually filled the depression to its present level and obliterated the original drainage pattern. Each lava flow filled the then existing river channel and forced the stream to cut a new channel farther to the southeast. The continuation of this process with each succeeding period of volcanic activity finally shifted the main river channel to its present position and left a series of buried channels in its wake. Sedimentary beds of loess, clay, sand, and stream alluvium are intercalated in the layers of lava throughout the plain, indicating that there were long intervals of quiescence between eruptions. Deep deposits of riverwash and coarse alluvium have been laid on top of the last lava flows in the upper valley by the flood waters of the Henrys Fork and Snake rivers as they emerged on the plain. These older alluvial deposits and a considerable area of the exposed lava fields have been covered during the recent geologic period by a fine loess soil and silt loam soils carried in by dust-laden winds and by surface streams. Nearly half a million acres of the surface of the Snake River Plain still consist, however, of bare lava with practically no soil covering.

These diverse processes produced a great basin floored with relatively impermeable rock and filled with a variety of materials which are readily permeated by ground water. The volcanic processes were inherently catastrophic, intermittent, and irregular. As a result, both the behavior of ground water and the appraisal of surface-water supplies under changing conditions are extremely complicated. The porous fill material overlying the impermeable basement rock throughout the plain acts like a mighty sponge which absorbs all natural precipitation that falls on the surface of the plain and takes water from all surface streams crossing or bordering it to maintain an immense underground reservoir and subterranean stream flow. Many of the old buried river channels connect directly with the present channels of Henrys Fork and Snake rivers between Ashton and American Falls and drew heavily on those streams. In spite of the heavy losses into the porous lava beds and subterranean channels, the Snake River with its abundant water resources has been able to maintain a surface flow of sufficient volume to cut the present canyons between Roberts and King Hill. The losses from the Henrys Fork and Snake rivers above Blackfoot and from all streams entering the plain from the north and west are carried through underground channels to the west of the Snake River and reappear in the form of springs in the present canyon below Milner Dam.

It was upon such a geologic structure that man began to project the present extensive irrigation development during the last decade of the last century. The early settlers had no records of stream flows and little, if any, knowledge of the subsurface formations and ground-water conditions. They merely followed the line of least resistance and began irrigating land on the upper reaches of the alluvial fans near Heise and St. Anthony where river water could be easily diverted and conveyed to the land. Experience gained in irrigation of the first small tracts was used as a guide as the irrigated areas were extended downstream. It soon became apparent that the irrigation of land in the Snake River Valley required far more water than in most of the other valleys being developed in the West at the same time. Surface irrigation gave way to subirrigation in the Henrys Fork Valley as soon as it was found that high water tables were beneficial to crop production in that area instead of detrimental as on most irrigation projects. The acknowledged heavy use of water caused no alarm, however, as the flows of the Snake and Henrys Fork rivers were considered inexhaustible at that time. As the irrigation development progressed downstream, it became necessary to operate the canal systems all winter in order to provide domestic and stock water because the depths to ground water ranged from 100 to 500 feet. The practice of operating canals during winter was universal and well established long before the need arose for storage regulation on the river. Prior to construction of American Falls Reservoir in 1926 there was no incentive to reduce or eliminate winter diversions because the winter flows of the main stream were passing, unused, to the Pacific Ocean anyway. The need for conservation of winter flows was first realized when American Falls Reservoir failed to fill during the drought period from 1929 to 1935.

The losses under natural conditions from the stream channels above Milner Dam have been heavily augmented by irrigation during the summer and by diversion of river flows into the canal systems during winter. The percolation losses from the canals and from the irrigated land have built up high water tables through most of the valley above American Falls. The influence of this percolation, however, reaches only a few miles into the lava fields to the west where the water tables sink rapidly. A portion of the unused water returns to the river from about half of the irrigated area in the upper valley where the water tables stand above river level. The deep percolation losses from the remainder of the upper valley and from all of the irrigated areas on the northwest side of the river below American Falls, except near Rupert, join the underground reservoir and subterranean stream network which pours a flow of nearly 8,000 second-feet into the Snake River between Milner Dam and Bliss. There it cannot be used for irrigation. Thus any reduction that can be made in the percolation losses joining this ground-water movement will augment the supply of irrigation water available above Milner Dam. Investigations and studies made by the Geological Survey, United States Department of the Interior, show an average annual ground-water loss from areas above Milner during the period from 1920 to 1927 as follows:

Henrys Fork Valley	700,000 acre-feet
Snake River Valley above Blackfoot	920,000 acre-feet
Minidoka Project	240,000 acre-feet
Twin Falls North Side Project	600,000 acre-feet
Total	2,460,000 acre-feet

The irrigated area served by diversions at and above Milner Dam now includes about 1,200,000 acres. Diversions to these lands during the irrigation season in years of abundant water supply range from 12 acre-feet per acre in parts of the area above American Falls to 6 acre-feet per acre in projects below American Falls. The shortage of stored water in recent dry years and the desire to extend the present irrigated area have often raised the questions of the justification and need for the heavy use of water on the existing projects. Only about 2 or 2.5 acre-feet per acre can be consumed by growing crops and by evaporation from the soil. On the other hand, however, all of the irrigated land is situated on what is probably the most porous foundation to be found under any irrigated valley in the West. Irrigation water cannot be conveyed across the deep gravel deposits and shallowly covered lava fields without incurring heavy losses, and there are no feasible means of preventing the deep percolation losses from joining non-tributary ground-water movements. The river channel losses and the large quantities of unused irrigation water passing through subterranean channels which empty into Snake River below Milner Dam are indeed unfortunate as they have prevented the full utilization of the water resources above Milner Dam. Neither the porous subsurface formations nor the non-tributary ground-water conditions are man-made, but man has had to cope with them in developing the existing irrigation projects and must recognize them in the planning of future extensions of irrigation development in the project area.

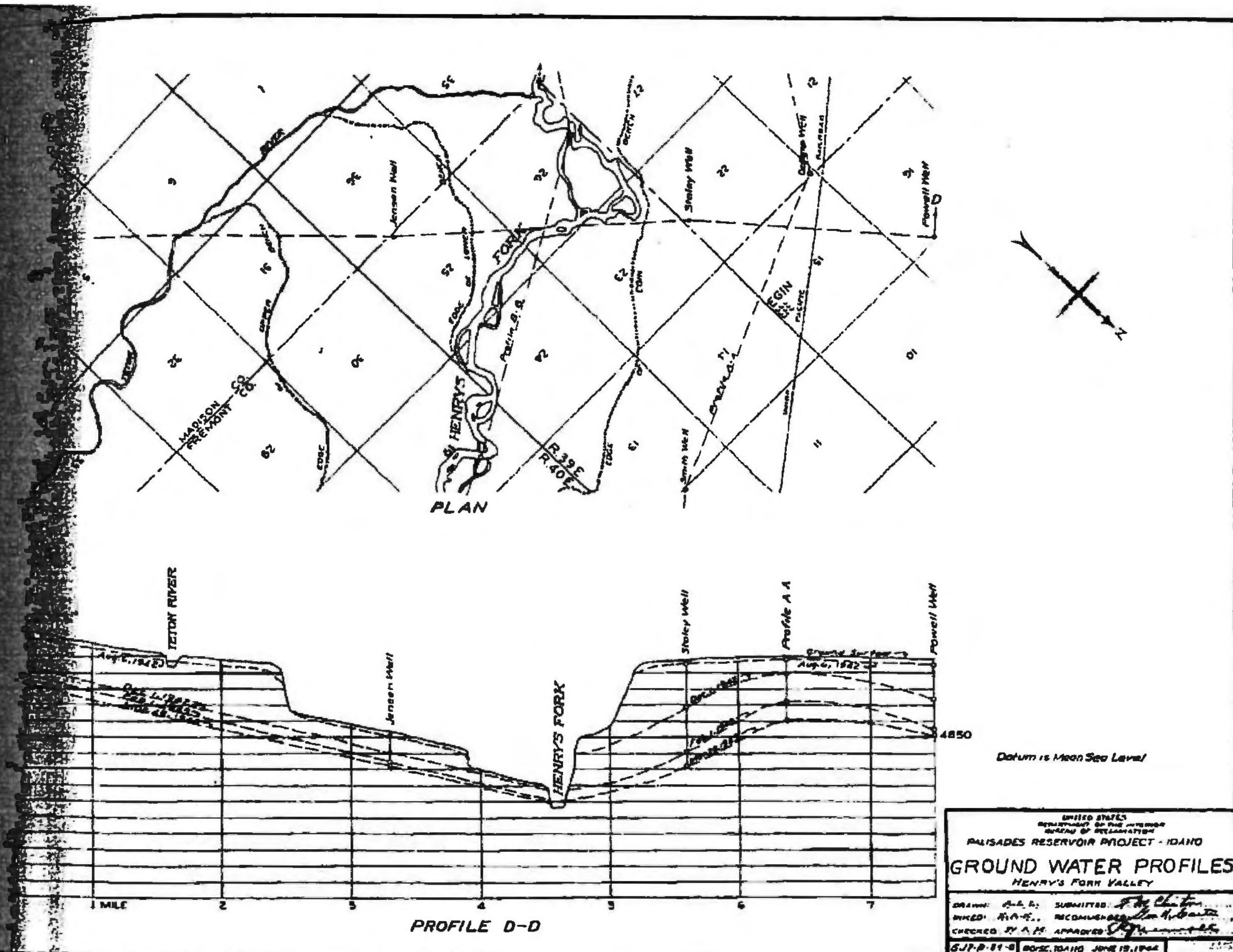
WATER USE IN THE HENRYS FORK VALLEY

There are about 130,000 acres under ditch in the Henrys Fork Valley, but only about 110,000 acres were under cultivation and irrigated in 1942. This acreage is served by ten diversions from the Henrys Fork River, twelve diversions from Fall River, and seventeen diversions from the Teton River. About 71,000 acres of this land are now subirrigated. About 28,000 acres of the subirrigated land lie west of the Henrys Fork on what is locally known as Egin Bench. For a distance of about 25 miles below the mouth of Fall River the Henrys Fork flows in a canyon and ground-water trough between the subirrigated areas with high water tables on each side. This condition is graphically presented on two accompanying drawings, which show profiles of the water table in the Henrys Fork Valley plotted from measurements of the depth to water in representative wells during the winter of 1942—43. The water table sinks rapidly in the lava fields to the west and north of the Henrys Fork Valley; and, as a result, there are heavy underground losses from irrigation in the valley. This ground-water movement passes under and around the Mud Lake area and joins the subterranean aqueducts which empty into the Snake River below Milner Dam.

In order to determine the amount and occurrence of these ground-water losses, the valley was divided into three areas, and records on the use of water in each throughout the year were compiled and studied separately. All the irrigated land on the west side of the Henrys Fork was included in one area, designated as the Egin Bench Area. All the irrigated land on both sides of Fall River in the vicinity of Ashton was included in the Ashton Area. The area which comprises all the irrigated land on the east side of the Henrys Fork between Fall River and Rexburg was designated as the East Side of the Henrys Fork, and was further subdivided as follows: the area north of the Teton River was called the Wilford-Chester Area, and the remainder was designated as the Teton Area. The results of the hydrographic work, studies, and findings in each of these three areas are given in the following paragraphs.

Egin Bench Area

The Egin Bench Area, comprising 28,000 acres, is a flat-topped bench which extends for a distance of about 20 miles along the west side of the Henrys Fork (See map following page 83.) The portion of the bench between St. Anthony and the upstream end consists of desert loam soil underlain by coarse gravel and lava rock. Below St. Anthony the formation changes progressively to a very sandy loam soil underlain by deep deposits of black volcanic sand, and in places the surface soil consists almost entirely of black sand. The deposits of gravel and volcanic sand range from 20 to 50 feet in depth along the


PLAN
HENRYS FORK
MADISON CO.
FREMONT CO.
R.39E.
R.40E.
Jensen Well
Staley Well
Powell Well
Smith Well
EGIN
TETON RIVER
HENRYS FORK
Profile A-A
Ground Surface
4850
1 MILE
2
3
4
5
6
7
PROFILE D-D
Datum is Mean Sea Level
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PALISADES RESERVOIR PROJECT - IDAHO
GROUND WATER PROFILES
HENRY'S FORK VALLEY
DRAWN:
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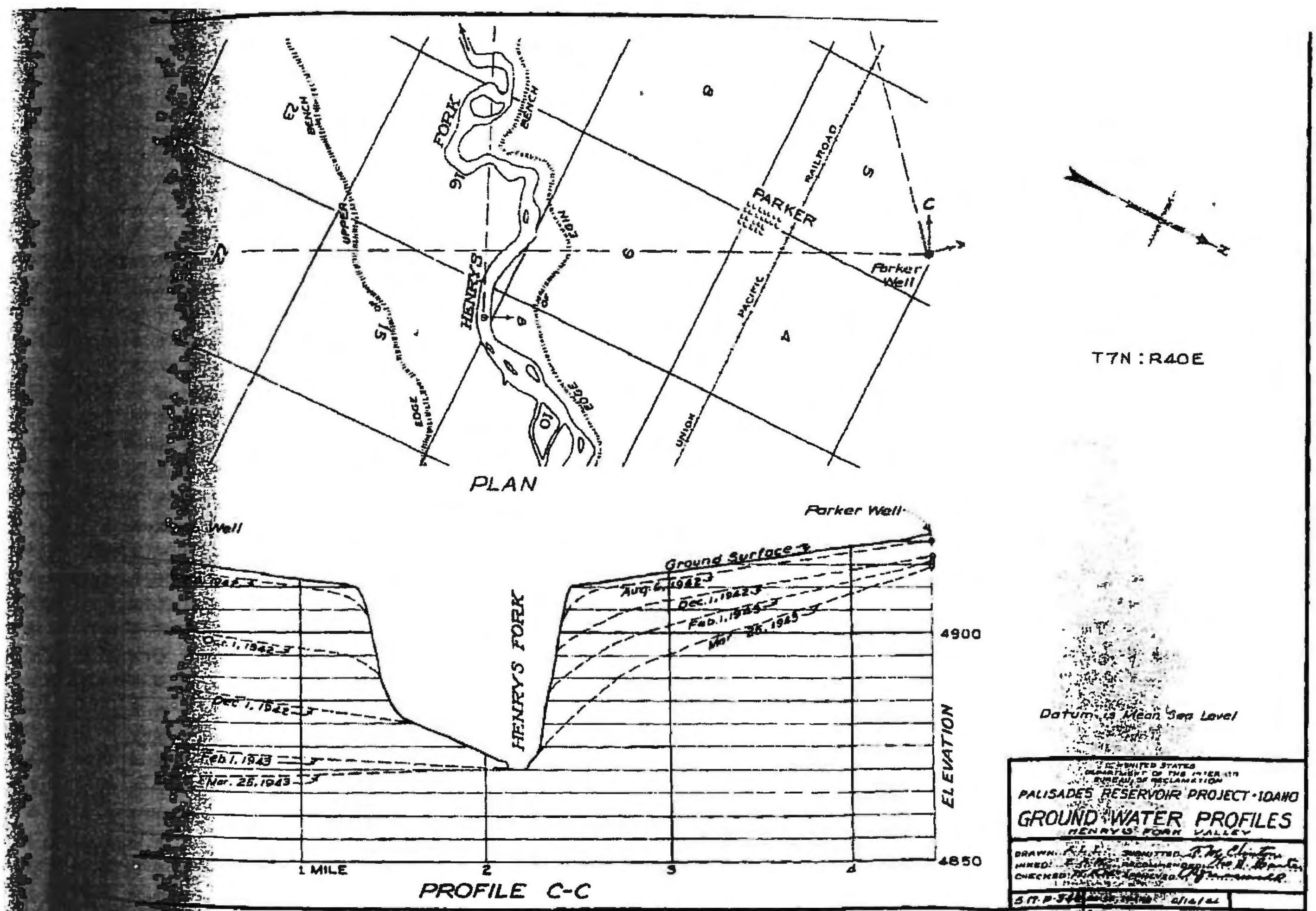
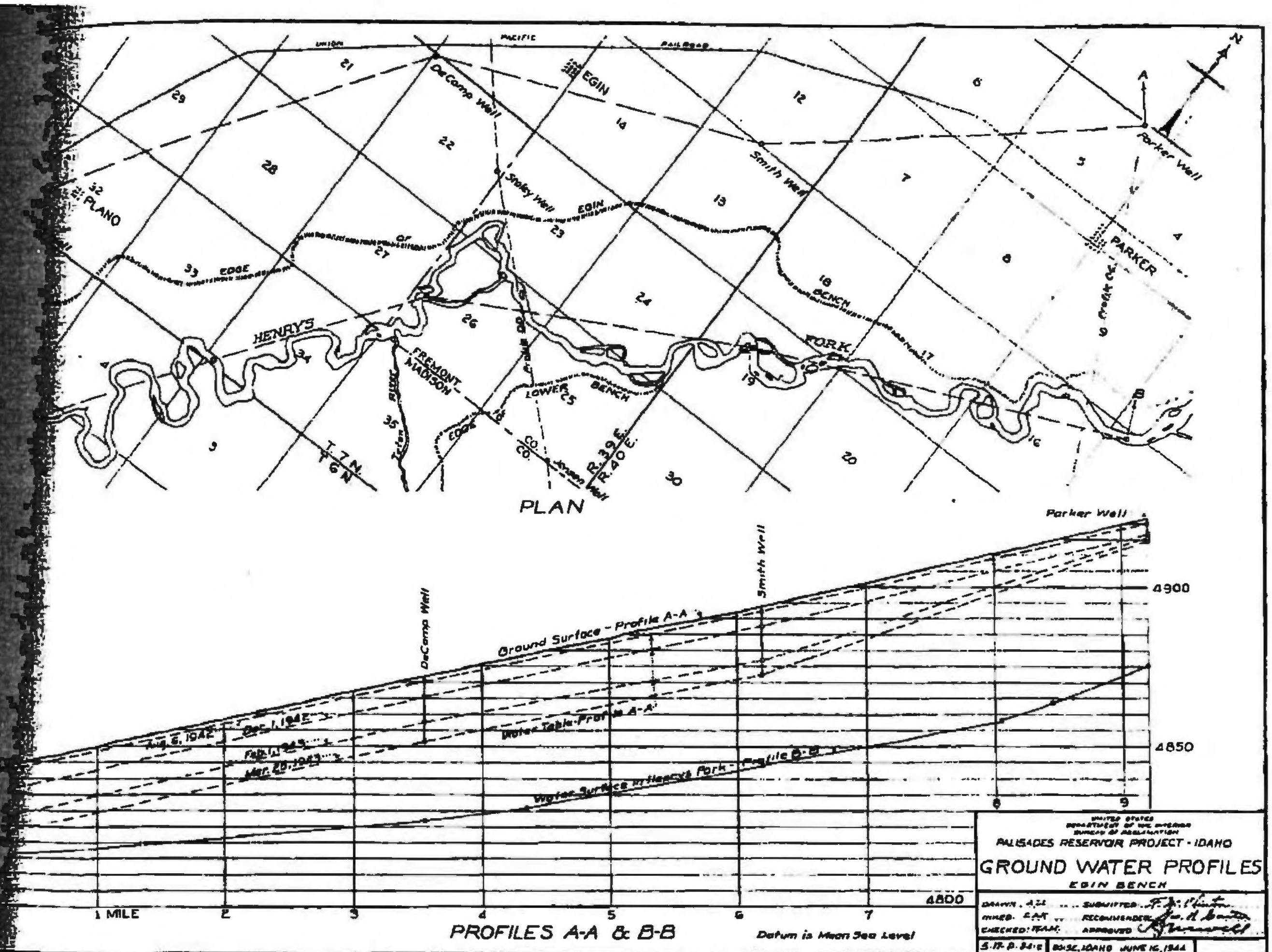
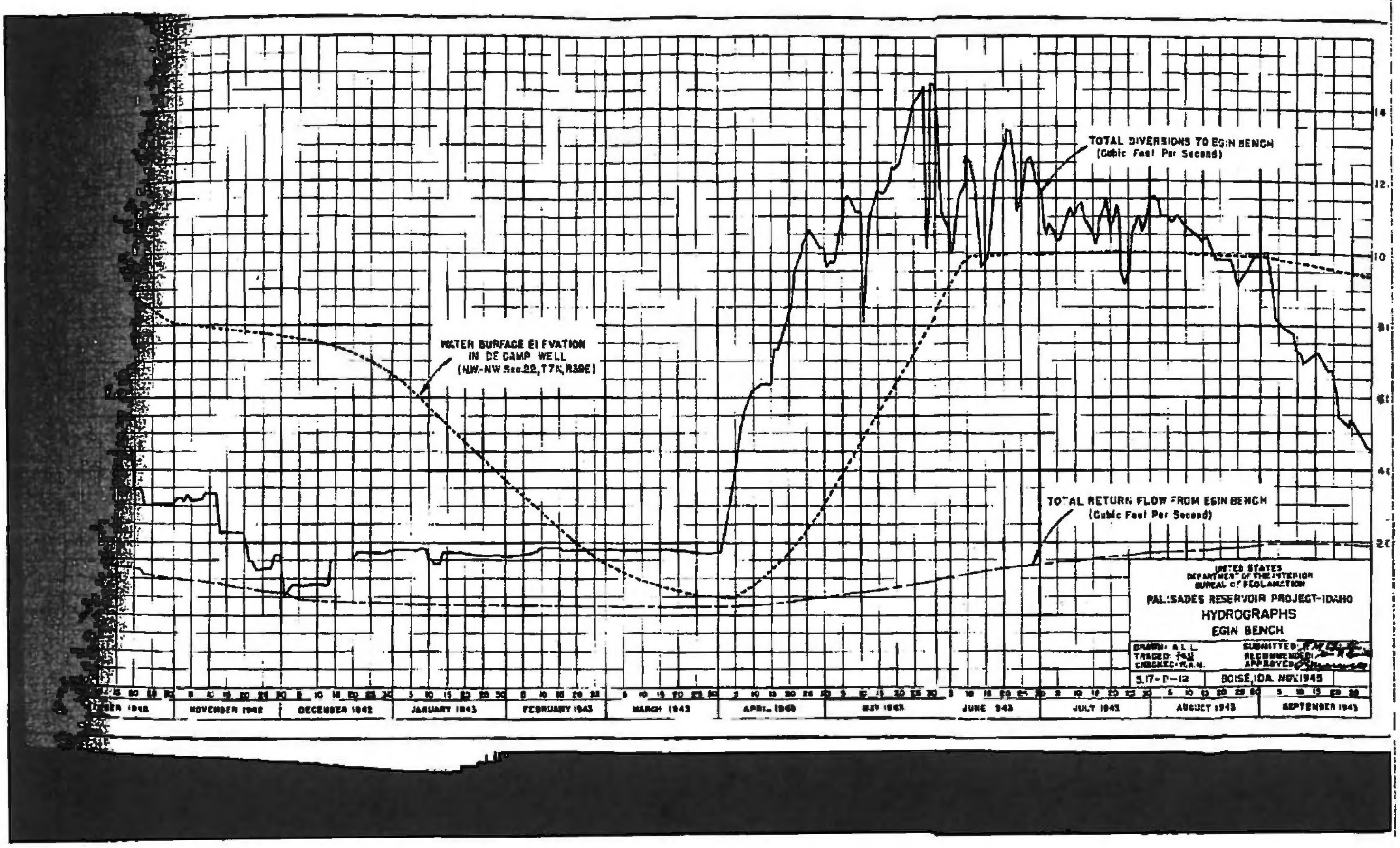
INKED:
RECOMMENDED:
CHECKED:
APPROVED:
BOISE, IDAHO



PLAN
T7N : R40E
HENRY'S FORK
UPPER BENCH
EDGE
PARKER
UNION PACIFIC RAILROAD
Parker Well
C
Well
Ground Surface
Aug. 6, 1942
Oct. 1, 1942
Dec. 1, 1942
Feb. 1, 1943
Mar. 25, 1943
4900
4850
ELEVATION
1 MILE
2
3
4
PROFILE C-C
Datum is Mean Sea Level
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PALISADES RESERVOIR PROJECT - IDAHO
GROUND WATER PROFILES
HENRY'S FORK VALLEY
DRAWN
TRACED
CHECKED
SUBMITTED
RECOMMENDED
APPROVED



EGIN
DeCamp Well
Smith Well
Parker Well
Sholey Well
PLANO
PARKER
HENRY'S
FORK
EGIN
BENCH
EDGE
LOWER
BENCH
FREMONT
MADISON
T.7 N.
T.6 N.
R.39 E.
R.40 E.
PLAN
Ground Surface - Profile A-A
Water Table-Profile A-A
Aug. 6, 1942
Oct. 1, 1942
Feb. 1, 1943
Mar. 20, 1943
Water Surface in Henry's Fork - Profile B-B
4900
4850
4800
1 MILE
PROFILES A-A & B-B
Datum is Mean Sea Level
PALISADES RESERVOIR PROJECT - IDAHO
GROUND WATER PROFILES
EGIN BENCH
BOISE, IDAHO JUNE 16, 1944


TOTAL DIVERSIONS TO EGIN BENCH
(Cubic Feet Per Second)
WATER SURFACE ELEVATION
IN DE CAMP WELL
(NW-NW Sec.22, T7N, R39E)
TOTAL RETURN FLOW FROM EGIN BENCH
(Cubic Feet Per Second)
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PALISADES RESERVOIR PROJECT-IDAHO
HYDROGRAPHS
EGIN BENCH
DRAWN: A.L.L.
TRACED:
CHECKED: W.A.N.
SUBMITTED:
RECOMMENDED:
APPROVED:
BOISE, IDA. NOV. 1945
NOVEMBER 1942
DECEMBER 1942
JANUARY 1943
FEBRUARY 1943
MARCH 1943
APRIL 1943
MAY 1943
JUNE 1943
JULY 1943
AUGUST 1943
SEPTEMBER 1943
14
12
10
20

edge of the terrace overlooking the river, but are progressively shallower inland. The cultivated portion of the bench is about [illegible] miles wide in the central part and tapers to a width of about one-half mile at both the upstream and downstream ends. Outcroppings of bare lava are visible along the north and west edges of the cultivated area, and well borings indicate that all of the deposits of gravel and volcanic sand rest on lava rock. The Henrys Fork River is confined in a small canyon in the lava rock until it reaches the railroad crossing below St. Anthony. Below that point it has cut a channel in the deep alluvial fill, and the stream bed lies from 50 to 70 feet below the surface of Egin Bench.

In the early stages of development the settlers built a canal from the Henrys Fork River near St. Anthony and attempted to surface-irrigate the land on Egin Bench in the usual manner. The water percolated into the porous soil and subsoil so fast, however, that the farm ditches became dry on very short runs. It was impossible to get a head of water across even a small field. This operational difficulty was disheartening in itself, but discouragement became widespread among the settlers when they found that the crops did not grow as they should even in the few places where it had been possible to keep the soil wet by irrigation. It appeared then that the soil was infertile and not worth irrigating. After several years of continued attempts to surface-irrigate a few scattered tracts, it was noted that the water table was rising rapidly under the upstream portion of the bench near St. Anthony and had reached the surface in a few places near the main canal. The flourishing crops and native vegetation in these "seeped" areas immediately proved that subirrigation was more beneficial to plant growth than surface irrigation. Greater efforts were then made to raise the water table to the surface over a larger area by providing ponding areas, by operating the main canal all winter, and by keeping water in the distribution system throughout the ice-free period. Five more diversions were soon made from the Henrys Fork River at and above St. Anthony, the canal systems were extended the full length of the bench, and the water table was eventually raised during the summer to the ground surface throughout the area.

Subirrigation has been successfully practiced for over 40 years on Egin Bench and the water table is now reverently referred to locally as "the sub". The area is served by six diversions from the Henrys Fork River and the main canals are operated throughout the year. Sufficient water is diverted during the fall and winter to keep the water table from dropping more than 20 feet below ground surface in the center of the bench. Heavy diversions begin in the spring as soon as the ice and snow have melted out or can be washed out of the main canals and the laterals, usually about the first of April. The percolation of canal water to the underground reservoir is accelerated by filling all available borrow pits along the roads, swales, and ponding areas provided for that purpose in the lava fields along the north and west edges of the cultivated area. The water table starts to rise with the increase in diversions in April and reaches the ground surface throughout the bench about the middle of June. It is then held within 6 to 18 inches of the ground surface, depending on the kind of crop, until late October. The water-table level is controlled by checks in the main canals and laterals and by regulating the flow in small feeder ditches across the fields. The process has apparently been made possible by the partial impermeability of the underlying lava rock, which has kept the rate of outflow from the underground reservoir considerably below the rate of inflow from surface percolation, thus allowing the water table to rise and be held at any desired level. There is a general local belief that the ground water mines fertility from the subsoil as it rises in the spring and thus contains a considerable amount of plant food. There are no alkalies in the soils.

The process of subirrigation on Egin Bench requires relatively large quantities of water each year. The records of the Geological Survey show the following summer diversions by the six canals serving the area in acre-feet during the recent period of adequate water supply.

Year	May	June	July	August	September	Total	Per Acre
1936	87,500	70,100	61,800	52,000	38,000	309,400	11.0
1937	84,000	68,100	60,200	54,100	41,000	307,400	11.0
1938	82,000	71,200	60,700	57,800	43,000	314,700	11.2
1939	90,500	67,600	67,600	60,600	39,800	326,100	11.6
1940	87,000	67,900	65,300	56,500	35,800	312,500	11.2
1941	82,600	65,600	58,900	54,100	34,000	295,200	10.5
1942	70,000	75,600	68,500	60,900	36,400	311,400	11.1
Average	83,300	69,500	63,300	56,600	38,300	310,900	11.1

The diversions into and the visible return flow from the Egin Bench Area were measured throughout the water year ending September 30, 1943, in order to determine the ground-water loss resulting from the subirrigation of land on the bench. Practically all of the visible return flow to the river originates in the form of springs along the toe of the terrace and flows in open channels for a short distance across bottom lands until it reaches the Henrys Fork River. About 95 percent of the total return flow is concentrated in fifteen of these channels during the summer, with the discharge of each ranging from 3 to 60 cubic feet per second. The total return flow from the bench was measured or estimated periodically in 21 separate channels entering the Henrys Fork River between the upper and lower ends of the bench. All channels discharging more than one cubic foot per second were measured with a current meter and the smaller flows were estimated. The total recorded inflow to the river reached a maximum of 193 cubic feet per second in September, when all of the channels were carrying water, and gradually diminished to a minimum of 27 cubic feet per second in March when water was flowing in only 13 of the channels. An inspection of the river channel throughout the length of the bench disclosed that the west bank was dry in all places except where the channel touches the toe of the bench in two places which together involved a channel distance of about 1,000 feet. It is believed that very little ground water from Egin Bench enters the river directly in the form of springs in the river channel. The recorded diversions into and return flow from the Egin Bench Area from October 1, 1942, to September 30, 1943, are as follows:

Month		Diversions (acre-feet)	Return Flow (acre-Feet)
Non-Irrigation Season			
October	1942	25,500	8,000
November	1942	14,200	4,800
December	1942	8,000	2,400
January	1943	10,400	1,800
February	1943	9,900	1,500
March	1943	11,000	1,700
April	1943	42,200	2,100
Sub-total		121,200	22,300
Irrigation Season			
May	1943	72,800	4,400
June	1943	70,100	7,100
July	1943	65,900	9,400
August	1943	63,400	10,900
September	1943	40,700	11,600
Sub-total		312,900	43,400
Total		434,100	65,700

The preceding table shows that of the total of 434,100 acre-feet diverted into the area during the year only 65,700 acre-feet of unused water returned to the river through surface drainage channels, thus leaving 368,400 acre-feet of net draft on the river for consumptive use and ground-water losses. The April--October consumptive use of water by crops and natural vegetation and by evaporation from the soil and ponding areas is estimated at 2 acre-feet per acre, but it is estimated that 0.4 of an acre-foot per acre is supplied by natural precipitation, thus leaving a net draft on the river of 1.6 acre-feet per acre. The cultivated acreage on Egin Bench was reported to be 27,800 acres in 1943. On the basis of this net consumptive use, the annual ground-water loss from the Egin Bench Area is computed in acre-feet as follows:

Item	Summer (Apr.-Oct.)	Winter (Nov.-Mar.)	Annual Total
Measured Diversions	380,600	53,500	434,100
Estimated Consumptive Use	44,400	0	44,400
Measured Return Flow	53,500	12,200	65,700
Ground-water Loss	282,700	41,300	324,000

With the exception of a small amount that may have entered the Henrys Fork River through springs in the river channel, it is believed that all of the above ground-water loss moved westward from Egin Bench and joined the subterranean channels under the desert which empty into Snake River below Milner Dam. It is a total loss to Snake River, therefore, insofar as irrigation above Milner Dam is concerned. If the entire annual net draft of 368,400 acre-feet is charged to the 27,800 acres on Egin Bench, it would average 13.2 acre-feet per acre. The computed ground-water loss amounts to 75 percent of the annual diversions. It is believed that the use of water on Egin Bench in 1942 and 1943 is typical of both past and future years of normal water supply. The bench is now fully developed and no increase in the cultivated acreage is anticipated in the future. It will be noted that the May to September diversions of 312,900 acre-feet in 1943 compare closely with the average diversions of 310,900 acre-feet during the same months from 1936 to 1942, inclusive.

The fluctuations of the water table under Egin Bench were measured periodically from August 1942 to June 1943 in six observation wells. The accompanying drawing entitled "Ground Water Profiles--Egin Bench" shows longitudinal profiles of the water table in the center of the bench between Parker and Plano at the maximum summer level, at two intermediate fall and winter levels, and at the minimum spring level just before the diversions were increased above the base winter flow. The annual fluctuation in the ground-water levels between Parker and St. Anthony is small, ranging from 3 to 6 feet in the center of the bench, because the upper reaches of all of the main canals are concentrated in that area. The control of ground-water levels by varying the flow of the canals serving the Egin Bench Area is clearly demonstrated by another accompanying drawing, entitled "Hydrographs - Egin Bench," which shows graphically the diversions into and surface return flow from the area and the water surface elevation in the DeCamp well from October 1, 1942, to September 30, 1943. The DeCamp well is located in the center of the bench and on the crest of the ground-water ridge. (A hydrograph of this well from 1921 to 1925 is given on page 62 of the U.S.G.S. Water Supply Paper No. 818.)

It is apparent from the hydrographs that a total diversion of about 130,000 acre-feet is required during April and May to raise the water table to the plant roots and that a total of about 250,000 acre-feet is needed to maintain it within reach of the roots of the growing crops during June, July, August, September, and October. This schedule of diversions has been derived from some 40 years of experience in manipulating the water table to give maximum crop production during the relatively short growing season in that area. The history of the development of the bench, together with its peculiar soils and subsurface formations, indicates that profitable crop production is impossible in that area without subirrigation. The hydraulic properties of the underground reservoir have definitely fixed the quantity of water required to raise the water table during the spring and to maintain it at the desired level during the growing season. The diversions must be scheduled accordingly and they cannot be reduced without curtailing crop production. The process of subirrigation requires careful regulation of the flow throughout the canal system after the water table has reached the desired growing season level. Any excessive diversions during this period will result in drowning of crops and flooding of fields, roads, and homes.

It will be noted from the records of water use that a total of 53,000 acre-feet were diverted from November 1, 1942, to March 31, 1943, and that a ground-water loss of 41,000 acre-feet occurred during that period. The diversions during that winter period are considered normal. The main canals are operated during the winter to retard the rate of drop of the water table. The canals have never been shut off during winter so it is not known how much farther the water table would drop if no water were contributed to the underground reservoir during the November--March period, but it is certain that it would stand at a lower level in March than it does under present operating conditions. It appears, therefore, that the water saved by elimination of winter diversions would have to be put back into the underground reservoir again the following spring in order to raise the water table to the present March levels. The only possible saving of water would be the difference between the ground-water losses at the present water-table stages and those that would occur at the lower winter stages. If the water table dropped below river level, the river would then become a losing stream and these savings probably would be offset by river losses. The elimination of winter diversions would introduce an operational difficulty because of the short period during which the water table would have to be raised in the spring. Water cannot be turned into the canals in the spring until the ice and snow have started to melt, and the flow must be increased gradually during the first 30 days to avoid ice jams. Under present operating practices a period of about 70 days is required to raise the water table from the March level to the normal summer level. The growing season proper begins on the date that the ground water reaches the roots of the crops, or about 70 days after the water is turned into the canals. The elimination of winter diversions, therefore, would shorten the growing season unless the water table could be raised from the lower March levels in the same period of time. Since the rate of percolation from the existing canals and ponding areas cannot be increased, the only means of accelerating the rise of the water table is by increasing the area of percolation. This would require larger main canals, more laterals, and more ponding areas. In view of the small and uncertain amount of water to be saved thereby, it appears that cost and operational difficulties involved in shutting off the canals during winter would not be warranted.

The investigation and study of the use of water on Egin Bench led to the general conclusion that the process of subirrigation, with its inherent heavy water requirements, must be continued as long as crops are grown in that area. The annual ground-water loss of about 320,000 acre-feet is unfortunate indeed, but there are no feasible means known by which it can be reduced or eliminated. The fact remains, therefore, that either the heavy use of water on Egin Bench should be justified and tolerated or the area should be retired and the water used on other lands which can be surface-irrigated with relatively small percolation losses.

Egin Bench is now one of the most prosperous farming communities in the Snake River Basin. The land is not marginal in any sense of the word. Recorded sales and Federal Land Bank records indicate that the land within one quarter mile of the edge of the bench--where it is difficult to maintain the water table--had an average value of $75 per acre in 1940. All land in the interior of the bench, or about 75 percent of the cultivated acreage, was valued at $150 per acre. The many modern and well-kept farm homes reflect prosperity, and the farmstead improvements are for the most part adequate and maintained in good condition. The cropping program is closely tied to the livestock industry, in which many of the farmers are engaged; and large numbers of range cattle and sheep are fed and fattened on the bench in the fall and winter. The following information on the distribution and yields of the various crops was obtained from the Fremont County Agent.

Present Water Use

Crop	Percent of Acreage	Yield Per Acre
Potatoes	29	110 sacks of No. 1
Alfalfa and Clover Hay	27	3 tons
Wheat, Barley, and Oats	25	30 bushels
Sugar Beets	10	13 tons
Field Peas	8	20 bushels
Miscellaneous	1	$40

From the standpoint of beneficial use of water, it might appear desirable to retire the land on Egin Bench and apply the water to some other tract where two or three acres could be irrigated with the same quantity of water that is now used on one acre. The advisability of this move is very questionable, however, when the human element and social consequences are considered. The farms on Egin Bench have been built up to their present high stage of development by the sweat and toil of two generations of farmers and the present inhabitants are proud of their homes, farms, and accumulated wealth. The past growth and prosperity of the cities of St. Anthony and Rexburg and of the community as a whole have been closely linked with the development of farms on Egin Bench, and the future stability of this social structure is dependent to a large extent on the continuation of crop production on these farms. About one-third of the irrigated acreage in the Henrys Fork Valley is situated on Egin Bench. Legal issues will also confront any proposal to curtail the use of water on Egin Bench because the rights to the present use of water in that area have been decreed by the courts. Moreover, the present irrigation of about 28,000 acres of land in the Mud Lake Area, as will be shown subsequently, has been made possible primarily by the irrigation of Egin Bench. The retirement of the lands on Egin Bench, therefore, would cause the loss of or serious damage to the prosperous communities that have been developed in both the Henrys Fork Valley and in the Mud Lake Area.

Ashton Area

The Ashton Area includes the irrigated lands on both sides of Fall River in the vicinity of Ashton. (See map following page 83.) A total of about 22,000 acres is irrigated on the north side of Fall River by the Yellowstone, Marysville, and Farmers Own canals, which divert water from Fall River. On the south side of Fall River there are about 2,000 acres of land formerly irrigated by diversions from Fall River through the Harrigfeld Canal. In recent years this canal has been abandoned because of difficulty of operation and the adequacy of the rainfall for dry farming. If another drought were to occur, however, this canal might be restored to use. The Ashton Area differs considerably from the rest of the Henrys Fork Valley in that it is a foothill area with rolling topography, and its soils are derived from parent materials in that region and from dust-laden winds. The lands in this area are surface-irrigated and deep percolation losses are relatively low. The area has an average elevation of 5,300 feet above sea level and an annual precipitation of about 16 inches, six of which occur during the growing season.

The summer showers together with the relatively short growing season and fairly tight subsoils result in a rather low irrigation requirement for lands in the Ashton Area. The records of diversions to lands in this area since 1936 are as follows in acre-feet:

Year	May	June	July	August	September	Total	Per Acre
1936	650	7,260	6,300	1,060	1,480	16,750	0.8
1937	1,530	11,600	3,850	2,220	840	20,040	0.9
1938	320	13,900	7,640	4,100	1,710	27,670	1.3
1939	2,430	11,400	15,800	8,640	3,480	41,750	1.9
1940	3,090	12,800	12,900	6,670	2,380	37,840	1.7
1941	1,210	10,100	13,800	5,660	2,640	33,410	1.5
1942	500	9,400	15,700	11,000	3,830	40,430	1.8
Average	1,390	10,900	10,900	5,620	2,340	31,130	1.4

The canals serving the Ashton Area are not operated during the winter. Records obtained of all diversions during the 1943 water year by the Yellowstone, Marysville, and Farmers Own canals are as follows in acre-feet:

October	3,200	May	500
November	600	June	9,500
December	0	July	15,800
January	0	August	12,800
February	0	September	4,600
March	0	Annual Total	47,000
April	0	Per Acre	2.14

Water-table levels throughout the Ashton Area are higher than the level of the Henrys Fork River and the ground-water movement is tributary to the river. Therefore, all deep percolation losses and surface waste that result from irrigation of these lands return to the river.

East Side of the Henrys Fork

This area includes all of the irrigated land on the east side of the Henrys Fork River between Fall River and Rexburg. The valley is irrigated by water diverted from Fall, the Henrys Fork, and Teton rivers. There is considerable intermingling of water from all three streams through overlapping of the canal systems. About four miles below the stream gage on the Teton River near St. Anthony there is an overflow channel which heads toward the south and flows into Moody Creek. There are control works on both the overflow channel and the Teton River by means of which the flow of water in either channel can be regulated after the spring flood season. All water diverted from the channel of Moody Creek is classed as Teton River water by the watermaster. The irrigated section includes both valley lands and rolling foothills. All valley lands are situated on a deep deposit of sand, gravel, and boulders laid down by the streams on reaching the flatter gradient of the valley. The surface soils covering the valley fill are quite shallow, sandy, and rocky in the vicinity of St. Anthony but are progressively deeper and heavier toward the southern end of the valley in the vicinity of Rexburg. The soils throughout the strip of foothill lands along the east edge of the valley rest on parent materials and are sandy loams which are very fertile.

A total of about 61,000 acres is irrigated in the valley. Practically all of the land resting on the valley fill (about 43,000 acres) is subirrigated in the same manner as on Egin Bench. The rapid percolation of water through the porous soils and deep gravel deposits makes it very difficult properly to surface-irrigate these lands. The strip of foothill lands along the east edge of the valley, comprising about 18,000 acres, has fairly water-tight subsoils and is surface-irrigated in the usual manner. Some of the canals serving the subirrigated section are operated throughout the winter to help maintain the water table and to provide domestic and stock water for the farmsteads not having wells. Both the Teton River and Moody Creek cross through the center of the valley, and the losses from these streams assist considerably in maintaining the water table during the winter and in raising it in the spring. The extremely porous nature of the valley fill allows water to percolate rapidly from the streams to the underground reservoir. As a result the water table rises rapidly when the Teton River reaches flood stage in the spring and the canal systems and ponding areas are filled with water. The water table drops as much as 60 feet below the ground surface along the eastern edge of the subirrigated area during the winter and is raised to the surface again in a period of about two months in the spring. This rapid rise in the water table is accounted for by the fact that the underground reservoir is confined by the heavier silt deposits at the downstream end of the alluvial fan and water cannot escape through this silt cover as fast as it percolates into the ground at the upper end of the valley.

Present Water Use

The channel of the Henrys Fork River above the mouth of Moody Creek is situated in a ground-water trough throughout the year and acts as a surface drain to collect the ground-water outflow from the east side of the valley. During the summer and fall, the Teton River is similarly situated in a ground-water trough and also acts as a surface drain for the east side of the valley. The ground-water map following page 9 indicates that some ground water can escape from the east side of the valley by passing under the Henrys Fork River near the Rexburg gaging station and joining the general movement to the west under the desert.

As on Egin Bench, the process of subirrigation on the east side of the valley requires heavy canal diversions during the summer. The records of the Geological Survey show in acre-feet the following summer diversions by the twenty-nine canals serving the east side of the valley during the recent period of adequate water supply:

Year	May	June	July	Aug.	Sept.	Total	Per Acre
1936	129,500	139,600	110,000	84,900	66,900	530,900	8.7
1937	114,000	142,500	98,900	69,900	41,700	467,000	7.7
1938	102,200	153,700	111,100	97,300	74,000	538,300	8.8
1939	135,400	147,400	122,600	98,400	74,400	578,200	9.5
1940	140,300	132,600	103,400	71,900	53,500	501,700	8.2
1941	125,000	139,900	108,300	85,900	56,800	515,900	8.5
1942	80,900	157,900	127,000	103,500	62,300	531,600	8.7
Average	118,200	144,800	111,600	87,400	61,400	523,400	8.6

In addition to these diversions, a considerable amount of water is diverted into the canal systems during the remainder of the year, but no records of these diversions have been obtained in the past. In order to determine the extent of water use outside the May--September period, the Bureau of Reclamation obtained complete records of all diversions in the valley from October 1, 1942, to May 1, 1943. The total diversions by all canals serving the east side of the valley during this period were as follows in acre-feet:

October --	46,400	February --	1,500
November --	19,000	March --	1,600
December --	8,500	April --	30,300
January --	3,700	Total --	111,000

Present Water Use

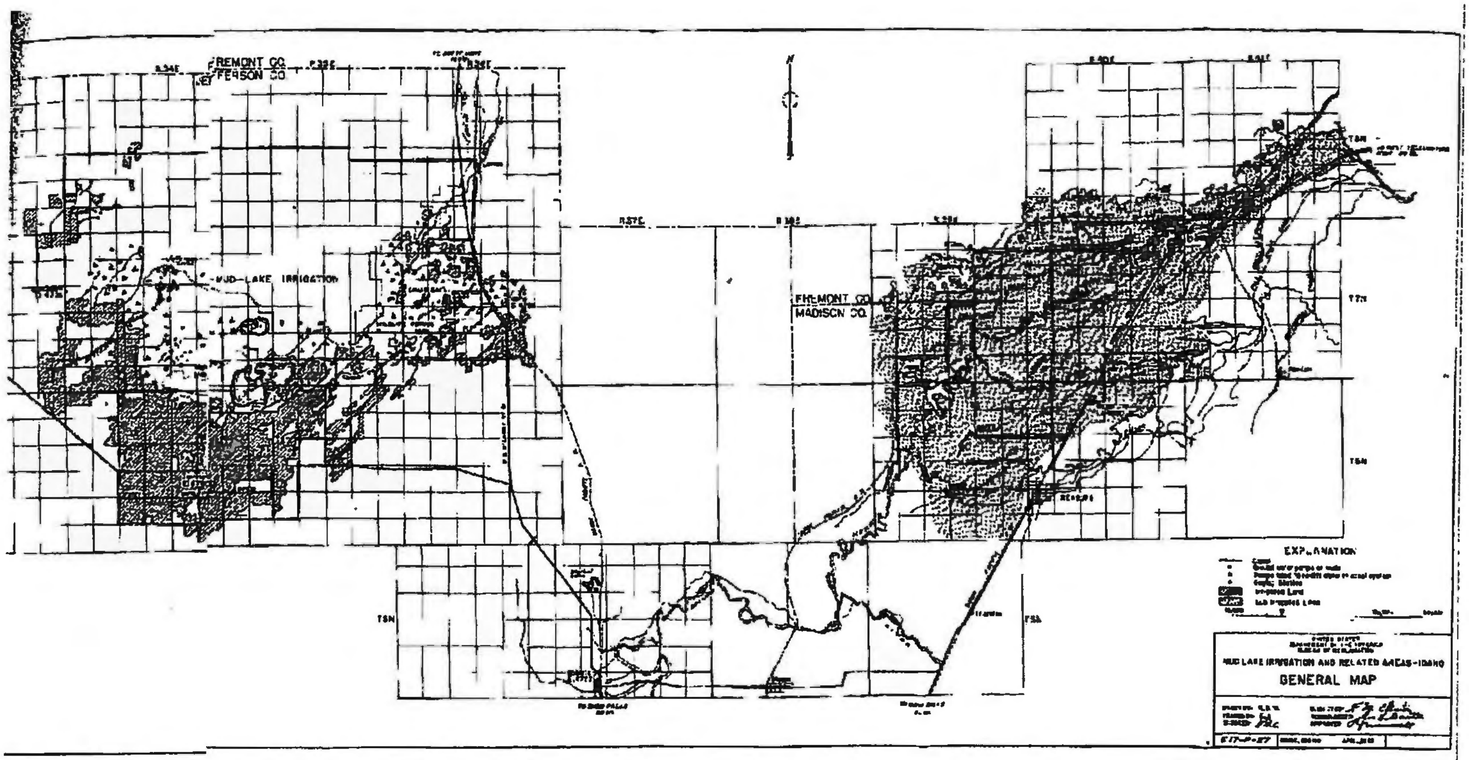
The greater part of the diversions to the east side of the river during the period from November to March, inclusive, was delivered to the portion of the valley lying north of the Teton River, or to what has been designated as the Wilford-Chester Area. (See map following page 83.) Records were obtained of the visible or surface return flow from this area during the period from November 1, 1942, to April 1, 1943, in order to determine the amount of water contributed to the underground reservoir by operation of the canals during the winter period. These records are as follows in acre-feet:

Month	Diversions Into Area	Return Flow From Area	Contribution to Ground Water
November 1942	12,100	3,500	8,600
December 1942	6,000	1,300	4,700
January 1943	2,700	500	2,200
February 1943	1,400	300	1,100
March 1943	1,500	400	1,100
Total	23,700	6,000	17,700

Relation to Mud Lake Area

Mud Lake is about 25 miles due west of Egin Bench and lies outside of the Snake River Watershed insofar as surface run-off is concerned. (See map on the following page.) The Mud Lake Area is a natural depression in the lava fields which has been filled by ancient lake bed materials that include a great amount of clay. The present lake occupies a shallow depression near the north edge of the ancient lake bed. The remainder of the ancient lake bed is covered with a clayey loam soil which is very fertile. Because of its low permeability, the ancient lake bed maintains a perched water table and acts as a collecting basin for both surface and ground waters originating in or flowing through that area. All of the streams originating in the Centennial Mountains north of Mud Lake contribute to the ground-water supply in the area, but Camas Creek is the only surface stream that flows directly into the lake.

A stage station on the route from Salt Lake City to Butte was established near Mud Lake in 1870, and the area has been inhabited by white men continuously since that time. According to the early residents of the area, Mud Lake was a more or less intermittent pond prior to 1900, and there were no springs in the vicinity of the lake. The flood waters of Camas Creek entered the lake each spring but were practically all dissipated by evaporation during the summer. The lake


FREMONT CO.
JEFFERSON CO.
MUD LAKE IRRIGATION
FREMONT CO.
MADISON CO.
EXPLANATION
GENERAL MAP
517-P-27

was reported dry in the summer of 1891. Prior to 1900 the water table was 100 feet below the ground surface at Camas and ranged from 20 to 50 feet below the surface around the periphery of the lake. About 1900--approximately five years after irrigation began on Egin Bench--water was noticed standing in pools along the railroad near Hamer, and from then on the water levels in the wells around Mud Lake rose steadily. Surveys of Mud Lake in 1908 and 1914 showed that the lake rose 5 feet during the intervening period, and new springs and spring-fed streams had appeared around the lake by 1914. Mud Lake continued to rise until 1923, when it reached its maximum content of 61,000 acre-feet. This great and progressive increase in the visible supply of water in the Mud Lake Area attracted wide attention and resulted in the promotion and development of several irrigation projects there. The first water filing was made on Mud Lake for irrigation in 1908, and the lake has been used as an irrigation reservoir ever since. In addition to that withdrawn from the lake, a considerable amount of irrigation water has been developed from flowing wells and by pumping ground water from wells.

The increase in the water supply in the Mud Lake Area since 1900 has long been attributed by inhabitants of the region to the percolation of water used in irrigation of land on Egin Bench. The Geological Survey made a detailed investigation and study of the geology and water resources of the Mud Lake region from 1921 to 1929 in order to determine the cause of this phenomenal increase in the water supply, the quantity and permanence of this supply, and the best methods of conserving and utilizing it. A ground-water map of the entire Mud Lake Area and the Henrys Fork Valley, prepared from observations during the investigation, showed that the ground-water movement from the north and west sides of Egin Bench passes beneath and around the Mud Lake Area. The general conclusion reached as a result of these studies was that the underground outlets south of Mud Lake must have had sufficient capacity to carry away beneath the surface all the ground water moving toward the lake prior to 1900. They apparently did not have sufficient capacity to carry the additional water arriving from Egin Bench. As a result, the water table rose to the surface. The clay beds under Mud Lake impeded the rise of the water table in that area and created a large ground-water reservoir in the porous lava formations on the north side of the lake. After the water table on the north side of the lake had gained sufficient height above the lake surface, springs began to appear around the edge of the clay beds and the inflow to the lake was greatly increased. This natural outflow of ground water has been accelerated by pumping from shallow wells on the north side of the lake in recent years. Nearly five years were required for the ground-water movement from Egin Bench to have any visible effect on the Mud Lake Basin, and about 23 years were for it to produce the maximum effect. The variations in the inflow to Mud Lake since 1923 can be mostly accounted for by the variations in the flow of Camas Creek. Except for the continuance of ground-water contributions from Egin Bench, Mud Lake no doubt would have been entirely dry during the recent years of deficient run-off from the Camas Creek drainage area.

The accompanying general map of the Mud Lake Area shows the present extent of the irrigated lands and the location of irrigation wells and main canals. A total of 28,300 acres was irrigated in the area in 1942. About one fourth of the water supply for this acreage is drawn directly from Mud Lake. The acreage irrigated from the lake has remained about the same during the last 20 years, but there has been a steady increase in the acreage irrigated by well water since 1930. Most of the existing wells were developed during the period from 1930 to 1936, and all of the wells are now being pumped. Prospecting for new wells still continues, and a few are developed each year. The acreage irrigated by well water may be increased somewhat in the future, but the development of new wells will be curtailed or stopped as soon as the draft on the underground reservoir exceeds the rate of recharge and causes a general drop in the water table throughout the basin. The present irrigators in the area are already viewing with alarm all proposals to increase the irrigated acreage by further draft on the ground-water resources of the basin because a slight drop in ground-water levels on the northeast or inflow side of the lake will cause a considerable reduction in the volume of ground-water inflow to the lake. The Camas National Wildlife Refuge, established in 1937, includes about 10,000 acres of swampy land along Camas Creek on the northeast side of Mud Lake. This refuge was established primarily as a nesting area for waterfowl, pheasants, and sage hens; and it also serves as a resting place for migratory flocks of ducks and geese. Any lowering of the ground-water levels would dry up the swamps and ponds in the area and make it useless as a refuge.

An inventory was made of the total supply of irrigation water developed in the Mud Lake Basin each year from 1936 to 1941, inclusive. A watermaster has kept complete records of the canal deliveries from Mud Lake and from all ground-water wells which are tributary to the lake. The yields from these sources constitute about two thirds of the irrigation water developed in the area. The water deliveries from the other wells and from minor lakes in the area were estimated from partial records, from pump and canal capacities, and from the operator's estimates of the time the pumps and canals were operated each year. These records and estimates of canal deliveries are summarized in the following table in acre-feet:

Year	From Mud Lake	From Minor Lakes	From Wells	Total
1936	16,200	2,000	54,800	73,000
1937	13,800	2,200	59,400	75,400
1938	19,700	3,100	50,900	73,700
1939	20,600	2,300	61,600	84,500
1940	19,800	2,300	63,900	86,000
1941	19,400	2,600	60,400	82,400

The total delivery of 82,400 acre-feet to the canal systems in 1941 averaged 2.9 acre-feet per acre irrigated in that year. Most of this water was actually delivered to the land because the canal systems are relatively short, and most of them are situated on the ancient lake beds where seepage losses are very low.

It is believed that the irrigation development in the Mud Lake Basin is now closely approaching a stage of stability; the developed supply of surface and ground water can be depended on properly to irrigate the land under cultivation at the present time. The water supply drawn from the underground reservoir through wells supplements the surface water supply and guarantees almost uniform deliveries in both wet and dry years. It is now generally conceded that the present irrigation development in the Mud Lake Basin has been made possible by the irrigation of Egin Bench and that the area would revert to its original desert status if the present use of water on Egin Bench were stopped. The irrigation of 28,300 acres in the Mud Lake Basin, therefore, should be credited to the diversions from the Henrys Fork River to Egin Bench.

Summary--Henrys Fork Valley

The records of water use obtained throughout the water year ending September 30, 1943, show that a total of 1,133,000 acre-feet was diverted into the canal systems in the Henrys Fork Valley during that year. This is an average of 10.2 acre-feet per acre actually irrigated in the valley. Of this total, only 88,000 acre-feet were diverted during the period from November 1, 1942, to March 31, 1943. Monthly computation of river gains between the inflow gaging stations on the Henrys Fork, Fall River, and the Teton River, and the outflow gaging station on the Henrys Fork near Rexburg show that a total of 351,000 acre-feet returned to the stream from the irrigated areas in the form of surface waste and ground-water inflow during the 1943 water year. Monthly computations of the stream depletion between the inflow and outflow gaging stations are shown in the following table in units of 1,000 acre-feet:

Month and Year	Inflow to Valley: Henrys Fork	Fall River 1/	Teton River	Total Inflow	Outflow at Rexburg	Total Stream Depletion
Oct. 1942	66	29	29	124	78	46
Nov. 1942	55	30	31	116	95	21
Dec. 1942	40	28	26	94	84	10
Jan. 1943	38	25	25	88	80	8
Feb. 1943	52	22	22	96	83	13
Mar. 1943	64	24	30	118	112	6
Apr. 1943	137	73	84	294	243	51
May 1943	170	71	109	350	270	80
June 1943	142	156	138	436	273	163
July 1943	92	110	103	305	144	161
Aug. 1943	104	57	57	218	75	143
Sept. 1943	104	45	41	190	110	80
Total	1,064	670	695	2,429	1,647	782

1/ Includes inflow from Conant Creek.

This stream depletion was caused by the ground-water loss from the valley, by consumption of water by crops on the 111,000 cultivated acres, by consumption of water by trees, brush, grass, and tules in the river bottoms and swampy areas, and by evaporation from the water surfaces of streams, canals, and ponds. It is estimated that there are about 9,000 acres of swamp land and river-bottom land in the valley which is covered with trees, brush, grass, and tules. The ground water stands on this land at or near the surface throughout the growing season. The average net consumptive use on the 120,000 acres of cultivated, river-bottom, and swampy lands is estimated to be 1.6 acre-feet per acre annually, exclusive of precipitation. From the foregoing data the annual ground-water loss from the entire valley is computed as follows:

Total stream depletion in valley . . .	782,000 acre-feet
Consumptive use on 120,000 acres . . .	192,000 acre-feet
Ground-water loss from valley.	590,000 acre-feet

Of this total ground-water loss, 324,000 acre-feet have been definitely accounted for as moving westward from Egin Bench and not returning to Snake River above Milner Dam. The ground-water contours indicate that the main direction of ground-water movement from the east side of the valley is southwesterly with the main avenue of escape probably being through an ancient buried channel under the Henrys Fork about one or two miles above the Rexburg gaging station. For this reason it is believed that little, if any, of the other 266,000 acre-feet of ground-water loss returns to Snake River above Milner Dam.

By crediting the irrigation of 28,000 acres in the Mud Lake Basin to the use of water in the Henrys Fork Valley and assuming that none of the 590,000 acre-feet of ground-water loss from the Henrys Fork Valley during the 1943 water year returned to the Snake River above Milner Dam, the total stream depletion of 782,000 acre-feet should be charged to 139,000 acres of cultivated and crop-producing land in the Henrys Fork Valley and the Mud Lake Area. This water use of 5.6 acre-feet per acre compares favorably with the use of water on many other irrigated areas in the Snake River Valley. If the irrigation of Mud Lake lands is credited to the net draft on the river of 368,400 acre-feet for irrigation of the Egin Bench lands only, the per acre use of water on the Egin Bench and Mud Lake lands would be 6.6 acre-feet. This water use is comparable to that on the North Side Twin Falls Project, which diverts about 6.5 acre-feet per acre irrigated with no return flow to the Snake River above Milner Dam.

Before irrigation began on Egin Bench in 1895, the water table stood more than 100 feet below the surface at Parker and more than 50 feet below the surface at Egin and Plano according to early settlers who dug the first wells in that area. The depth to water in the Wilford-Chester Area was reported to range from 50 to 100 feet before irrigation began in that area. This indicates that the Henrys Fork must have been a losing stream above the Rexburg gaging station before the high water tables were built up on both sides of it by irrigation. The water table on the west side of the river would very likely drop below river level again if irrigation of the Egin Bench were to cease, and water would again percolate westward directly from the river channel. The retirement of Egin Bench would not result in saving all of the percolation losses from that area, therefore, because a portion of the present ground-water loss would be replaced by a river channel loss. The loss of the support from the present high water table on the west side of the river would allow a westward ground-water movement beneath the river from the east side of the valley. This would increase the non-tributary loss from that area and make it more difficult to maintain the high water tables needed for subirrigation of land on the east side of the river. In view of these facts, it is impossible to predict what the net saving of water would be if the lands on Egin Bench were retired from cultivation and all diversions to those lands were eliminated.

The investigations and studies of water use in the Henrys Fork Valley resulted in the conclusion that the present use cannot be curtailed without adversely affecting crop production in that valley and seriously reducing the water supply in the Mud Lake Basin. The present winter diversions are needed to maintain the water tables in the subirrigated areas. The elimination of such diversion would result only in a heavier draft on the river in the spring in order to raise the water tables from lower levels and would make little, if any, reduction in the present annual stream depletion. When the irrigation of about 28,000 acres in the Mud Lake Basin is credited to the water use in the Henrys Fork Valley, the stream depletion per acre irrigated compares favorably with that in the Snake River Valley. It is believed that the present use of water in the Henrys Fork Valley can thus be justified from this standpoint at the present time. The uncertainties involved in predicting the amount of water that might be saved by reducing the present diversions would make it difficult to justify any water conservation plan that might be devised, and the possible savings are too small to warrant disturbing the present stable ground-water conditions in that valley and in the surrounding areas. For these reasons, it is believed that the use of water in the Henrys Fork Valley should continue in the future as it has in the past.

WATER USE IN THE UPPER SNAKE RIVER VALLEY

The Upper Snake River Valley as referred to herein includes all of the area irrigated from the main stream between Heise and American Falls. A total of about 410,000 acres of land is irrigated in this section by 58 canals diverting from the main stream. Most of the canals in this section are operated throughout the winter to furnish domestic and stock water to the farmsteads. This practice causes a considerable reduction in the storable inflow to the American Falls Reservoir during the winter because a portion of the percolation losses from the canals joins a ground-water movement which is not tributary to the river above Milner Dam. In order to determine the extent of the loss of irrigation water that results from winter operation of the canals, it was necessary to segregate the areas in which the ground-water movement is not tributary to the river above Milner Dam. During the field investigation of winter water use the valley was divided into nine areas, of which four have a non-tributary ground-water movement. The ground-water map of the valley made by the Geological Survey was used as a guide in selecting the boundaries of the areas of tributary and non-tributary ground-water movement. Complete records of the diversions into and return flow from six of the areas were obtained during the winter of 1942--1943. Similar hydrographic work was continued during the winter of 1943--1944 in two of the non-tributary areas where the heaviest losses occur. A description of each of these areas and a discussion of the use of water in each are given in the following paragraphs:

Present Water Use

Thornton Area

Named for the small town in its center, the Thornton Area comprises all of the alluvial fan of the Snake River which lies on the north side of that stream between Heise and the Henrys Fork. (See map following page 83). About 20,000 acres of land in this triangular area are irrigated by the Sunnydell, Lenroot, Reid, Texas Feeder, Nelson-Corey, and Hill-Pettinger canals. The soils in the area range from a sandy loam in the upstream portion to a heavy clay and silt loam in the lower reaches near the Henrys Fork River. The entire area is underlain with a deep deposit of sand, gravel, and cobbles. The depth to water is a little over 40 feet at the heading of the Sunnydell Canal, but decreases downstream to a point near the mouth of the Henrys Fork where the water table is practically at the surface. The ground-water movement is parallel to the Snake River and large quantities of ground water are discharged through springs and sloughs throughout the year in the downstream end of the area. Considerable annual fluctuation of the water table occurs in the upstream half of the area as a result of recharge by irrigation, which in turn causes a variation in the flow of springs and sloughs in the downstream half of the area. The ground-water outflow reaches a maximum in July and August and constitutes a large portion of the natural flow of the Henrys Fork at its mouth during late summer.

Relatively large quantities of water are required properly to irrigate the land in this area because there are heavy percolation losses through the porous soils and subsoils in the upstream half of the area. All of the land is surface-irrigated except a small acreage along the edge adjoining the subirrigated area in the Henrys Fork Valley. Records of the Geological Survey show the following summer diversions in acre-feet by the six canals serving the area:

Year	May	June	July	August	September	Total	Per Acre
1936	25,300	38,800	39,100	31,100	25,600	159,900	8.0
1937	26,800	41,200	38,500	29,500	19,300	155,300	7.6
1938	19,000	45,600	38,900	34,300	29,700	167,500	8.4
1939	30,300	38,700	41,200	32,700	22,700	165,600	8.3
1940	33,900	40,900	35,300	23,900	15,800	149,800	7.5
1941	28,000	40,000	37,900	29,400	23,900	159,200	8.0
1942	18,200	42,900	42,500	34,000	20,600	158,200	7.9
Average	25,900	41,200	39,100	30,700	22,500	159,400	8.0

The Sunnydell, Nelson-Corey, and Hill-Pettinger canals are operated during the fall and the Lenroot, Reid, and Texas Feeder canals are operated all winter to furnish stock water to the farmsteads in the Thornton Area. No records of these non-irrigation season diversions have been obtained by the Geological Survey. In order to determine the extent of the water use during the non-irrigation season, the Bureau of Reclamation obtained complete records of the diversions into and return flow from the Thornton Area during the winter of 1942--1943. These records are summarized as follows in acre-feet:

Month		Diversions Into Area	Return Flow From Area	Gain
November	1942	9,900	12,200	2,300
December	1942	1,900	6,400	4,500
January	1943	1,500	5,700	4,200
February	1943	1,400	5,600	4,200
March	1943	1,500	6,600	5,100
	Total	16,200	36,500	20,300

It will be noted from the above records that the return flow from the area exceeded the diversions into the area throughout the non-irrigation season. This is due to the fact that the ground-water storage accumulated in the alluvial fan during the summer drains out gradually during winter through the springs and sloughs in the lower end of the area. This ground-water outflow would continue during winter even if there were no canal diversions into the area. In view of this condition it is believed that no loss of irrigation water results from the winter operation of canals in the Thornton Area.

Island Area

The Island Area, triangular-shaped, is bounded by the Great Feeder on the south and by the Snake River on the north and west. It comprises the central and uppermost portion of the large alluvial fan which has been laid down by the main stream as it emerges onto the plain. The Great Feeder is an old flood-water channel which is now used as a carrier of irrigation water. Fourteen canals diverting water from the north side of the Great Feeder serve about 17,000 acres of irrigated land in the Island Area. The entire area is underlain with deep deposits of coarse riverwash material. Surface soils range from sandy and rocky soils in the upstream end to heavy clay-loam soils in the lower reaches of the area. Some of the soils in the upstream end of the area are so sandy and rocky that the land is considered marginal. The Island Area is situated on the crest of the ground-water ridge built up by heavy percolation losses from the Snake River and from irrigation on the alluvial fan. The general ground-water movement beneath the area is parallel to and tributary to the main stream except near the upstream end. There, some ground water may spill over the side of the narrow point of the ridge and move southward. The water table stands within 10 feet of the surface in the downstream half of the area throughout the year, but in the upstream half it fluctuates between a maximum summer level about 40 feet below the surface and a minimum winter level about 60 feet below the surface. Large quantities of ground water drain from the Island Area through springs and sloughs in the lower end and flow into the Snake River throughout the year. As in the Thornton Area, the ground-water outflow reaches a maximum in July and August and a minimum in March and April.

Irrigation of the lands in this area requires heavy canal diversions from the river because the water percolates rapidly into the porous soils and subsoils in the upstream half of the area. All diversions are made in the upstream end of the area where the soils are most porous. Subirrigation has never been practiced in this area because the water table is radically affected by changes in the water level of the main stream. Irrigation season diversions by the 14 canals serving the irrigated lands in this area, as recorded by the Geological Survey, are as follows in acre-feet:

Year	May	June	July	August	Sept.	Total	Per Acre
1936	31,400	49,500	55,200	43,600	37,800	217,500	12.8
1937	24,700	50,200	54,100	45,000	33,800	207,800	12.2
1938	24,300	56,300	50,500	51,000	38,300	220,400	13.0
1939	37,400	54,100	57,000	48,100	37,000	233,600	13.7
1940	36,800	53,400	49,800	42,700	30,700	213,400	12.6
1941	28,600	52,200	52,400	39,700	37,600	210,500	12.4
1942	17,600	56,500	59,000	47,800	34,200	215,100	12.7
Average	28,700	53,200	54,000	45,400	35,600	216,900	12.8

Of the 14 canals serving this area, the Lowder, East Labelle, and Dilts canals are operated during the fall. Only the Butler Island and Long Island canals are operated throughout the winter. All of the other canals are shut off at the end of the irrigation season. Records of the diversions into and return flow from the

Island Area, obtained by the Bureau of Reclamation during the winter of 1942—1943, are summarized in acre-feet as follows:

Month		Diversions Into Area	Return Flow From Area	Loss	Gain
November	1942	9,200	6,400	2,800	0
December	1942	3,200	3,500	0	300
January	1943	1,100	2,500	0	1,400
February	1943	1,000	2,000	0	1,000
March	1943	2,200	2,600	0	400
Total		16,700	17,000	2,800	3,100

Studies of ground-water movement in the Island Area indicate that practically all of the percolation losses from canals during winter return to the river through the springs and sloughs in the lower end of the area. The above records of diversions and return flow appear to bear out this fact and to indicate that no loss of irrigation water results from operation of the canals during winter.

A field inventory in 1942 showed that all farmsteads except ten had adequate well facilities to provide the farm homes with domestic water. The canals are operated during winter primarily for watering livestock in the fields.

Idaho Falls Area

The Idaho Falls Area includes that portion of the Upper Snake River Valley which lies on the east side of the Snake River between the Great Feeder and Firth. About 153,000 acres of land are irrigated in this area by 12 canals diverting from the Great Feeder and by five canals diverting from the main stream. The area is bounded on the east and upstream side by the Anderson and Eagle Rock canal system, which diverts from the main stream above the head of the Great Feeder. The downstream end of the area is fixed by a line drawn through the town of Firth at right angles to the Snake River.

The Idaho Falls Area is characterized by deep alluvial deposits laid down on the lava rock by the main stream. The irrigated lands in the area are generally fertile and produce good crops. An exception is the northeast corner, where the surface soils are sandy and rocky. Between 5,000 and 10,000 acres of land along the Great Feeder are considered marginal and, during recent years, water rights have been transferred from some of this land to better lands elsewhere.

Present Water Use

The depth to ground water ranges from 150 feet near the head of the Idaho Canal to 50 feet in the vicinity of Firth. The water table stands from 30 to 200 feet below the river bed throughout the section between Firth and the mouth of the Great Feeder at all times. The ground-water map of the Snake River Valley, noted previously, shows that the ground-water movement beneath the entire Idaho Falls Area is toward the west. It passes beneath the Snake River between the mouth of the Great Feeder and Firth and joins the subterranean stream network which discharges into the Snake River Canyon below Milner Dam.

Rather large quantities of water are required to irrigate the land in the Idaho Falls Area because of the porous nature of the soils and subsoils. Canal losses are heavy, and water percolates rapidly into the gravel subsoils as it flows across the land. The records of the irrigation season diversions by the 17 canals serving this area are summarized as follows in acre-feet:

Year	May	June	July	Aug.	Sept.	Total	Per Acre
1936	191,900	264,000	322,000	258,000	218,800	1,254,700	8.2
1937	158,000	260,000	310,000	264,800	194,400	1,187,200	7.8
1938	140,600	300,200	285,600	282,300	237,200	1,245,900	8.1
1939	250,300	268,700	323,800	280,300	188,600	1,311,700	8.6
1940	226,500	276,200	296,100	228,200	154,800	1,181,800	7.7
1941	179,000	268,500	314,300	237,000	217,300	1,216,100	7.9
1942	124,900	302,700	334,500	288,400	188,300	1,238,800	8.1
Average	181,600	277,200	312,300	262,700	199,900	1,233,700	8.1

With the exception of three small ditches, all of the canals serving this area are operated during winter to supply domestic and stock water to the farmsteads. There are no records of these diversions prior to 1942. Beginning in October 1942 the Bureau of Reclamation obtained complete records of all diversions into and surface return flow from the area during two winters in order to determine the extent of the water loss caused by this practice. The records of water use during the winter of 1942--1943 are summarized in acre-feet as follows:

Month		Diversions Into Area 1/	Return Flow From Area	Loss
November	1942	71,100	27,100	44,000
December	1942	43,700	18,600	25,100
January	1943	26,200	7,900	18,300
February	1943	19,000	3,400	15,600
March	1943	20,500	5,000	15,500
Total		180,500	62,000	118,500

1/ Includes flow of Willow Creek.

The records of water use during the winter of 1943--1944 in acre-feet are summarized as follows:

Month		Diversions Into Area 1/	Return Flow From Area	Loss
November	1943	62,000	34,000	28,000
December	1943	45,500	18,100	27,400
January	1944	23,700	7,100	16,600
February	1944	20,300	6,900	13,400
March	1944	27,200	8,400	18,800
Total		178,700	74,500	104,200

1/ Includes flow of Willow Creek.

The Geological Survey's ground-water map of the valley indicates that all water percolating from the canals and irrigated land in the Idaho Falls Area joins a ground-water movement to the west under the desert and returns to the river through springs in the canyon below Milner. The percolation losses, it has been noted, cannot be recaptured and used for irrigation above Milner Dam. In view of this fact, the diversion of water into the canals in the Idaho Falls Area during winter for domestic and stock watering purposes should be eliminated wherever possible.

The ground-water map of the entire Snake River Valley, prepared from summer well readings by the Geological Survey, shows that there is a ground-water movement along the east edge of the Idaho Falls Area between Ririe and Shelley. The movement is deflected toward the river at Shelley and joins the general movement to the west under the desert. There was some question as to whether this movement continued past Shelley and was tributary to American Falls Reservoir during the winter, when the water table in the vicinity of Blackfoot receded. In order to explore this possibility, the depth to water in four wells near Firth was measured once a month during the winter of 1942--1943, and the elevation of the water level in all existing wells in the Shelley--Firth Area was measured in March 1943. The accompanying drawing, entitled "Ground Water Map, Shelley--Firth Area", shows the profiles prepared from these well readings. It is evident from the ground-water map and profiles that the movement between Shelley and Firth throughout the winter is at right angles to the river and passes beneath it toward the desert. The deflection of the downstream movement at Shelley is evident from the shape of the water table contours in that vicinity. It is concluded, therefore, that none of the percolation losses from canals in the Idaho Falls Area is tributary to the river above American Falls.

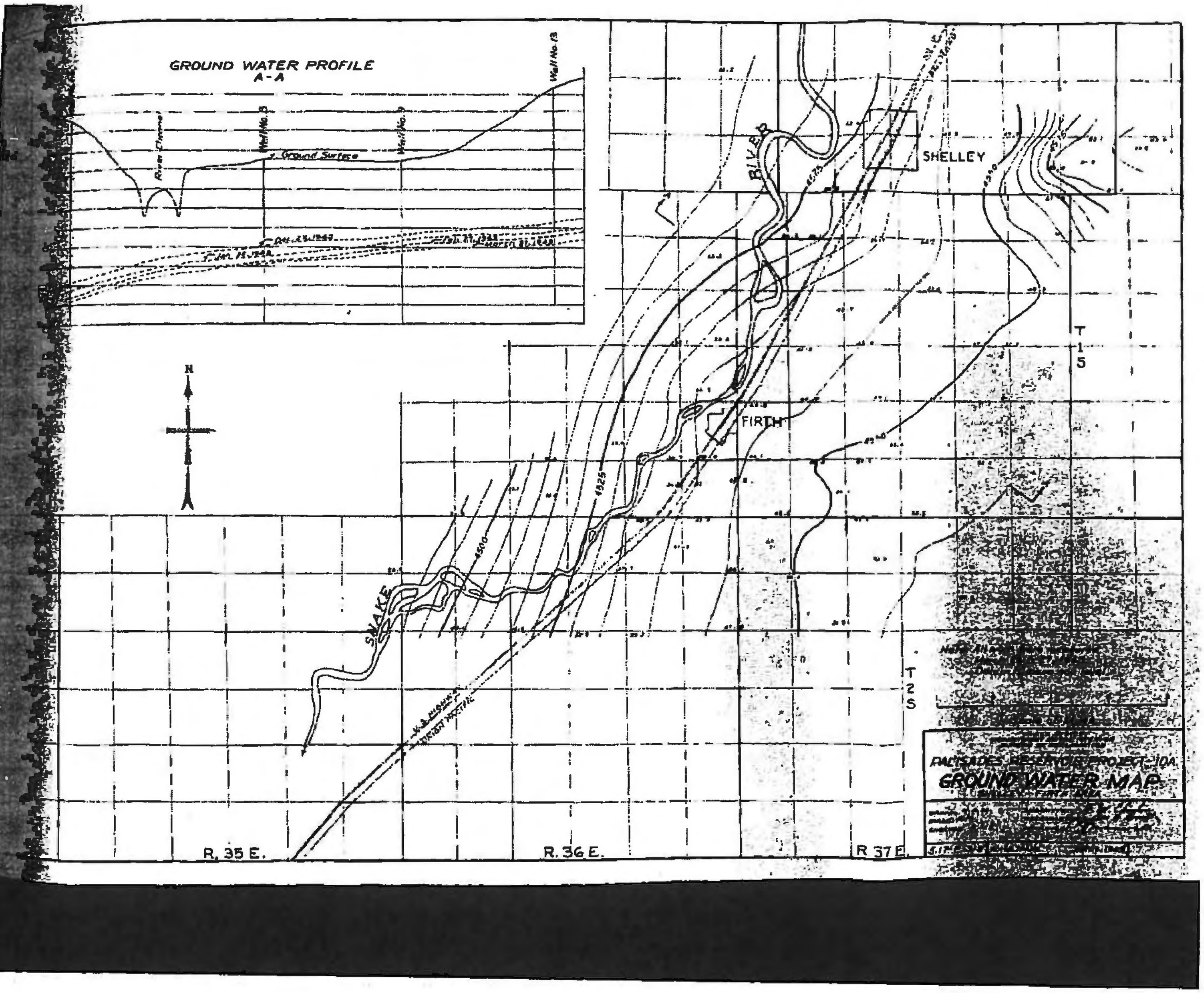
New Sweden Area

The New Sweden Area extends from the Osgood Canal to the town of Firth and includes all of the irrigated lands on the west side of the Snake River between those points. A total of about 36,000 acres is irrigated in this area by seven canals diverting from the Snake River. All of the canals divert by gravity except the Osgood Canal, from which water is pumped through a lift of about 65 feet.

The topography of the area is generally rolling, and a considerable portion of the irrigated land lies on relatively steep slopes. The area is covered with a desert type of soil which was carried in and laid down largely by wind. The soils are of the sandy loam type and are free-working and very fertile. They are especially well adapted to the growing of potatoes. The surface soils are underlain by lava rock throughout the area.

The depth to ground water ranges from 250 feet in the upstream end of the area to 100 feet at the downstream end. The ground-water map of the valley shows that the water table slopes away from the river and that the ground-water movement from the entire New Sweden Area is toward the west and is not tributary to the Snake River above Milner Dam. The percolation losses from the canals and irrigated land in the area join the general ground-water movement beneath the desert.

Although the soils are fairly water-tight, their relatively shallow depths allow a considerable amount of irrigation water to percolate into the underlying permeable lava rock. As a result of these percolation losses, the annual diversions from the river for irrigation are rather high. The records of the irrigation season diversions by the seven canals serving this area are summarized in acre-feet as follows:



GROUND WATER PROFILE
A-A
River Channel
Ground Surface
Well No. 9
Well No. 13
N
SHELLEY
RIVER
FIRTH
SNAKE
T 1 S
T 2 S
R. 35 E.
R. 36 E.
R 37 E
GROUND WATER MAP

Year	May	June	July	August	Sept.	Total	Per Acre
1936	38,100	55,400	50,700	49,400	34,900	228,500	6.3
1937	26,900	48,800	49,700	49,600	27,200	202,200	5.6
1938	27,500	57,500	49,900	56,400	41,400	232,700	6.5
1939	41,800	48,800	56,400	50,600	37,000	234,600	6.5
1940	38,000	48,500	51,800	45,800	23,900	208,000	5.8
1941	36,600	46,000	53,900	42,700	35,700	214,900	6.0
1942	25,100	53,300	59,500	56,900	34,100	228,900	6.4
Average	33,400	51,200	53,100	50,200	33,500	221,400	6.2

The Great Western, Porter, and Woodville canals are operated throughout the winter to furnish domestic and stock water to the farmsteads in the area. The Bureau of Reclamation obtained complete records of the diversions into and return flow from the New Sweden Area during the winters of 1942--1943 and 1943--1944. These records of water use during the winter of 1942--1943 are summarized as follows in acre-feet:

Month	Diversions Into Area	Return Flow From Area	Loss
November 1942	11,400	6,100	5,300
December 1942	10,000	6,100	3,900
January 1943	8,300	5,300	3,000
February 1943	5,100	2,400	2,700
March 1943	3,500	1,900	1,600
Total	38,300	21,800	16,500

The records of water use in acre-feet during the winter of 1943--1944 are summarized as follows:

Month	Diversions Into Area	Return Flow From Area	Loss
November 1943	9,900	6,400	3,500
December 1943	10,000	5,900	4,100
January 1944	6,900	4,400	2,500
February 1944	6,100	3,100	3,000
March 1944	5,600	3,000	2,600
Total	38,500	22,800	15,700

Since the percolation losses from the New Sweden Area are not tributary to the river above Milner Dam, the non-irrigation season diversions should be eliminated wherever possible. The above records indicate that the inflow to the American Falls Reservoir could be increased by 16,000 acre-feet annually if the canals serving the New Sweden Area were shut off during the non-irrigation season.

Thomas Area

The Thomas Area is located on the west side of the Snake River and extends from the town of Firth to the mouth of the Blackfoot River. It is bounded on the northwest side by the Peoples Canal and the downstream end of the Great Western Canal. About 43,500 acres are irrigated in this area by eight canals diverting from the Snake River between Firth and Blackfoot. All lands are irrigated by gravity flow from the river. Most of the area is underlain with coarse river gravel. Alluvial soils are found along the river, but merge with desert type soils along the northwest side.

The depth to water ranges from 80 feet in the upstream end of the area to 20 feet in the downstream end. The water table contours indicate that the ground-water movement is toward the west. The deep percolation losses do not return to the river above Milner Dam except in a small portion of the area at the extreme downstream end where the movement is toward and tributary to American Falls Reservoir.

The records of the irrigation season diversions during recent years by the eight canals serving the Thomas Area are summarized as follows in acre-feet:

Year	May	June	July	August	Sept.	Total	Per Acre
1936	64,500	66,900	66,100	53,900	47,600	299,000	6.9
1937	50,600	64,500	65,600	53,400	44,200	278,300	6.4
1938	48,300	71,300	61,800	62,500	49,700	293,600	6.7
1939	72,000	63,600	64,700	60,400	49,300	310,000	7.1
1940	66,900	60,900	57,900	46,300	32,600	264,600	6.1
1941	51,300	63,100	62,600	52,800	49,400	279,200	6.4
1942	54,800	69,700	69,900	56,800	41,400	292,600	6.7
Average	58,300	65,700	64,100	55,200	44,900	288,200	6.6

Most of the canals in the Thomas Area are operated throughout the winter to furnish domestic and stock water to the farmsteads.

The Bureau of Reclamation obtained complete records of all diversions into and return flow from the area during the winter of 1942--1943. These records are summarized as follows in acre-feet:

Month		Diversions Into Area	Return Flow From Area	Loss
November	1942	11,100	5,000	6,100
December	1942	6,500	1,700	4,800
January	1943	4,200	1,200	3,000
February	1943	1,800	700	1,000
March	1943	2,700	800	1,900
Total		26,300	9,400	16,900

The above records indicate that about 17,000 acre-feet percolates from the canals in this area during the non-irrigation season. Since practically all of these percolation losses occur in the upstream half of the area, it is believed that they join the groundwater movement to the west and do not return to the river above Milner Dam. The inflow to American Falls Reservoir would be increased by about 17,000 acre-feet annually, if the diversions to the Thomas Area during the non-irrigation season were eliminated.

Blackfoot Area

The Blackfoot Area is triangular in shape and is located between the Blackfoot River and the Snake River. It joins the Idaho Falls Area at the town of Firth. The irrigated land in the area is served by the Blackfoot, Corbett, and Nielsen-Hansen canals diverting from the Snake River and by the Eastern Idaho Canal diverting from the Blackfoot River. About 17,400 acres of land in the area are irrigated from the Snake River with a total diversion of 120,000 acre-feet from May to September, inclusive. About 50,000 acre-feet are diverted from the Blackfoot River to 9,000 acres in this area during the same period each year.

The water table beneath the Blackfoot Area stands from 10 to 20 feet below the surface throughout the year. The contours of the water table indicate that it slopes toward the American Falls Reservoir in all of the area except in the upstream end near Firth, where it slopes toward the west. It is believed that practically all of the percolation losses from the canals and irrigated land in the area are tributary to the river above American Falls.

The Corbett and Blackfoot canals are operated during the winter to furnish stock water to the farms in the area. Records of the diversions by these canals and losses during the winter of 1942--1943 are as follows in acre-feet:

Month	Diversions Into Area	Return Flow From Area	Loss
November 1942	5,100	4,000	1,100
December 1942	2,800	3,700	0
January 1943	300	-	-
February 1943	400	-	-
March 1943	1,200	-	-
Total	9,800	-	-

The return flow was not measured after December 30, 1942, because it consisted almost entirely of ground water being discharged through sloughs and springs along the Blackfoot River. It is believed that the loss during the month of November returns to the river later in the winter.

Miscellaneous Projects

The Butte and Market Lake Canal diverts from the west side of the Snake River and irrigates about 17,000 acres in the vicinity of Roberts. The annual diversion requirement for this project is about 70,000 acre-feet. Practically all of the irrigated lands are located in an old lake bed and are underlain by clay deposits which have created a perched water table. The water table slopes away from the river, and it is believed that none of the deep percolation losses returns to the river above Milner Dam. The percolation losses from the irrigated area are relatively small, however, because the surface soils are underlain by layers of clay which are fairly water tight. Water is diverted into the canal system after the end of the irrigation season for stock watering purposes. Records of the winter operation during 1942 and 1943 show that the diversions were cut to 6 cubic feet per second on November 9, 1942, and were gradually reduced to zero by the end of December 1942. The total diversions during November and December amounted to only 1,000 acre-feet, and about 400 acre-feet returned to the river through wasteways. Although the amount of water now used in this area during winter is small, the Butte and Market Lake Canal should be shut off at the end of the irrigation season as a matter of policy, inasmuch as the deep percolation losses are not tributary to the river. The elimination of non-irrigation season diversions may tend to reduce the drainage problems on the project.

Present Water Use

The Fort Hall Project is located on the east side of the Snake River between the Blackfoot and Portneuf rivers. About 34,000 acres of land are now irrigated in the project, and the irrigable acreage is estimated at about 47,000 acres. The supply of irrigation water for the project is obtained from both the Blackfoot and Snake rivers and also from the surface waste of the irrigated lands in the Idaho Falls Area. Water is diverted from the Snake River at Shelley and is carried to the Blackfoot River through the Reservation Canal. The Reservation Canal also collects the return flow from the Idaho Falls Area and carries it to the Blackfoot River. The total water supply is then diverted to the project lands through the Fort Hall Main Canal and the North Canal. A small equalizing reservoir has been constructed on the Blackfoot River between the mouth of the Reservation Canal and the head of the Fort Hall Canal to regulate the various flows before they are diverted to the project lands. No water is diverted from the Snake River during the non-irrigation season, but the return flow from the Idaho Falls Area is carried through the Reservation Canal to the Blackfoot River throughout the winter. This return flow together with the natural flow in the Blackfoot River is diverted into the Fort Hall and North canals during the fall and early spring months for stock watering purposes. The operation of these canals during the non-irrigation season causes no appreciable loss of irrigation water, however, because the ground-water movement under the entire area is tributary to the American Falls Reservoir.

The Aberdeen Canal, diverting from the west side of the Snake River near Firth, serves an area of about 61,000 acres in a long strip between Moreland and the American Falls Dam. In normal years about 330,000 acre-feet of water are diverted by this canal for irrigation use. All farmsteads in the project are equipped with wells, and no water is diverted into the canal system during winter for stock watering purposes. The canal headgates are usually closed early in November and not opened again until the irrigation season begins in the latter part of April. The records of diversions during 1942 and 1943 show that the canal was shut off on November 9, 1942, and that no water was diverted again until April 26, 1943. A considerable portion of the water diverted after the middle of October returns to the river through wasteways, and most of the deep percolation losses are tributary to the American Falls Reservoir. In view of these facts there is no apparent reason for disturbing the present operating schedule on this project.

Summary--Upper Snake River Valley

The investigations and studies of water use in the Upper Snake River Valley show that the operation of the canals during the winter causes an appreciable reduction in the storable inflow to the American

Falls Reservoir. Most of the loss occurs in the Idaho Falls, New Sweden, and Thomas areas, where the ground-water movement is not tributary to the river above American Falls Dam. The records of diversions into and return flow from these three areas during the winters of 1942--1943 and 1943--1944 show the following average losses from November to March, inclusive:

Area	Average Loss (acre-feet)
Idaho Falls	110,000
New Sweden	16,000
Thomas	17,000
Total	143,000

If all of the canals serving the Idaho Falls, New Sweden, and Thomas areas were shut off by November 1 every fall and were not turned on again until April 1 of the next spring, the inflow to American Falls Reservoir would be increased by about 143,000 acre-feet annually. It is believed that the winter diversions during the period from 1942 to 1944, upon which this estimate is based, are representative of other past years. The irrigation season normally begins during the last week of April and ends during the latter part of October. In extremely dry years, however, the farmers begin irrigating by the 1st of April and demand water during the first half of November to irrigate fields for fall plowing. It is in such dry years that the saving of irrigation water is most essential. It is believed that an effort should be made to shut off the canals by November 1 in those years in order to increase the storage in American Falls Reservoir.

In wet years, when American Falls Reservoir spills large amounts of water, cessation of winter diversions will not increase the supply of stored water. Other means will have been provided for supplying domestic and stock water in order to conserve irrigation water in dry years, however, so there will be no incentive or need for making winter diversions for domestic purposes, even in wet years. Furthermore, it is impossible to predict on November 1 how much water will be available for storage in American Falls Reservoir during the following winter and spring. It is necessary, therefore, that canals in those areas where the ground-water movement is not tributary to Snake River above American Falls Dam be shut off every year in order to assure the saving of water for storage in dry years.

WATER USE IN THE LOWER SNAKE RIVER VALLEY

The American Falls Reservoir controls the water supply for the lower valley, and, for this reason, it is a logical point at which to divide the entire valley into two sections. The portion of the valley lying between the American Falls Reservoir and Bliss is designated herein as the Lower Snake River Valley. A total of about 480,000 acres of land is irrigated in this section by five large canals, and a supplemental water supply is delivered through the Gooding Canal to about 57,000 acres of land along the lower reaches of the Big and Little Wood rivers. About 18,000 acres of new land under the Gooding Canal can be irrigated from that canal. The acreage irrigated by each of the five canals is as follows:

Canal	Acres
South Side Twin Falls	203,000
North Side Twin Falls	162,000
Minidoka North Side	54,000
Minidoka South Side	52,000
Milner Low Lift	9,000
Total.	480,000

The North and South Side Twin Falls canals are the only ones in the lower valley operated throughout the winter to furnish domestic and livestock water. Although some water is diverted during the fall by the Minidoka canals for stock watering purposes, they are generally shut off by the first of December. Complete records of the diversions by all canals in the lower valley have been obtained by the Geological Survey since 1918. The use of water on each of these projects is discussed in the following paragraphs.

Minidoka Project

The Minidoka Dam, which raised the water surface of the Snake River about 50 feet and created Lake Walcott, was constructed during the period 1907--1909 primarily to divert water to lands in the Minidoka Project. Water is conveyed to the project lands by two main canals diverting from the north and south sides of the river with capacities of 1,600 and 1,100 cubic feet per second, respectively. About 46,000 acres of the land served by the south side canal are irrigated by pumping through a weighted mean lift of 70 feet. The other 60,000 acres in the project are irrigated by gravity flow.

All of the project lands are underlain by lava rock at various depths. Overlying the lava are lake and stream deposits of gravel, sand, and silt, upon which rests a cover of wind-blown material of irregular thickness. Many areas of blow sand, present during the early stages of development of the project, have been largely bedded down by plowing up the subsoils, by the accumulation of humus, and by a covering of plant growth. Clay beds exist under some areas on the north side of the river. These impervious layers have created perched water tables and have interfered with the drainage of surplus irrigation water. This condition has made it necessary to construct an extensive system of surface drains. Most of these drains discharge into the river, but a few on the north side discharge into drainage wells which carry the water downward to the deep water table of the desert to the north. The ground-water contour map of the project indicates that practically all of the deep percolation losses from the canals and irrigated land join the ground-water movement which enters the river below Milner Dam and cannot be re-used for irrigation above Milner Dam. The deep percolating water which returns to the river below Milner Dam amounts to about 260,000 acre-feet annually--about one-third of the total amount diverted to the project at Minidoka Dam. This estimate is based on measurements and studies made by the Geological Survey from 1916 to 1927.

The records of the irrigation season diversions to the Minidoka Project during the period from 1936 to 1942 are as follows in units of 1,000 acre-feet:

Irrigation Season	Apr.	May	June	July	Aug.	Sept.	Oct	Total	Per Acre
1936	25.6	169.4	128.0	168.9	149.7	99.0	47.6	788.2	7.6
1937	18.2	144.9	129.9	176.4	156.3	95.5	48.1	769.3	7.4
1938	31.6	146.8	145.3	144.5	167.1	112.9	42.3	790.5	7.5
1939	76.8	164.0	130.5	164.5	158.8	96.7	38.2	829.5	7.7
1940	34.7	162.5	156.2	173.0	158.9	49.9	35.4	770.6	7.3
1941	20.3	151.8	124.8	169.3	148.5	89.5	32.1	736.3	6.9
1942	14.9	87.3	154.9	181.1	170.3	100.8	45.0	754.3	7.1
Average	31.7	146.7	138.5	168.2	158.5	92.0	41.2	776.9	7.4

All farms in the Minidoka Project are equipped with wells; the canals, therefore, are not operated during the winter. Water is diverted during November and December in some years, however, for watering livestock in the fields. The records of diversions by the North and South Side Minidoka canals during the fall and winter from 1936 in units of 1,000 acre-feet are given on the following page.

Water Year	November	December	January	Februray	March	Total
1936	13.4	1.5	0	0	0	14.9
1937	26.7	5.5	0	0	0	32.2
1938	30.7	5.9	0	0	0	36.6
1939	23.2	5.8	0	0	0	29.0
1940	22.5	0.8	0	0	0	23.3
1941	3.3	0	0	0	0	3.3
1942	0	0	0	0	0	0
1943	0	7.1	0	0	0	7.1
Average	15.0	3.3	0	0	0	18.3

The operation of the Minidoka canals for stock watering purposes during the above period cannot be reasonably justified when all farms in the project are equipped with wells. For this reason the Minidoka canals should be shut off on the first of November in the future unless the irrigation season extends beyond that date.

North Side Twin Falls Project

Water was first turned into the North Side Twin Falls Canal in 1908, but the system was not substantially completed until 1916. The project area of about 185,000 acres lies along the north side of the Snake River and extends from Milner to Bliss, Idaho. Water is diverted from the Snake River at Milner Dam into a 3,200 second-foot main canal which extends about 36 miles northwestward to the Big Wood River. A lateral carries water beyond the Big Wood River to a small tract of land near Bliss. A total of 162,000 acres is now irrigated in the project. Except for a few small pumping tracts along the upper reaches on the main canal, the entire area is served by gravity flow from the river.

The entire tract is underlain by permeable basalt. This basalt does not occur entirely in thin flows with intercalated loess beds, however, as in many places in the valley. Geologists believe that the Snake River formerly flowed through canyons parallel to and north of its present channel in this reach. As each successive lava flow occurred, it filled the then existing canyon and forced the stream to cut a new channel farther to the south. Several of these buried canyons are believed to exist under the North Side Twin Falls Project. The basalt in these V-shaped fills is very permeable; as a result, the water moves rapidly through the fills, especially along the contacts. They serve as extensive drains for the entire northwest side of the valley and discharge large quantities of ground water into the present canyon between Milner and Bliss. As a result of this geologic condition, the water table under the project has not risen appreciably since irrigation began. The water table now stands from 100 to 300 feet below the ground surface, and the tract has no seeped areas resulting from irrigation.

The lava rock is covered by both stream deposits and desert soils except in a few areas within the project where bare lava is exposed. Desert-type soils are predominant throughout the project, and the irrigated land produces excellent crops. The irrigation of this land requires heavy diversion of water from the river, however, because of the rapid percolation of water through the thin surface soils and the porous lava rock beneath them. The records of the irrigation season diversions to the North Side Twin Falls Canal during the period from 1936 to 1942 in units of 1,000 acre-feet are as follows:

Irrig. Season	Apr.	May	June	July	Aug.	Sept.	Oct.	Total	Per Acre
1936	41.9	197.3	196.9	198.6	194.6	126.8	43.4	999.5	6.5
1937	40.4	172.5	181.5	224.1	214.3	123.4	33.2	989.4	6.4
1938	51.4	177.0	198.0	207.1	207.9	151.3	41.6	1,034.3	6.7
1939	93.9	204.4	193.4	213.1	211.7	108.8	38.8	1,064.1	6.9
1940	60.9	172.7	190.4	204.7	189.2	100.3	32.4	950.6	6.1
1941	66.5	182.6	168.9	202.0	190.1	107.2	35.1	952.4	6.3
1942	71.1	174.8	185.0	212.0	217.3	157.9	41.8	1,059.9	6.6
Average	60.9	183.0	187.7	208.8	203.6	125.1	38.1	1,007.2	6.5

Note: These figures include water diverted by the Gooding Canal and delivered to the North Side Twin Falls Canal at Mile 3.5.

The North Side Twin Falls Canal is operated throughout the winter to furnish domestic and stock water to the farmsteads which are not equipped with wells. Records of the non-irrigation season diversions are shown in units of 1,000 acre-feet on the following page.

Water Year	November	December	January	February	March	Total
1936	28.3	27.4	26.7	19.6	24.9	126.9
1937	33.1	28.5	24.4	16.2	18.2	120.4
1938	33.1	31.8	28.9	26.7	28.5	149.0
1939	31.8	25.8	24.5	21.8	24.9	128.8
1940	35.1	32.1	27.1	24.3	20.7	139.3
1941	33.5	29.5	25.6	23.9	25.1	137.6
1942	33.7	31.5	28.8	24.7	30.8	149.5
1943	36.2	32.8	30.5	25.9	34.5	159.9
Average	33.1	29.9	27.1	22.9	25.9	138.9

The above records indicate that the storage in the American Falls Reservoir would have been increased substantially if the North Side Twin Falls Canal had been shut off from the first of November to the end of March each winter during the period from 1936 to 1943. The average non-irrigation season on this project coincides with these dates. In view of the large saving of irrigation water that could thus be realized, it is believed that the present winter diversions for stock watering purposes should be eliminated.

South Side Twin Falls Project

The South Side Twin Falls Project developed under the Carey Act is considered one of the most successful irrigation projects in the United States. Water was first turned onto the land in 1905, and the project was fully settled and developed by 1915. The main canal, with a capacity of about 3,600 cubic feet per second, diverts from the Snake River at Milner Dam and parallels the river for a distance of about 50 miles. The project area includes somewhat more than 200,000 acres of irrigated land in a compact body about 35 miles long and 10 miles wide. All of the land is irrigated by gravity flow except for a few thousand acres above the main canal which are served by pumping from the main canal.

The project area is underlain by layers of lava rock intercalated with loess beds. Unlike the North Side Project across the river, however, these layers of rock and loess have not been cut through by former channels of the Snake River. It is believed that the river has never cut a channel farther south than the present one in the vicinity of Twin Falls. The lava rock is covered by a surface mantle of wind-deposited soil which ranges from 2 to 15 feet in depth. The surface soils are very fertile and produce excellent crops.

Present Water Use

During the early stages of development, it was generally believed that there would never be a drainage problem on the project because it was cut diagonally by many small canyons and the depth to water in the first drilled wells ranged from 50 to 400 feet. In spite of these supposedly favorable conditions, however, the water table rose rapidly after irrigation of the land began, and the first appreciable seepage appeared in 1912 on lands south and west of Twin Falls. Since then the water table has risen to the surface in many places throughout the project. Damage to the land by seepage has been largely prevented, however, by construction of various kinds of artificial drains including buried tile, open ditches, wells, and tunnels. The extension of this system of artificial drains has been a continuing process and is still in progress. This extensive drainage problem is attributed to the following geologic and hydrologic conditions. As the water from canals and irrigated fields percolates downward through the lave flows, some of it is arrested by the loess beds and percolates northward down the ancient surface over which the lava flowed. As the flows narrow both laterally and vertically toward the north, an artesian wedge is built up between the confining loess beds. These layers of clayey materials between the lava flows are somewhat permeable and leakage occurs when the artesian pressure becomes sufficiently great. In most places the water can escape only upward, causing a local rise in the surface water table. Seepage of land then results if the water table is near the surface. It has been found that the best and most practical way of solving this peculiar drainage problem is to drive a tunnel under the seeped area from the nearest coulee or canyon. The tunnel is driven on a steep grade and as deep beneath the surface as possible. The overlying saturated beds are drained into the tunnel by holes drilled from the surface to the tunnel roof. The tunnels are located in a loess bed wherever possible in order to lower the cost of excavation and to cut through one of the confining beds. Much of the drainage water thus developed is diverted from the coulees and used for irrigation of lands at lower elevations in the project.

Like all of the other projects situated on lava formations, the South Side Twin Falls Project requires rather large quantities of irrigation water, even though some drainage water is recovered and re-used. The records of the irrigation season diversions during the period from 1936 to 1942 in units of 1,000 acre-feet are as follows:

Irrig. Season	Apr.	May	June	July	Aug.	Sept.	Oct.	Total	Per Acre
1936	53.8	208.7	194.9	219.1	218.8	141.8	78.6	1,115.7	5.5
1937	56.9	190.9	179.3	217.2	216.0	144.2	71.2	1,075.7	5.3
1938	54.8	186.6	186.7	198.3	214.9	166.8	64.2	1,072.3	5.3
1939	125.8	207.8	195.4	214.8	220.6	150.6	50.4	1,165.4	5.8
1940	69.8	191.4	201.1	220.0	219.9	126.2	42.5	1,070.9	5.3
1941	101.1	193.8	173.8	208.9	214.0	137.6	52.0	1,081.2	5.3
1942	82.3	175.3	176.7	212.0	216.4	149.0	62.0	1,073.7	5.3
Average	77.8	193.5	186.8	212.9	217.2	145.2	60.1	1,093.6	5.4

The South Side Twin Falls Canal is operated throughout the winter to furnish domestic and stock water to the farms and municipal water to the cities of Buhl and Twin Falls. Records of the non-irrigation season diversions are as follows in units of 1,000 acre-feet:

Water Year	November	December	January	February	March	Total
1936	33.8	36.0	32.0	21.8	32.2	155.8
1937	35.4	39.3	36.0	31.2	33.1	175.0
1938	27.0	35.2	31.9	25.6	30.7	150.4
1939	30.9	37.2	36.0	31.4	31.4	166.9
1940	36.4	37.5	34.6	30.1	31.6	170.2
1941	33.4	37.0	35.6	30.9	28.6	165.5
1942	38.4	37.4	34.3	29.0	32.5	171.6
1943	38.4	36.4	36.7	31.4	28.3	171.2
Average	34.2	37.0	34.6	28.9	31.1	165.8

Only about 2 to 3 percent of the winter diversions noted above are actually used for domestic and stock-watering purposes. The remainder returns to the river below Milner Dam through surface wasteways and subterranean channels. All water diverted into the canal system in excess of that actually consumed is lost insofar as irrigation use is concerned. The above records indicate that the annual storage in American Falls Reservoir would have been increased substantially if this canal had not been operated during the non-irrigation season. An alternate supply of domestic, municipal, and stock water must be provided, however, before the canal can be shut off during the non-irrigation season.

Gooding Project

The Gooding Canal was constructed by the Bureau of Reclamation to deliver a supplemental water supply to about 57,000 acres of land under canals from the Big Wood and Little Wood rivers and to irrigate about 18,000 acres of new land between Milner and Shoshone. None of the new land has as yet been developed except for a few hundred acres at the former War Relocation Center at Hunt. The main canal, completed in 1931, extends from the Snake River at Milner Dam to Big Wood River, a distance of about 70 miles. The canal has a diversion capacity at Milner Dam of 2,580 cubic feet per second; of this total, 1,600 cubic feet per second are used to deliver water to the Wood River lands, and 955 cubic feet per second are diverted at Mile 3.5 to the North Side Twin Falls Canal. The first 56 miles of the canal cross the desert between Milner and Gooding and a considerable amount of the excavation is in lava rock. Measurements of seepage losses in this section of the canal during the irrigation seasons for the year of 1943 and the year of 1944 show that only about 67 percent of the water diverted from the river is delivered to Mile 56, where the first turnout is made to the Wood River lands.

The records of the irrigation season diversions by the Gooding Canal during recent years in units of 1,000 acre-feet are as follows:

Irrig. Season	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
1936	1.9	66.4	72.9	83.1	68.8	39.0	0	332.1
1937	10.3	60.0	66.3	75.4	67.4	42.6	0	322.0
1938	2.8	39.5	60.5	76.0	74.0	62.5	0	315.3
1939	31.4	75.7	69.1	79.4	75.1	52.9	0	383.6
1940	18.5	70.6	82.3	91.0	82.7	57.2	0	402.3
1941	21.4	71.3	75.2	95.5	88.4	62.6	0	414.4
1942	18.5	77.0	77.9	95.7	89.8	67.2	1.5	427.6
Average	15.0	65.8	72.0	85.2	78.0	54.9	0.2	371.0

Note: These figures do not include water delivered to the North Side Twin Falls Canal.

The Gooding Canal is not operated during the winter. A run of about a week, however, is made in November each year to fill ponds and cisterns. The canal is then shut off until the beginning of the next irrigation season. Records of the November diversions are as follows:

Year	Acre-feet
1936	3,200
1937	4,300
1938	5,400
1939	4,200
1940	5,700
1941	5,400
1942	8,200
1943	5,500
Average	5,240

The short run of the canal during November to fill ponds and cisterns is believed justified, and no steps should be taken to eliminate it. The small amount of water that could be saved would not warrant the cost and inconvenience involved in eliminating this run.

Miscellaneous Projects

The Milner Low Lift Project is located above the South Side Twin Falls Canal between Milner and Murtaugh Lake. Water is pumped from Milner Lake to the main canal through a lift of 68 feet and to a high-line canal through a total lift of 108 feet. A total of about 9,000 acres of land is now irrigated in the project with an average annual diversion of about 50,000 acre-feet. As all farmsteads in the project are equipped with wells, the canal is not operated during the non-irrigation season.

The PA Lateral of the North Side Twin Falls Project serves about 2,500 acres of land on the north side of Milner Lake above the North Side Twin Falls Canal. Water is pumped directly from Milner Lake into this lateral. The pumping plant and canals serving this small tract are not operated during the non-irrigation season. About 20,000 acre-feet of water are used during the irrigation season.

Power Production

The existing power developments on the Snake River between American Falls and Bliss are listed in the following table:

Name of Plant	Owner	Head (feet)	Installed Capacity (kilowatts)
American Falls	Idaho Power Company	49	27,000
Minidoka	Bureau of Reclamation	48	13,400
Twin Falls	Idaho Power Company	145	9,375
Shoshone Falls	Idaho Power Company	210	12,500
Upper Salmon Falls	Idaho Power Company	48	18,000
Lower Salmon Falls	Idaho Power Company	37	7,200
Total	-	-	87,475

The water released from Lake Walcott and American Falls Reservoir for diversion by the two Twin Falls canals during winter is used for generation of power by the plants at American Falls and at Minidoka Dam. The Idaho Power Company has a primary and unqualified right to the use of 45,000 acre-feet of storage capacity in American Falls Reservoir. Water is normally drawn from this storage right in the late summer and early fall and used for power generation at the series of plants owned by the company. In addition to its primary right, the Idaho Power Company has a secondary right to 255,000 acre-feet of storage capacity in American Falls Reservoir for capture and utilization of the first 300,000 acre-feet of storable inflow after October 1. Under a "water saving contract" with the United States dated October 1, 1934, the Idaho Power Company, in consideration of the United States' refraining from construction of a power plant at American Falls, agreed to limit the use of water from its primary and secondary storage rights. The contract provides that only water which can be used beneficially at the Shoshone Falls plant will be claimed by the company. The releases for use of the company in any event are not to exceed an amount that will produce the following flows at the head of Shoshone Falls:

Flow (cubic feet per second)	Period
790	Oct. 1 to Nov. 30
870	Dec. 1 to Jan. 31
790	Feb. 1 to Feb. 12
690	Feb. 13 to Mar. 15

The storage releases from American Falls Reservoir which were passed over Milner Dam to meet the above requirements averaged 108,000 acre-feet annually from October 1934 to March 1938, a period during which every effort was made to conserve water. No additional releases are made or required for the other plants below Shoshone Falls which are owned by the Idaho Power Company.

Summary--Lower Snake River Valley

The investigations and studies of water use in the Lower Snake River Valley show that the operation of the canals during the winter requires a considerable release of water from American Falls Reservoir. In years when American Falls does not fill, this release of water during the winter causes a reduction in the quantity of stored water available during the ensuing irrigation season. Winter diversions to any canal below American Falls Reservoir, therefore, cause a loss of irrigation water. There are four projects which now make a practice of diverting water for stock and domestic use during the period from November 1 through March 31. The average winter diversions to these projects for the 1936--1943 period were as follows:

Project	Average Nov.-March Diversion (acre-feet)
South Side Twin Falls	166,000
North Side Twin Falls	139,000
Minidoka	18,000
Gooding	5,000
Total	328,000

Present Water Use

The diversion of 5,000 acre-feet to the Gooding Project is made early in November to fill farm cisterns and should be continued in the future. The remainder of the above winter diversions should be eliminated if a satisfactory supply of domestic and stock water can be provided from some other source at reasonable cost.

In dry years it is most desirable that this water conservation be effected in order to increase the storage in American Falls Reservoir. To be sure of accomplishing this, it will be necessary to eliminate the winter diversions in all years, even those in which American Falls would spill large amounts of water. It is impossible to predict on November 1 what the inflow during the ensuing winter and spring will be and, consequently, it cannot be foretold whether winter diversions will decrease the storage in American Falls Reservoir. Furthermore, with other means of supplying domestic and stock water to all areas, there would be no incentive or need for making winter diversions.

CHAPTER III

PROPOSED WATER CONSERVATION PROGRAM

The investigation and study of present water use disclosed that the present canal diversions in the Henrys Fork Valley could not be curtailed without adversely affecting crop production in that valley and in the Mud Lake Basin. The investigation also disclosed that a large saving of water could be realized by elimination of the winter operation of canals in several areas in the Snake River Valley without adversely affecting crop production on any of the existing irrigation projects. Inasmuch as the canals serving these areas are operated during winter solely to provide domestic, municipal, and stock water, a water supply for these purposes must be provided from some other source before the canals can be shut off. All possible sources of such an alternative supply were investigated in each area in order to determine which was most suitable and could be most capable of economic development. The possible ways and means of providing the alternative water supplies are discussed in the following paragraphs.

UPPER SNAKE RIVER VALLEY

The water saving program in the upper valley should be confined mostly to the elimination of winter operation of canals in the Idaho Falls, New Sweden, and Thomas areas because these are the only areas in which the canal losses are not tributary to the river above American Falls Reservoir. Moreover, these are the only areas into which any appreciable amount of water is diverted during the non-irrigation season.

Idaho Falls Area

A field inventory in 1942 showed that 418 farmsteads in the Idaho Falls Area, or only about 20 percent of all farmsteads, were not equipped with wells and depended entirely on the canals for domestic and stock water. Prior to the war, many new wells were being drilled each year, and the number of farmsteads with adequate well facilities was increasing rapidly. The fact that about 80 percent of the farmsteads have wells indicates that a more satisfactory supply of domestic water can be obtained from wells than from the canals. All of the cities and towns in the area obtain their water supply from wells. The Lincoln and Shelley sugar factories obtain their water supply from canals, however, because of the large volume needed.

The ground water in the Idaho Falls Area is of sufficiently high quality that it is satisfactory for domestic use. The relatively thick mantle of gravelly alluvium covering most of the area acts as a filter which protects the ground water from pollution. From a health standpoint, therefore, the water drawn from wells is far superior to that obtained from open canals. Although relatively hard, its total hardness is less than 250 parts per million, the maximum allowable total hardness of water used for domestic purposes. The following results of analyses of three representative samples of the ground water were furnished by the Union Pacific Railroad:

Location	Total Dissolved Solids (parts per million)	Total Hardness as $CaCO_3$ (parts per million)
Railroad well at Ririe	292	225
Railroad well at Ucon	223	172
Railroad well at Firth	362	280
Average	292	226

The initial cost of drilling a well and equipping it with a pumping system has been the main deterrent to those farmers who have not yet provided their farmsteads with wells. The depth of the 418 wells needed in the Idaho Falls Area averages 125 feet and ranges from about 40 feet near Rigby to about 200 feet in the vicinity of Idaho Falls. If the farm owners employ a local driller and purchase all the necessary pipe and pumping equipment from local hardware stores at retail prices, the total cost of the 418 wells needed in the Idaho Falls Area is estimated as follows:

Item	Cost
Drilling, 52,600 ft. @ $1.50 per ft.	$ 79,000
Casing, 6-inch, 19,300 ft. @ $1.15 per ft.	22,000
Pumping Systems, 418 @ $275 each	115,000
Subtotal	$216,000
Contingencies, 10 percent	21,000
Total, 418 Wells	$237,000
Average Per Well	$ 565

As an indication of the range in total cost per well, a 40-foot well, fully cased, would cost about $260, while a 200-foot well with 50 feet of casing would cost about $700. These cost figures include a complete pumping system and its installation but do not include the piping necessary to carry water to the house and barns. Although these initial costs are a sizeable item in a farm budget, they are believed to be within the means of the average farm owner.

The records of water use in the Idaho Falls Area during the water years of 1943 and 1944 show, as noted, an average loss of 110,000 acre-feet during the winter period from the 1st of November to the 1st of April. Even though all farms were equipped with wells, all of this loss could not be eliminated because the natural flow of Willow Creek will still have to cross the area and surface water should continue to be delivered to the Lincoln and Shelley sugar factories in order to avoid the difficulties and excessive cost involved in developing a new supply. The November--March flow of Willow Creek near Ririe amounted to 15,000 acre-feet in 1943--1944. The loss from the Willow Creek channels below Ririe is estimated to be about 30 percent--about 4,500 acre-feet--during the period from November 1 to April 1. The loss incurred through delivering water to the Lincoln sugar factory by canal from a channel of Willow Creek and from delivering water to the Shelley factory from the river by canal is estimated to be about 3,500 acre-feet. After allowing for these continued losses an average saving of 102,000 acre-feet of water should be obtained each year.

New Sweden Area

Well drilling was in progress on many farms in the New Sweden Area prior to the war, and undoubtedly it will be resumed now that manpower and equipment are becoming available. As a result of the prewar drilling program, only 30 farmsteads in the entire area were not equipped with wells in 1942. This number amounted to only about 8 percent of the total number of farmsteads in the area. There are no towns or sugar factories there.

The depth of the required farm wells averages 170 feet and ranges from 100 feet near Firth to 200 feet near Idaho Falls. Assuming that the 30 required wells will be installed by the farm owners, the total cost is estimated as given on the following page.

Proposed Water Conservation Program

Item	Cost
Drilling, 5,100 ft. @ $1.50 per ft.	$ 7,600
Casing, 6-inch, 1,200 ft. @ $1.15 per ft.	1,400
Pumping Systems, 30 @ $315 each	9,400
Subtotal.	$18,400
Contingencies, 10 percent	1,800
Total , 30 Wells.	$20,000
Average Per Well	$ 670

The free movement of ground water through the broken lava formations beneath the area and the filtering effect of the thick soil mantle insures a satisfactory quality of water in all wells. The ground water has about the same total hardness as that in the Idaho Falls Area and is somewhat softer than canal water. In every respect the well water is considered superior to canal water and this fact undoubtedly accounts for the widespread development of wells in the New Sweden Area.

There is no apparent reason why all of the farmsteads in the New Sweden Area cannot be equipped with wells to supply all domestic and stock water needs. When this goal is reached the canals serving the area can be shut off during the non-irrigation season with a resultant saving of about 16,000 acre-feet of water annually.

Thomas Area

A field survey of the Thomas Area in 1942 showed that all farmsteads were equipped with wells but some did not have adequate stock watering facilities. It is apparent, therefore, that the canals serving this area are operated during winter primarily for convenience in watering livestock. Inasmuch as the records of use showed a loss of about 17,000 acre-feet of water during the non-irrigation season and the Geological Survey ground-water map shows that these losses are not tributary to American Falls Reservoir, it appears advisable to eliminate winter diversions to this area. Sufficient water can be obtained from wells for domestic and stock watering purposes, and its quality is equal to or better than the canal water. The ground water is far less subject to pollution.

Possible Water Savings in Upper Valley

It is concluded that a satisfactory and adequate supply of domestic and stock water for all farms in the Idaho Falls, New Sweden, and Thomas areas in the upper valley can be obtained from wells without placing an excessive burden on farm owners. For this reason it is believed that the owner of every farm in these areas depending on the canals for domestic and stock water should equip his farm with adequate well facilities in order that the canals serving these areas may be shut off during the non-irrigation season. If this goal is realized, the following amounts of water can be saved annually in the valley above American Falls:

Area	Acre-feet
Idaho Falls	102,000
New Sweden	16,000
Thomas	17,000
Total	135,000

Inasmuch as this amount of water could pass down the natural channel of the Snake River without increasing the channel losses, all of it would be available for storage in American Falls Reservoir and could be used for irrigation of land during the summer. It is realized that this saved water cannot be stored in wet years because of inadequate reservoir capacity, but it can be stored in dry years when it is so urgently needed for irrigation of land in existing projects.

The saving of 135,000 acre-feet annually, noted above, is based on shutting off the canals in the Idaho Falls, New Sweden, and Thomas areas during the period from November 1 to March 31, inclusive. No credit has been allowed for the savings that would be obtained in April and October because of the uncertainties involved in fixing the beginning and end of the irrigation season in each year of the period of study. In some years there is a demand for irrigation water from the first week of April until the last week of October, whereas in other years the canal headgates need not be opened until the last week of April and can be closed by the middle of October. In the latter case an appreciable saving of water would be realized in April and October. If all farms are equipped with wells, the April and October diversions to these areas should be held to the minimum required for irrigation in order further to increase the supply of stored water in dry years.

LOWER SNAKE RIVER VALLEY

During dry years the entire flow of the Snake River between American Falls and Milner Dam can be fully controlled by reservoirs, except for the small amount of inflow between the Minidoka and Milner dams. The winter operation of any canal or power plant below American Falls Dam in dry years, therefore, involves the release of water which could otherwise be stored in Lake Walcott or American Falls Reservoir. As all of the water delivered to canals or power plants in the lower valley during the non-irrigation season is lost insofar as irrigation is concerned, it is highly desirable to eliminate this practice wherever possible. The two Twin Falls canals are now operated throughout the winter and water has been delivered to the Minidoka Project in November and December in past years. Water also has been passed over Milner Dam to fill power rights below that point, but this use of water will have to continue until satisfactory arrangements can be made for replacing the firm power produced at those plants.

Minidoka Project

Records of diversions show that an average of 18,000 acre-feet of water was delivered to the Minidoka Project in November and December each year during the period from 1936 to 1943. All of the farmsteads are fully equipped with wells and the project canals have not been operated in January, February, or March for several years. The diversions during November and December were made mainly to facilitate the watering of livestock in the fields during the harvest season. The fact that no diversions were made in November and December of 1942 indicates that the practice could be eliminated in the future without undue hardship.

North Side Twin Falls Project

The results of a field inventory of wells in the North Side Twin Falls Project during 1943 showed that 592 farmsteads did not have wells and depended entirely on the canals for domestic and stock water. The inventory showed, further, that 905 farmsteads, or 60 percent of the total in the project, had adequate well facilities. All of the cities and towns in the project area obtain their water supplies from wells. There are no sugar factories or other industrial establishments that depend on the canals for water.

The ground water in the North Side Twin Falls Project is suitable for domestic use. There has been some pollution of the ground water around the cities and towns in the past when it was common practice to dispose of raw sewage by drilling a hole into the underlying lava until an open crevice was found. Although this practice has been largely curbed, constant vigilance on the part of health authorities will be needed in the future to prevent pollution of wells supplying domestic water to the rural residents of the project. The large volume of ground water that flows freely beneath the project insures adequate yields from all wells without excessive draw-down. Chemical analyses of several representative samples of the ground water show that it is suitable for domestic use. The total dissolved solids and total hardness of the water in five representative wells from which samples were analyzed by the chemists of the Union Pacific Railroad and Geological Survey are shown in the following table:

Location	Total Dissolved Solids (parts per million)	Total Hardness as $CaCO_3$ (parts per million)
Railroad well at Eden	446	238
Railroad well at Jerome	304	170
Well in Sec. 12, T9S, R16E	376	228
Well in Sec. 29, T8S, R15E	279	178
Well in Sec. 31, T6S, R14E	207	150
Average	322	193

The depth of the required wells averages 280 feet and ranges from 480 feet north of Jerome and in the east end of the project to 80 feet in the vicinity of Wendell. If the required wells and pumps are provided by the farm owners at local retail prices, the total cost of the 592 required wells is estimated as follows:

Item	Cost
Drilling, 161,000 ft. @ $1.50 per ft.	$241,000
Casing, 6-inch, 14,000 ft. @ $1.15 per ft.	16,000
Pumping Systems, 592 @ $410 each.	243,000
Subtotal	$500,000
Contingencies, 10 percent	50,000
Total, 592 Wells	$550,000
Average Per Well	$ 930

It is estimated on the above basis that the deepest required well in the project (480 feet) would cost the farm owner about $1,330, including the pumping system, if only 25 feet of casing were needed to reach sound rock. The cost of the pumping system and its installation alone for this depth of well would be about $580. There are many wells of this depth on the project at the present time. The total cost of an 80-foot well with 25 feet of casing would be about $380.

The records of diversions to the North Side Twin Falls Canal from 1936 to 1943 show that an average of 139,000 acre-feet of water has been diverted each winter from November 1 to April 1. If the project farmsteads were fully equipped with wells so that the canal could be shut off during these five winter months, this amount of water would be available for storage in the future, in reservoirs on the river.

South Side Twin Falls Project

The procurement of water of satisfactory quality for domestic use has been an acute problem in the South Side Twin Falls Project since it was first settled. The canal system serving the project has been operated throughout the year ever since water was first turned into it. Two of the cities, one sugar factory, and about half of the farm homes in the project still depend on the canals for their entire supply of water for municipal and household use. Many wells have been drilled in the project, but the quality of the water obtained from almost every well is so poor that it is unsuitable for domestic use. The cities of Twin Falls and Buhl have drilled wells as deep as 1,000 feet in search of better quality of water, but no improvement was found at the greater depths. Both of these cities obtain their water supply from the Twin Falls Canal at the present time. A field survey of the project in 1943 showed that 854 farm homes--34 percent of the total in the project--did not have wells and depended entirely on the canals for domestic water. Many existing wells are used solely for stock watering because the canal water is more desirable for domestic use. In a few cases both well and canal water are used in the house.

A complete chemical analysis was made of one sample of water from each of 43 representative wells distributed evenly at about 3-mile intervals over the 200,000-acre project area. The results of these analyses show that the well waters representing the ground-water supply in the project area are extremely hard. Total hardness computed as $CaCO_3$ ranged from 214 to 600 parts per million. The average was 424 parts per million. Only four of the wells showed a total hardness of less than 310 parts per million. Three of these wells are located in the east end of the project. In all cases except one the hardness of the water is in excess of 250 parts per million, generally considered the maximum desirable for domestic use. The analyses also showed that the concentrations of total dissolved solids range from 468 to 1,340 parts per million. In all cases except one the concentrations were in excess of 500 parts per million, the desirable upper limit prescribed in standards recommended by the United States Public Health Service for drinking water of good chemical quality. Thirteen of the samples showed concentrations in excess of 1,000 parts per million, which is the permissible upper limit prescribed by the Public Health Service for drinking water. After careful study of the results of analyses of the 43 representative samples, it is concluded that the ground water in the project area is not satisfactory for domestic use. Various types of water softening equipment can reduce the total hardness to acceptable limits, but such equipment is not adapted to reducing the concentration of dissolved solids. Because of the stagnant nature of the ground water, the taste is undesirable and in many areas the water is subject to pollution.

Analyses of samples of the canal water show a total hardness of about 213 parts per million and a dissolved solids concentration of 339 parts per million. From a chemical standpoint, therefore, canal water is suitable for domestic use and is far superior to the water obtained from wells in the project. It is subject to pollution at all times, however, and not safe to be drunk without treatment to remove harmful bacteria. The city of Twin Falls filters and chlorinates the canal water, but the city of Buhl only settles and chlorinates it before delivery to the mains. Various methods of treatment of canal water are used in the farm homes, but in many cases they are not adequate to provide safe drinking water at all times.

Because a well program to supply domestic water cannot be recommended for the South Side Twin Falls Project, a satisfactory supply of water for domestic use in the farm homes and for municipal and industrial use must be provided by some other means before the Twin Falls Canal can be shut off during winter. The Bureau of Reclamation has made a thorough study of this problem and has considered every possible means of eliminating the winter operation of the entire canal system or a part of it in order to conserve water for irrigation use. The several plans which were investigated and studied for accomplishing this end are summarized as follows:

(a) Using a gravity supply for impounded Rock Creek water for towns and equipping all farms with wells for stock watering and with cisterns to store sufficient canal water for domestic use during the non-irrigation season.

(b) Pumping water to towns from Blue Lakes, Clear Lake, or some other spring source in the Snake River Canyon, and supplying the farms as in (a) above.

(c) Piping water to the farms and towns from the main canal.

(d) Piping water to the farms and towns from Milner Reservoir.

(e) Piping water to the farms and towns from Murtaugh Lake.

(f) Piping water to the farms and towns from Crockett Reservoir, south of the project, using Rock Creek water supplemented by Murtaugh Lake water when flow in Rock Creek is inadequate.

After a preliminary analysis and cost estimate was made of each of the above plans, more detailed investigative work and studies were made of the last three which preliminary work had shown to be most practical and desirable. All three of these plans, designated as A, B, and C, would provide piped water supplies under pressure with the water fully treated and sterilized. The three selected supply plans with the one distribution system common to all are shown on the general map entitled "Twin Falls Domestic Water System" following page 73. A brief description of each supply plan is given below.

Plan A

The source of supply under Plan A is Milner Reservoir. This would require the construction of a treating plant at Milner Dam; two pump lines from the dam to a point near the northeast corner of Section 15, Township 11 South, Range 19 East; a clearwater reservoir in the northeast quarter of Section 15; and two gravity flow lines from the reservoir to a connection with the distribution system. All pipe lines would be installed under the ground surface at a depth sufficient to prevent freezing.

Plan B

The source under Plan B is Murtaugh Lake, which is fed by the South Side Twin Falls Canal diverting at Milner Dam. Sufficient water would be stored in the top 10 feet of the lake at the end of the irrigation season to meet the anticipated requirement of the domestic water system during the winter months. If necessary, the lake storage would be replenished by a short run of the canal during late winter. The plan contemplates the construction of a treating plant at Murtaugh Lake; two pump lines from the treating plant to a point near the northeast corner of Section 15, Township 11 South, Range 19 East; a clearwater reservoir in the northeast quarter of Section 15; and two gravity flow lines from the reservoir to a connection with the distribution system.

Plan C

The source of supply under Plan C is water from Rock Creek impounded in Crockett Reservoir. This supply would be supplemented by water pumped from Murtaugh Lake during periods of low flow in the creek.

Rock Creek is considered a desirable source because its waters have a total dissolved solids concentration of only 145 parts per million and a total hardness of only 80 parts per million. This plan provides for use of the entire creek flow in the domestic water system by delivering Snake River water to all lands having irrigation rights on Rock Creek. Even with this full exchange, however, the flow of Rock Creek would not have been sufficient to supply the requirements of the domestic water system in several past years. In order to deliver water from Murtaugh Lake to 2,670 acres of land irrigated from Rock Creek above the Twin Falls Canal and to deliver a supplemental supply of domestic water to the Crockett Reservoir on Rock Creek, construction would be required of a pumping plant (No. 1) at Murtaugh Lake; a pump line from pumping plant No. 1 to a point in the northeast quarter of Section 1, T 12 S, R 18 E; a pumping plant (No. 2) in the northeast quarter of Section 1; a pump line from pumping plant No. 2 to Crockett Reservoir; an 85-foot, earth-fill dam to provide 6,000 acre-feet of live storage space in Crockett Reservoir; a treating plant and a clearwater reservoir near the dam; and two gravity flow lines from the clearwater reservoir to a connection with the distribution system.

Three sets of estimates covering the cost of the distribution system in combination with each of the three selected plans for the supply system were prepared. The bases of these estimates are discussed in the following paragraphs.

Water Requirements

Each of the three plans considered consists of a supply system and a distribution system designed to serve the estimated population at the end of 40 years. This population was estimated by assuming an increase of 100 percent in urban population, and an increase of 25 percent in the number of farm homes to be served. These assumptions were based upon a study of population trends in the area to be served as well as upon trends in similarly located areas. Estimates of the total amount of water required are based on data available regarding present monthly water consumption in the towns and also on records of monthly water consumption on several typical farms as indicated by meter readings taken over a period of several months. After a study of all available material, water requirements exclusive of leakage and wash water used at the treating plant were estimated as given on the following page.

Month	Estimated Water Consumption		
	Towns (gals. per day)	Farms (gals. per day)	Sugar Factory (gals. per month)
	Per Capita	Per Farm	
January	192	1,110	0
February	181	1,060	0
March	183	1,020	0
April	210	700	0
May	278	830	0
June	358	940	0
July	414	930	0
August	392	930	0
September	284	850	0
October	207	700	30,000,000
November	183	970	30,000,000
December	170	970	30,000,000

The peak-day water consumption in towns and the peak-day and peak-hour consumptions on farms were estimated, for the purpose of establishing pipe sizes, as follows:

> In towns, the peak-day consumption per capita was assumed as 130 percent of the maximum average daily consumption shown above.
>
> On farms, the peak-day consumption per farm was assumed as 140 percent of the maximum average daily consumption shown; and the peak-hour consumption was assumed as 150 percent of the peak-day consumption.

Pipe sizes in the distribution system were, in general, proportioned to carry the estimated peak-hour rate of consumption, including leakage, to the farms. The required peak capacity of the supply system was estimated on the assumption that each of the towns to be served will provide and maintain storage facilities having a capacity equal to its peak-day consumption, provide and maintain its own distribution system. It was assumed, further, that each town will fill its storage tank or reservoir at times that will not interfere with delivery of water to farm homes during periods of maximum consumption.

The table below shows the estimated storage capacities in gallons required for each town.

Town	Population		Storage Available	Additional Storage Required	
	First Year	40th Year		First Year	40th Year
Castleford	300	600	0	165,000	340,000
Buhl	2,414	4,900	3,000,000	0	0
Filer	1,239	2,500	150,000	520,000	1,200,000
Twin Falls	11,851	23,700	5,000,000	1,400,000	7,800,000
Kimberly	963	2,000	59,000	461,000	1,041,000
Hansen	527	1,100	30,000	255,000	570,000
Total	17,294	34,800	8,239,000	2,801,000	10,951,000

Distribution System

As the area to be covered by the distribution system slopes toward the Snake River with differences in elevation of as much as 1,000 feet, the system was divided into six pressure zones in order to equalize pressures insofar as possible. Boundaries between adjacent zones follow in general the contour lines at elevations 3,075; 3,275; 3,475; 3,675; and 3,875 feet above sea level. Slight modifications of these boundaries were made in some areas to avoid numerous crossings of canals by secondary mains. Where crossings of creeks and canals are contemplated, it is assumed that the water mains will be supported on bridges where practicable. The estimates are based on a distribution system substantially as shown on the general map following page 73. The regulating tank indicated near Clover City on the map would have a capacity of 350,000 gallons. This tank will be needed to equalize pressures and take care of fluctuations in demand. Final studies may indicate the desirability of providing several regulating tanks of various capacities in the distribution system.

The maximum static pressure in any individual zone would be limited to approximately 125 pounds per square inch by means of pressure regulators. Any commercial water pipe of the 125-pound or 150-pound class would meet this pressure requirement. All pipes are to be buried at a sufficient depth below the ground surface to prevent freezing. Soil conditions in the area might make the use of some types of pipe impracticable, but information upon which to base an opinion regarding the proper type of pipe to use in this territory is not available at this time. It is assumed, however, that the following types of pipe would meet the requirements: welded steel pipe with spun enamel lining on the inside and enamel-coated asbestos wrapping on the outside; cast iron pipe, class 150; asbestos-cement pipe, class 150; or concrete pressure pipe. Costs of these various types of pipe were obtained from manufacturers and from office cost records. The use of concrete pressure pipe for the 48-inch and 36-inch sizes and asbestos-cement pipe with cast-iron fittings for all sizes 24-inch and smaller appears to be the most economical combination. If it should be found that asbestos-cement pipe would not meet the requirements imposed by unfavorable soil or other conditions, cast-iron pipe could be substituted with little change in the cost estimate.

The estimate includes a service tap, meter, and meter box for each of the anticipated 3,130 agricultural customers. It is proposed that water mains be laid only along section lines, public highways, or along secondary public roads serving property which has no frontage on a section line or a public highway. Where the mains cannot be laid within the limits of the right-of-way of public roads or highways, it would be necessary to secure easements from the adjacent property owners. It is assumed that the meters will be placed either at the customer's property line nearest the main if the main is located on a public highway or road, or at the edge of the proposed water district's right-of-way where mains parallel the public highways, secondary roads, or section lines.

Costs

A summary of the estimated costs of construction and operation together with the average cost of water delivered for each of the three plans is shown in the following table:

Plan	Total Construction Cost	Repayment, Operation and Maintenance Costs for First 40-year Period		Average Cost Per 1,000 Gallons During First 40 Years	
		Without Softening	With Softening	Without Softening	With Softening
A	$15,470,000	$23,090,000	$25,855,000	$ 0.167	$ 0.187
B	14,070,000	20,950,000	23,685,000	0.151	0.171
C	16,050,000	22,225,000	24,025,000	0.161	0.174

Estimates of the cost of construction shown above were based on prices prevailing in 1946. The estimates of repayment of construction costs are based on a proposal to finance the water system under the Reclamation Act, on a 40-year repayment contract without interest. The construction costs would be underwritten by a domestic water district, the organization of which is recommended. Interest-free financing is necessary in order to provide a satisfactory water supply at a cost which the prospective consumers in the area to be served can afford. As Snake River water has a total hardness of about 225 parts per million--considerably above the desired hardness for domestic use--the estimates cover the cost of treated water with and without softening in the central treating plant. Softening of the water, however, would be optional. While any plan selected would be subject to further revisions, the estimates which have been made are believed to be as accurate as any which could be prepared at this time without incurring unreasonable expense.

It will be noted in the table above that Plan B has the lowest construction cost, approximately the same operating cost as Plan C, and an operating cost considerably below that of Plan A. Under either Plan B or C water could be delivered at rates comparing favorably with prevailing water rates in a number of cities in various parts of the United States. As Plan B involves the smallest investment and is without the uncertainties of Plan C, its adoption is recommended as a basis for further investigation and final estimates.

The break-down of the estimated costs for Plan B is as follows:

Construction Costs

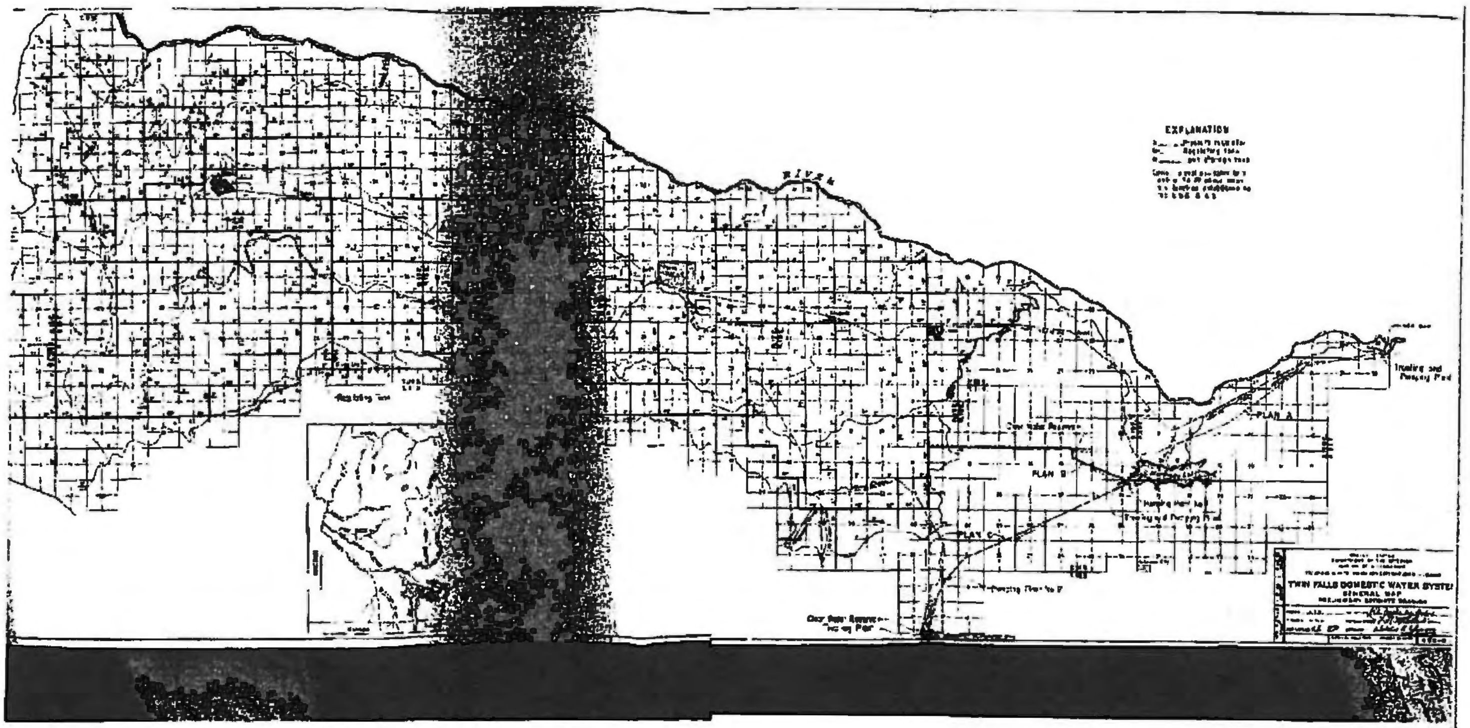
Feature	Initial Installation	Future Additions	Total Cost
Treating and Pumping Plant	$ 1,100,000	$ 270,000	$ 1,370,000
Supply Conduits from Murtaugh Lake to Connection with Distribution System	800,000	500,000	1,300,000
Distribution System	11,400,000	-	11,400,000
Totals	$13,300,000	$ 770,000	$14,070,000

Repayment, Operation and Maintenance Costs
(First 40-Year Period)

Item	Cost
Repayment of Construction Cost	$14,070,000
Administration	1,500,000
Raw Water Pumpage	130,000
Filtered Water Pumpage	680,000
Purification	1,940,000
Maintenance	2,600,000
Sub-Total	$20,920,000
Softening	2,765,000
Total	$23,685,000

Average Cost Per Year	$592,125
Average Cost Per 1,000 Gals., Delivered, Softened	$0.171
Average Cost Per 1,000 Gals., Delivered, Unsoftened	$0.151

The treating plant would consist of a pumping station, and aerators, mixing tanks, clarifiers, settling basins, rapid sand filters, a filter control gallery, and a wash-water tank. The initial installation would provide facilities for filtering and chlorinating 14,300,000 gallons of water per day. Softening of the same quantity of water could also be handled by the same plant with the addition of minor equipment. Contemplated future additions, to keep pace with the anticipated increase in consumers, would increase the capacity of the plant gradually to 20,000,000 gallons per day. The initial pump line installation would consist of one 26-inch pipe having an estimated capacity of 16 cubic feet per second. A contemplated future addition would consist of a second 26-inch pipe, making a total capacity of 32 cubic feet per second. The clear water reservoir would have an initial capacity of 5,000,000 gallons. Contemplated future additions to be provided as required would increase the capacity to 7,000,000 gallons. The initial gravity line installation would consist of one 36-inch pipe having an estimated capacity of 16 cubic feet per second. A contemplated future addition would consist of a second 36-inch pipe, making a total estimated capacity of 32 cubic feet per second.



EXPLANATION
RIVER
PLAN A
PLAN B
PLAN C
Regulating Tank
TWIN FALLS DOMESTIC WATER SYSTEM
GENERAL MAP

Water Rates

Adoption of a final rate schedule should be deferred at least until after the preparation of final estimates of construction and operating costs, and preferably until the unit costs that will prevail during the actual construction period can be forecast with a reasonable degree of accuracy. It is possible at this time, however, to set up a tentative schedule predicated upon the preliminary cost estimates which have been made. For the purpose of establishing such a tentative water-rate schedule, estimated average operating costs during the first 40-year period of operation have been used. It appears, however, that any rates adopted should include a differential between the rate for water delivered to towns and distributed to consumers through municipally owned distribution systems and the rate for water delivered to the farms. It is felt that such a differential should be equal to the operating costs incurred by the municipalities, including legitimate charges for financing the investment, depreciation, and miscellaneous expenses. It also seems logical that these costs should be based on reasonable anticipated valuations at the end of the first 40-year period of operation in view of the fact that other estimated operating costs have been based on estimated total investments at the end of the 40-year period. Information upon which to base such estimates is very meager, but it is felt that a differential of about four cents per 1,000 gallons would be fair to all concerned.

The large difference between the amount of water used per customer on the farms and the amount delivered to each town makes it possible to adopt a single schedule of rates with a sliding scale so that the charge for water delivered to the town reservoirs will average about four cents per 1,000 gallons less than the amount charged the farmer. Such a schedule, for completely treated and softened water, might be set up as follows:

Gallons Used Per Month	Cost Per 1,000 Gallons
First 10,000	$ 0.22
Next 10,000	0.20
Next 10,000	0.18
All Over 30,000	0.16

Minimum Charge--$2.00 Per Month Per Meter.

The estimated revenue which these rates would produce during the entire first 40-year period of operation is shown in Table 1.

TABLE 1

ESTIMATED REVENUES, TWIN FALLS DOMESTIC WATER SYSTEM

	First Year			Fortieth Year			Average Revenue Per Year	Revenue 40-Year Period
	Thousands of Gals. Delivered	Rate Per 1,000 Gals.	Revenue	Thousands of Gals. Delivered	Rate Per 1,000 Gals.	Revenue		
To Towns		$	$		$	$		
	720	0.22	158	720	0.22	158		
	720	0.20	144	720	0.20	144		
	720	0.18	130	720	0.18	130		
	1,606,740	0.16	257,078	3,235,340	0.16	517,654		
Totals	-	-	$257,510	-	-	$518,086	$ 387,798	$15,511,920
Average Per 1,000 Gallons			-	-	-	-	-	$ 0.16004
To Farms		$	$		$	$		
	300,480	0.22	66,106	375,600	0.22	82,632		
	300,480	0.20	60,096	375,600	0.20	75,120		
	237,140	0.18	42,685	296,300	0.18	53,334		
	-	0.16	-	-	0.16	-		
Totals		-	$168,887	-	-	$211,086	$ 189,986	$ 7,599,440
Average Per 1,000 Gallons			-	-	-	-	-	$ 0.20151
To Sugar Factory (3 months operation per year)								
	30	$ 0.22	$ 7	30	$ 0.22	$ 7		
	30	0.20	6	30	0.20	6		
	30	0.18	5	30	0.18	5		
	89,910	0.16	14,386	89,910	0.16	14,386		
Totals		-	$ 14,404	-	-	$ 14,404	$ 14,404	$ 576,160
Average Per 1,000 Gallons			-	-	-	-	-	$ 0.16004

Estimated Total Revenue During 40-Year Period $23,687,520

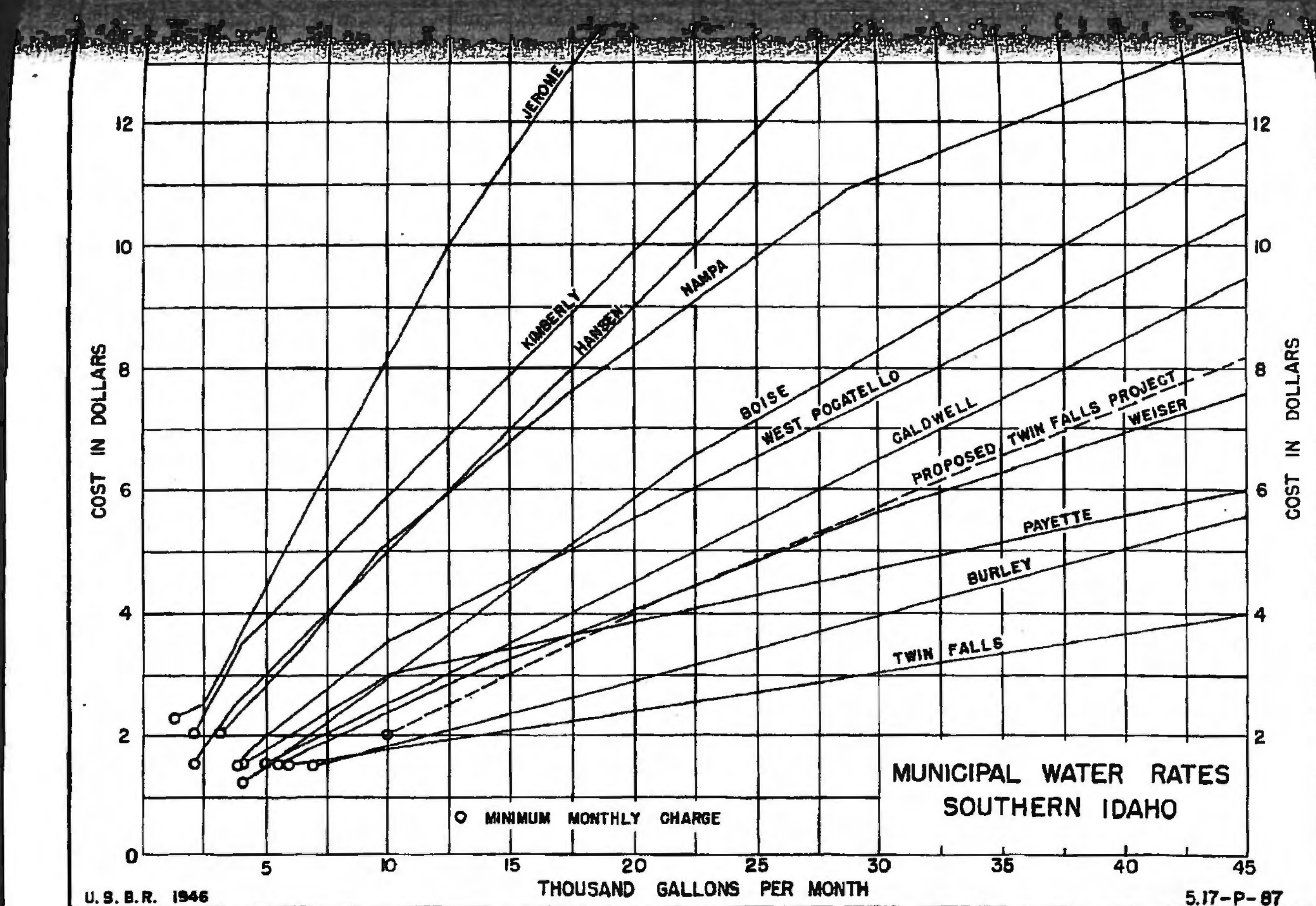
The estimated average monthly cost per farm home, based on the rates shown above, is $5.60. As the responsibility for fixing municipal rates preferably should be left to the administration of each town, the cost of water delivered to the individual town consumers would depend on the rates prevailing in the towns. The rates fixed by the towns would have to provide sufficient revenue to pay the domestic water district for water delivered at the town reservoirs and to cover the cost of operation and maintenance of their distribution systems.

In considering the total cost of water to the farmers, it should be borne in mind that about 37 percent of the water used on the farms (amounting to about 9 percent of the total amount supplied to both farms and towns) is used for the watering of livestock. As the raising of livestock must be considered a business with definite financial returns, the cost of the portion of the water used by livestock should be deducted from the total cost of all water used in order to arrive at a fair estimate of the cost to farmers for domestic water. If this were done, the estimated average monthly charge to the individual farm home for strictly domestic water would be reduced to approximately $3.55 and $3.20 for softened and unsoftened water respectively.

A comparison of the tentative schedule of rates with prevailing municipal water rates demonstrates the feasibility of the project from the standpoint of water costs to consumers. The following figures showing typical water rates per 1,000 gallons for the first 15,000 gallons of water used per month were published by Barcus, Kindred and Co. in 1942. All the 15 representative American cities listed have municipally owned water plants.

City	Rate Per 1,000 Gals.	City	Rate Per 1,000 Gals.
Jersey City, N.J.	$0.12	Minneapolis, Minn.	$0.171
Oakland, Calif.	0.294	Buffalo, N.Y.	0.187
Portland, Ore.	0.167	Milwaukee, Wisc.	0.09
Columbia, Mo.	0.216	Pittsburgh, Pa.	0.196
Denver, Colo.	0.171	Boston, Mass.	0.246
Rochester, N.Y.	0.18	Los Angeles, Calif.	0.198
Houston, Tex.	0.19	New York, N.Y.	0.201
Kansas City, Mo.	0.227		

The figures show a minimum rate of $0.09 and a maximum rate of $0.294, the average being $0.19 for the 15 cities. This compares with an average rate of $0.21 for the first 15,000 gallons per month in the proposed Twin Falls system. The accompanying chart, "Municipal Water Rates, Southern Idaho", shows a comparison of the suggested rate schedule for the proposed Twin Falls system with those prevailing in several towns and cities in southern Idaho.



MUNICIPAL WATER RATES
SOUTHERN IDAHO
○ MINIMUM MONTHLY CHARGE
COST IN DOLLARS
THOUSAND GALLONS PER MONTH
JEROME
KIMBERLY
HANSEN
NAMPA
BOISE
WEST POCATELLO
CALDWELL
PROPOSED TWIN FALLS PROJECT
WEISER
PAYETTE
BURLEY
TWIN FALLS
0
2
4
6
8
10
12
5
10
15
20
25
30
35
40
45
U.S.B.R. 1946
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The average rate of $0.21 for the first 15,000 gallons per month in the proposed Twin Falls system rate schedule is based on water completely treated and softened. It is not known to what extent the water is treated in the cities named on the preceding page. The treatment no doubt varies widely from city to city in order to suit the quality of the water supply. If it is assumed that softening is not used at most of the plants, the Twin Falls rates may be reduced by about 10 percent to provide a better comparison with the above municipal rates. The reduced rates would then be as follows:

Gallons Used Per Month	Rate Per 1,000 Gals.
First 10,000	$0.20
Next 10,000	0.18
Next 10,000	0.16
All Over 30,000	0.14

The rate for the first 15,000 gallons would be $0.19 per 1,000 gallons--identical with the average rate for the 15 cities listed on the preceding page. Considering, however, the much lower density of population in the farm area of the Twin Falls Project, the resulting long pipe runs between customers, and the necessary increase in the sizes of secondary mains to offset the greater friction losses, the above rate is not unreasonable. From the standpoint of water cost alone the project appears to be feasible even though the benefits to be derived from the conservation of irrigation water are not taken into consideration.

Water Softening

The water to be delivered may be softened either individually by each farm and town customer, in plants provided by each town, or in a central treating plant. Snake River water, having an average hardness of 225 parts per million, is not suitable for efficient domestic use. Softening the water down to 100—125 parts per million would reduce soap consumption, increase the life of washable fabrics, and decrease the cost of operating boilers, water heaters, and other equipment. A saving of from $1.00 to $2.00 per capita per year is apparent from the various investigations made on the subject. In addition to these savings, softening, if done prior to filtration, will increase the efficiency of filtration; help to preserve color; facilitate the removal of iron and bacteria; and produce a noncorrosive water. Because of the beneficial effects in filtration and the lower cost of operation, it would be preferable to soften all the water in a central treating plant rather than with individual zeolite softeners in each home or in separate plants by each town. It is understood that the present cost of operation of individual softeners is $2.00 per month. As the number of customers during the first year of operation is estimated at 5,310 in the towns and 2,504 on the farms, with an anticipated increase to 10,620 and 3,130, respectively, at the end of the first 40-year period of operation, the average number of customers would be about 10,780. Based on this estimate, the mean annual cost of operating zeolite softeners is estimated at $258,720. In comparison, the estimated mean annual cost of central softening under Plan B, as shown previously, would be only $69,125, or 26.7 percent of the cost of individual softening. It is recommended, therefore, that the entire water supply be softened in the central treating plant to reduce costs and to provide full, efficient laboratory control of filtration, sterilization, and softening operations.

Benefits

It has been noted that the water now being used for domestic purposes in some of the towns and in many of the farm homes does not meet the requirements of modern health standards. There is, consequently, a great need for a water supply and distribution system that will provide an adequate quantity of water free from disease-producing bacteria. The primary benefits of such a system would be the saving of about 152,000 acre-feet of water annually for irrigation use in dry years. In addition, a number of incidental benefits and advantages would be derived by the farmers in the Twin Falls Project from construction of such a domestic water system. These benefits may be summarized as follows:

1. By eliminating winter operation of the Twin Falls main canal the firm yield of the storage owned in American Falls Reservoir by irrigators of the South Side Twin Falls Project would be increased in dry years.

2. Irrigators of the Twin Falls tract would be relieved of the present cost of operating their canal system during the non-irrigation season.

3. Considerable reduction in drainage cost would result from reducing further water-logging of land by keeping the canal system empty during the non-irrigation season.

4. Water delivered through buried pipes would be warmer during winter than water in open canals. The warmer water would be beneficial to livestock. Stockmen have long recognized the value of taking the chill from ice-water for livestock use, and some have heated water or installed wells for this specific purpose.

5. As domestic water would be supplied to the farms at a minimum pressure of 40 pounds per square inch, it would be possible for all farm homes to have modern plumbing, sanitary

facilities, water supply for lawn sprinkling, and better fire protection. This protection would tend to reduce present insurance rates.

6. In contrast to the present unsafe domestic water supply, which is always subject to pollution, the proposed piped water system would provide a safe, potable water. It would protect the consumers against water-borne diseases and at the same time provide clear, odorless water.

7. By softening the present hard water to 100 or 125 parts per million, the various benefits discussed under "Water Softening" will be realized.

8. A good domestic water system would provide the finishing touch to the South Side Twin Falls Project, which now enjoys a dependable and low cost irrigation supply on land of the highest productivity.

Water consumers in the towns would realize the greatest benefit from the delivery of soft water. Aside from the benefits derived in each home, soft water would attract new industries to the towns, inasmuch as its use would be advantageous in many industrial processes. Moreover, the flow of water in buried pipes is less subject to interruption than the flow through open canals, especially in the winter months. As a result, the water supply for towns such as Twin Falls and Buhl, where canal water is now used, would be far more dependable than their present source. Supply mains of sufficient capacity would be provided to meet the requirements of the estimated population of the towns 40 years hence. The proposed water system would provide for purification and softening operations in a central treating plant. This would be more efficient and economical than treatment and softening in separate plants by each town or softening by each individual consumer. Through saving water for irrigation use in the Snake River Valley, the system would increase the prosperity of the valley as a whole. A substantial portion of this benefit would accrue to the Twin Falls Area and its business center, the city of Twin Falls.

Administration and Repayment

The construction, operation, and maintenance of such an extensive water system presents special problems of administration and repayment. Trained personnel will be required to operate, maintain, and administer the system; and its financing presents problems as to the most suitable type of organization.

The organization to do the financing job adequately would appear to need, among others, these authorities: (1) to embrace within its jurisdiction all of the rural areas which are to be served by the domestic water system; (2) to enter into obligations in connection with the construction and operation and maintenance of the system, including particularly the authority to enter into a long-term contract with the United States for the repayment of the construction cost of the system; (3) to provide domestic water service to the lands within the jurisdiction of the organization and to contract to supply domestic water to persons and other entities, including municipal corporations, not within its jurisdiction; and (4) to fix charges for water service adequate to meet its construction and operation and maintenance obligation and in general to provide efficient and effective service. These authorities probably would need to be coupled with some power to levy and collect assessments against the benefited properties within its jurisdiction whether or not water is used.

Consideration has been given to the kind of organization required to meet these problems. The existing organization in the area is the Twin Falls Canal Company, a corporation created under the general corporation laws of the State of Idaho, but having special statutory powers in common with other Carey Act operating companies. A preliminary examination of the Company's charter and of the special statutes under which it operates leads to the conclusion that before it could do the financing job adequately its charter would have to be amended. It appears likely also that its special statutory powers would have to be modified and extended.

There is no irrigation district now serving the area. Even if there were, it is not believed that such districts have the requisite authority under the existing statutes to meet the problems that would be involved.

It would appear that another kind of organization suited to the job would be a special domestic water district having powers such as those outlined above. There is at present, however, no statutory authority in Idaho for the creation of such a district. It is proposed, therefore, that further study be made and that a draft of statute be prepared for discussion with the local interests, to the end of having a draft of a bill ready for presentation to the 1947 session of the Idaho Legislature.

Possible Water Savings in Lower Valley

By equipping all farms in the North Side Twin Falls Project with adequate well facilities to supply domestic and stock water and by constructing the proposed pipe-line system to supply municipal, domestic, and stock water to the towns and farms in the South Side Twin Falls Project, it would be possible to shut off the canals serving these projects during the non-irrigation season.

The canals serving the Minidoka Project can be shut off at the end of the irrigation season because all farms and towns in that project are already equipped with wells. The records of water use on these three projects show the following average annual non-irrigation season diversions during the period from 1936 to 1943, inclusive:

Project	Acre-feet
Minidoka	18,000
North Side Twin Falls	139,000
South Side Twin Falls	166,000
Total	323,000

All of this water could not have been stored in Lake Walcott and American Falls Reservoir, however, because 5,000 acre-feet of water would have been needed during the five winter months to supply the domestic water system for the South Side Twin Falls Project. Moreover, the release of stored water over Milner Dam would have had to be increased to fill the power rights at Shoshone Falls. This additional water would have been needed to offset the reduction in river gains between Minidoka Dam and Shoshone Falls resulting from shutting off the canals during winter. A monthly comparison of the estimated river gains assuming all canals shut off during the winter months with the past river gains and the monthly power requirements at Shoshone Falls showed that the releases of stored water past Milner Dam would have had to be increased by about 18,000 acre-feet annually during the eight-year period from 1936 to 1943. After allowing for these increased power releases and for domestic water for the South Side Twin Falls Project during winter, the net saving of water during the 1936—1943 period would have averaged 300,000 acre-feet annually. Hence, this amount of water would have been available for storage in reservoirs in those years.

SUMMARY OF WATER CONSERVATION PROGRAM

It appears that the well-drilling programs for the Idaho Falls and New Sweden areas in the upper valley and for the North Side Twin Falls Project in the lower valley will provide a satisfactory and adequate supply of domestic and stock water for the farms in those areas. From a health standpoint it will be far superior to that now obtained from open canals. Moreover, water drawn from wells is better for watering livestock during winter because it is warmer than canal water. Although the cost of the deeper wells is appreciable, it is believed that it would not be an excessive financial burden on the farm owner under normal economic conditions. This is evidenced by the fact that wells of comparable depth have been provided by many farm owners in the same areas. In justice to the many farm owners in these same areas who have already equipped their farms with wells, it appears that the remaining needed wells should be provided by the farm owners at their own expense. The desirability of wells and the need for conserving water for irrigation use in dry years should be sufficient inducement and justification for the individuals to shoulder this burden.

The investigation and study of the domestic water problem in the South Side Twin Falls Project has clearly demonstrated that a well program cannot be recommended for that project because of the bad quality of the ground water in that area. A supply of treated and softened water, however, could be delivered by a pipe system to all farms and towns in the project at a reasonable cost providing the construction cost were financed on an interest-free basis. When the merits of such a water supply are compared with those of the supply now available for domestic and municipal use in the project, it appears that the proposed water system would be a desirable asset well worth its cost. The saving of irrigation water resulting from construction of the proposed water system for this project should justify financing its construction cost under the Reclamation Act without interest.

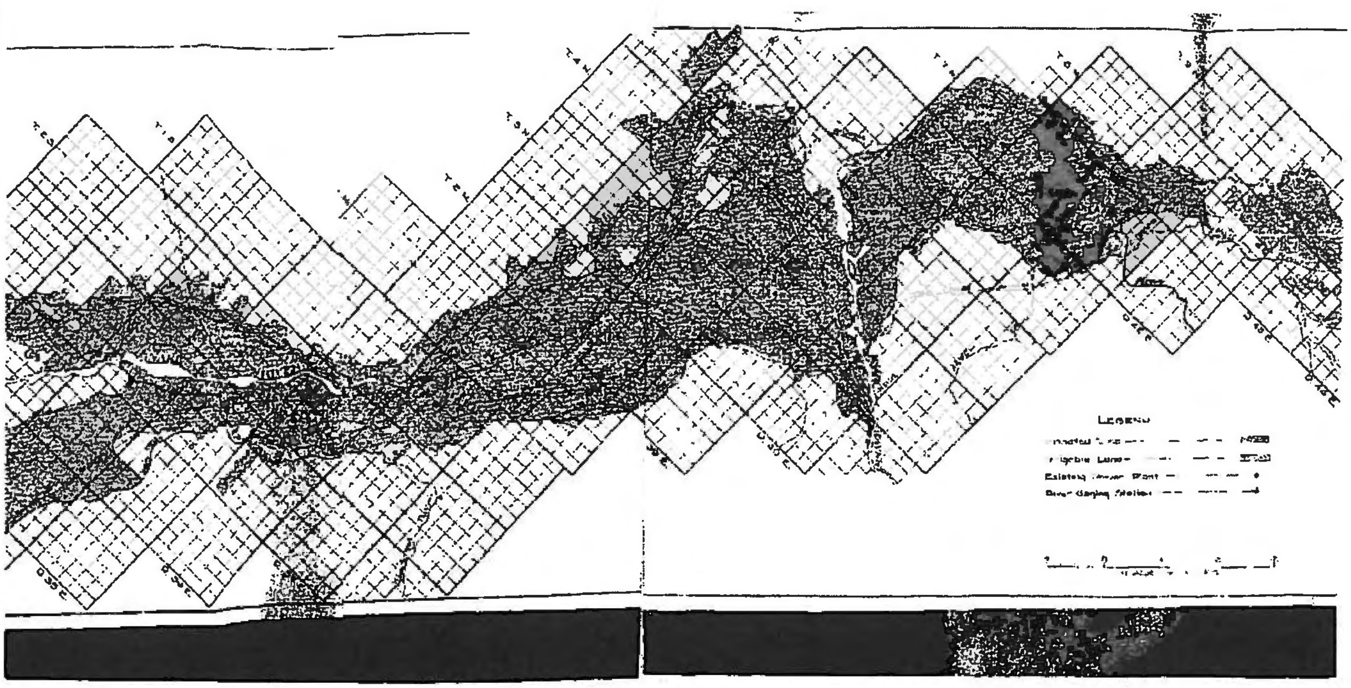
If the full water conservation program outlined herein is accomplished, the following average amounts of water could be saved annually for irrigation use:

Area	Acre-feet
Upper Valley	135,000
Lower Valley	300,000
Total	435,000

In dry years, when this conserved water could be stored in reservoirs, there would be only periodic releases from American Falls Reservoir and Lake Walcott during the non-irrigation season. This would result in the loss of the present firm power production during winter by the power plants at American Falls and Minidoka dams. It is estimated that this firm power production has averaged about 5,700 kilowatts during recent years. About 21,000,000 kilowatt-hours have been produced by the two plants during the five-month period from the first of November to the end of March, assuming a base flow of 1,000 cubic feet per second and an efficiency of 65 percent for the Minidoka plant and 75 percent for the American Falls plant. A uniform release of about 100 cubic feet per second from American Falls Reservoir could be maintained during the non-irrigation season to replenish storage in Lake Walcott not filled by inflow below American Falls. However, the value of such a small release for power production with the existing generating equipment in the American Falls plant is questionable.

The possibility of conserving water during the irrigation season by lining of canals also was considered during the investigation. It was concluded, however, that the present cost of water developed by this means, using the conventional types of lining available, would be greater than that for water developed by storage in Palisades Reservoir, if in each case the water were used to reduce shortages on existing projects in dry years. The operation of the reservoirs and the amount of water available for storage in them would not be appreciably affected if water conserved by canal lining were used for development of new land. The water thus conserved could be applied directly to new land with little or no further regulation.

The conservation of water during the irrigation season by lining of canals offers real possibilities for development of additional land in the valley in the future, especially if an inexpensive type of lining can be developed. The Bureau of Reclamation and the manufacturers of various lining materials are now conducting experiments to develop a less expensive type than those now in use. It is entirely possible that research along these lines will prove fruitful in the future. A very large amount of water could be saved by canal lining. About 5,000,000 acre-feet, or about 6.5 acre-feet per acre, are diverted each irrigation season to 775,000 acres of presently developed land in areas where the ground-water movement is not tributary to the river above Milner Dam. Measurements of diversions to and from deliveries from several of the canal systems serving these non-tributary areas show that the canal losses range from 20 to 40 percent. Measurements of losses from the Gooding Canal in 1943 showed that only 67 percent of the water diverted from the river was delivered at mile 56, where the first turnout is made from the main canal. It seems reasonable to assume, therefore, that at least 20 percent, or about 1,000,000 acre-feet, could be saved by lining the main canals and most of the laterals serving the existing projects in areas where the ground-water movement is not tributary to the river. If this amount of water were delivered to new land through lined canals, it should be sufficient to irrigate about 250,000 acres. Although many legal, financial, and administrative problems would be encountered in such a development program, it appears that these obstacles must be overcome if the future demands for more irrigated land in the Snake River Valley are to be met. Such a program, however, is beyond the scope of this report.


LEGEND

CHAPTER IV

PLANS FOR FUTURE DEVELOPMENT

The drought during the period from 1930 to 1936 caused serious shortages of irrigation water in the Snake River Valley and brought requests for additional storage facilities from practically all water users' organizations. The four storage reservoirs, with a combined capacity of 2,700,000 acre-feet, which were in operation during that period, averted what otherwise would have been a catastrophe. They failed, however, to provide enough late season water to mature all crops. The annual run-off at Heise dropped to an all-time low of 2,800,000 acre-feet in 1934, or only about 60 percent of the long-time average. As noted in Chapter I, the Bureau of Reclamation started an investigation in 1932 of all possible reservoir sites on the river which might be developed to provide a supplemental supply of hold-over storage water to protect the existing projects against a severe water shortage resulting from another drouth period. These investigations have been carried on intermittently since 1932 and have resulted in the construction of the Island Park and Grassy Lake reservoirs in the Henrys Fork watershed and in the selection of the Palisades reservoir site as the most promising storage development on the Snake River. The latter is now proposed for construction as a multiple-purpose project to provide stored water for irrigation use, to control floods, and to generate hydroelectric power. A power plant with an installed capacity of 30,000 kilowatts would be constructed at the dam. Reports have been published by the Bureau of Reclamation and the Corps of Engineers in House Document Nos. 457 and 452, respectively, of the 77th Congress, first session, on the planning of Palisades Reservoir and the allocation of its construction cost to the various features involved. This reservoir, with a live storage capacity of 1,277,000 acre-feet, will be the key unit in any and all plans for additional irrigation development in the Snake River Valley in the near future.

An important item that must be considered in any plan for further irrigation development is the disposal of the 433,000 acre-feet of unsold space in American Falls Reservoir. This 433,000 acre-feet of reserved space was first leased to the existing projects in the area in 1931 when a serious shortage of stored water occurred, and those projects have continued to lease and utilize this space since that time. Because of its relatively high firm yield, the use of this space proved a life saver to those projects in 1931, 1934, and 1935; they have drawn a considerable amount of water from it in most years since 1931. In view of the serious water shortages that occurred on practically all of those projects during the drought period from 1930 to 1936--even with full use of the reserved space--it is apparent that the yield of the reserved space should not be used for irrigation of new land until additional hold-over storage space is developed on the river.

The construction of the proposed Palisades Reservoir and the adoption of the water conservation program proposed herein would greatly increase the supply of stored water on the river in all except a series of extremely dry years. Since it is assumed that the Palisades Reservoir will be operated in accordance with state water laws, no water would accrue to its storage right in extremely dry years when the American Falls Reservoir storage right is not filled. Such a condition would have occurred in 1934 and 1935, even though the full water conservation program were in effect with 435,000 acre-feet of water being made available for storage by elimination of winter diversions. In such years the projects owning space in Palisades Reservoir would receive only the hold-over storage they had accumulated in previous years. On the other hand, the water conservation program will increase the yield of American Falls Reservoir, even in the driest years. The Palisades Reservoir, therefore, would be essentially a hold-over reservoir, best suited to providing a supplemental water supply for existing projects in dry years. The unsold space in American Falls Reservoir, with its firm yield, could be used best for supplying water to new land. Many of the existing projects obtain an adequate water supply in normal years from their natural flow rights and from their storage rights in existing reservoirs. If these projects owned space in Palisades Reservoir, they could accumulate hold-over storage in it in years of average or above-average run-off.

It is believed that permanent disposition should be made of the unsold space in American Falls Reservoir before the proposed Palisades Reservoir is constructed in order that the existing projects now leasing that space may be able to make an intelligent appraisal of their storage needs. As an aid to determining the best and most satisfactory disposition of this space, two plans are presented herein. These plans are extreme in that one provides for full use of the reserved space in American Falls Reservoir by the existing projects while the other calls for using the reserved space entirely for development of new land. Operation studies were made of the river system with Palisades Reservoir in operation and the proposed water conservation program in effect to determine the adequacy of the water supply under each of the two plans. The results of these studies, which are discussed subsequently, will serve as a guide for selection of a plan most satisfactory to all interests concerned. The two extreme plans, which have been designated as Plan A and Plan B, are described in the following paragraphs.

PLAN A -- WITHOUT DEVELOPMENT OF NEW LAND

Under Plan A the 433,000 acre-feet of unsold space in American Falls Reservoir and all of the live storage space in Palisades Reservoir would be used to provide a supplemental supply of stored water for the existing projects in the Snake River Valley. In order to extend the advantages of the low cost, firm yield of American Falls storage to a greater area than at present, the cost and yield of the reserved space in American Falls Reservoir would be pooled with the cost and yield of the 1,277,000 acre-feet of live storage space in Palisades Reservoir. Although the combined space would be sold as a unit, as if it were all in one reservoir, the amount of stored water accruing to the pool each year would be computed on the basis of the priority of the storage right of each reservoir. With full use of this pooled space and elimination of winter diversions as proposed herein, the existing projects would be assured of receiving some water, in addition to their holdover storage, from the pool every year. For this reason the water users on existing projects have expressed a desire to utilize the unsold American Falls space in this manner.

PLAN B -- WITH DEVELOPMENT OF NEW LAND

Under Plan B the reserved space in American Falls Reservoir would be used for development of new land, and the live storage space in Palisades Reservoir would be used to provide a supplemental supply of stored water for the existing projects on the river. Although the unsold space in American Falls Reservoir was originally reserved for developing new land in future extensions of the Minidoka Project, it is believed that consideration should be given at this time to the possibility of developing at least a part of the new land in areas where the deep percolation losses and surface return flow are tributary to the river above American Falls Dam. In this way some of the unused water could be recaptured and used again by projects having natural flow rights on the Snake River and by those projects having storage rights in American Falls Reservoir.

For the purpose of this study, 223,000 acre-feet of the reserved space in American Falls Reservoir was allotted to the North Side Pumping Division of the Minidoka Project. With a diversion requirement of about six acre-feet per acre annually this would permit the development of 37,000 acres of new land in that project. These lands can be irrigated by pumping from Lake Walcott with a maximum lift of about 80 feet. The project area was withdrawn from entry in 1908. It is characterized by relatively large tracts of gently sloping and smooth land separated by terraces and shallow coulees. The soils are generally deep, and their productivity under irrigation should compare favorably with the land in any of the existing projects in the valley. The cost of irrigating this land should likewise compare favorably with that involved in irrigating any other area of new land in the lower valley.

The Michaud Unit of the Fort Hall Project is the only irrigable area in the upper valley that includes good agricultural land from which all of the unused water would return to the river. In order to obtain the most efficient use of the water from American Falls Reservoir, therefore, the Michaud Unit was selected as one of the projects of new land to be included in this plan. For the purpose of this study, a net irrigable area of about 30,000 acres in the project was assumed. The Indian Service has estimated that about seven acre-feet of water would have to be diverted from the river to irrigate each acre of land in this project because of heavy percolation losses through the porous subsoils underlying the land and the supply canal. This estimate is based on delivery of water to the Michaud Unit by gravity through an extension of the existing Fort Hall Canal and includes an allowance for a loss of 14 percent in that canal. At this rate a total of 210,000 acre-feet of water would have to be diverted from the river each year to irrigate a 30,000-acre project. Since this irrigation demand would have to be supplied entirely from storage in dry years, a total of 210,000 acre-feet of the reserved space in American Falls Reservoir was allotted to the project for the purpose of this study. Further study may show, however, that the project can be served by collecting the surface inflow to American Falls Reservoir near the Portneuf River and pumping it to the canal system serving the Michaud lands. Such a plan would result in a reduction in the amount of water required to be diverted.

The location and approximate extent of the lands in the Michaud Unit of the Fort Hall Project and in the North Side pumping Division of the Minidoka Project, which would be irrigated under Plan B, are shown on the general map at the head of this report. The development of these two projects would increase the irrigated area in the Snake River Valley by at least 67,000 acres. The general plan for their development is outlined and tentative allocations of storage space were made in this report merely to show the effect they would have on the water supply for all projects in the Snake River Valley. Detailed investigations of each of these projects of new land will be needed as the basis for making a finding of the feasibility of their development and for determining the exact acreage that can be irrigated in each.

In order to assure that lands of comparable quality are irrigated in the Michaud Unit of the Fort Hall Project and in the North Side Pumping Division of the Minidoka Project, the lands in both projects should be classified in accordance with present Bureau of Reclamation land classification standards. A detailed investigation and study should be made of the water requirements for each project in order to assure that efficient use of water will be achieved on both projects. This should include a study of the possibility of serving the Michaud Unit by pumping as described above. Any reduction in the assumed storage requirements for the Michaud Unit that results from a reduction in acreage in or water requirements for that project would make additional storage water available for development of more new land in the North Side Pumping Division. These limitations on development of new land in the Michaud Unit would assure the development of at least 37,000 acres of new land in the North Side Pumping Division.

The final allocation of American Falls storage to each project should not be made until the above investigations and studies have been completed. If American Falls storage is utilized to develop new land in the Michaud Unit, the same limitations on individual land holdings and controls on land speculation which are in force on a regular reclamation project should prevail on the Michaud lands.

CHAPTER V

WATER SUPPLY
FOR THE HENRYS FORK VALLEY

The Henrys Fork River, the largest tributary of the Snake River above Milner Dam, drains about 3,000 square miles on the southern and western slopes of the Rocky Mountains. A large portion of the watershed lies at elevations of 7,000 to 12,000 feet above sea level and includes a considerable amount of heavily timbered slopes. Heavy snowfall at these high elevations during the winter causes a copious run-off during the spring and early summer months and maintains late summer flows above the average of most western streams. The porous rock formations in the vicinity of the west boundary of Yellowstone National Park absorb considerable amounts of water during the spring snow-melt. This water reappears at lower elevations in the form of springs. These springs, including some of the largest in the United States, help materially in maintaining the late summer flows of the Henrys Fork. The two main tributaries of the Henrys Fork are Fall River and the Teton River, with drainage areas of 380 and 920 square miles, respectively. Both of these streams enter the Henrys Fork Valley from the east and contribute a large portion of the Henrys Fork run-off. The Teton River drains the west slope of the Teton Mountains, and Fall River drains the southwest corner of Yellowstone National Park. Both have a large run-off.

The purpose of the Henrys Fork water-supply studies was to discover the effects of the present irrigation development and storage regulation since 1918 in order to obtain the modified flow of the Henrys Fork at its mouth for use in studies on the Snake River. The greater part of the storage regulation on the Henrys Fork has been developed since 1938. The studies were also made to determine the adequacy of the natural flow with existing storage regulation to meet irrigation demands in dry years. New storage, if needed, can be obtained either by construction of a new reservoir in the Henrys Fork watershed or by purchase of space in the Palisades Reservoir. In the latter case, Palisades water could be exchanged for the natural flow on the Henrys Fork which now must be allowed to pass on to the Snake River in order to fill prior natural flow rights on that stream.

PRESENT DEVELOPMENT

Irrigated Land

The bulk of the irrigation development on the Henrys Fork is centered in the Henrys Fork Valley proper. The valley averages about 8 miles in width and extends from the mouth of Fall River to the Snake River, a distance of about 20 miles. The Teton River flows diagonally across the valley for about 12 miles, joining the Henrys Fork near its mouth. The cultivated lands in the main valley, totaling about 89,000 acres, are irrigated by 35 canals diverting from the Henrys Fork, Fall, and the Teton rivers. About 71,000 acres of this land are subirrigated. In addition to the above, there are about 22,000 acres of bench and rolling lands in the vicinity of Ashton irrigated by four canals from Fall River before it enters the main valley. This irrigation development is summarized as follows:

Stream	No. of Canals	Total Acreage Under Canals	Total Acreage Irrigated in 1942
Henrys Fork River	10	47,600	44,400
Fall River	12	52,000	37,800
Teton River	17	30,400	28,800
Total	39	130,000	111,000

Only the above irrigation development was included in the Henrys Fork water-supply studies. In addition to these, there are about 40,000 acres of land irrigated by natural flow in a small basin in the upper reaches of the Teton River watershed on both sides of the Idaho--Wyoming state line and about 4,000 acres irrigated by natural flow from small tributaries of Fall River above the Henrys Fork Valley. This irrigation development was excluded because it has been the same throughout the period of study, the stream depletion caused by it is reflected in all past records of flow entering the main valley, and no reservoirs of consequence or changes in acreage are contemplated for these projects in the future.

Existing Reservoirs

There are three storage reservoirs in the Henrys Fork watershed. Pertinent data on each of these reservoirs are summarized as follows:

Name of Reservoir	Surface Area (acres)	Capacity (acre-feet)	Drainage Area (sq.mi.)	Average Annual Inflow (acre-feet)
Henrys Lake	6,356	79,000	104	36,000
Island Park	7,794	127,000	374 1/	356,000 2/
Grassy Lake	312	15,000	12	22,000
Total	14,462	221,000	490	414,000

1/ Excluding Henrys Lake drainage area.
2/ Excluding inflow to Henrys Lake.

Henrys Lake Reservoir, located in the headwaters of the Henrys Fork River, was constructed in 1922 by the North Fork Reservoir Company, an organization of water users on the Henrys Fork. The reservoir was formed by a concrete dam at the outlet of Henrys Lake, which had an original surface area of 3,472 acres. The dam raised the lake surface 15 feet. The reservoir filled and water went through the spillway for the first time in 1943. A feeder canal diverts the flow of Dry Creek, a small tributary, into the reservoir.

Island Park Reservoir, located on the Henrys Fork about 15 miles below Henrys Lake Reservoir, was built by the Bureau of Reclamation and was completed in the fall of 1938. The reservoir is situated in a flat, marshy basin and was formed by an earth-fill, rock-faced dam about 70 feet in height.

Grassy Lake Reservoir, located in the headwaters of Fall River, was constructed by the Bureau of Reclamation and was completed in the fall of 1939. The reservoir was formed by an earth-fill, rock-faced dam at the outlet of Grassy Lake, which had an original surface area of about 65 acres. The dam raised the original lake surface 75 feet. The reservoir is on Grassy Lake Creek, a small tributary of Fall River. In order to provide sufficient inflow to fill the reservoir, a feeder canal with a capacity of 220 cubic feet per second, was constructed to divert water from Cascade Creek, an adjoining tributary of Fall River.

Provision was made to deliver stored water to the canals diverting from the Teton River by constructing a feeder canal from the Henrys Fork, known as the Cross Cut Canal. This canal was built by the Bureau of Reclamation and started operating in 1938. It diverts from the Henrys Fork just below the mouth of Fall River and empties into the Teton River a short distance above the highest canal diversion. The Cross Cut Canal can also deliver stored water from the Henrys Fork to about 5,000 acres under the lower canals diverting from Fall River.

Power

The Utah Power and Light Company owns and operates hydroelectric power plants on the main stream at Ashton and at St. Anthony. The Ashton plant was constructed in 1913--15 and has an installed capacity of 5,800 kilowatts with an average operating head of about 46 feet. Head for the plant was developed by constructing a rock-fill dam across the stream with a height of 60 feet. The St. Anthony plant was constructed in 1914--15. It has an installed capacity of only 500 kilowatts and operates under a 15-foot head, which was developed by diverting water from the Henrys Fork and conveying it through a 600-foot concrete flume to the powerhouse on the right bank of the river.

The operation of these two power plants during the irrigation season does not reduce the supply of irrigation water available for use in the Henrys Fork Valley because they are located above the points of diversion to most of the Henrys Fork canals. An agreement was reached with the power company at the time that Island Park Reservoir was constructed whereby the beginning of the storing season at Island Park would be delayed until November 15 each year in order to maintain the power production at the Ashton plant during the fall when the lowest run-off occurs. This operation schedule will cause no reduction in storage in the Island Park Reservoir because in wet years there is always sufficient inflow after November 15 to fill the reservoir and in dry years the water will have to be passed downstream to fill the prior storage right of American Falls Reservoir.

WATER SUPPLY

Available Stream Flow Records

In order to make complete studies of the operation of the existing irrigation projects in the Henrys Fork Basin, it was necessary to have actual records of the following:

(1) Monthly changes in storage content of all existing reservoirs since construction;

(2) Regulated outflow from all existing reservoirs;

(3) Past regulated inflow to the valley just above the highest canal diversions;

(4) All past canal diversions; and

(5) Past flows of the Henrys Fork at its mouth.

Fortunately there are either complete or partial records of all of these items. Complete records of discharge at all of the above critical points, except winter canal diversions, have been obtained by the Geological Survey since 1934. This agency has operated gaging stations at most of these points since 1918, and a few partial records extend back as far as 1903. All of these records, which have been published in the U.S.G.S. Water Supply Papers and in the Snake River watermaster's annual reports, were used in the study of the water supply available for irrigation use in the Henrys Fork Valley.

Natural Flow

The natural flow at Henrys Lake Dam during the summer months from 1923 to 1942 was obtained by adding algebraically the recorded change in storage in Henrys Lake Reservoir and the recorded flows at the gaging station below the dam. The total winter flows during this period were obtained from the difference between the last recorded reservoir content in the fall and the first recorded reservoir content in the spring. Since the gates were closed during the winter, no spills from the reservoir occurred during this period, and leakage through the dam that by-passed the gaging station was assumed to be negligible. The monthly distribution of the total winter flow thus obtained was not important for the purpose of this study so was estimated offhand. Summer records of the natural flow at the dam are available from 1920 to 1922 and were estimated for 1918 and 1919. Winter flows from 1918 to June 1923 were estimated offhand. Storage in the reservoir began in the fall of 1922. The actual records and estimates of the natural flow at Henrys Lake Dam are given in Table 2.

The natural flow at Island Park Dam from January 1933 through September 1942 was obtained by correcting the recorded flows at the Island Park gaging station for operation of Henrys Lake Reservoir during that period and for the operation of Island Park Reservoir since November 1938. The natural flow at Island Park Dam from April 1918 to December 1932 was estimated by means of a correlation of concurrent records of natural flow of the Henrys Fork at Island Park and at Warm River from January 1933 through

September 1942. Recorded flows at Warm River were corrected for the recorded changes in storage at Henrys Lake and Island Park reservoirs to obtain natural flows. The recorded and estimated natural flows at Island Park Dam from 1918 to 1942 are given in Table 3.

The recorded flows at the Ashton gaging station since April 1920 were corrected for the operation of Henrys Lake and Island Park reservoirs to obtain records of natural flow at that station. The natural flow during period of missing records from 1918 to 1927 was estimated from a correlation of concurrent records of natural flow at the Warm River and Ashton gaging stations. The estimated and recorded natural flow of the Henrys Fork on entering the Henrys Fork Valley is given in Table 4.

There are no records of the natural flow available for storage at Grassy Lake Reservoir prior to construction of the reservoir. Complete records of the content of the reservoir are available for the period since storage began in October 1939; however, 1941 is the only year for which complete records are available of the outflow from the reservoir. From these records the natural inflow to the reservoir was computed for 1941. For the purpose of this study, a detailed estimate of the natural inflow for each year of the study is not warranted because it is assumed that Grassy Lake Reservoir will be operated as a hold-over reservoir, and the dry years in which a storage draft will be made on it are far enough apart that there is no question that the inflow between drafts will fill the reservoir. Therefore, the natural inflow in 1941 was used as a basis for determining the average natural inflow for the period of study from 1919 to 1942, inclusive. This was done by comparison with the 1941 and average 1919--42 natural flows of Fall River near Squirrel. The monthly distribution of the average natural inflow to Grassy Lake Reservoir was estimated offhand. The same monthly flows were used in each year of the operation study.

The natural flow of Fall River near Squirrel was obtained by correcting the recorded flow at the Squirrel gaging station for the diversions to the three canals above the station since 1918 and for the operation of Grassy Lake Reservoir since October 1939. The recorded natural flow of Fall River on entering the irrigated area is given in Table 5.

All recorded flows of the Teton River near St. Anthony prior to construction of the Cross Cut Canal in 1938 are natural flows entering the Henrys Fork Valley; there are no canal diversions to that valley above the gaging station and there are no reservoirs in the Teton River watershed. Past consumptive use from irrigation in the upper Teton Basin is reflected in all records of inflow to the Henrys Fork Valley, and only slight changes in the amount of this consumptive use are anticipated in the future. The return flow from the Enterprise Canal entering the Teton River above the gaging station is small and was neglected in computing the natural river flow at the gage. The recorded flows since 1938 were corrected for records of inflow above the station from the Cross Cut Canal in order to obtain natural flow. The natural flow at the Teton gaging station during the periods of missing records prior to 1934 was estimated from a correlation of concurrent records of natural flow at this station and the natural flow of the Henrys Fork at Warm River. The recorded and estimated natural flows of the Teton River on entering the Henrys Fork Valley are given in Table 6.

The combined natural inflow to the valley, which is available for irrigation of the lands included in this study, averaged 2,020,000 acre-feet annually from 1919 to 1942, inclusive. The highest inflow during this period was 2,710,000 acre-feet in 1927, and the lowest was 1,390,000 acre-feet in 1934.

TABLE 2

NATURAL FLOW OF THE HENRYS FORK RIVER NEAR LAKE, IDAHO

Units of 1,000 Acre-feet — Drainage Area--104 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	e 3	e 3	e 3	e 3	e 3	e 3	e 3	e 3	e 5	e 4	e 2	e 2	37
1920	e 2	e 3	e 2	e 3	e 2	e 3	e 3	pe 18	12	8	4	4	64
1921	5	e 5	e 5	e 5	e 5	e 5	pe 10	11	14	8	4	4	81
1922	3	e 3	e 3	e 3	e 3	e 3	e 3	24	12	6	5	2	70
1923	4	4	4	4	4	4	4	10	6	2	2	4	52
1924	2	2	2	2	2	2	2	4	3	2	1	2	26
1925	3	3	3	3	3	3	3	3	12	6	3	7	52
1926	2	2	2	2	2	2	2	6	2	2	1	1	26
1927	4	2	2	3	2	3	3	3	15	7	3	4	51
1928	3	2	3	2	3	3	3	4	5	2	0	0	30
1929	e 2	e 2	e 2	e 2	e 2	e 2	e 2	2	7	1	0	2	26
1930	3	2	2	2	2	2	2	4	4	0	4	2	29
1931	1	0	1	1	1	2	4	4	2	1	1	1	19
1932	1	1	1	1	1	1	1	5	11	6	1	1	31
1933	2	3	2	3	2	3	3	4	6	2	0	1	31
1934	1	1	1	1	1	1	3	3	1	0	0	0	13
1935	0	2	2	2	2	2	2	4	7	2	0	0	25
1936	0	2	3	2	2	3	2	5	4	1	1	1	26
1937	2	2	2	2	2	2	2	3	6	1	0	0	24
1938	0	3	3	3	3	3	3	3	14	8	2	2	47
1939	3	3	3	3	3	3	3	3	4	1	0	0	29
1940	0	2	2	2	2	2	2	3	3	0	0	1	19
1941	2	2	2	2	2	2	2	2	3	0	2	2	23
1942	2	2	3	2	1	2	4	5	7	4	0	1	33
Mean	2	2	2	2	2	3	3	6	7	3	2	2	36

e - Estimated   pe - Partially estimated

TABLE 3

NATURAL FLOW OF THE HENRYS FORK RIVER NEAR ISLAND PARK, IDAHO

Units of 1,000 Acre-feet — Drainage Area—478 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	37	32	28	32	24	28	52	58	37	30	28	28	414
1920	31	28	28	27	23	24	26	85	66	40	32	28	438
1921	32	29	27	28	22	28	45	100	84	48	38	37	518
1922	36	34	33	24	23	30	34	88	68	45	39	33	487
1923	35	34	32	34	26	31	32	80	60	39	32	31	466
1924	32	30	30	28	26	28	30	40	27	28	26	26	351
1925	29	28	24	28	25	26	45	89	70	44	34	36	478
1926	34	30	31	27	26	30	49	53	31	30	30	29	400
1927	31	30	25	25	24	28	30	90	109	54	39	37	522
1928	41	42	34	32	29	33	38	67	46	37	31	31	461
1929	35	32	29	28	27	29	30	57	49	28	28	30	402
1930	30	26	28	28	25	28	43	39	32	25	31	26	361
1931	30	25	23	23	20	24	32	32	20	24	22	20	295
1932	22	20	20	20	18	19	23	85	62	24	25	24	362
1933	26	25	25	25	23	26	31	55	48	26	26	26	362
1934	26	24	24	24	22	26	32	26	21	19	20	19	283
1935	20	20	21	21	19	18	23	55	45	25	22	21	310
1936	23	24	25	24	21	22	37	55	33	23	24	23	334
1937	26	24	24	24	22	23	25	54	37	25	23	22	329
1938	23	25	25	25	22	25	34	78	69	46	30	28	430
1939	32	28	25	25	23	25	46	54	31	24	27	25	365
1940	28	26	25	23	24	25	40	46	32	23	24	29	345
1941	29	25	23	22	20	21	29	37	30	22	26	26	310
1942	26	24	26	22	19	19	40	62	55	31	25	27	376
Mean	30	28	26	26	23	26	35	62	48	32	28	28	392

Note—April 1918 to Dec. 1932, by correlation with the Henrys Fork at Warm River (Natural Flow) Jan. 1933 to Sept. 1942, Geological Survey records corrected for regulation at Henrys Lake since Oct. 1922 and at Island Park Reservoir since Nov. 1938.

NATURAL FLOW OF THE HENRYS FORK RIVER NEAR ASHTON, IDAHO 1/

Units of 1,000 Acre-feet — Drainage Area--1,030 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	c 86	c 78	c 68	c 77	c 62	c 70	e 130	e 130	e 80	e 71	e 69	e 69	990
1920	c 75	c 68	c 69	c 67	c 58	c 62	pe 70	189	124	86	76	73	1,017
1921	c 77	c 71	c 66	c 68	c 57	c 69	pe 103	216	151	95	84	80	1,137
1922	c 85	c 81	c 78	c 61	c 59	c 73	e 85	191	127	91	88	pe 77	1,096
1923	c 82	c 81	c 77	c 79	c 64	c 74	pe 88	179	119	87	79	77	1,086
1924	c 75	c 71	c 72	c 70	c 65	c 68	e 75	pe 92	61	64	60	58	831
1925	65	pe 60	c 62	c 68	c 63	c 65	pe 122	213	129	96	84	88	1,115
1926	pe 67	74	pe 77	c 67	c 64	c 73	pe 127	120	73	74	72	69	957
1927	74	73	pe 67	c 68	c 61	c 68	84	210	197	110	90	86	1,188
1928	90	93	81	76	72	81	88	161	101	86	78	78	1,085
1929	84	79	74	73	69	74	81	145	110	73	74	73	1,009
1930	74	69	71	68	61	70	113	90	73	62	70	63	884
1931	67	60	59	61	56	62	75	78	58	58	56	54	744
1932	57	52	54	52	52	59	68	174	129	81	66	63	907
1933	67	64	62	65	59	67	78	136	104	66	67	63	898
1934	64	61	62	60	54	66	75	62	56	52	54	49	715
1935	53	54	53	52	47	54	68	121	90	62	58	60	772
1936	51	56	55	56	55	56	95	137	80	62	61	60	824
1937	62	58	59	57	55	61	66	132	86	65	61	56	818
1938	59	59	61	59	53	60	93	182	129	92	71	66	984
1939	72	66	64	64	57	66	121	132	82	67	69	67	927
1940	70	66	64	63	62	69	111	121	79	66	67	72	910
1941	70	64	61	61	55	65	83	102	77	64	67	65	834
1942	66	66	66	60	52	58	100	142	114	76	68	68	936
Mean	70	68	66	65	59	66	92	144	101	75	70	68	944

c - Correlation with natural flow of the Henrys Fork at Warm River. pe - Partially estimated; partial records available. e - Estimated by comparison with natural flow of the Henrys Fork at Warm River. 1/ Except as noted, figures are Geological Survey records corrected for regulation at Henrys Lake since October 1922 and at Island Park Reservoir since November 1938.

TABLE 5

NATURAL FLOW OF FALL RIVER NEAR SQUIRREL, IDAHO 1/

Units of 1,000 Acre-feet — Drainage Area—380 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	30	26	27	27	24	25	42	123	67	31	28	25	475
1920	24	26	28	26	21	24	26	101	129	55	36	30	526
1921	30	29	27	25	21	26	35	124	146	56	41	32	592
1922	31	29	28	25	22	24	27	105	173	59	40	31	594
1923	26	26	24	25	20	26	32	108	118	71	40	33	549
1924	30	27	25	20	26	21	27	94	63	29	24	23	409
1925	24	24	18	20	20	23	48	164	141	92	53	48	675
1926	40	34	31	22	25	27	67	112	59	34	31	27	509
1927	27	30	24	24	21	24	31	114	232	154	61	50	792
1928	45	54	36	33	32	36	42	187	120	76	53	42	756
1929	37	33	28	28	26	28	30	95	153	62	35	31	586
1930	28	21	22	15	20	24	55	80	88	32	28	24	437
1931	24	20	20	18	18	20	36	92	44	22	20	19	353
1932	16	16	17	14	16	18	27	129	164	78	42	34	571
1933	30	29	28	27	21	24	34	87	198	46	32	28	584
1934	25	23	23	21	20	28	61	70	37	27	24	22	381
1935	21	20	22	20	18	20	31	95	123	44	34	30	478
1936	30	28	25	23	21	23	54	154	112	45	38	32	585
1937	30	28	26	23	20	23	25	118	119	42	30	27	511
1938	27	22	28	23	20	22	46	125	158	76	45	36	628
1939	35	32	30	27	22	29	62	125	94	47	36	32	571
1940	30	25	25	24	22	24	47	161	123	34	26	25	566
1941	23	22	22	22	19	22	36	113	74	33	28	27	441
1942	26	25	26	20	19	21	46	82	125	57	33	29	509
Mean	29	27	25	23	21	24	40	115	119	54	36	31	545

1/ Diversions to 3 canals above gage added to records at gage to obtain natural flow, corrected for the regulation by Grassy Lake Reservoir since October 1939.

TABLE 6

NATURAL FLOW OF THE TETON RIVER NEAR ST. ANTHONY, IDAHO 1/

Units of 1,000 Acre-feet — Drainage Area--920 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	c 43	c 36	c 29	c 36	c 25	c 31	e 65	e 70	e 70	e 45	e 35	e 30	515
1920	c 34	c 29	c 30	c 29	c 22	c 25	pe 37	94	126	65	45	42	578
1921	c 36	c 32	c 28	c 29	c 22	c 30	e 60	pe 142	181	63	46	42	711
1922	37	36	29	25	22	25	37	90	124	53	45	36	559
1923	c 39	c 39	c 36	c 38	c 27	c 34	pe 42	92	98	64	42	34	585
1924	c 35	c 32	c 32	c 30	c 27	c 29	e 40	pe 63	45	36	27	25	421
1925	31	pe 27	c 25	c 29	c 26	c 27	pe 53	160	142	112	52	47	731
1926	pe 42	c 33	c 34	c 28	c 26	c 33	55	86	50	36	30	25	478
1927	pe 28	c 33	c 29	c 29	c 24	c 29	pe 47	101	199	117	53	44	733
1928	c 48	c 49	c 38	c 38	c 32	c 37	49	193	107	81	47	39	758
1929	c 39	c 36	31	c 30	c 28	c 31	pe 46	77	112	63	41	37	571
1930	c 33	c 28	c 29	c 29	c 25	c 30	53	65	61	46	44	36	479
1931	c 32	c 26	c 22	c 23	c 18	c 24	e 40	48	41	27	26	22	349
1932	c 21	c 18	c 19	c 19	c 16	c 18	e 35	98	126	72	41	32	515
1933	c 27	c 26	c 26	c 26	c 21	c 27	pe 52	57	109	45	38	30	484
1934	27	24	23	23	20	25	30	39	29	22	18	17	297
1935	22	19	19	17	16	20	36	63	89	48	34	28	411
1936	26	23	20	21	19	21	57	150	111	47	36	30	561
1937	28	24	20	20	16	22	38	75	66	45	32	25	411
1938	26	25	26	21	19	26	68	113	136	85	43	36	624
1939	34	30	26	24	21	37	59	99	71	52	37	33	523
1940	32	26	25	22	22	34	34	84	73	40	30	30	452
1941	30	26	23	21	19	39	31	87	92	51	41	36	496
1942	33	28	30	25	21	22	54	93	120	64	37	32	559
Mean	33	29	27	26	22	28	47	93	99	57	38	33	533

c - Correlation with natural flow of the Henrys Fork at Warm River. pe - Partially estimated; partial records available. e - Estimated by comparison with natural flow of the Henrys Fork at Warm River. 1/ No correction made for upstream irrigation use in Teton Basin; spill from Cross Cut Canal into the Teton River above gage since 1938 subtracted to obtain natural flow.

WATER REQUIREMENTS

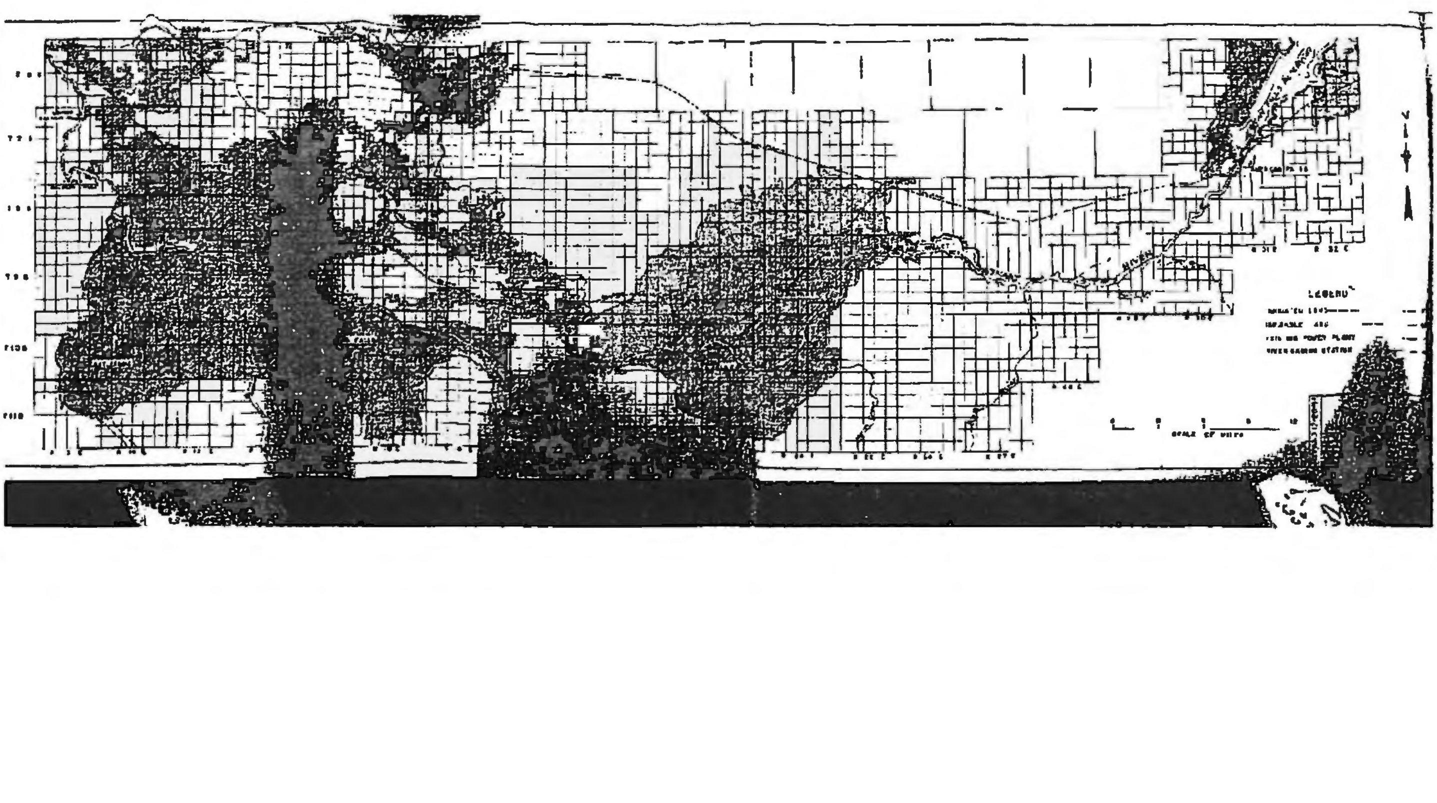
The irrigation requirements under future conditions in the Henrys Fork Valley were determined by making an analysis of past records of canal diversions, river gains, and precipitation and then applying estimated corrections to them for changes in the supply of stored water and for changes in the cropping program since 1918. It was assumed that no new reservoirs or additional acreage would be developed in the future in the Henrys Fork Basin, and that the present practice of subirrigation would be continued.

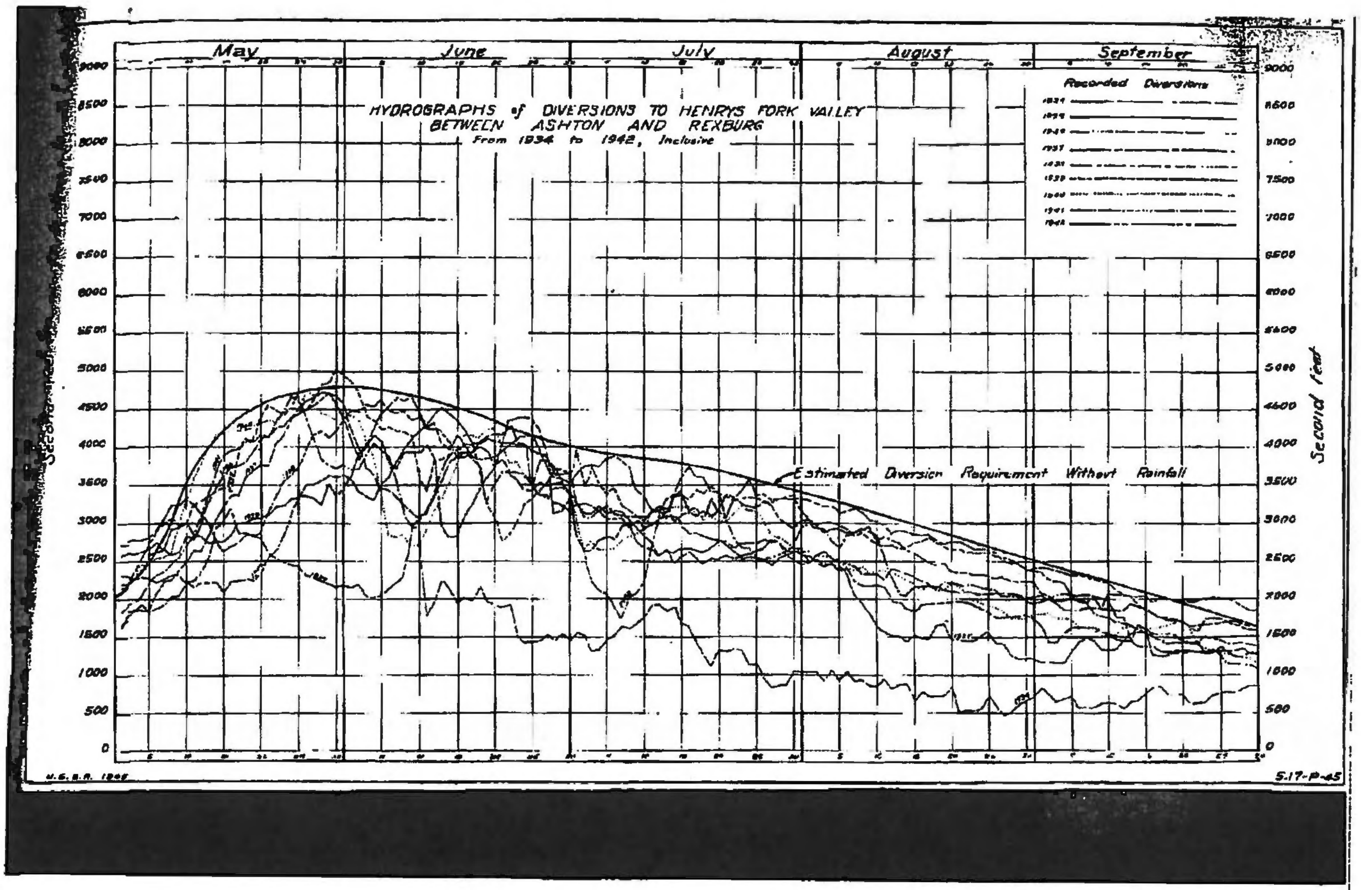
Irrigation Requirements

The recent investigations and studies of water use in the Henrys Fork Valley have led to the conclusion that the present methods of irrigation cannot be changed and the present use of water cannot be reduced without causing serious inconvenience and crop losses in that valley and depriving the irrigation projects in the Mud Lake area of their present dependable water supply. For the purpose of the studies of the water supply for the Henrys Fork Valley, therefore, it is assumed that the past operation of the canal systems will continue.

There has been a gradual shift in the cropped acreage from hay and grain to beets and potatoes during the last 25 years. The completion of Island Park Reservoir in 1938 and the improved market and prices since then have greatly accelerated the increase in the acreage of potatoes and have caused some increase in the sugar beet acreage. These changes in cropping practices and gradual increase in the irrigated acreage have increased the demand for irrigation water and for storage regulation needed to distribute it throughout the growing season according to crop needs.

The maximum irrigation demand with no rainfall during the growing season was estimated by plotting a combined hydrograph of past records of daily diversions in cubic feet per second since 1934 and drawing a curve which touched the peaks of the recorded diversions during this period. The "Hydrographs of Diversions to Henrys Fork Valley..." on the following page present this information graphically. The period from 1938 to 1942, in which all of the existing reservoirs and estimated future cropping program were in operation, largely determined the late-season location of the estimated demand curve without rainfall. The peaks in the hydrographs of recorded diversions since 1938 all occurred during periods of no rainfall when there was an abundant supply of both natural flow and stored water available. An exception was 1940, when there was a shortage of natural flow and stored water after the first of July.

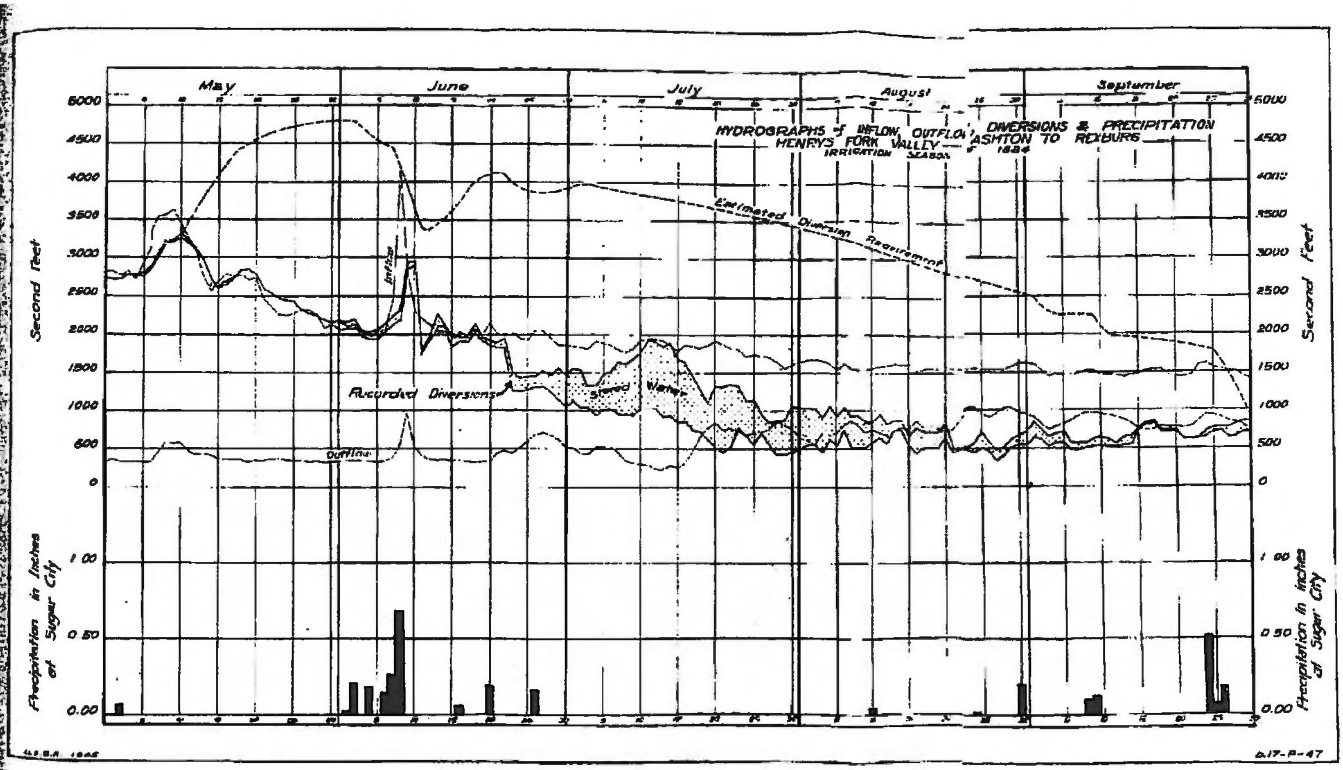



HYDROGRAPHS of DIVERSIONS TO HENRYS FORK VALLEY
BETWEEN ASHTON AND REXBURG
From 1934 to 1942, Inclusive
May
June
July
August
September
Recorded Diversions
Estimated Diversion Requirement Without Rainfall
Second feet
5.17-P-45

Water Supply for the Henrys Fork Valley

A separate hydrograph was plotted for each year since 1930 showing the total inflow to the valley, total diversions of natural flow and stored water, and the outflow at Rexburg in daily cubic feet per second. The records of daily precipitation at Sugar City and St. Anthony were also plotted on each of these sheets. All of these data, together with the maximum demand curve without rainfall and the watermaster's report on shortages, were used to analyze the past records of water use and to determine what changes would be made under assumed future conditions. The variations in the hydrographs of past diversions could generally be accounted for by a study of the accompanying graphs of inflow, outflow, and rainfall in years of adequate water supply. The irrigated acreage increased about 6,000 acres from 1930 to 1937 but has remained constant since 1937. The past records of outflow at Rexburg are influenced by the amount of natural flow that has to pass the Rexburg gaging station to meet the prior natural flow rights on the Snake River, but these amounts are accounted for in the watermaster's reports in recent years.

The daily diversion requirement in cubic feet per second from May 1 to September 30 under future conditions was estimated for each year since 1930 by sketching in its hydrograph on each of the above-described sheets using all of the available information thereon and the watermaster's reports and maximum demand curve as a guide. The estimated or "sketched-in" hydrograph of required diversions coincided with the hydrograph of past diversions through periods of adequate water supply where there was no apparent reason for an increase or decrease. During periods in which there was a water shortage in past years, the "sketched-in" hydrograph of required diversions followed the maximum demand curve, except when there was sufficient rainfall to cause a reduction in diversions. The reduction in diversion requirements because of rainfall was estimated by using as a guide the cuts made in recorded diversions because of usable rainfall in years of adequate water supply. This method is demonstrated by the accompanying chart showing the hydrograph for the 1934 irrigation season. The watermaster has for many years stopped all deliveries of stored water on the last day of September, as an operating and cost accounting convenience because there is seldom, if ever, an urgent demand for stored water after that date. It was assumed for the purpose of this study, therefore, that this practice will continue in the future, and, as a consequence, the estimated hydrographs of required diversions were not extended beyond the end of September. The daily diversions in second-feet shown by the hydrographs of estimated future diversions were totaled for each month and converted to acre-feet in order to obtain the estimated monthly requirements to be used in the operation studies.


HYDROGRAPHS of INFLOW, OUTFLOW, DIVERSIONS & PRECIPITATION
HENRYS FORK VALLEY — ASHTON TO REXBURG
IRRIGATION SEASON
May
June
July
August
September
Second Feet
Precipitation in Inches at Sugar City
Estimated Diversion Requirement
Inflow
Recorded Diversions
Stored Water
Outflow

The period from 1918 to 1929 was not critical insofar as water supply is concerned so it did not warrant a study as detailed as was made from 1930 to 1942 to determine the irrigation requirements. Moreover, the records of diversions during that period were not as useful in determining the full requirements because the cropping practices and irrigated acreage were different from recent years and from those anticipated in the future. The full diversion requirement for each year from 1918 to 1929, inclusive, was estimated by comparing the actual records of diversions with those of recent normal years and making adjustments for water shortages, recorded rainfall, and the changes in acreage and cropping practices. The maximum demand without rainfall, estimated from records of diversions in recent normal years, also was used as a guide in estimating the diversion requirements during this period.

The operation studies were conducted on the basis of allowing the same depletion during the period from October to April of each water year as was recorded by the river stations in the past. This presumes that the same canals will be operated and the same amounts of water will be diverted during these months in the future as in the past and eliminates the need of predicting the diversion requirements and river gains during these months.

The monthly diversion requirements from 1919 to 1942 under future conditions, estimated by the above methods, are given in Table 7.

Storage Requirements on Fall River

Land irrigated by diversion from Fall River above the Cross Cut Canal can be supplied with stored water only from Grassy Lake Reservoir. It was therefore necessary to compute the storage requirements for this land in order to know when water had to be released from Grassy Lake Reservoir, aside from releases for all Henrys Fork Valley land after Island Park and Henrys Lake reservoirs were empty. The estimated net diversion requirements on Fall River at Squirrel were computed on the basis of recorded diversions during 1939 and 1942, both of which were normal years. One half of the diversion to the Fall River Canal was assumed to be supplied from the Cross Cut Canal and was therefore subtracted from the total recorded diversions to Fall River canals. The gain in Fall River from Squirrel to Chester was used to supply part of these diversions. The remainder was the estimated net diversion demand on Fall River at Squirrel. The average requirements for each month were determined from the computations for 1939 and 1942. The natural flow of Fall River at Squirrel was then applied against this average diversion requirement, and any deficiency was called a storage requirement from Fall River. Releases were made from Grassy Lake Reservoir to meet this storage requirement.

TABLE 7

ESTIMATED TOTAL DIVERSION REQUIREMENTS
FOR THE HENRYS FORK CANALS

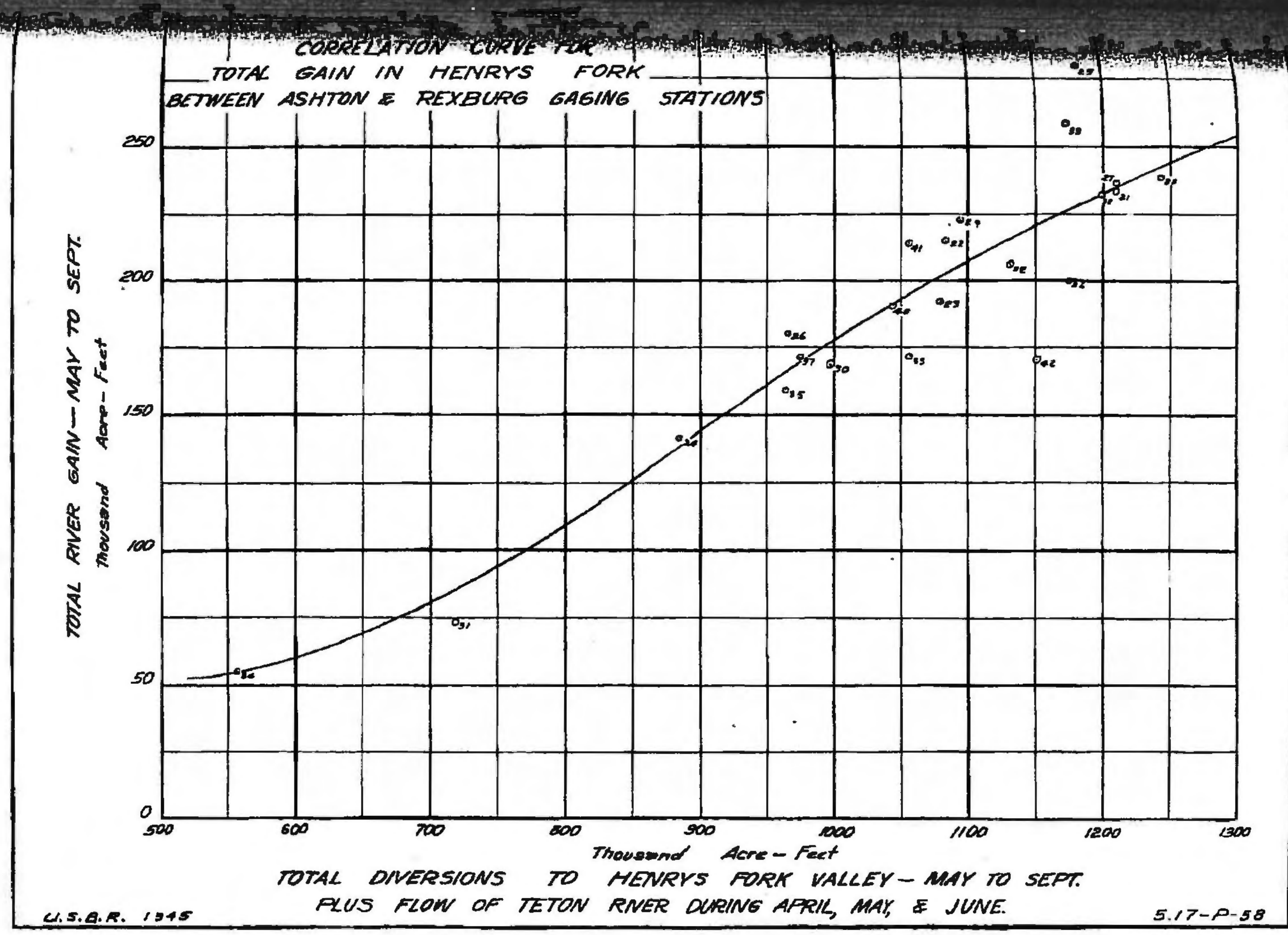
Units of 1,000 Acre-feet

Year	May	June	July	Aug.	Sept.	Total
1919	200	260	215	183	120	978
1920	171	250	230	175	110	936
1921	177	220	215	175	115	902
1922	157	260	210	170	120	917
1923	181	210	210	180	115	896
1924	243	250	210	183	120	1006
1925	176	220	200	175	110	881
1926	246	240	210	180	110	986
1927	149	220	230	183	110	892
1928	224	200	215	180	115	934
1929	163	239	220	183	110	915
1930	202	235	225	164	106	932
1931	221	234	230	176	115	976
1932	205	222	192	177	112	908
1933	162	267	226	178	114	947
1934	239	243	230	183	115	1010
1935	187	235	228	183	123	956
1936	218	225	227	181	121	972
1937	200	226	213	178	116	933
1938	185	239	183	178	118	903
1939	228	224	206	168	117	943
1940	230	218	206	176	110	940
1941	209	221	208	146	104	888
1942	151	243	222	176	108	900
Average	197	233	215	176	114	935

River Losses and Gains

The total river gains between the inflow stations to the Henrys Fork Valley and the outflow station at the mouth of the Henrys Fork near Rexburg consist of tributary inflow below the inflow gaging stations, surface waste from the canal systems, and ground-water inflow to the river channels. There are no records of the amount of water contributed to the river by any of these separate sources. The total of all of them in the past, however, can be determined by taking the difference between the total of the recorded inflow to the valley and the total of all recorded diversions plus the recorded flow of the Henrys Fork near Rexburg. These gains were computed for the May to September period of each year from 1921 to 1942, inclusive, as complete records were available of total inflow, diversions, and outflow during this period. The total gains from Ashton to Rexburg for each season were plotted against total diversions, total inflow to the valley, spring flows of the Teton River, and combinations of these in an effort to find a correlation between the river gains and their causes. It was found that they correlated best with the total diversions from May to September, inclusive, plus the total of the April, May, and June flows of the Teton River. Hence, this correlation curve was used in estimating river gains under future conditions. The adopted correlation curve is shown on the chart on the following page. The losses from the Teton River in the gravel formations during spring floods when ground-water levels are low have an appreciable effect on the river gains during the ensuing irrigation season. Of the two sources of gains used in this correlation, only the total diversions will be changed under future conditions. Therefore, the total river gains under future conditions were obtained for each year by shifting the point of each year's actual record parallel to the mean curve by the amount of the difference between the total diversions under past and future conditions. Practically all of the increase in the diversions over those recorded each year in the past would be used to maintain the water table at higher levels in the subirrigated areas during July, August, and September to mature row crops requiring late season moisture. It is estimated that 20 per cent of the increase in return flow would occur in July, 40 per cent in August, and 40 per cent in September during all years except 1919, 1920, 1931, 1932, and 1934. In each of those years separate monthly distributions were estimated. Practically all increases in river gains and return flow would appear as ground-water outflow from the higher water tables on both sides of the river caused by increased diversions.

About two thirds of the total river gains between Ashton and Rexburg during the May--September period occur below the lowest canal headings and cannot be used for irrigation in the Henrys



CORRELATION CURVE FOR
TOTAL GAIN IN HENRYS FORK
BETWEEN ASHTON & REXBURG GAGING STATIONS
TOTAL RIVER GAIN — MAY TO SEPT.
Thousand Acre - Feet
0
50
100
150
200
250
500
600
700
800
900
1000
1100
1200
1300
Thousand Acre - Feet
TOTAL DIVERSIONS TO HENRYS FORK VALLEY — MAY TO SEPT.
PLUS FLOW OF TETON RIVER DURING APRIL, MAY, & JUNE.
U.S.B.R. 1945
5.17-P-58

Fork Valley. All of the usable river gains occur on Fall River and on the Henrys Fork River above the St. Anthony gaging station. It is known that some surface waste from canals and spring inflow enter the Teton River above the lowest diversions. A review of recent records of diversions and river flows at the inflow gaging station during the period when the watermaster reported both the Teton River and Moody Creek dry at the lowest diversions, however, shows that the total diversions remained very nearly equal to the total measured inflow at the inflow gaging station. This is explained by the fact that the channel losses from the gravel sections of the river bed east of the subirrigated area, where the water table is below the river bed throughout the year, apparently offset the accumulated gains in the Teton River. It was assumed in this study, therefore, that there is no appreciable net gain or loss in the Teton River in crossing the Henrys Fork Valley. Past records of the usable gains above St. Anthony were obtained from the difference between the recorded inflow at Ashton and Squirrel and the sum of the diversions above St. Anthony and the river flows at St. Anthony. These past gains were plotted against the total diversions in that section. The plotted points aligned very well in most years of low run-off, but scattered rather widely in years of abundant water supply. The latter condition is accounted for mostly by the variation in the inflow from Conant Creek, which constitutes a considerable amount of the gain in this section during May and June in wet years. No records of the flow of Conant Creek at its mouth are available. This correlation was not used to estimate the usable river gains because of the wide variations from year to year. It is assumed that the small possible increase in diversions under future conditions in this section would not cause any appreciable increase in the river gains above St. Anthony, so the past usable river gains were assumed to be the same under future conditions except in 1934, when a slight increase was made. The non-usable river gains under future conditions were obtained by subtracting the usable gains above St. Anthony from the total river gains from Ashton to Rexburg as estimated by means of the accompanying correlation curve.

The only complete records of winter diversions in the Henrys Fork Valley are those obtained by the Bureau of Reclamation during the 1943 water year. It is therefore impossible to compute the winter river gains from available records for the years since 1918. The total stream depletion that has occurred in past winters from October to April, inclusive, however, was computed since 1930, during which period there are complete records of inflow to and outflow from the valley. This winter stream depletion has been caused by a combination of consumptive use by plants in irrigated and wet areas, percolation losses from the canals that do not return to the river, and losses, if any, from the river channels. Since it is anticipated that the same canals will be operated in winter in the future as in the past, it is assumed that the winter stream depletion will remain the same. These past records of depletion, therefore, were used in the river operation studies. The average normal winter depletion from 1930 to 1942, exclusive of 1934 and 1935, was used from 1919 to 1929. During this period the gaging station records of inflow and outflow were not complete.

Natural Flow Passed to the Snake River

For the operation studies, it was assumed that the Henrys Fork canals would not buy any space in Palisades Reservoir to exchange stored water for natural flow, but would continue to pass sufficient natural flow to meet all prior rights on the Snake River. The amount of natural flow that must be passed to the Snake River was assumed to be the same as in the past and was computed from records. The total recorded diversion to all Henrys Fork canals below St. Anthony was subtracted from the recorded flow of the Henrys Fork at St. Anthony. The remainder was assumed to be natural flow passed to the Snake River, perhaps including a small amount of operation waste. The natural flow thus obtained was reduced by the 2,000 acre-feet per month allowed for operation waste in the studies.

Losses from Reservoirs

The losses from existing reservoirs in the Henrys Fork watershed, which are of concern in this study, include only the increase in the net losses which are not reflected in past records of stream flow at critical points in the stream and canal network. If the existing reservoirs had been in operation throughout the period of study from 1918 to date and future irrigation requirements would make no change in the past operation of the reservoirs, all of the reservoir losses would be reflected in past stream flow records. There would be no need for a determination of their amount or even for making an operation study of the river. Such is not the case, however, as none of the existing reservoirs has been in operation throughout the period of study, and future irrigation requirements will cause changes in the past records of their operation. The additional stream depletion caused by placing all existing reservoirs into operation in 1918 and by changes in their past operation, if significant, should be accounted for in the studies. This additional depletion would include the increases in evaporation losses and non-tributary seepage losses which are not reflected in past stream flow records. In estimating the evaporation losses, an allowance should be made for the evaporation and transpiration that was taking place in the reservoir areas before the reservoirs were built.

Henrys Lake Reservoir was completed and started storing water in October 1922. The construction of the reservoir increased the area of exposed water surface by only 2,884 acres, since the original lake surface covered 3,472 acres. It is estimated that the increase in evaporation from the 2,884 acres of new water surface over the evaporation and transpiration which was already taking place in the area did not exceed seven inches annually. With the reservoir at full capacity throughout the year this increased loss would amount to only about 1,700 acre-feet, or about 5 per cent of the average annual inflow to the reservoir and about 0.18 per cent of the average summer diversion requirements in the Henrys Fork Valley. From available information it appears that all seepage losses from the reservoir return to the river above Island Park Reservoir. In view of these facts neither the increased seepage nor evaporation losses were included in the operation studies.

Island Park Reservoir was completed and started storing water in November 1938. The increase in evaporation losses from 1918 to 1938 over those already occurring in the reservoir area are estimated to have been about nine inches annually. Studies of the reservoir operation since 1918 show that with this rate, the average net loss would have amounted to about 5,000 acre-feet annually and would not exceed 7,000 acre-feet in any year. The average loss amounts to about 4 per cent of the capacity of the reservoir or about 0.54 per cent of the average summer diversion requirement in the Henrys Fork Valley. Examination of the records of the operation of the reservoir since 1938 disclosed only small seepage losses and it is believed that most of these return to the river above Ashton. Inasmuch as the inclusion of these small seepage losses and increases in evaporation losses from this reservoir in the operation studies was not deemed warranted, both were omitted.

The maximum water surface of Grassy Lake Reservoir covers only 312 acres, so evaporation losses from such a small water surface at an elevation of 7,200 feet are negligible. All seepage losses are believed to return to the river below the dam.

RIVER OPERATION STUDIES

A complete operation study was made of all reservoirs in the Henrys Fork watershed using the basic data previously described and assuming no new land developed in the Henrys Fork Valley, Palisades Reservoir in operation, and the proposed water conservation program in effect on the Snake River. Two results were desired from the operation studies. The first was a determination of the adequacy of the present storage facilities for supplying the derived irrigation requirements to existing Henrys Fork projects in all past years. If the water supply thus developed were not adequate, it was desired to know the amount of the shortages and the years of occurrence. It was also necessary to know the modified flow of the Henrys Fork at the Rexburg gaging station for use as the inflow from the Henrys Fork in the Snake River operation studies.

Criteria

In order to conduct a uniform study which accurately shows the desired results, it was necessary to assume or define certain criteria in order to establish procedures which could be followed in each year of the study. The criteria established for the Henrys Fork study are described in the following paragraphs.

The operation study was begun with all reservoirs full at the end of June 1918. The records of stream flow indicate that there was sufficient run-off in the spring of 1918 to fill all reservoirs, even if all were empty at the end of the irrigation season in 1917. The period of study extended from July 1918 through September 1942, covering the same period as the Snake River studies. The natural flows of the Henrys Fork River, Fall River, and the Teton River, which were obtained from actual records or by estimation as previously described, were used in the study. The derived irrigation storage requirements on Fall River, river losses and gains, and natural flow passed to the Snake River were used in the study.

The reservoirs in the Henrys Fork Valley were operated on a hold-over basis throughout the study. No natural flow except spill and no stored water were allowed to pass the dam at the outlet of Henrys Lake until Island Park Reservoir was empty. Similarly, no natural flow except spill and no stored water were allowed to pass Grassy Lake Dam until Henrys Lake and Island Park reservoirs were empty, except for releases made from Grassy Lake Reservoir for storage requirements of land on Fall River above the Cross Cut Canal. In operating on this hold-over basis, water was sometimes stored in upstream reservoirs when releases were being made from downstream reservoirs. In many years natural flow was stored in Henrys Lake Reservoir during the summer while an equivalent amount of stored water was being released from Island Park Reservoir in order to accumulate as much storage as possible in the former for irrigation use in dry years and to reduce the amount of spills from the latter in wet years. In like manner, natural flow belonging to Snake River projects was stored in the Henrys Fork reservoirs while an equivalent amount of stored water was being released from American Falls Reservoir. This stored natural flow was not released to the downstream reservoirs until it was needed to avoid shortages on the projects owning rights in those reservoirs. If an equivalent amount of water spilled from the Henrys Fork reservoirs before any irrigation shortages occurred on the Snake River projects, the natural flow was credited to the upstream reservoir from which it spilled. No injustice to established natural flow rights on either stream would result from operating the reservoirs in this manner, and this method of operation would assure the maximum possible accumulation of hold-over storage for use in dry years.

Water was also stored in the Island Park and Grassy Lake reservoirs adversely against storage rights in American Falls Reservoir. The "water saving contract" between the United States and the Idaho Power Company dated October 1, 1934, specifies that a certain portion of the water saved by the agreements could be stored in any new reservoirs built in the Henrys Fork watershed. The amount which could be thus stored was not specified in the contract, but it was estimated to average about 45,000 acre-feet annually, this being the amount which the company agreed to refrain from drawing during the winter from its storage rights in American Falls Reservoir. Island Park and Grassy Lake reservoirs are therefore entitled to store a minimum of 45,000 acre-feet each year even if American Falls Reservoir does not fill. Any water stored in excess of this amount was credited to the American Falls storage right, up to the amount needed to fill that right. It was not released, however, until it was needed to avoid shortages on projects owning space in American Falls Reservoir.

In conformity with the agreement with the Utah Power and Light Company, none of the natural inflow to the Island Park Reservoir prior to November 15 was considered storable. This is necessary in order to maintain the power output at the company's power plant at Ashton during the fall when the stream flow is at a low stage.

The average operation waste at the lowest canal heading on the Henrys Fork was assumed to be 2,000 acre-feet per month during the irrigation season. This waste of about 33 cubic feet per second was allowed in the reservoir operation study because of irregular river flows and the time interval required to transmit storage releases from the reservoirs to the points of diversion.

Results

A summary of the reservoir operation study for the Henrys Fork River is shown in Table 8. This summary shows that there was an adequate supply of stored water for all existing projects throughout the period from 1919 through 1942 except for five dry years. The shortages in these years were as follows:

Irrigation Season	Shortage	
	Acre-feet	Percent of Div. Req't.1/
1924	74,000	7
1926	14,000	1
1931	143,000	15
1934	364,000	36
1935	131,000	14

1/ Requirement for May to September, inclusive.

The Henrys Fork operation study and these resulting shortages are based on the assumption that the Henrys Fork projects will not buy additional space in the reservoirs on the Snake River. Such an assumption appears reasonable because the shortages are not excessive. It is concluded, therefore, that the existing storage facilities in the Henrys Fork watershed are adequate to meet the needs of the existing irrigation projects in the Henrys Fork Valley.

The modified flow at Rexburg, which was used in the Snake River operation studies, is shown in Table 9.

TABLE 8

SUMMARY OF OPERATION STUDY OF PROJECTS IN THE HENRYS FORK VALLEY

Units of 1,000 Acre-feet

Water Year	Combined Nat. Inflow to Valley	Usable River Gains	Diversion Requirement	Nat. Flow Passed to Snake River	Storage Releases	Shortage	Water Stored	Non-usable River Gains	Oct.-April Depletion	Mod. Flow at Rexburg	Henrys Lake Reservoir: Nat. In-flow	Henrys Lake Reservoir: Content End of Year	Henrys Lake Reservoir: Content Maxi-mum	Island Park Reservoir: Regu-lated Flow	Island Park Reservoir: Content End of Year	Island Park Reservoir: Content Maxi-mum	Grassy Lake Reservoir: Nat. In-flow	Grassy Lake Reservoir: Content End of Year	Grassy Lake Reservoir: Content Maxi-mum
1919	1980	66	978	79	203	0	32	164	175	1228	37	7	79	486	0	127	22	11	15
1920	2121	66	936	42	62	0	195	164	175	1107	64	71	71	374	65	127	22	15	15
1921	2440	88	902	66	27	0	70	162	175	1570	81	79	79	510	100	127	22	15	15
1922	2249	96	917	62	18	0	27	139	175	1383	70	79	79	487	109	127	22	15	15
1923	2220	52	896	27	36	0	18	153	175	1372	52	79	79	466	91	127	22	15	15
1924	1661	43	1006	69	221	74	36	162	175	944	26	0	79	430	0	127	22	0	15
1925	2521	120	881	54	4	0	194	175	175	1570	52	52	52	426	123	127	22	15	15
1926	1944	49	986	78	210	14	26	191	175	1221	26	6*	74	446	0	127	22	0	15
1927	2713	77	892	0	0	0	193	163	175	1693	51	57	57	471	127	127	22	15	15
1928	2599	83	934	31	27	0	22	162	175	1740	30	79	79	439	100	127	22	15	15
1929	2166	83	915	46	70	0	27	152	175	1354	26	79	79	402	57	127	22	15	15
1930	1800	29	932	33	122	0	70	171	230	890	29	79	79	361	8	127	22	12	15
1931	1446	22	976	70	221	143	122	133	188	679	19	0	79	374	0	127	22	0	15
1932	1993	84	906	50	50	0	173	131	208	969	31	31	31	331	77	127	22	15	15
1933	1966	42	947	28	135	0	80	158	179	1095	31	53	61	340	0	127	22	15	15
1934	1393	22	1010	68	121	364	90	68	392	513	13	0	64	336	0	79	22	0	15
1935	1661	44	956	60	60	131	167	131	294	717	25	0	25	310	0	127	22	0	15
1936	1970	58	972	13	131	0	167	167	178	1009	26	21	25	313	0	127	22	15	15
1937	1740	60	933	26	142	0	151	150	190	818	24	30	45	320	0	127	22	15	15
1938	2236	83	903	45	31	0	174	152	197	1228	47	77	77	383	96	127	22	15	15
1939	2021	68	943	55	84	0	33	192	129	1260	29	79	79	363	43	127	22	15	15
1940	1928	30	940	100	197	0	84	185	156	1160	19	10	79	414	.0	127	22	14	15
1941	1771	58	888	55	99	0	151	167	115	941	23	33	33	287	30	127	22	13	15
1942	2004	61	900	45	84	0	132	114	139	1092	33	66	66	343	43	127	22	15	15
Aver.	2023	62	935	50	98	30	101	154	188	1148	36	-	-	392	-	-	22	-	-

* Belonged to American Falls Reservoir.

TABLE 9

MODIFIED FLOW OF THE HENRYS FORK RIVER NEAR REXBURG, IDAHO

Units of 1,000 Acre-feet | Drainage Area—3,010 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	114	104	93	125	101	116	177	166	41	67	61	63	1,228
1920	86	88	83	80	67	77	46	237	176	44	56	67	1,107
1921	93	96	79	85	90	115	138	354	309	49	73	89	1,570
1922	108	109	110	76	93	112	89	282	226	47	68	43	1,383
1923	102	109	121	127	101	124	102	226	189	52	57	62	1,372
1924	95	95	93	105	108	108	82	44	27	43	69	75	944
1925	72	76	65	74	73	79	135	424	242	154	70	106	1,570
1926	102	115	125	100	103	121	187	123	40	64	77	64	1,221
1927	80	100	79	81	71	83	77	317	442	191	68	104	1,693
1928	135	174	137	130	123	141	116	376	196	79	59	74	1,740
1929	115	112	107	116	113	123	97	198	198	48	55	72	1,354
1930	98	85	71	54	91	111	128	61	39	33	55	64	890
1931	94	85	65	60	61	71	35	30	40	40	49	49	679
1932	23	40	59	58	53	59	50	209	223	86	57	52	969
1933	72	84	71	81	89	100	116	162	186	47	37	50	1,095
1934	51	74	63	66	38	21	23	24	36	66	49	2	513
1935	32	17	46	48	42	54	33	83	122	35	152	53	717
1936	53	71	63	66	62	67	111	247	141	43	43	42	1,009
1937	65	74	60	62	55	66	56	146	104	40	39	51	818
1938	66	63	72	66	60	73	101	274	230	123	49	51	1,228
1939	97	109	88	102	93	129	198	179	102	43	51	69	1,260
1940	100	87	74	80	74	108	134	174	124	70	84	51	1,160
1941	92	85	76	77	66	94	78	120	79	56	64	54	941
1942	95	89	85	73	59	74	135	177	153	46	54	52	1,092
Mean	85	89	83	84	79	93	102	193	153	65	62	61	1,148

CHAPTER VI

WATER SUPPLY FOR THE SNAKE RIVER VALLEY

The Snake River rises on the west side of the Continental Divide, in the southern part of Yellowstone National Park, and flows southward through Wyoming for about 130 miles between the Teton and Wind River mountain ranges. Upon entering Idaho it bends abruptly and follows a northwesterly course for about 60 miles until it is joined by the Henrys Fork, soon after entering the upper reaches of the Snake River Valley. Below this junction the main stream heads southwest and crosses southern Idaho in a large arc. From its source the river flows through mountainous country and is confined in small basins, canyons, and narrow valleys until it emerges into the great Snake River Plain at Heise, Idaho. In crossing the Plain, the main stream has eroded several spectacular canyons in the lava formations. The lava flows are covered by shallow depths of alluvial and wind-deposited soils throughout the plain.

The Snake River watershed is one of the most prolific watersheds in the West, averaging about 800 acre-feet per square mile annually on the drainage area of about 5,740 square miles above Heise. The prevailing moisture-laden air currents from the Pacific Ocean, in crossing the Continental Divide, cause heavy precipitation in the form of snow on its west slopes during winter. The spring and summer melting of the deep snow beds causes an abundant run-off during the spring and early summer; and the ground-water outflow from the porous, water-bearing formations on the mountain slopes maintains a dependable base stream flow during late summer and fall. Climatic cycles have affected the annual run-off of the Snake River just as much as other western streams, however, and as a result, considerable hold-over storage facilities are needed to make approximately full use of available water.

Detailed studies were made of the water requirements for irrigation of lands under the existing canals diverting from the Snake River. The requirements derived from these studies were used in detailed studies of the operation of the river system covering the period from 1919 to 1942 with all existing reservoirs and the proposed Palisades Reservoir in operation and with the full winter water saving program as previously outlined in effect. The river operation studies were conducted for Plan A and Plan B, described in Chapter IV, in order to determine the adequacy of the water supply under the conditions with and without two projects of new land. This chapter deals with the derivation of the basic data used, the criteria adhered to, and the results of the river operation studies.

PRESENT DEVELOPMENT

The abundant water supply in the Snake River together with the many thousands of acres of fertile land in the Snake River Plain is one of the most lavish gifts of nature in the West. This fact was soon recognized by the pioneer settlers, and they and their successors have developed this resource to almost its fullest extent in the last 50 years. From a beginning of a few small hay meadows irrigated near Menan in the early 1880's, the area irrigated from the Snake River above Milner has now expanded to about one million acres. Another half million acres of arable land could be irrigated if water were available. The increasing cost of storage regulation has been the only deterrent to full utilization of the water supply for irrigation. Power development kept pace with the irrigation development in the early years, but the demand for irrigation water soon curbed power development after reservoirs were built to store winter flows. Power is now of only secondary importance on the river. An adequate water supply during droughts for the presently irrigated acreage and the further development of new lands is dependent on providing additional storage facilities on the river. The proposed Palisades Reservoir is only another step toward more complete use of the available water supply in the Snake River.

Irrigated Land

There were about 1,022,000 acres under canals diverting from the Snake River between Heise and Milner in 1942; about 947,000 acres were actually irrigated. This acreage is entirely dependent on the Snake River for its water supply, with the exception of the small amounts of water delivered to the upper valley from Willow Creek and the Blackfoot River. The present development of irrigated lands between Heise and Milner is summarized as follows:

Location	Number of Canals	Total Acreage Under Canals	Total Acreage Irrigated in 1942	Aver. Div. Requirement In Acre-feet
Above Amer.Falls	58	451,000	410,000	2,875,000
Below Amer.Falls	7	571,000	537,000	3,472,000
Total	65	1,022,000	947,000	6,347,000

No extensions of the existing canal systems or increase in the acreage under them is anticipated in the future, but the present irrigated acreage will be farmed more intensively and more of the present idle acreage will be irrigated if additional stored water is made available. The development of any new land outside the limits of the existing projects will generally require new and separate distribution systems. There are but few opportunities to develop new land by pumping out of existing canals without enlarging them.

In addition to the above, there are about 10,000 acres of land irrigated from the Snake river and its tributaries between Heise and the Idaho--Wyoming state line, and there are about 100,000 acres irrigated in Wyoming from the Snake River and its tributaries in Jackson Hole and Star Valley. The water requirements for these projects were not included in this study because there has been no appreciable change in the irrigated acreage during the critical period since 1930. Moreover, the consumptive use of water on these lands is reflected in all downstream records of stream flow. Several new reservoirs have been proposed in Wyoming at various times in the past to provide a supplemental water supply for the presently irrigated lands and to enable the development of some new lands in Wyoming. None of these proposals, however, has been investigated in enough detail as yet to appraise its feasibility or to warrant including it in this study. Any increase in the irrigation development in Wyoming will deplete the flow of the Snake River entering Idaho by the amount of the increase in consumptive use and will decrease, in like amount, the water supply available for Idaho projects as shown by this study.

Water is delivered by gravity flow from the river to practically all irrigated lands in the Snake River Valley in Idaho. The Osgood and Milner Low Lift Projects, comprising 6,000 and 9,000 acres, respectively, are the only large pumping projects lifting water directly from the river. Water is pumped from the Minidoka South Side Canal to about 46,000 acres composing the Burley Irrigation District. Several small pumping plants lift water from other main canals to serve land above them. All of the lands in existing projects along the Snake River are surface-irrigated in the usual manner except in few areas where the water table has risen to the surface as a result of irrigation. Artificial drainage has been developed to relieve most of the seeped areas, and the construction of drains is a continuing process on some of the projects. Inasmuch as prolonged water-logging is detrimental to the land in every case, sub-irrigation has not been practiced intentionally.

Reservoirs

Although the increase in irrigated area in the past 25 years has been slight, there has been a growing demand for storage construction. This demand is attributed mostly to the changing to row crops, which require more late-season water. The demand for hold-over storage was greatly accentuated by the lessened run-off during the 1930-1936 period. The table of existing reservoirs and dates of completion on the following page portrays the history of storage development in the watershed above Bliss.

Reservoir	Stream	Date Completed	Capacity (Acre-feet)
Lake Walcott	Snake River	1909	95,000
Wilson Lake	North Side Canal	1909	18,000
Salmon	Salmon Falls Creek	1911	183,000
Portneuf	Portneuf River	1911	16,000
Goose Creek	Goose Creek	1912	74,000
Mackay	Big Lost River	1916	38,000
Jackson Lake	Snake River	1916 1/	847,000 1/
Magic	Big Wood River	1917 2/	192,000 2/
Two Ocean Lake	Pacific Creek	1920	3,000
Emma Matilda Lake	Pacific Creek	1920	2,000
Cedar Creek	Salmon Falls Creek	1920	28,000
Henrys Lake	Henrys Fork River	1922	79,000
Fish Creek	Fish Creek	1922	18,000
Grays Lake	Willow Creek	1924	40,000
Blackfoot Marsh	Blackfoot River	1924 3/	350,000 3/
American Falls	Snake River	1927	1,700,000
Island Park	Henrys Fork River	1938	127,000
Grassy Lake	Fall River	1939	15,000
Little Wood River	Little Wood River	1940	10,000
Miscellaneous	-	-	9,000
Total	-	-	3,844,000

1/ Initial construction provided a capacity of 300,000 acre-feet in 1907.

2/ Initial construction provided a capacity of 172,000 acre-feet in 1909.

3/ Initial construction provided a capacity of 300,000 acre-feet in 1909.

The completion of American Falls Reservoir in 1927 doubled the amount of storage space in the watershed. At that time it was thought that this reservoir, together with Jackson Lake Reservoir, would provide sufficient stored water for all irrigated lands dependent on the main stream. These reservoirs failed to provide sufficient stored water during the 1931--1935 period, however, even though they fully regulated the flow above Milner Dam. The elimination of winter operation of the canals would have increased the storage of water in American Falls Reservoir during this period, but the supply still would not have been adequate every year.

Power

There are nine hydroelectric power plants on the main stream above Bliss. The following table lists these installations in downstream order, with pertinent data:

Name of Plant	Owner	Head (feet)	Installed Capacity (kilowatts)
Upper	City of Idaho Falls	19	2,400
Middle	City of Idaho Falls	21	2,000
Lower	City of Idaho Falls	18	1,500 1/
American Falls	Idaho Power Company	49	27,000
Minidoka	Bureau of Reclamation	48	13,400
Twin Falls	Idaho Power Company	145	9,375
Shoshone Falls	Idaho Power Company	210	12,500
Upper Salmon Falls	Idaho Power Company	48	18,000
Lower Salmon Falls	Idaho Power Company	37	7,200
Total	-	-	93,375

1/ Plant and penstocks built for two 1,500 kilowatt units, but only one unit has been installed.

The Idaho Falls power plants are run-of-the-river plants, and their operation does not interfere with irrigation in any way. As previously discussed, power production at the existing plants at American Falls and Minidoka Dam will be greatly reduced if the winter operation of the canals in the lower valley is eliminated.

All electric power used in the Snake River Valley, except on the Minidoka Project, is delivered by transmission lines of the Utah Power and Light Company and the Idaho Power Company. These two systems are interconnected near Soda Springs, Idaho. The Minidoka Project is supplied by Federal transmission lines. The plants operated by the city of Idaho Falls are located in and adjacent to that city, and the city consumes all of the output except for recent deliveries of some secondary power to the Utah Power and Light Company.

WATER SUPPLY

The water supply for irrigation of lands in the Snake River Valley below Heise is derived largely from the flow of the main stream, which enters the valley at Heise, and from the flow of the Henrys Fork River at its mouth. Practically all of the remainder of the supply comes from the flow of springs which rise in the American Falls Reservoir area. The water supply contributed by tributary streams below the mouth of the Henrys Fork is significant in wet years but is almost negligible in dry years.

Available Stream Flow Records

The Geological Survey, United States Department of the Interior, in cooperation with the State of Idaho and the water users on the Snake River, has maintained gaging stations at all critical points on the river and has handled the distribution of storage and natural flow to the irrigation projects each summer since 1919. In connection with this work, complete records have been obtained of all canal diversions during the irrigation season from May to September, inclusive. Complete records have been obtained of all winter diversions below American Falls, but no records were kept of the many winter diversions in the upper valley. The Bureau of Reclamation obtained complete records of all canal diversions and return flow above American Falls during the winter from October 1, 1942, to April 30, 1943, and continued the same work in the Idaho Falls and New Sweden areas during the winter of 1943--1944.

Complete stream flow records are available from Geological Survey gaging stations on the Snake River at Moran, Clough, Neeley, Minidoka, Milner, and Kimberly since 1918, and at Heise since 1925. The Moran station is located below the outlet from Jackson Lake Reservoir; the Clough station is located just below the mouth of Blackfoot River; and the Neeley station is located about one half mile below American Falls Dam. Records of winter flow at Heise are missing prior to 1925. Records of the discharge of the Snake River at the Palisades dam site are available for the summer months of April to October, inclusive, from 1934 to 1936; and complete records are available from April 1939 to September 1941. Complete records of the operation of Jackson Lake Reservoir, American Falls Reservoir, and Lake Walcott are available since each of these reservoirs was completed. The river-gaging stations at Moran, Neeley, and Minidoka have recorded all releases and spills from these reservoirs.

Natural Flow

In order to make an operation study of the Snake River under conditions different from those existing in the past, it was necessary to convert all records of stream flows above Heise back to natural flow. The unregulated flows at Moran, Palisades dam site, and Heise were obtained by correcting the gaging-station records for all recorded changes in storage in Jackson Lake Reservoir. The effect on the flow of the main stream from past operation of the Emma Matilda and Two Ocean Lake reservoirs, with a combined capacity of 5,000 acre-feet, is so small that it was neglected in computing the unregulated flow at Heise and at Palisades dam site. The unregulated flow at Heise during the winters from 1918 to 1925 was estimated by means of correlation with concurrent records of natural flow of the Henrys Fork River at Warm River. The unregulated flow at Palisades dam site during periods in which no records were available at that station was estimated by means of a correlation with concurrent records of unregulated flow at Heise. Good correlations were obtained in both cases.

In order to obtain the natural flow at Heise and at the Palisades dam site each year since 1918, it would be necessary to increase the above derived unregulated flow by the amount of the stream depletion caused by irrigation of lands above those stations each year in the past. The acreage irrigated in these headwater areas in Idaho and Wyoming has increased gradually since 1918, but there are no accurate records of the acreage actually irrigated each year. The lack of records makes it impossible to estimate reliably the stream depletion which occurred each year in the past. It is believed, however, that there has been no appreciable change in the amount of this depletion since 1930. For the purpose of this study, therefore, it is assumed that this depletion will remain the same in the future as in the past. The unregulated flows at Heise and Palisades dam site are considered the same as natural flow and will be referred to as such subsequently.

The natural flow of the Snake River at Moran since 1918, computed from actual records, is given in Table 10. The natural flows at Palisades dam site and Heise, which were computed and estimated as described above, are given in Tables 11 and 12, respectively.

The recorded flows at the river gaging stations at Clough and Neeley were modified in the operation studies to reflect irrigation requirements and river gains under future conditions with Palisades Reservoir in operation and with the proposed winter water conservation program in effect.

WATER REQUIREMENTS

In conducting an operation study of any river system it is necessary to determine the amount of water that must be delivered each month at critical points in the system in order to meet all diversion requirements between or below those points. In the case of the Snake River, these critical points are at Heise and at American Falls, where the river can be controlled almost fully by reservoirs after the proposed Palisades Reservoir is built. The net irrigation requirement of the Snake River at Heise is the sum of the diversion requirements for all canals between Heise

TABLE 10

NATURAL FLOW OF THE SNAKE RIVER AT MORAN, WYOMING

Units of 1,000 Acre-feet — Drainage Area—816 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	46	29	22	24	29	32	42	234	140	39	27	21	685
1920	26	30	30	28	23	28	30	173	360	162	68	34	992
1921	41	32	33	33	24	25	35	286	342	129	55	33	1,068
1922	26	34	34	29	27	25	25	179	394	142	59	34	1,008
1923	20	22	29	32	23	28	32	197	322	160	50	31	946
1924	30	24	27	28	23	19	30	216	142	67	20	20	646
1925	42	30	27	35	32	26	74	357	369	203	84	48	1,327
1926	36	32	26	23	26	23	79	244	148	67	38	21	763
1927	29	35	35	35	37	24	37	190	598	258	83	55	1,416
1928	40	61	49	40	26	32	47	479	293	172	58	32	1,329
1929	31	24	34	30	27	27	35	150	314	116	48	31	867
1930	23	14	28	24	26	23	67	186	207	100	64	32	794
1931	43	24	20	20	17	23	38	149	148	47	29	17	575
1932	22	19	25	26	27	30	35	228	358	135	62	25	992
1933	20	20	22	31	28	20	25	118	390	112	53	33	872
1934	21	19	20	28	21	28	112	209	86	49	21	14	628
1935	28	28	27	30	23	26	45	168	354	135	51	19	934
1936	22	23	20	40	38	28	66	382	284	91	52	23	1,069
1937	18	13	21	24	27	21	28	230	232	100	45	19	778
1938	24	22	32	29	26	36	51	223	438	157	64	41	1,143
1939	31	28	30	28	28	26	66	278	191	107	52	26	891
1940	23	14	19	27	29	28	49	264	205	73	38	24	793
1941	26	24	23	27	22	18	33	225	186	85	63	47	779
1942	40	32	40	28	25	20	59	160	279	133	46	24	886
Mean	30	26	28	29	26	26	48	230	282	118	51	29	924

TABLE 11

NATURAL FLOW OF THE SNAKE RIVER AT PALISADES DAM SITE, IDAHO

Units of 1,000 Acre-feet — Drainage Area--5,110 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	260	209	171	207	147	174	456	842	463	217	176	159	3,481
1920	180	162	178	168	135	144	207	1,078	1,391	686	327	250	4,906
1921	207	184	164	171	131	168	329	1,268	1,517	558	336	259	5,292
1922	212	223	209	144	138	182	202	1,029	1,446	535	349	259	4,928
1923	198	222	205	216	159	188	256	1,016	1,148	666	328	221	4,823
1924	209	173	165	179	161	165	264	820	582	307	177	161	3,363
1925	210	164	137	157	145	168	480	1,343	1,204	792	391	304	5,495
1926	249	204	180	150	142	192	455	797	520	287	239	175	3,590
1927	192	184	178	175	150	143	274	1,032	1,849	971	397	316	5,861
1928	271	272	232	220	161	197	330	1,772	1,083	724	333	234	5,829
1929	226	185	167	159	152	152	203	692	1,010	507	269	242	3,964
1930	200	157	164	138	131	158	423	711	852	443	325	224	3,926
1931	264	180	156	135	124	146	231	467	510	190	161	140	2,704
1932	151	138	130	125	115	135	247	965	1,199	603	310	214	4,332
1933	192	173	155	163	132	138	215	548	1,256	406	243	191	3,812
1934	165	149	135	138	113	156	pe 347	r 629	r 307	r 186	r 138	110	2,573
1935	139	128	120	120	100	119	r 276	r 662	r 1,204	r 531	r 259	r 170	3,828
1936	r 164	146	127	140	128	125	r 376	r 1,542	r 1,208	r 466	r 288	r 216	4,926
1937	r 181	153	149	136	124	128	197	930	755	367	197	168	3,485
1938	170	152	159	140	121	151	390	991	1,331	639	300	230	4,774
1939	213	184	172	161	134	174	r 420	r 898	r 675	r 420	r 241	r 180	3,872
1940	r 173	r 137	r 133	r 132	r 131	r 148	r 244	r 755	r 622	r 242	r 166	r 159	3,042
1941	r 161	r 144	r 132	r 130	r 110	r 129	r 220	r 759	r 724	r 341	r 264	r 228	3,342
1942	211	175	178	140	122	128	426	685	978	511	231	183	3,968
Mean	200	175	162	156	134	155	311	926	993	483	269	208	4,172

r - Geological Survey records corrected for regulation by Jackson Lake Reservoir.

pe- Partially estimated.

Note: All other months estimated by correlation with natural flow of the Snake River at Heise; depletion caused by irrigation of lands above station is reflected in all flows.

TABLE 12

NATURAL FLOW OF THE SNAKE RIVER NEAR HEISE, IDAHO

Units of 1,000 Acre-feet . . . Drainage Area—5,740 Sq. Mi.

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1919	pe 285	c 232	c 192	c 230	c 167	c 195	pe 491	896	499	240	197	179	3,803
1920	201	pe 183	c 199	c 189	c 154	c 164	230	1,143	1,472	733	356	275	5,299
1921	pe 230	c 206	c 185	c 192	c 150	c 189	pe 356	1,343	1,604	598	365	284	5,702
1922	pe 235	c 247	c 232	c 164	c 157	c 204	pe 224	1,092	1,530	574	379	284	5,322
1923	pe 220	c 246	c 228	c 239	c 179	c 210	pe 281	1,079	1,217	711	357	245	5,212
1924	232	194	pe 186	c 200	c 182	c 186	pe 289	873	623	335	198	181	3,679
1925	233	185	156	177	165	189	516	1,422	1,276	844	423	332	5,918
1926	274	226	201	170	162	214	490	849	558	314	253	196	3,907
1927	214	206	199	196	170	163	300	1,095	1,953	1,031	429	344	6,300
1928	297	298	256	243	181	219	359	1,872	1,149	772	362	258	6,266
1929	250	207	188	179	172	172	226	739	1,072	544	295	267	4,311
1930	222	177	185	157	150	178	456	759	907	477	354	248	4,270
1931	289	202	176	154	143	166	255	503	548	212	181	160	2,989
1932	171	157	149	144	133	154	272	1,025	1,271	645	338	237	4,696
1933	214	194	175	184	151	157	238	588	1,330	439	268	213	4,151
1934	186	169	154	157	131	176	357	633	335	205	151	128	2,782
1935	158	147	139	138	118	137	308	722	1,231	551	274	189	4,112
1936	180	166	146	159	147	144	427	1,655	1,280	489	315	242	5,350
1937	206	173	169	155	143	147	219	988	805	398	219	189	3,811
1938	191	172	179	159	140	171	422	1,052	1,409	684	328	254	5,161
1939	236	206	193	181	153	195	490	983	735	458	275	217	4,322
1940	197	158	154	154	150	172	289	827	665	276	191	184	3,417
1941	182	163	150	148	128	154	248	823	761	377	306	257	3,697
1942	234	196	199	158	141	147	460	731	1,039	549	255	205	4,314
Mean	222	196	183	176	153	175	342	987	1,053	519	294	232	4,533

c – Estimated by correlation with natural flow of the Henrys Fork at Warm River.

pe– Partially estimated.

Note: All other months are Geological Survey records corrected for regulation by Jackson Lake Reservoir; depletion caused by irrigation of lands above station is reflected in all flows.

and American Falls Reservoir less the inflow from the Henrys Fork and the usable return flow entering the river above Blackfoot. The net irrigation requirement at American Falls is the sum of the diversion requirements for all canals diverting at Minidoka and Milner dams less the tributary inflow and return flow entering the river between American Falls and Milner.

The determination of the net irrigation requirements at Heise and American Falls is complicated by the percolation losses from the river channel in both sections which join a ground-water movement to the west and do not return to the river above the lowest canal diversions at Milner Dam. These channel losses absorb a considerable portion of the tributary inflow and return flow entering each section and at times exceed it. At such times, the irrigation requirement at Heise and American Falls is greater than the total diversion requirements of all canals. This condition occurs quite often in April, May, and June in the section between Heise and Clough. The net effect of the inflow and channel losses in each section of the river can best be expressed in terms of river losses and gains, and is referred to as such subsequently. For convenience in conducting the river operation studies, the inflow from the Henrys Fork has been classed as a part of the original water supply, and the river gains and losses between Heise and Clough have been computed and estimated accordingly.

The determination of diversion requirements and river losses and gains under future conditions, with Palisades Reservoir in operation and with elimination of winter diversions, is discussed in the following paragraphs.

Irrigation Requirements for Existing Projects

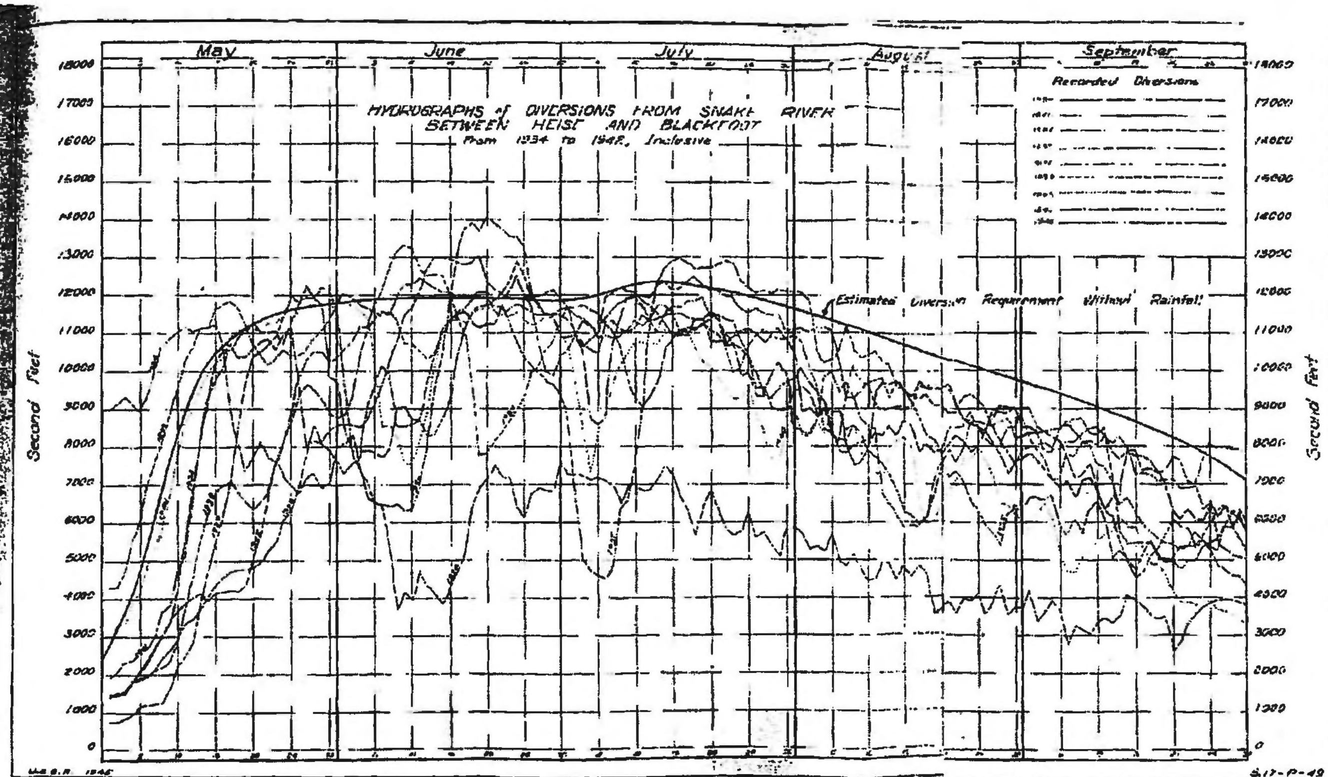
In planning projects of new land it is necessary to estimate the diversion requirement on the basis of consumptive use of water by crops, effective rainfall during the growing season, anticipated losses in the canal system, and deep percolation losses and surface waste from the irrigated land. Records of water use on adjoining or similar projects, which have been in operation for several years, are usually used as a guide in estimating each of the elements involved in the total diversion requirement. This procedure was not followed in estimating the future diversion requirements for existing projects on the Snake River because complete records of all past diversions in the lower valley are available, and there are records of all diversions in the upper valley from May to September, inclusive, each year since 1919. Practically all of the projects are now fully developed and have diverted almost their full irrigation requirement in a few years of abundant water supply since 1936. The new supply of irrigation water to be provided by Palisades Reservoir and by elimination of winter diversions will be used on existing projects only as a supplement to the present supply of natural flow and stored water. The full irrigation requirement for each year during the period of study, therefore, was estimated by using all available records of past water use and of rainfall as a guide.

The detailed determination of future irrigation requirements in the upper valley was limited to the May--September period because all of the new stored water to be used by existing projects will be delivered during that period in both the upper and lower valleys. The greater part of it will be delivered in July, August, and September. No change will be made in the amount of water delivered in April and October because no shortages of irrigation water have occurred in those months in the past. The irrigation season in the upper valley normally begins during the last half of April and ends about the middle of October. In the lower valley, where a milder climate prevails, irrigation begins about the first of April and continues until late in October. All summer rainfall in excess of about one half inch per storm is effective in reducing canal diversions in the upper valley. The lands in that area are served by relatively short canal systems which can be easily manipulated in order to take advantage of the rainfall. Precipitation there averages about four and one half inches during the May to September period. The average precipitation of about three inches from May to September, inclusive, in the lower valley causes little or no reduction in canal diversions in that area because very few storms exceed one half inch of rainfall. Moreover, the lands are irrigated by long canal systems which cannot be easily manipulated.

The maximum irrigation demand that would have occurred in the past between Heise and Blackfoot, with no rainfall during the growing season, was determined by plotting a combined hydrograph of past records of daily diversions in cubic feet per second since 1934 and by drawing a smooth curve on it which touched the peaks of the hydrographs for each year. This curve would have been the hydrograph of diversions if no rain had fallen. It reflects past supplies of stored water and past irrigated acreages and cropping programs, however, and will hold true in the future only if none of these factors is changed. The demand hydrographs for May and June will remain the same in the future, except in extremely dry years, regardless of the supply of stored water, because changes in cropping programs or acreage should have but little effect on the demand during these months. The maximum demand during July, August, and September was determined by making an estimate of the full demand of each canal, using its past diversions as a guide and allowing for the increased use of water if an adequate supply of stored water were available.

The position of the past-demand hydrograph in daily cubic feet per second was then shifted upward until it coincided with the assumed future demand in acre-feet, as estimated above. The hydrographs of recorded diversions since 1934 and the estimated maximum demand curve without rainfall are shown on the chart on the following page. The position of the maximum-demand hydrograph without rainfall exceeds the peaks of hydrographs of all past diversions during July, August, and September by from 500 to 800 cubic feet per second except in 1938 and 1942, when unusually high diversions occurred in July. It ranges from a maximum of about 12,400 cubic feet per second in July to about 7,000 cubic feet per second at the end of September.

The diversion requirement above American Falls for each year during the critical period from 1930 to 1942 was estimated graphically by means of a combined hydrographic sheet for each year showing the combined inflow at Heise and Rexburg, the total diversions of natural flow and stored water, the outflow at Clough in daily cubic feet per second, and the daily precipitation in inches at Idaho Falls. The hydrograph of the maximum future demand without rainfall was superimposed on each of these sheets to determine the upper limit of daily diversions under future conditions during periods of no rainfall. With all of this information shown graphically on each sheet, the factors influencing diversions each year in the past were analyzed visually and used as a guide in sketching the hydrograph of the full diversion requirement on each sheet. The watermaster has for many years stopped all deliveries of stored water on the last day of September as a matter of convenience and economy because there is no urgent need for stored water after that date. It is assumed that this practice will continue in the future, and because of this the estimated hydrographs of future diversions were not extended beyond the end of September. The daily diversions in cubic feet per second shown by the estimated hydrographs of required diversions were totaled for each month and converted to acre-feet in order to obtain the estimated monthly requirements to be used in the operation studies. The accompanying hydrographic sheet entitled "Hydrographs of Inflow, Outflow, Diversion, and Precipitation--Snake River Valley" for the 1934 irrigation season demonstrates the method used for determination of diversion requirements in the upper valley during the period from 1930 to 1942. The period from 1918 to 1929 was not critical insofar as water supply is concerned and did not warrant the above detailed study to determine future irrigation requirements. The requirements for this period were estimated by using as a guide the records of past diversions, rainfall records, and the estimated maximum demand without rainfall.



HYDROGRAPHS of DIVERSIONS FROM SNAKE RIVER
BETWEEN HEISE AND BLACKFOOT
From 1934 to 1942, Inclusive
May
June
July
August
September
Recorded Diversions
Estimated Diversion Requirement Without Rainfall
Second Feet
Second Feet
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
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1000
0
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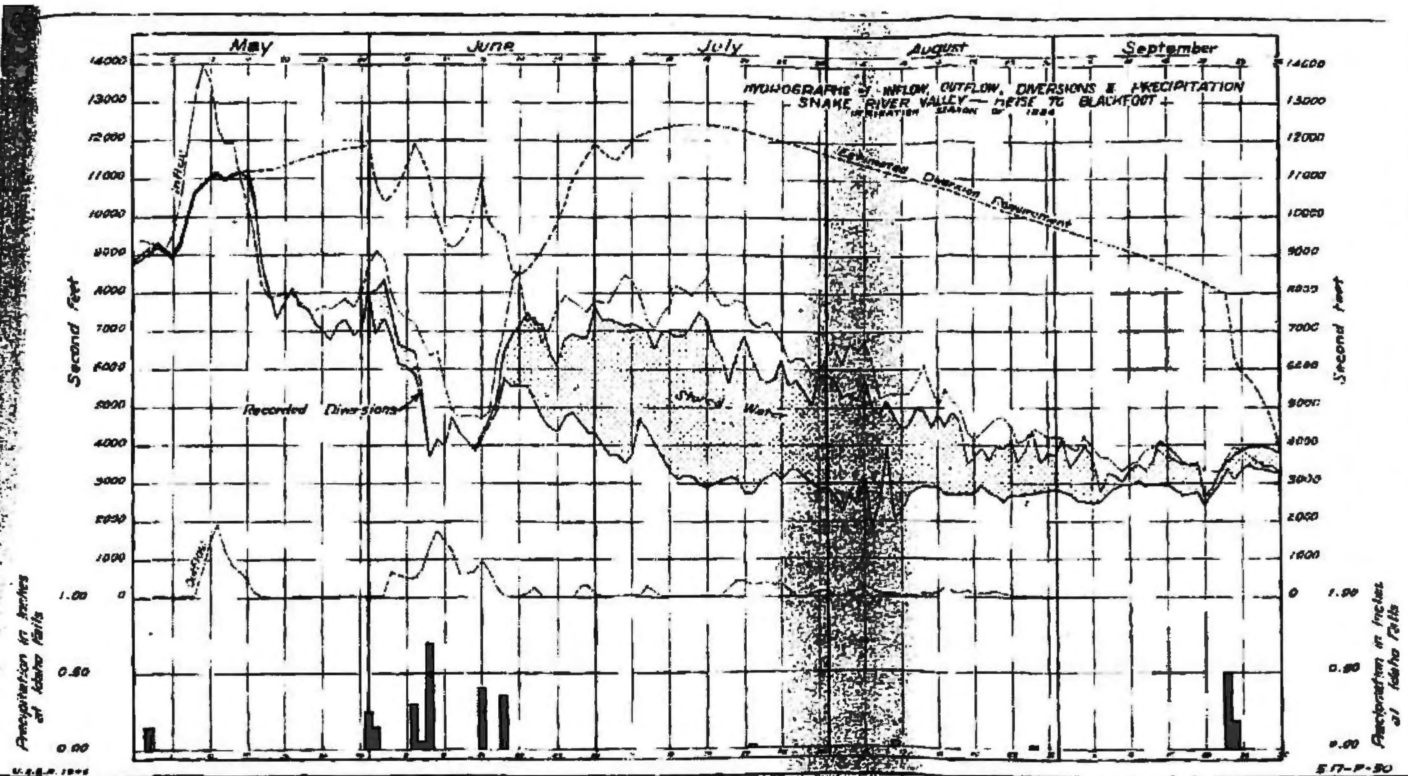


HYDROGRAPHS OF INFLOW, OUTFLOW, DIVERSIONS & PRECIPITATION
SNAKE RIVER VALLEY — HEISE TO BLACKFOOT
IRRIGATION SEASON OF 1934
May
June
July
August
September
Second Feet
Inflow
Outflow
Recorded Diversions
Stored Water
Estimated Diversion Requirement
Precipitation in Inches at Idaho Falls
U.S.G.P. 1946
517-P-30

The estimated monthly diversion requirements from May 1 to September 30 for all existing projects served by canals diverting from Snake River between Heise and Blackfoot are shown in Table 13. The diversion requirements for the upper valley during April and October were not estimated because of lack of complete records of past diversions in those months and the uncertainties involved in fixing the beginning and end of the irrigation season in each of the years included in the river operation studies. It was assumed, therefore, that the stream depletion caused by past diversions in April and October would remain the same under future operating conditions. It is recognized that some saving of water would be realized in those months if the canals were shut off during the winter, but this saving was neglected in the operation studies because it was impossible to evaluate it for each year included in the period of study.

The diversion requirements for canals below American Falls were estimated by using as a guide the recorded diversions in recent years when there was an adequate supply of stored water available for all projects. Shortages reported by the watermaster in past dry years were also used as a guide in estimating what the diversions would have been in those years if a full water supply had been available for all projects. Summer rainfall was ignored in estimating the diversion requirements in the lower valley. The irrigation season in the lower valley was assumed to extend from April 1 to October 31. The estimated monthly diversion requirements during this period of each year included in the river operation studies are shown in Table 14.

Irrigation Requirements for New Land

As discussed heretofore, two plans for future utilization of the water resources of Snake River are presented in this report. Under Plan A the entire water supply would be reserved for use on existing projects; under Plan B two projects of new land would be developed by utilizing the reserved space in American Falls Reservoir for that purpose. No detailed studies were made to determine the diversion requirements for the new lands in these projects because they are not critical insofar as this report is concerned. Since their water supply is fixed by and limited to the yield of the 433,000 acre-feet of reserved space in American Falls Reservoir, the estimated diversion requirements affect only the acreage in, and the amount of reserved reservoir space assigned to each project. A detailed investigation of each project may show somewhat different acreages and amounts of reservoir space, but such changes will not have any appreciable effect on the water supply for the Snake River Valley as a whole as presented herein. The derivation of the diversion requirements for the two tracts of new land, which

TABLE 13

ESTIMATED TOTAL DIVERSION REQUIREMENTS
FOR EXISTING IRRIGATION PROJECTS BETWEEN HEISE AND BLACKFOOT

Units of 1,000 Acre-feet

Irrigation Season	May	June	July	August	Sept.	Total
1919	500	700	710	650	430	2,990
1920	400	680	720	600	420	2,820
1921	300	620	700	640	500	2,760
1922	320	670	690	550	490	2,720
1923	390	540	660	630	460	2,680
1924	550	620	700	650	490	3,010
1925	400	660	700	620	390	2,770
1926	590	680	730	650	470	3,120
1927	300	620	730	650	460	2,760
1928	460	585	740	640	500	2,925
1929	260	650	735	640	460	2,745
1930	436	675	721	521	479	2,832
1931	466	703	734	646	482	3,031
1932	379	563	687	644	498	2,771
1933	226	756	712	645	506	2,845
1934	668	601	738	655	481	3,143
1935	276	684	738	655	502	2,855
1936	489	619	723	645	507	2,983
1937	392	601	696	632	504	2,825
1938	356	680	628	652	513	2,829
1939	585	620	737	654	450	3,046
1940	548	640	700	655	358	2,901
1941	444	623	724	560	480	2,831
1942	314	684	735	655	426	2,814
Average	419	644	712	631	469	2,875

TABLE 14

ESTIMATED TOTAL DIVERSION REQUIREMENTS
FOR EXISTING IRRIGATION PROJECTS BELOW AMERICAN FALLS

Units of 1,000 Acre-feet

Irrig. Season	April	May	June	July	Aug.	Sept.	Oct.	Total
1919	256	621	633	707	697	465	169	3,548
1920	254	586	640	672	626	473	135	3,386
1921	222	592	638	692	634	447	150	3,375
1922	206	582	642	695	622	496	148	3,391
1923	246	598	618	679	641	471	140	3,393
1924	339	595	638	697	687	465	211	3,632
1925	306	588	598	655	643	433	159	3,382
1926	384	602	613	687	667	455	204	3,612
1927	194	560	608	682	673	481	172	3,370
1928	230	633	625	690	691	487	188	3,544
1929	159	582	628	686	690	472	148	3,365
1930	430	451	616	692	697	455	138	3,479
1931	262	612	643	727	707	485	168	3,604
1932	195	552	579	705	697	513	162	3,403
1933	260	583	667	696	716	508	190	3,620
1934	330	602	648	717	707	495	175	3,674
1935	164	553	626	707	691	491	161	3,393
1936	163	667	618	694	686	456	164	3,448
1937	156	600	589	724	693	455	160	3,377
1938	179	602	628	657	697	506	155	3,424
1939	338	668	616	700	699	463	155	3,639
1940	216	618	645	710	706	475	120	3,490
1941	228	621	577	695	696	453	110	3,380
1942	209	529	615	712	710	483	138	3,396
Average	247	592	623	695	682	474	159	3,472

were used in the river operation studies, is discussed in the following paragraphs.

A recent report on the Fort Hall Project by the Indian Service states that seven acre-feet of water measured at the proposed Palisades Reservoir will be needed properly to irrigate each acre of new land in the Michaud Unit. At this rate, a total of 210,000 acre-feet of water would be needed each season to irrigate 30,000 acres of land in the Michaud Unit of the Fort Hall Project. The monthly distribution of this total requirement was estimated by using as a guide the records of water deliveries to the Fort Hall Project during years when that project had an adequate water supply. The soils and underlying materials in the existing Fort Hall Project are similar to those in the Michaud Unit, and it is anticipated that the water requirements will be about the same.

The new lands in the proposed North Side Pumping Division of the Minidoka Project are similar to those of the Burley Irrigation District which are served entirely by pumping, and it is anticipated that they will require about the same amount of water. The recorded diversions from Lake Walcott for the Burley Irrigation District have averaged about six acre-feet per acre irrigated in years of adequate water supply since 1931. At this rate a total of 37,000 acres could be irrigated with an annual diversion of 223,000 acre-feet. The monthly distribution of this requirement was assumed to be the same as past deliveries to the Burley Irrigation District.

River Losses and Gains

The tributary inflow from surface streams between the mouth of the Henrys Fork and Milner is negligible when compared with the flow of the main stream. Practically all of it is concentrated in Willow Creek, the Blackfoot River, the Portneuf River, the Raft River, and Goose Creek. These streams drain the west slope of the low range of hills and mountains bordering the Snake River Plain on the south and east sides. Most of the summer flows of these streams is used for irrigation and very little of it reaches the Snake River. The most important tributary inflow to the main river between the mouth of the Henrys Fork and Milner occurs in the form of springs in the American Falls Reservoir basin. The flow of these springs averages about 2,500 cubic feet per second throughout the year. The source of these springs has been generally attributed to underflow along the Snake River, Blackfoot River, and Portneuf River.

In flowing across the valley floor between Heise and American Falls, the Snake River has influent and effluent sections in which considerable quantities of water are lost and gained, respectively. An alluvial fan with deep deposits of sand, gravel, and boulders extends from Heise to the mouths of the Henrys Fork and the Great Feeder, a distance of about 20 miles. The water table in this section is below the river bed through the upstream half, but stands at or above the river level in the downstream half during the summer. As it drops in winter, the balance point is shifted farther downstream. Heavy channel losses occur through the upstream portion of this section, but they are mostly offset by the ground-water outflow from the lower reaches of the fan. Between the lower end of this fan and Shelley, the river is confined in a small canyon cut in the lava formations. Although the water table lies from 50 to 100 feet below the river bed throughout this canyon, there are only small channel losses from the river. The cracks and crevices in the lava rock have apparently been well sealed by river silt through the ages. Below Shelley the river again flows across deep gravel deposits until it reaches the ancient lake beds near Clough. The water table is below the river bed between Shelley and Blackfoot, but stands at or above river level from Blackfoot to the American Falls Reservoir. Although heavy channel losses occur in the former section they are partially offset by gains between Blackfoot and Clough. A considerable portion of the channel losses in the first 10 miles below Heise and in the Shelley--Blackfoot section joins the ground-water movement to the west under the river between the mouth of the Great Feeder and Firth. As noted, all of the losses from the river channel that join this ground-water movement are a total loss to the Snake River above Milner. The river is confined in lava rock canyons through most of the distance between American Falls and Milner. There are probably some channel losses in this section, but stream flow records show that they must be very small and that they are generally offset by tributary inflow. Seepage losses from Lake Walcott and Milner Lake, when held at high stages, constitute the bulk of the losses in this section; most of this seepage joins non-tributary ground-water movements. The gains from tributary inflow and from return flow from the Minidoka Project always more than offset the channel losses below Minidoka Dam.

The monthly river losses and gains between Heise and Clough from May to September, inclusive, were computed since 1918 from the records of inflow at Heise and Rexburg, canal diversions, and outflow at Clough. These records show a wide variation from year to year, ranging from a gain of 400,000 acre-feet in 1928 to a loss of 100,000 acre-feet in 1934. These river losses and gains are the net result of surface waste from the canal systems and tributary inflow entering the river above Clough, ground-water inflow to the river in sections where the water tables are higher than the river, and percolation losses from the river channels in sections where the water table lies below the river bed. The surface waste from the canal systems reaches a maximum during wet years when there is an abundance of natural flow and considerable summer rainfall, decreases as more stored water is used, and drops to a minimum during summers of deficient water supply. The amount of ground-water inflow to the river in the Lorenzo--Roberts and Blackfoot--Clough sections is dependent on the height of the water table in those sections. This is in turn dependent on contributions to the ground-water reservoir from river channel losses and from percolation losses from irrigation in those areas. The water tables stand at maximum levels during wet years, when large contributions are made to the ground-water reservoir by spring floods in the river and by copious irrigation of lands adjoining the river. They drop to the lowest levels during dry years when there are no spring floods and a deficiency exists in the supply of irrigation water usually delivered to the irrigated areas adjoining the river. During the extremely dry year of 1934, when there was no spring flood and diversions in the upper valley were reduced to about half of the usual amount, the water tables dropped below river level throughout practically all of section between Heise and Blackfoot. This reduced the ground-water inflow above Blackfoot to almost zero and increased the river channel losses to the point where they exceeded the surface return flow from irrigation. The result was a net loss instead of the usual gain between Heise and Clough. During extended drought periods, such as occurred from 1930 to 1936, there is a general lowering of ground-water levels throughout the mountain slopes and surrounding plains. This tends to lower the water table in the irrigated portion of the valley, even though the river flows and deliveries to the canal systems in the valley proper are kept normal by releases of stored water from reservoirs. The many factors causing the variations in the summer river losses and gains above Clough, therefore, greatly complicate the problem of estimating future river gains under the changed conditions whereby the river flow at Heise will be further regulated by Palisades Reservoir and more stored water will be delivered to the canal systems.

The recorded Snake River gains during the May--September period each year were plotted against total recorded diversions above Clough, total recorded diversions minus recorded diversions by the Reservation and Aberdeen canals, recorded inflow at Heise and Rexburg since previous Octobers, recorded river flows at Heise during April, May, and June of the same year, and various combinations of these in an effort to find a correlation from which the gains under changed conditions could be estimated. The best correlation resulted from plotting the river gains against the total diversions minus the diversions by the Reservation and Aberdeen canals, which contribute no return flow to the river above

Clough. The plotted points lined up better in this correlation than in any of the others, indicating that the variations in the amount of water diverted into the irrigated areas above Clough is the major cause of variations in the river gains. Although the plotted points for the 26 years from 1919 to 1944, inclusive, were somewhat scattered, they defined a rather definite slope, and all years with normal or average ground-water conditions lined up very well. The eight dry years from 1931 to 1940 (excluding 1937 and 1938), during which the ground-water levels were below normal throughout the watershed, all plotted below the normal line. They, however, still lined up well enough to define a correlation curve for the sub-normal years which gives a river gain about 70,000 acre-feet lower than the curve for normal years. The curve for the wet years of 1922, 1923, 1925, 1927, and 1928, during which ground-water levels were generally above normal and irrigation practices were somewhat different from recent years, was conservatively estimated to lie parallel to the normal curve and to pass through the plotted point for the year 1922. The curve for these wet years gives a river gain about 100,000 acre-feet higher than the curve for years with normal ground-water conditions.

In order to use these curves for estimating the river gains under changed conditions, it was necessary to estimate the diversions which would have been made each year by the Reservation and Aberdeen canals if Palisades Reservoir had been in operation. The increase that would have been made each year in the diversions by the Aberdeen Canal was determined by a comparison of recorded diversions with the estimated full diversion requirement for that project, allowing for the shortages that would have occurred with Palisades Reservoir in operation. The operation of the Fort Hall Project, however, is rather complex and a separate operation study of the Blackfoot River system was necessary in order to determine the amount of water that would be diverted by the Reservation Canal under future conditions. The Fort Hall Project obtains its present water supply from natural flow of the Snake River and from natural flow and storage on the Blackfoot River. For the purpose of this study, it was assumed that the Fort Hall Project would acquire 135,000 acre-feet of storage space in the pool under Plan A and 150,000 acre-feet of storage space in Palisades Reservoir under Plan B. The present capacity of the Blackfoot Marsh Reservoir is 350,000 acre-feet, but the Indian Service plans to raise the China Hat Dam, a dike at the upper end of the reservoir, in order to increase the reservoir capacity to 410,000 acre-feet. Hence, the operation studies of the Blackfoot Marsh Reservoir were based on an ultimate capacity of 410,000 acre-feet.

The three correlation curves which were used to estimate the Snake River gains under the changed conditions with Palisades

Reservoir in operation are shown on the chart on the following page. The gain in each year was taken from the curve believed to represent most closely the ground-water conditions prevailing generally throughout the Snake River Plain in that year. The high curve was used for the years 1922, 1923, 1925, 1927, and 1928. The low curve was used for the years 1931, 1932, 1933, 1934, 1935, 1936, 1939, and 1940. The normal curve was used for all other years in the period of study. The recorded river gains and those estimated for conditions under Plan A and Plan B are shown in Table 15. The monthly distribution of the total seasonal gain obtained from the correlation curves was estimated by using the recorded monthly gains as a guide. Most of the adjustments were made on the basis of changes in the diversion requirements. The bulk of the increase in diversions would be made in July, August, and September as a result of deliveries of the additional stored water. Consequently it was assumed that most of the increase in river gains would occur in those months. The monthly distribution is not an important item insofar as total water supply is concerned.

The portion of the total Snake River gain which is not usable for irrigation above Clough occurs below Blackfoot and consists of the flow of Blackfoot River at its mouth and the inflow from springs and return flow entering the river between Blackfoot and Clough. These non-usable gains under future conditions were estimated by using past records of the flow of Blackfoot River at the mouth as a guide and allowing 150 cubic feet per second of spring inflow and return flow between Blackfoot and Clough, a quantity which has remained almost constant in past years of average water supply. There will be an increase in the amount of canal waste water and spring inflow entering American Falls Reservoir as a result of delivering more stored water to the Fort Hall and Aberdeen Projects. No credit was taken in the operation studies for the increase in return flow from the Aberdeen Project because of the uncertainties involved in predicting the amount in acre-feet. There are 12,800 acres under ditches in the Fort Hall Project which have not been irrigated in the past due to lack of water, but it is assumed that this land will be irrigated under either Plan A or Plan B. This acreage is not classed as new land, but is considered as an expansion of an existing project. An allowance was made in the river operation studies for the return flow from these lands and from the new lands in the Michaud Unit of Fort Hall Project.

There are no records of winter diversions between Heise and Clough during the past except those obtained by the Bureau of Reclamation from 1942 to 1944. It is impossible, therefore, to compute monthly river gains or losses in this section during all past winters. The total stream depletion was computed, however, from records of inflow at Heise and Rexburg and outflow

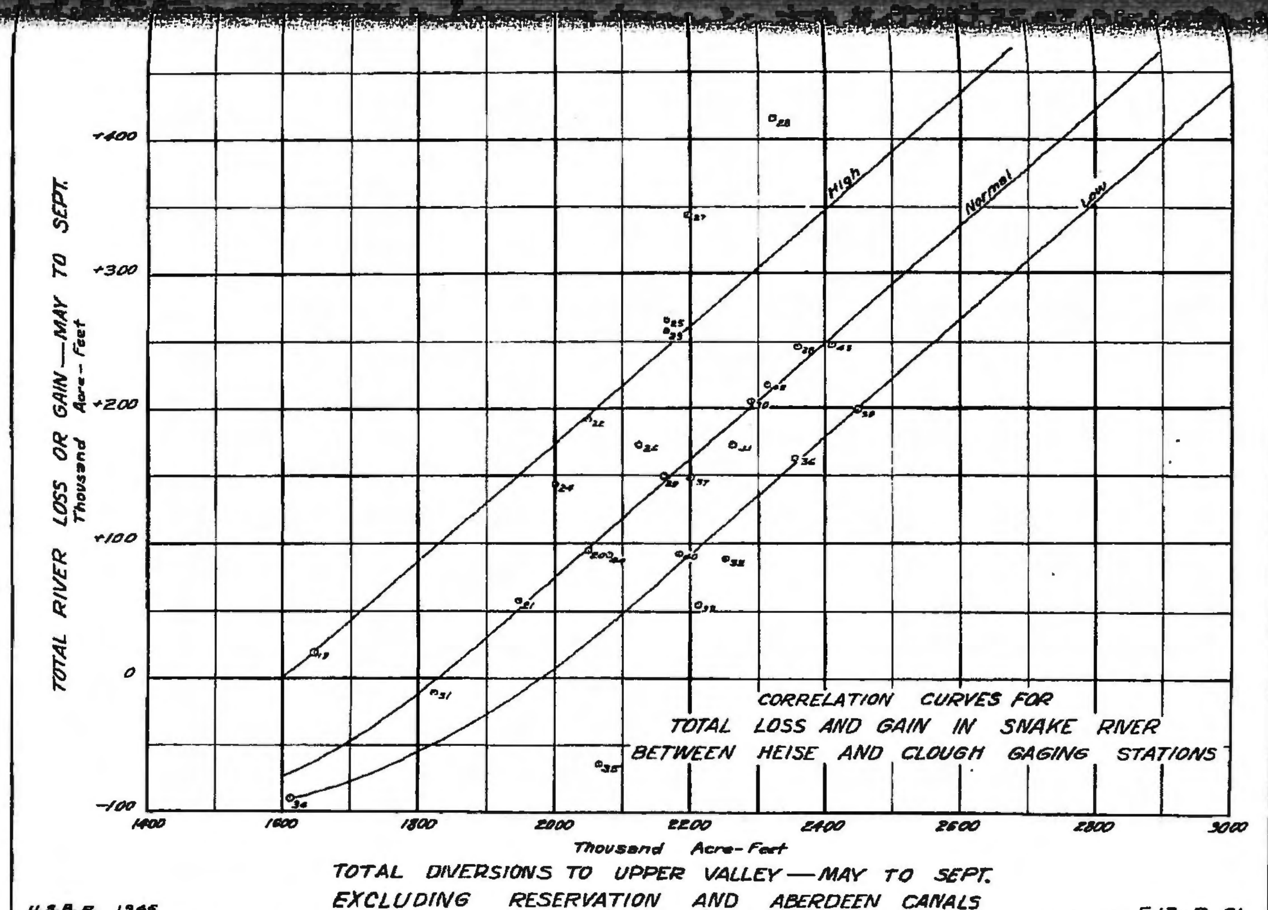

TOTAL RIVER LOSS OR GAIN — MAY TO SEPT.
Thousand Acre-Feet
+400
+300
+200
+100
0
-100
1400
1600
1800
2000
2200
2400
2600
2800
3000
Thousand Acre-Feet
TOTAL DIVERSIONS TO UPPER VALLEY — MAY TO SEPT.
EXCLUDING RESERVATION AND ABERDEEN CANALS
High
Normal
Low
CORRELATION CURVES FOR
TOTAL LOSS AND GAIN IN SNAKE RIVER
BETWEEN HEISE AND CLOUGH GAGING STATIONS
U.S.B.R. 1946
5.17-P-51

TABLE 15

TOTAL LOSSES AND GAINS IN THE SNAKE RIVER
BETWEEN HEISE AND CLOUGH GAGING STATIONS
DURING MAY TO SEPTEMBER, INCLUSIVE 1/

Units of 1,000 Acre-feet

Water Year	Recorded Under Past Conditions	Estimated Under Conditions With Plan B	Estimated Under Conditions With Plan A
1919	+ 20	+ 300	+ 300
1920	+ 93	+ 240	+ 240
1921	+ 59	+ 210	+ 210
1922	+ 191	+ 300	+ 300
1923	+ 258	+ 290	+ 290
1924	+ 144	+ 310	+ 310
1925	+ 266	+ 320	+ 320
1926	+ 173	+ 350	+ 350
1927	+ 344	+ 310	+ 310
1928	+ 415	+ 370	+ 370
1929	+ 150	+ 210	+ 210
1930	+ 205	+ 240	+ 240
1931	- 12	+ 250	+ 250
1932	+ 87	+ 150	+ 150
1933	+ 52	+ 180	+ 180
1934	- 91	- 91	+ 190
1935	- 67	- 67	+ 130
1936	+ 162	+ 230	+ 230
1937	+ 149	+ 240	+ 240
1938	+ 246	+ 240	+ 240
1939	+ 198	+ 250	+ 250
1940	+ 92	+ 200	+ 200
1941	+ 172	+ 240	+ 240
1942	+ 219	+ 240	+ 240
Average	+ 147	+ 230	+ 250

1/ A plus sign indicates a gain and a minus sign indicates a loss at Clough. This stream depletion has been caused by losses from the canal systems in operation during the winter, by losses occurring in the river channel, and by consumptive use. The operation of Palisades Reservoir should make little or no change in the amount of the river channel losses from October to April, inclusive, in critical dry years. The cessation of winter operation of canals, however, will eliminate all stream depletion caused by this practice in the past. In order to obtain the winter depletion with the proposed water conservation program in effect, the recorded depletion was decreased each month by the following estimated water savings:

Month	Acre-feet
November	44,000
December	33,000
January	21,000
February	17,000
March	20,000
Total	135,000

The resulting modified winter stream depletion was used in all of the river operation studies. No credit was taken for the small reduction in depletion that would occur in April and October as a result of shutting off canals during winters in the upper valley.

The monthly river losses or gains which have occurred in the past between American Falls and Milner were computed from complete records of inflow, diversions, and outflow in that section since 1918. These recorded losses or gains were used unchanged in the operation studies because it is assumed that Lake Walcott and Lake Milner will be operated approximately the same in the future as in the past and that the additional water delivered to the Minidoka Project will not cause an appreciable increase in the river gains.

Power Requirements

The power plant to be constructed as a part of the proposed Palisades Dam is the only new power development anticipated in the near future above Milner Dam. This plant would have a total installed capacity of 30,000 kilowatts in two units operating under static heads ranging from 245 feet with the reservoir full to 104 feet with the reservoir at dead-storage level. The winter or firm output of this plant would be limited to 15,000 kilowatts, as that is the maximum output that could have been maintained during the critical winter of 1934--35 after the reservoir had been emptied during the irrigation season of 1934. The reservoir operation studies were conducted, therefore, on the basis of limiting the releases from Palisades Reservoir during the non-irrigation season to only those needed to maintain a continuous output of 15,000 kilowatts at the Palisades power plant. These releases were computed on the basis of the number of days in the month and the average head prevailing during the month. The efficiency of the plant was assumed to vary from 70 per cent with a full reservoir to 80 per cent with a static head of 125 feet, with a rapid drop to 75 per cent at dead storage level. The releases thus computed ranged from 1,000 cubic feet per second with the reservoir full to 2,300 cubic feet per second at dead-storage level.

The winter power releases from Palisades Reservoir together with the inflow below that point always would be sufficient to operate the power plants at Idaho Falls. The firm power production at these plants, if Palisades Reservoir had been in operation, would have been at least equal to and probably greater than that in the past.

In the reservoir operation studies, a total of 45,000 acre-feet of water was reserved in American Falls Reservoir for the exclusive use of the Idaho Power Company. This water accrues to the company from its primary storage right in American Falls Reservoir and was released in August, September, and October of each year according to past operating practices. This water is used to maintain and regulate the output of the company's hydroelectric plants on the Snake River below Milner Dam. The only additional releases made from American Falls Reservoir during each winter for power production were those needed to meet deficiencies in the required flow at the head of Shoshone Falls, as specified in the 1934 water-saving contract between the Idaho Power Company and the Government. The power company is entitled to this water from its secondary storage right of 255,000 acre-feet in American Falls Reservoir.

Domestic Water Requirements

The only water requirements for domestic use which must be shown in the reservoir operation studies are those which constitute a draft on the Snake River. All water needed from the Snake River for domestic use during the irrigation season is included in the irrigation requirements because such domestic use has been reflected in past records. Domestic requirements for areas assumed to rely on wells for such water in the future were not included because these requirements do not constitute a draft on the Snake River. The only domestic water requirements which were included in the operation studies, therefore, are those for the

South Side Twin Falls Project and the Gooding Project from November through March, inclusive. This requirement is estimated to be 1,000 acre-feet per month for the South Side Twin Falls Project and 5,000 acre-feet during November for the Gooding Project.

Losses From Reservoirs

The losses from American Falls Reservoir under past and future conditions were taken into consideration in the river operation studies because the losses from operation of this reservoir prior to 1927 are not reflected in stream flow records at and below Neeley, and the changes in future operation over past operation of the reservoir will cause changes in the losses which are not reflected in past stream flow records. The net evaporation loss from American Falls Reservoir was estimated in inches as follows:

Month	Normal Evaporation From Free Water Surface	Previous Transpiration and Evaporation in Reservoir Area	Net Loss From River
April	4.4	1.7	2.7
May	5.7	2.8	2.9
June	6.7	3.4	3.3
July	7.9	3.9	4.0
August	6.9	3.2	3.7
September	4.7	2.2	2.5
October	3.0	0.9	2.1
Total	39.3	18.1	21.2

An allowance was made for this net evaporation loss in the operation studies from 1918 to 1926. From 1927 through 1942, no evaporation loss from American Falls Reservoir was computed for the operation studies. Calculations showed that the change in loss caused by the difference between future operation and past operation of American Falls Reservoir was so slight that its omission would not affect the accuracy of the studies.

The net evaporation loss which will result from the operation of Palisades Reservoir was estimated in inches as shown on the following page.

Month	Normal Evaporation From Free Water Surface	Previous Transpiration and Evaporation in Reservoir Area	Net Loss From River
April	2.4	2.0	0.4
May	3.6	1.9	1.7
June	5.0	2.8	2.2
July	5.7	3.2	2.5
August	5.3	2.4	2.9
September	3.4	1.5	1.9
October	2.1	0.7	1.4
Total	27.5	14.5	13.0

If the reservoir were full throughout the year, the net evaporation loss of 13 inches would deplete the stream by only about 17,000 acre-feet annually. The net evaporation loss shown above for each month was included in the operation studies of Palisades Reservoir.

The small change that will be made in the exposed water surface of Jackson Lake, under future operating conditions, would not make enough change in the evaporation loss to warrant including it in the operation studies. The original lake had a water surface area of 17,000 acres and the present reservoir covers 25,000 acres. Thus all of the change in evaporation losses must take place in the fringe of 8,000 acres. Normal evaporation from the lake from May to September, inclusive, as shown by pan measurements, is about 22 inches.

The only years in which the evaporation losses from reservoirs will affect the supply of irrigation water are those in which water shortages occur. In such years the shortages will be increased by the accumulated total of monthly losses since the last month in which American Falls Reservoir spilled prior to the shortage. The evaporation losses during other years will only reduce the amount of the spills from the reservoirs.

All past seepage losses from Jackson Lake Reservoir are reflected in past river flow records. These seepage losses will be increased somewhat in the future because the reservoir will be operated on a hold-over basis and will be kept full most of the time. It is believed that all seepage losses from Jackson Lake return to the river above Heise, however, and therefore the anticipated change in their amount was not included in the operation studies. There will be some seepage losses from Palisades Reservoir, but they were also neglected because it is believed they will return to the river above Heise and will cause no stream depletion. It is known that there are some seepage losses from American Falls Reservoir, when it is held at high stages, which do not return to the river above Milner. No allowance was made for them in the operation studies because no reliable means of estimating their amount at different reservoir stages could be devised from an analysis of past records of the operation of the reservoir. They are of about the same magnitude as the errors involved in measurements of the inflow to and outflow from the reservoir, and it is impossible to estimate accurately the submerged inflow. The seepage losses under past operating conditions are reflected in records of the flow at Neeley since the reservoir was completed in 1926. The change in the amount of these losses since 1926, which will result from changes in future operation over that of the past, will be very small. All seepage and evaporation losses from Lake Walcott in the past are reflected in the computed river losses or gains between American Falls and Milner used in the operation studies. It is assumed that Lake Walcott will be operated about the same in the future as in the past.

RIVER OPERATION STUDIES

If the winter water conservation program proposed herein is adopted and the proposed Palisades Reservoir is placed in operation, there will be a substantial increase in the supply of stored water available for irrigation use in the Snake River Valley. The increased use of stored water in the upper half of the Valley will in turn increase the river gains which are usable for irrigation. In order to evaluate these increases in the water supply and to determine the adequacy of the augmented supply to meet the irrigation requirement with and without development of new land, a series of operation studies were made of the river system under the different operating conditions. In addition to showing the adequacy of the water supply, these studies demonstrate the most efficient method of operating the series of reservoirs in order to conserve the maximum amount of stored water for irrigation use in critical dry years. The results of the operation studies also serve as a useful guide for selection of the plan for disposal of the reserved space in American Falls Reservoir most satisfactory to all concerned.

In conducting an operation study of a river system as complicated as that of the Snake, it is necessary to make numerous assumptions in setting up basic requirements and operating procedures. The assumptions involved in the various phases of the Snake River operation studies are conservative and practical.

Those involved in the basic requirements have been discussed heretofore. The criteria adhered to in conducting the operation studies and the results of those studies are discussed in the following paragraphs.

Criteria

The river operation studies were begun with all reservoirs full at the end of June 1918 because stream flow records show that there was sufficient run-off in the spring of 1918 to fill all reservoirs, including Palisades Reservoir, even if all were empty at the end of the 1917 irrigation season. The studies were limited to the period from July 1918 through September 1942. Records of stream flow and diversions are not complete for years prior to 1918, and the water supply has been above normal and not critical since 1942. The period of study includes two years (1931 and 1934) with the lowest run-off recorded since 1896.

The modified flow of the Henrys Fork at Rexburg, as shown by the operation study of that river system, and the computed natural flow at Heise were used as the original water supply available for regulation and use in the Snake River Valley. The operation studies were conducted progressively downstream by applying the various water requirements in the upper valley to this original supply and allowing for the estimated river losses and gains, operation waste, and the anticipated winter water savings in the upper valley in order to obtain the modified flow at Neeley without regulation by American Falls Reservoir. Storage in Jackson Lake and Palisades reservoirs was computed on the basis of their natural and regulated inflows, respectively. The modified flow at Neeley was obtained by adjusting the recorded flow to remove past regulation by American Falls Reservoir and to reflect the operation of the upstream reservoirs as well as the use of water in the upper valley under future conditions. This modified flow was used as the inflow to American Falls Reservoir in conducting the operation study of that reservoir in conjunction with Lake Walcott. Releases from and storage in American Falls Reservoir and Lake Walcott were based on the requirements as derived heretofore for irrigation, domestic, and power use in the lower valley with the proposed water conservation program in effect.

The water assumed saved by elimination of winter diversions was considered as natural flow and was credited to the reservoirs on the basis of the storage right priority of each. The distribution of the winter water savings in accordance with the priority of the storage rights of the several reservoirs would result in all of the saved water being allotted to the American Falls storage right in dry years, when that reservoir would not otherwise fill. Upon first thought this method may seem inequitable insofar as the projects making the water saving possible are concerned. A study of the rights that those projects now have in American Falls Reservoir and those which they will likely acquire in Palisades Reservoir, however, will show that they would receive about the same amount of the saved water in this way as they would if Palisades Reservoir were given a special right to store all of the water saved by shutting off canals during winter. As an example, the North Side Twin Falls Project would have to acquire more than 250,000 acre-feet of space in Palisades Reservoir in order to obtain a larger share of the saved water than it would receive through its owned space in American Falls Reservoir. From the standpoint of administration, the method of distribution of the winter water savings according to reservoir storage rights is simpler and less subject to controversy than any other method. The uncertainties involved in estimating and fixing the amount of water saved by elimination of winter diversions would always leave the special storage right for Palisades Reservoir subject to legal dispute.

The winter releases from Palisades Reservoir were limited to those needed to maintain a continuous hydroelectric power output of 15,000 kilowatts, and all winter inflow in excess of this power requirement was stored until the reservoir was full. Water was released from Jackson Lake Reservoir during winter whenever it was needed to maintain the firm power output of the Palisades plant. Such releases could be made without loss to owners of Jackson Lake space through temporary storage of the released water in American Falls Reservoir and subsequent release therefrom to the owners in years when Jackson Lake failed to fill. No releases exclusively for power production were made from Palisades Reservoir or Jackson Lake Reservoir during the irrigation season.

The plan of operation of Palisades Reservoir for flood control purposes depends on what arrangements are finally worked out between the Department of the Interior and the War Department, having regard for the provisions of House Document No. 457, 77th Congress, 1st Session, and of section 7 of the 1944 Flood Control Act. The Bureau of Reclamation and the Corps of Engineers, War Department, have discussed these arrangements at some length, and the Bureau expects to pursue these discussions to a conclusion. The operating plan which the Bureau will seek to have adopted is as follows:

> The top 900,000 acre-feet of storage space will be used jointly for flood control, irrigation, and power development in order to achieve its multiple purposes. The operation of this portion of the reservoir for control of floods will be predicated upon a forecast of the run-off each year. Damaging floods in the Snake

River result from melting snow, and their magnitude can be forecast from climatic records and snow surveys. With the aid of complete records of snow surveys and subsequent run-off from Jackson Lake watershed since 1919, similar records on the watershed between Jackson Lake and Palisades dam site since 1936, and long-time records of precipitation and temperature, it is believed that a reasonably accurate forecast of the flood volume can be made each year. Operation of Palisades Reservoir would be scheduled to impound flood inflows in excess of the damaging discharge at Heise, which has tentatively been selected as 20,000 cubic feet per second. Beginning on February 1 of each year when damaging floods are in prospect, storage capacity would be vacated as needed in accordance with run-off forecasts made on the first of February and on the first of each succeeding month thereafter, or at more frequent intervals when necessary, until the flood season has started. During the early part of the flood season, the only water impounded in the reservoir would be the flows in excess of 20,000 cubic feet per second at Heise. As soon as it becomes apparent that the danger of high floods has passed, the operations schedule would be aimed to capture the tail end of the flood flow in any remaining unfilled storage capacity of the reservoir.

Evacuation of storage from Palisades Reservoir for flood control purposes in accordance with the foregoing plan was not taken into account in the reservoir operation studies, however, because of the uncertainties involved in run-off forecasting. Absolute accuracy in forecasting the volume and timing of run-off would be needed in critical years in order to realize the amounts of storage shown available for irrigation use each year in the operation studies. It is not reasonable to assume that this accuracy can be obtained in actual practice, however, because the forecasting of run-off is not an exact science. Experience on this and other watersheds with similar run-off characteristics has shown that the errors in forecasting should not average more than 10 to 15 percent; however, they may be as high as 22 percent for the Jackson Lake watershed in any one year. Although such errors will not always cause a loss of irrigation storage water, they should be taken into consideration in appraising the results of the reservoir operation studies shown in this report.

An average operation waste of 20,000 acre-feet per month was allowed in the reach of the river above the Clough gaging station during the irrigation season in order to facilitate the diversions by canals in the vicinity of Blackfoot. This operation waste has averaged about 30,000 acre-feet per month during dry years in the past, but the shorter transmission distance from

Palisades Reservoir should enable the watermaster to reduce the amount of waste by about one third. No operation waste was allowed at Milner Dam because there has been none in the past. The river can be fully controlled at Minidoka Dam during the irrigation season in dry years, and it is only about 35 miles from there to Milner Dam.

For convenience in conducting the operation studies, the active capacity of Lake Walcott was combined with the capacity of American Falls Reservoir and the two carried as one reservoir inasmuch as there are no diversions between them. The active capacity of Lake Walcott was assumed to be 80,000 acre-feet. Since the completion of American Falls Reservoir, the irrigation season draft on Lake Walcott has equalled or exceeded 80,000 acre-feet in only four years and only 87,000 acre-feet of water was drawn in the extremely dry year of 1934. Any draft in excess of 80,000 acre-feet during the irrigation season interferes with the delivery of water to the canals serving the Minidoka Project.

The actual distribution of the new supply of stored water to projects above and below American Falls will not be known until the disposal of the reserved space in American Falls Reservoir has been decided upon and all contracts for sale of Palisades Reservoir space have been negotiated with existing projects. In conducting the reservoir operation studies, therefore, it was necessary to assume a distribution in order to divide the supply in years of shortage and to estimate the change in river losses and gains in the upper valley. Under Plan A it was assumed that the pooled space would be distributed to the various existing projects so that the shortages above and below American Falls would be about equal in the critical year of 1934. This resulted in 940,000 and 770,000 acre-feet of space being allotted to the upper and lower valleys, respectively. Under Plan B it was assumed that the storage space in Palisades Reservoir would be divided among the existing projects so that those below American Falls would have used practically all of their stored water in 1931, but would have suffered no shortage in that year. This required that 919,000 acre-feet of the space be allotted to the upper valley and 358,000 acre-feet to the lower valley.

If the proposed Palisades Reservoir is constructed, it is believed that every effort should be made to operate all reservoirs in the Snake River system in a manner which will result in the least spills from American Falls Reservoir in wet years and in the maximum delivery of stored water from all reservoirs in dry years. The following criteria were adhered to, therefore, in conducting the reservoir operation studies:

1. No water was released from Palisades Reservoir for irrigation use in the lower valley until American Falls Reservoir had been emptied.

2. No water was released from Jackson Lake until Palisades Reservoir had been emptied.

3. Water belonging to the American Falls storage right was temporarily stored in space which otherwise would be empty in Palisades, Island Park, and Grassy Lake reservoirs until it was either needed by the American Falls rights or was spilled from the upstream reservoirs.

4. Natural flow was stored in vacant space in Jackson Lake, Palisades, and the Henrys Fork reservoirs during the irrigation season while an equivalent amount of storage water was being released from either Palisades or American Falls Reservoir. This water was either delivered to the downstream reservoirs when it was needed on projects owning space in those reservoirs or was spilled from the upstream reservoirs.

It is evident that the above operating criteria provide a means of accumulating and holding storage in or shifting storage to the farthest upstream reservoirs, which are less likely to spill. The operation of the reservoirs in this manner in actual practice will require that accurate records be kept of seasonal storage allotments and of hold-over storage belonging to the owners of space in each reservoir. The temporary holding of American Falls Reservoir water in upstream reservoirs has been practiced in the past and this practice should be extended to include Palisades Reservoir. The purchasers of space in Palisades Reservoir, therefore, should agree to that procedure when they sign repayment contracts. The present procedures in administration of and accounting for the distribution of stored water will insure that no owner of space will be deprived of any stored water to which he would have been entitled if this practice were not permitted.

Although it was not taken into consideration in the reservoir operation studies, provision should be made for lowering the level of Jackson Lake every fall in order to avoid possible damage to the dam during the winter. This evacuation of storage should be limited to that which can be safely refilled during the following spring. Such refilling will also provide some flood control along the Snake River in the vicinity of Jackson, Wyoming.

The determination of the amount of hold-over storage that may be credited to each storage right in each reservoir at the beginning of the irrigation season involves many complexities when the three reservoirs are operated on a hold-over basis. Some of the lower valley projects will have storage rights in all three reservoirs, but will draw all of their storage water from American Falls Reservoir in average years. With the upper and lower valley projects having storage rights in all three reservoirs, an exchange of stored water must be made in order to deliver American Falls storage water to lands in the upper valley. This exchange could always be made with Palisades Reservoir in operation. The question will arise, however, as to whether the exchange should be made between American Falls and Jackson Lake reservoirs or between American Falls and Palisades reservoirs. The amount of hold-over storage that may be credited to the owners of storage rights in American Falls and Palisades reservoirs each spring will be vitally affected by the manner in which the exchanges are made and storage releases are charged during the previous year. No attempt was made to resolve these matters in the river operation studies because the method finally adopted for calculation of the hold-over storage in each reservoir will not appreciably affect the total supply of storage water available to the Snake River Valley as a whole. It will be necessary that a satisfactory method be worked out during the negotiation of repayment contracts with prospective purchasers of space in Palisades Reservoir, however, and the method adopted should be made a part of those repayment contracts. Any method agreed upon should include a limitation that no user will be allowed to accumulate more Palisades storage water than that which can be retained in the space he owns in that reservoir.

Results

Inasmuch as separate operation studies were conducted for Plan A (without new land) and for Plan B (with new land), the results for each plan are discussed separately in the following paragraphs.

Plan A. A summary of the results of the river operation studies with Plan A in effect is shown in Table 16 for the portion of the river system above the Clough gaging station and in Table 17 for the portion below the Clough gaging station. These summaries show that there would have been an adequate supply of stored water for all existing projects throughout the period of study, except during the extremely dry years of 1934 and 1935. The shortages in these two years would have been as shown in the table on page 149.

TABLE 16

SUMMARY OF OPERATION STUDY OF THE SNAKE RIVER SYSTEM ABOVE CLOUGH GAGING STATION WITH PALISADES RESERVOIR AND WATER CONSERVATION PROGRAM, PLAN A - WITHOUT NEW LAND

Units of 1,000 Acre-feet

Water Year	Nat. Flow at Heise	Mod. Flow at Rexburg	Usable River Gain	Diversion Requirement	Storage Release and Evap. Loss	Shortage	Surplus Flow	Water Stored	Non-usable River Gain	Depletion Oct.-April	Mod. Flow at Clough	Jackson Lake Reservoir: Nat. In-flow	Jackson Lake Reservoir: Content: End of Year	Jackson Lake Reservoir: Content: Maxi-mum	Palisades Reservoir: Regu-lated In-flow	Palisades Reservoir: Content: End of Year	Palisades Reservoir: Content: Maxi-mum	Spill
1919	3803	1228	243	2990	998	0	3169	205	57	522	2632	685	847	847	3481	370	1401	1527
1920	5299	1107	173	2820	123	0	3767	1031	67	522	2381	992	847	847	4906	1278	1401	1525
1921	5702	1570	110	2760	213	0	4719	123	100	522	4274	1068	847	847	5292	1188	1401	3261
1922	5322	1383	199	2720	129	0	4197	213	101	522	3663	1008	847	847	4928	1272	1401	2675
1923	5212	1372	208	2680	266	0	4262	129	82	522	3793	946	847	847	4823	1135	1401	2745
1924	3679	944	255	3010	767	0	2521	266	55	522	1963	646	847	847	3363	559	1401	963
1925	5918	1570	240	2770	31	0	4874	873	80	522	3659	1327	847	847	5495	1401	1401	2691
1926	3907	1221	295	3120	768	0	2956	0	55	522	2604	763	847	847	3590	618	1401	1500
1927	6300	1693	228	2760	77	0	5423	838	82	522	4245	1416	847	847	5861	1379	1401	3271
1928	6266	1740	280	2925	301	0	5546	22	90	522	5192	1329	847	847	5829	1100	1401	3947
1929	4311	1354	137	2745	414	0	3356	301	73	522	2706	867	847	847	3964	987	1401	1680
1930	4270	890	163	2832	384	0	2761	414	77	506	2018	794	847	847	3926	1017	1401	1108
1931	2989	679	196	3031	1154	0	1874	384	54	531	1547	575	536	847	3015	124	1401	426
1932	4696	969	66	2771	431	0	3279	1622	84	743	1456	992	847	847	4021	646	1401	251
1933	4151	1095	111	2845	696	0	3094	755	69	719	1789	872	847	847	3812	705	1401	1026
1934	2782	512	129	3143	1117	375	1664	374	61	851	1285	628	0	847	3420	124	1079	0
1935	4112	717	73	2855	537	187	2663	1405	57	709	1574	934	0	702	3828	124	825	0
1936	5350	1009	156	2983	733	0	4153	2146	74	652	1629	1069	847	847	4079	590	1401	419
1937	3811	818	172	2825	785	0	2647	811	68	605	1444	778	847	847	3485	571	1401	683
1938	5161	1228	157	2829	429	0	4031	830	83	574	2810	1143	847	847	4774	972	1401	1992
1939	4322	1260	196	3046	656	0	3273	429	54	479	2519	891	847	847	3872	745	1401	1386
1940	3417	1160	144	2901	767	0	2474	656	56	542	1432	793	847	847	3042	634	1401	508
1941	3697	941	182	2831	521	0	2396	767	58	438	1349	779	847	847	3342	880	1401	419
1942	4314	1092	173	2814	564	0	3215	521	67	504	2357	886	847	847	3968	837	1401	1462
Aver	4533	1148	179	2875	536	23	3430	630	71	567	2513	924	-	-	4172	-	-	1478

TABLE 17

SUMMARY OF OPERATION STUDY OF THE SNAKE RIVER SYSTEM BELOW CLOUGH GAGING STATION WITH PALISADES RESERVOIR AND WATER CONSERVATION PROGRAM, PLAN A - WITHOUT NEW LAND

Units of 1,000 Acre-feet

Water Year	Recorded Flow at Neeley	Correction for Change in Flow at Clough	Rec. Change in Content of Am. Falls Res.	Modified Flow at Neeley	River Gain Neeley-Milner	Diversion Requirement	Power Reqmt. at Milner	Storage Release & Evap. Loss	Shortage	Surplus at Milner	Spill at Milner	Water Stored	Modified Flow at Milner	American Falls Reservoir: Content: End of Year	American Falls Reservoir: Content: Maximum	American Falls Reservoir: Spill
1919	4606	- 3	--	4603	139	3521	112	1763	0	2798	1828	970	1940	17	1780	1810
1920	5326	- 961	--	4365	107	3430	136	1187	0	2012	194	1818	330	648	1780	187
1921	6773	- 363	—	6410	272	3370	106	1186	0	4305	3173	1132	3279	594	1780	3126
1922	6017	- 219	—	5798	212	3403	116	1206	0	3613	2427	1186	2543	574	1780	2387
1923	5628	+ 259	--	5887	229	3411	121	1022	0	3519	2313	1206	2434	758	1780	2272
1924	3902	+ 61	--	3963	133	3571	102	1763	0	2115	1093	1022	1195	17	1780	1057
1925	6287	- 639	—	5648	39	3444	122	711	0	2747	967	1780	1089	1086	1780	967
1926	4785	- 168	+ 4	4621	170	3577	117	1763	0	2786	2092	694	2209	17	1780	2048
1927	5077	- 292	+ 1385	6170	148	3412	181	805	0	3530	1751	1779	1932	991	1780	1742
1928	7170	+ 423	- 421	7172	298	3538	119	1106	0	4919	4130	789	4249	674	1780	4078
1929	4986	- 86	- 222	4678	348	3415	119	1265	0	2757	1651	1106	1770	515	1780	1554
1930	4442	- 202	- 194	4046	191	3499	136	1409	0	2011	746	1265	882	371	1780	695
1931	3811	+ 285	- 513	3583	116	3584	155	1763	0	1723	314	1409	469	17	1780	314
1932	3874	- 603	+ 193	3464	141	3419	185	1464	0	1465	1	1464	186	17	1481	0
1933	4006	- 277	+ 12	3741	200	3602	159	1376	0	1556	9	1547	168	188	1515	0
1934	2776	+ 572	- 212	3136	117	3699	172	1345	450	1177	3	1174	175	17	1362	0
1935	3275	+ 127	+ 13	3415	114	3417	196	1222	84	1222	0	1222	196	17	1237	0
1936	4163	- 1254	+ 561	3470	216	3455	197	1645	0	1679	34	1645	231	17	1656	0
1937	3876	- 304	- 194	3378	259	3391	200	1323	0	1369	46	1323	246	17	1340	0
1938	4818	- 364	+ 273	4727	240	3439	197	999	0	2330	567	1763	764	781	1780	562
1939	4650	+ 250	- 433	4761	285	3649	168	1426	0	2361	2362	999	1530	354	1780	1333
1940	3539	- 177	+ 12	3374	247	3535	179	1623	0	1530	104	1426	283	157	1780	92
1941	3468	- 239	+ 56	3285	263	3400	183	1616	0	1581	11	1570	194	111	1727	0
1942	4161	+ 140	+ 90	4391	256	3378	171	1304	0	2402	733	1669	904	476	1780	692
Aver.	4642	- 168	+ 17	4491	198	3482	152	1346	22	2396	1065	1332	1217	-	-	1038

Water Supply for the Snake River Valley

Irrig. Season	Upper Valley (Heise to Clough)		Lower Valley (Neeley to Milner)		Entire Valley (Heise to Milner)	
	Ac.-ft.	Percent Of Div. Req't. 1/	Ac.-ft.	Percent Of Div. Req't. 2/	Ac.-ft.	Percent Of Div. Req't.
1934	375,000	12	450,000	12	825,000	12
1935	187,000	7	84,000	2	271,000	4

1/ Requirement for May to September, inclusive.
2/ Requirement for April to October, inclusive.

An operation study of the river system with the present winter diversions and only the existing reservoirs in operation was made in order to determine the increase in deliveries of stored water and the decrease in irrigation shortages that would result from placing Palisades Reservoir in operation and from adoption of the proposed winter water saving program. In this operation study it was assumed that the unsold space in American Falls Reservoir would be divided between the existing projects in the upper and lower valleys on the same basis as the pooled space was divided: 55 percent to the upper valley and 45 percent to the lower valley. The same criteria were adhered to in conducting this study as in the study of the river system with Palisades Reservoir in operation in order to make the results comparable. The deliveries of stored water for irrigation use under Plan A with and without Palisades Reservoir and the water-saving program are shown in Table 18. The deliveries are shown graphically on the accompanying drawing entitled "Deliveries of Stored Water--Plan A".

The comparison of shortages in the entire valley with and without Palisades Reservoir and the water-saving program is shown in the table on the following page.

The decrease in the shortages shown in the table is due to the increase in deliveries of stored water as a result of placing Palisades Reservoir in operation, to the adoption of the proposed winter water-saving program, and to the increase in the usable river gains in the upper valley which would result from the application of additional storage water on lands in that area.

It should be recognized that the deliveries of stored water from the four reservoirs in the Snake River system, as shown by the operation studies, do not represent the maximum possible yield of the reservoir system. These deliveries merely indicate the extent of reservoir use necessary to supplement the natural flow in order to meet the diversion requirements of the existing irrigation projects on the river. The deliveries do not show the full capability of the reservoir system. If there were a demand for 3,859,000 acre-feet of stored water in every year of the period of study, all reservoirs would have been emptied every year, and the annual delivery of stored water would have been equal to the total storable inflow. In order to demonstrate this principle, the amount of water accruing to the storage right of each of the four reservoirs in each year was computed from the results of the operation studies of Plan A. The yield of each reservoir's storage right was computed on the basis of river flows and irrigation requirements in total acre-feet per month. No attempt was made to determine the actual day on which the storing season began and ended. The possible annual yield of the four reservoirs with an annual demand equal to their combined irrigation capacity of 3,859,000 acre-feet is shown in Table 19. The information is presented graphically by the accompanying drawing entitled "Yield of Reservoir Storage Rights--Plan A." This drawing clearly shows the relative value of the several storage rights with the proposed winter water conservation program in effect.

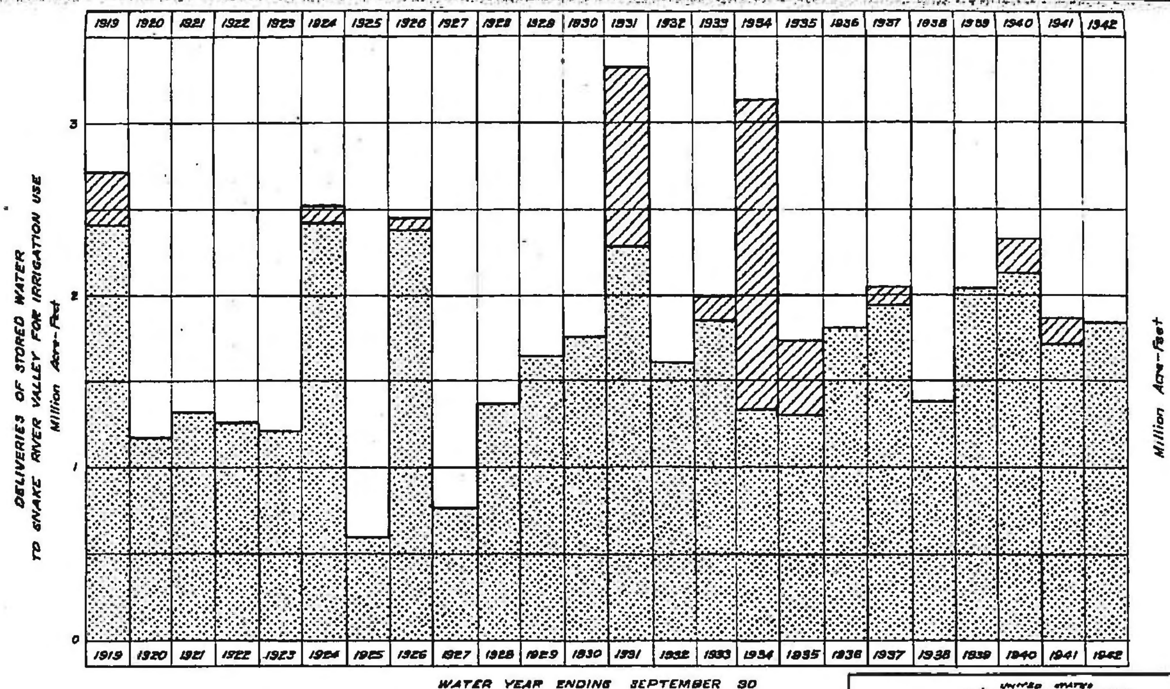
Irrigation Season	Shortages with Present Storage Facilities and With Present Winter Diversions (Acre-feet)	Shortages with Palisades Reservoir in Operation and with Proposed Winter Water Conservation Program in Effect (Acre-feet)	Difference (Acre-feet)
1919	413,000	0	413,000
1924	94,000	0	94,000
1926	71,000	0	71,000
1931	1,265,000	0	1,265,000
1933	228,000	0	228,000
1934	2,913,000	825,000	2,088,000
1935	859,000	271,000	588,000
1937	141,000	0	141,000
1940	201,000	0	201,000
1941	147,000	0	147,000
Total	6,332,000	1,096,000	5,236,000
24-Year Average	264,000	46,000	218,000

TABLE 18

DELIVERIES OF STORED WATER TO SNAKE RIVER VALLEY WITH PALISADES AND WATER CONSERVATION AND UNDER PRESENT CONDITIONS

PLAN A - WITHOUT DEVELOPMENT OF NEW LAND

Water Year	Delivery With Existing Storage Facilities and Present Winter Diversions (Acre-feet)	Delivery With Palisades Reservoir in Operation and With Proposed Winter Water Conservation Program in Effect (Acre-feet)	Difference (Acre-feet)
1919	2,413,000	2,716,000	303,000
1920	1,174,000	1,174,000	0
1921	1,322,000	1,322,000	0
1922	1,260,000	1,260,000	0
1923	1,210,000	1,210,000	0
1924	2,419,000	2,513,000	94,000
1925	598,000	598,000	0
1926	2,375,000	2,446,000	71,000
1927	770,000	770,000	0
1928	1,370,000	1,370,000	0
1929	1,643,000	1,643,000	0
1930	1,754,000	1,754,000	0
1931	2,282,000	3,312,000	1,030,000
1932	1,607,000	1,607,000	0
1933	1,845,000	1,987,000	142,000
1934	1,331,000	3,123,000	1,792,000
1935	1,297,000	1,725,000	428,000
1936	1,809,000	1,809,000	0
1937	1,929,000	2,040,000	111,000
1938	1,381,000	1,381,000	0
1939	2,043,000	2,043,000	0
1940	2,123,000	2,314,000	191,000
1941	1,716,000	1,858,000	142,000
1942	1,831,000	1,831,000	0
Average	1,646,000	1,825,000	179,000



Delivery of stored water with existing storage facilities and present winter diversions.

Increase in delivery of stored water due to placing Palisades Reservoir in operation and to adoption of the proposed winter water conservation program.

UNITED STATES
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BUREAU OF RECLAMATION

PALISADES RESERVOIR PROJECT-IDAHO

DELIVERIES OF STORED WATER

PLAN A

DRAWN: W.J.M. SUBMITTED: [signature]
TRACED: H.H.W. RECOMMENDED: [signature]
CHECKED: N.W.S. APPROVED: [signature]

617-P-23 | BOISE, IDAHO. 7-18-46

TABLE 19

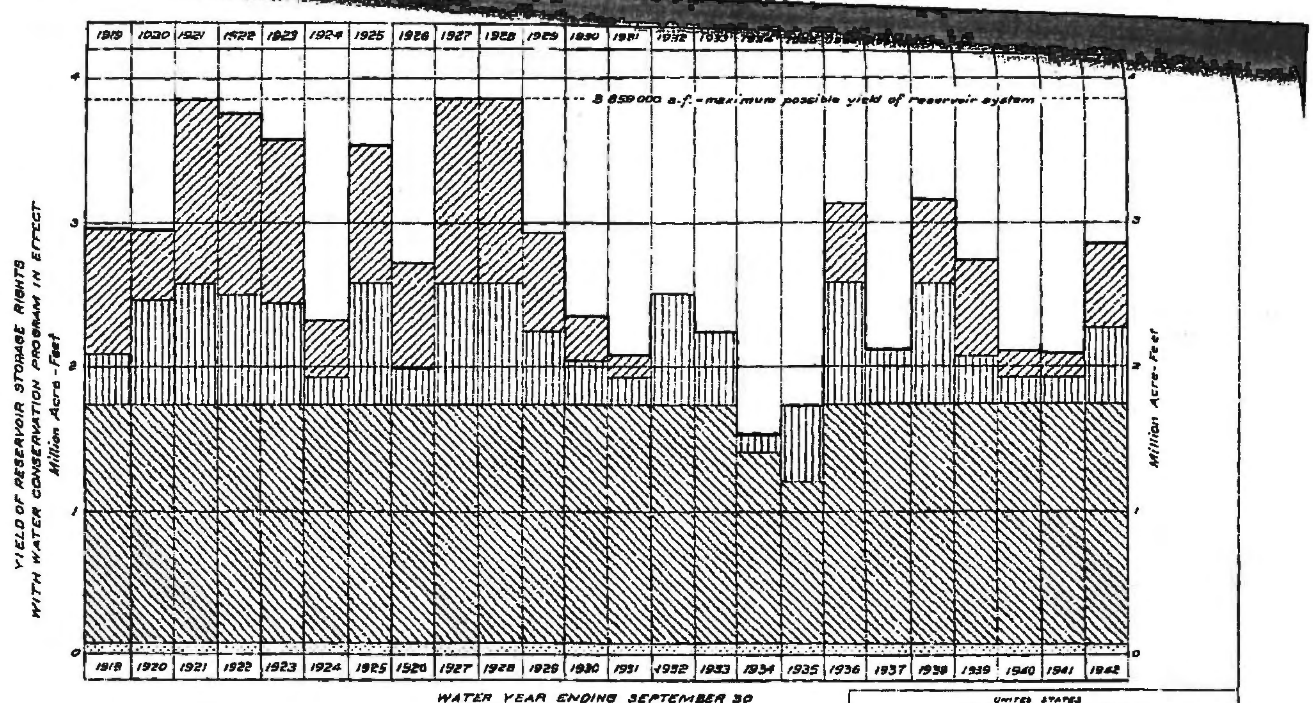
POSSIBLE YIELD OF RESERVOIR STORAGE RIGHTS WITH WATER CONSERVATION PROGRAM IN EFFECT

PLAN A

Units of 1,000 Acre-feet

Water Year	Jackson Lake Reservoir	Palisades Reservoir	American Falls Reservoir 1/	Lake Walcott	Total
1919	356	875	1,655	80	2,966
1920	728	492	1,655	80	2,955
1921	847	1,277	1,655	80	3,859
1922	773	1,257	1,655	80	3,765
1923	705	1,146	1,655	80	3,586
1924	181	409	1,655	80	2,325
1925	847	963	1,655	80	3,545
1926	245	744	1,655	80	2,724
1927	847	1,277	1,655	80	3,859
1928	847	1,277	1,655	80	3,859
1929	506	692	1,655	80	2,933
1930	297	315	1,655	80	2,347
1931	185	161	1,655	80	2,081
1932	769	0	1,655	80	2,504
1933	508	0	1,655	80	2,243
1934	127	0	1,325	80	1,532
1935	530	0	1,123	80	1,733
1936	847	548	1,655	80	3,130
1937	382	0	1,655	80	2,117
1938	847	570	1,655	80	3,152
1939	335	669	1,655	80	2,739
1940	189	187	1,655	80	2,111
1941	190	163	1,655	80	2,088
1942	532	595	1,655	80	2,862
Average	526	567	1,619	80	2,792
Average % of Capacity	62	44	98	100	72

1/ Does not include power water storage right of 45,000 acre-feet.



Palisades Reservoir

Jackson Lake

American Falls Reservoir (not including power water storage right of 45 000 a. f.)

Lake Walcott

NOTE

Yield of reservoir storage rights is based on operation studies with the proposed winter water conservation program in effect

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PALISADES RESERVOIR PROJECT-IDAHO

YIELD OF RESERVOIR STORAGE RIGHTS

PLAN A

DRAWN: ______ SUBMITTED: ______

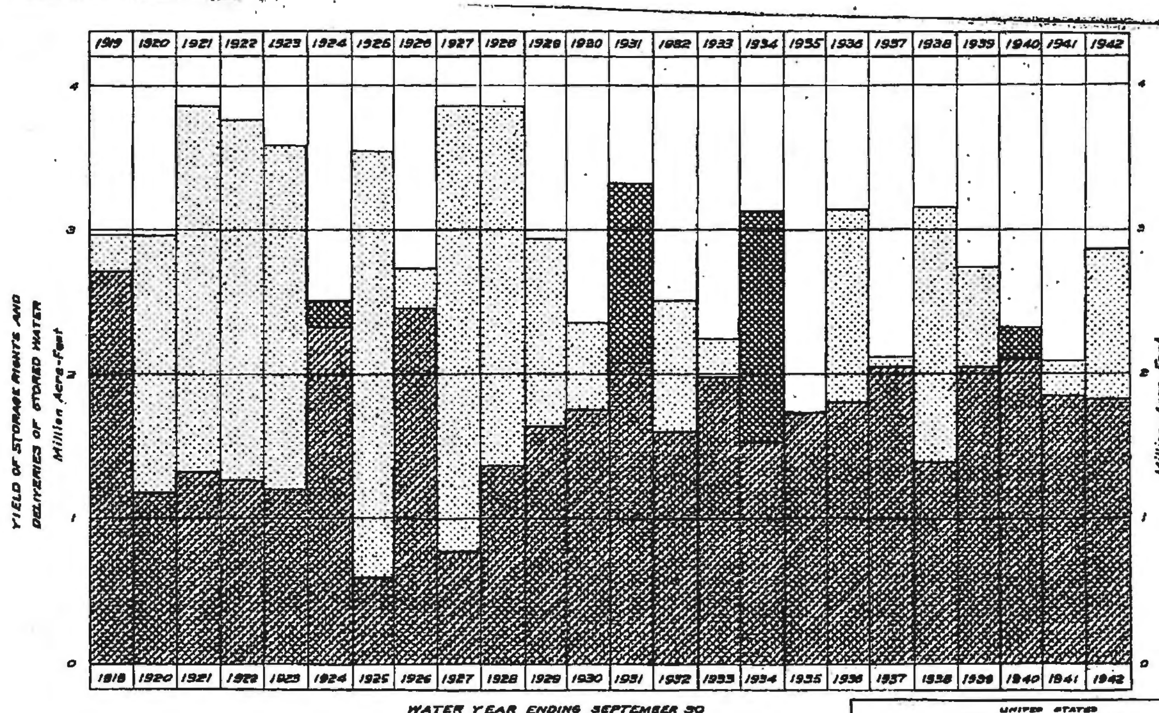
TRACED: ______ RECOMMENDED: ______

CHECKED: ______ APPROVED: ______

5.17-P-52 BOISE, IDAHO. DEC. 31, 1945

The extent of use of the total yield of the reservoir system and the amount of hold-over storage delivered from year to year under Plan A are shown graphically by an accompanying drawing entitled "Yield of Storage Rights and Deliveries of Stored Water--Plan A." It is evident from this graphical presentation that hold-over storage actually can be used only in either extremely dry years or in a succession of dry years. Hold-over storage can be accumulated in many years, but a large portion of it is dissipated by spills before the need for it occurs. It should be recognized that the deliveries of hold-over storage shown by the operation studies are based on operation of all projects in the upper valley as a unit and on operation of all projects in the lower valley as a unit. An analysis of the deliveries of stored water to individual projects within these units would very likely show that some projects retained storage at the end of the 1934 and 1935 irrigation seasons while others suffered an equivalent increase in shortage. The future distribution of space in Palisades Reservoir will vitally affect the deliveries of stored water to individual projects. The most equitable distribution of this new space would provide for every existing project using all of its storage water in existing reservoirs and in Palisades Reservoir during the 1934 irrigation season.

The operation study of the river system under conditions of Plan A showed that a firm or continuous power output of 15,000 kilowatts, or 131,000,000 kilowatt-hours annually, could have been maintained throughout the 24-year period, except during five months of the critical winter of 1934--35. During those months an average deficiency of about 12 per cent would have occurred. The Palisades power plant could have been operated at its full capacity of 30,000 kilowatts during May to September, inclusive, in all years of the period of study. It would have been necessary to release water from Jackson Lake Reservoir in order to maintain the above firm power output in 1932, 1935, and 1936, but this water would not have been lost because American Falls Reservoir would not spill in those years. Sufficient water could always be stored in Jackson Lake and Palisades reservoirs during the following spring to meet the needs for stored water in the upper valley. In order to assure the above firm power output, it will be necessary that water users having storage rights in Jackson Lake agree to such winter releases from that reservoir. This agreement should include a provision that a record be kept of such releases and that any loss of irrigation storage water resulting from the practice shall be charged to the Palisades storage rights. The Jackson Lake rights would have been fully protected in 1932, 1935, and 1936 by retaining all of the water to their credit in American Falls Reservoir.



Yield of reservoir storage rights

Delivery of water stored during year

Delivery of holdover storage

NOTE

Yield of reservoir storage rights and deliveries of stored water from Snake River reservoir system are based on operation studies with proposed winter water conservation program in effect.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PALISADES RESERVOIR PROJECT – IDAHO

YIELD OF STORAGE RIGHTS AND DELIVERIES OF STORED WATER

PLAN A

DRAWN: RAB SUBMITTED: F. M. Clinton
TRACED: RAB RECOMMENDED: Geo. H. Baxter
CHECKED: W.O.W. APPROVED: R. J. Newell

517-P-53 BOISE, IDAHO. DEC. 27, 1945

Plan B.--A summary of the results of the operation studies of the river system with Palisades Reservoir and development of 67,000 acres of new land in the Fort Hall and Minidoka projects is shown in Tables 20 and 21. This operation study showed that there would have been an adequate supply of stored water for all existing projects and for the two projects of new land throughout the period of study, except during the dry years of 1934 and 1935. The shortages shown for the existing projects in those two years are as follows:

Irrig. Season	Upper Valley (Heise to Clough)		Lower Valley (Neeley to Milner)		Entire Valley (Heise to Milner)	
	Ac.-ft.	Percent of: Diversion Req't. 1/	Ac.-ft.	Percent of: Diversion Req't. 2/	Ac.-ft.	Percent of Diversion Req't.
1934	1,379,000	44	803,000	22	2,182,000	32
1935	502,000	18	157,000	5	659,000	11

1/ Requirement for May to September, inclusive.
2/ Requirement for April to October, inclusive.

The two projects of new land would have had a full water supply in every year of the period of study, except in 1934 and 1935 when the American Falls storage right would not have been filled. The shortage in 1934 would have amounted to about 15 percent and that in 1935 would have been about 29 percent. Neither of these shortages would have caused serious crop losses.

An operation study was made of the river system under present conditions with winter diversions and with only the existing reservoirs in operation, but with 67,000 acres of new land under irrigation in the Fort Hall and Minidoka projects. The results of this operation study were compared with those shown by the operation study of Plan B with Palisades Reservoir and the water saving program. In this manner the increase in deliveries of stored water and the decrease in shortages that would result from placing Palisades Reservoir in operation and adoption of the proposed winter water saving program was determined. Inasmuch as the same criteria were adhered to in both studies, the results are comparable. The comparison of deliveries of stored water under each condition is shown in Table 22 and by the accompanying drawing entitled "Deliveries of Stored Water--Plan B." The smaller delivery of stored water in 1930 with Palisades Reservoir and the water saving program is due to the fact that the two projects of new land could have diverted some natural flow in that year because American Falls Reservoir would have spilled in May. No spills would have occurred

TABLE 20

SUMMARY OF OPERATION STUDY OF THE SNAKE RIVER SYSTEM ABOVE CLOUGH GAGING STATION
WITH PALISADES RESERVOIR AND WATER CONSERVATION PROGRAM
PLAN B - WITH NEW LAND
Units of 1,000 Acre-feet

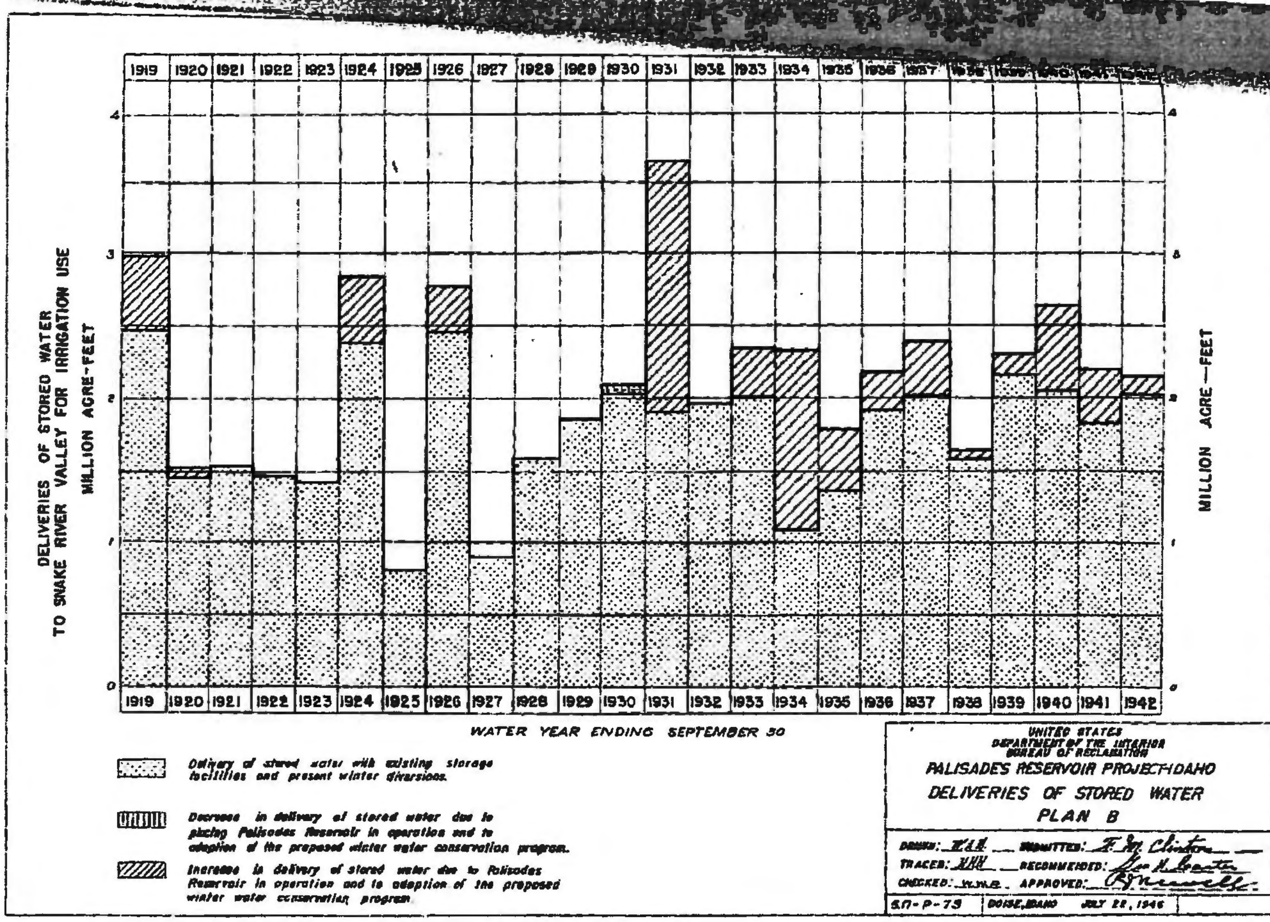
Water Year	Nat. Flow at Heise	Mod. Flow at Rexburg	Usable River Gain	Diversion Requirement	Storage Release and Evap. Loss	Shortage	Surplus Flow	Water Stored	Non-usable River Gain	Depletion Oct.-April	Mod. Flow at Clough	Jackson Lake Reservoir: Nat. Inflow	Jackson Lake Reservoir: Content End of Year	Jackson Lake Reservoir: Content Maximum	Palisades Reservoir: Regulated Inflow	Palisades Reservoir: Content End of Year	Palisades Reservoir: Content Maximum	Spill
1919	3803	1228	243	3200	1179	0	3140	285	57	522	2606	685	829	847	3499	124	1401	1417
1920	5299	1107	173	3030	203	0	3638	1295	67	522	1988	992	847	847	4888	1198	1401	979
1921	5702	1570	110	2970	349	0	4646	203	100	522	4121	1068	847	847	5292	1052	1401	3137
1922	5322	1383	199	2930	266	0	4124	349	101	522	3454	1008	847	847	4928	1135	1401	2462
1923	5212	1372	208	2890	346	0	4132	266	82	522	3526	946	847	847	4823	1055	1401	2478
1924	3679	944	255	3220	904	0	2448	346	55	522	1991	646	847	847	3363	241	1401	820
1925	5918	1570	240	2980	79	0	4712	1231	80	522	3139	1327	847	847	5495	1393	1401	2158
1926	3907	1221	295	3330	947	0	2927	8	55	522	2702	763	847	847	3590	304	1401	1463
1927	6300	1693	228	2970	125	0	5261	1120	82	522	3801	1416	847	847	5861	1299	1401	2806
1928	6266	1740	280	3135	381	0	5416	102	90	522	4982	1329	847	847	5829	1020	1401	3751
1929	4311	1354	137	2955	551	0	3283	381	73	522	2553	867	847	847	3964	850	1401	1526
1930	4270	890	163	3042	521	0	2688	551	77	506	1808	794	847	847	3926	880	1401	892
1931	2989	679	196	3241	1344	0	1855	521	54	531	1521	575	216	847	3335	124	1401	265
1932	4696	969	66	2981	523	0	3162	1756	84	743	1514	992	782	847	3766	124	1215	0
1933	4151	1095	111	3055	832	0	3021	1342	69	719	1676	872	745	847	3849	124	1401	169
1934	2782	513	-152	3353	581	1411	1678	70	61	851	1152	628	0	803	3318	124	124	0
1935	4112	717	-124	3065	453	562	2547	1289	57	709	1542	934	0	696	3828	124	715	0
1936	5350	1009	156	3193	869	0	4080	2146	74	652	1687	1069	847	847	4079	323	1401	330
1937	3811	818	172	3035	921	0	2574	1078	68	605	1502	778	760	847	3572	124	1401	282
1938	5161	1228	157	3039	515	0	3908	1370	83	574	2147	1143	847	847	4687	892	1401	985
1939	4322	1260	196	3256	792	0	3201	509	54	479	2367	891	847	847	3872	609	1401	1233
1940	3417	1160	144	3111	904	0	2401	792	56	542	1422	793	847	847	3042	298	1401	279
1941	3697	941	182	3041	656	0	2323	1030	58	438	1453	779	847	847	3342	232	1328	0
1942	4314	1092	173	3024	701	0	3142	1169	67	504	1636	886	847	847	3968	700	1401	640
Aver.	4533	1148	159	3085	623	82	3346	800	71	566	2345	924	-	-	4172	-	-	1170

TABLE 21

SUMMARY OF OPERATION STUDY OF THE SNAKE RIVER SYSTEM BELOW CLOUGH GAGING STATION WITH PALISADES RESERVOIR AND WATER CONSERVATION PROGRAM, PLAN B - WITH NEW LAND

Units of 1,000 Acre-feet

Water Year	Recorded flow at Neeley	Correction for Change in flow at Clough	Rec. Change in Content of Am. Falls Reservoir	Increased Return Flow Ft. Hall Proj.	Modified Flow at Neeley	River Gain Neeley-Milner	Diversion Requirement	Power Reqmt. at Milner	Stor. Release & Evap. Loss	Shortage	Surplus at Milner	Spill at Milner	Water Stored	Modified Flow at Milner	American Falls Reservoir: Content: End of Year	American Falls Reservoir: Content: Maxi-mum	American Falls Reservoir: Spill
1919	4606	- 29	--	165	4742	139	3744	112	1763	0	2717	1624	1093	1736	17	1780	1606
1920	5326	- 1354	—	165	4137	107	3653	136	1712	0	2093	7	2086	143	391	1641	0
1921	6773	- 516	—	165	6422	272	3593	106	1251	0	4163	2774	1389	2880	529	1780	2727
1922	6017	- 428	—	165	5754	212	3626	116	1273	0	3414	2163	1251	2279	507	1780	2123
1923	5628	- 8	—	165	5785	229	3634	121	1145	0	3319	2046	1273	2167	635	1780	2005
1924	3902	+ 89	—	165	4156	133	3794	102	1763	0	2088	943	1145	1045	17	1780	907
1925	6287	- 1159	—	165	5293	39	3667	122	912	0	2372	586	1786	708	891	1780	586
1926	4785	- 70	+ 4	165	4884	170	3800	117	1763	0	2831	1942	889	2059	17	1780	1898
1927	5077	- 736	+ 1385	165	5891	148	3635	181	831	0	3054	1291	1763	1472	949	1780	1282
1928	7170	+ 213	- 421	165	7127	298	3761	119	1231	0	4776	3945	831	4064	549	1780	3893
1929	4986	- 239	- 222	165	4690	348	3638	119	1333	0	2614	1383	1231	1502	447	1780	1286
1930	4442	- 412	- 194	165	4001	191	3722	136	1538	0	1872	539	1333	675	242	1780	488
1931	3811	+ 259	- 513	165	3722	116	3807	155	1763	0	1639	101	1538	256	17	1780	101
1932	3874	- 545	+ 193	165	3687	141	3642	185	1516	0	1517	1	1516	186	17	1533	0
1933	4006	- 390	+ 12	165	3793	200	3825	159	1563	0	1572	9	1563	168	17	1580	0
1934	2776	+ 439	- 212	140	3143	117	3922	172	1544	837	1547	3	1544	175	17	1561	0
1935	3275	+ 95	+ 13	118	3501	114	3640	196	1272	221	1272	0	1272	196	17	1289	0
1936	4163	- 1196	+ 561	165	3693	216	3678	197	1687	0	1721	34	1687	231	17	1704	0
1937	3876	- 246	- 194	165	3601	259	3614	200	1436	0	1482	46	1436	246	17	1453	0
1938	4818	- 1027	+ 273	165	4229	240	3662	197	1533	0	2143	28	2115	225	599	1780	23
1939	4650	+ 98	- 433	165	4480	285	3872	168	1555	0	2280	1099	1181	1267	225	1780	1070
1940	3539	- 187	+ 12	165	3529	247	3758	179	1763	0	1602	47	1555	226	17	1780	35
1941	3468	- 135	+ 56	165	3554	263	3623	183	1705	0	1716	11	1705	194	17	1722	0
1942	4161	- 581	+ 90	165	3835	256	3601	171	1503	0	1822	41	1781	212	295	1741	0
Aver.	4642	- 336	+ 17	162	4485	198	3705	152	1473	44	2318	861	1457	1013	-	-	835



DELIVERIES OF STORED WATER TO SNAKE RIVER VALLEY FOR IRRIGATION USE
MILLION ACRE-FEET
MILLION ACRE—FEET
0
1
2
3
4
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
WATER YEAR ENDING SEPTEMBER 30
Delivery of stored water with existing storage facilities and present winter diversions.
Decrease in delivery of stored water due to placing Palisades Reservoir in operation and to adoption of the proposed winter water conservation program.
Increase in delivery of stored water due to Palisades Reservoir in operation and to adoption of the proposed winter water conservation program.
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
PALISADES RESERVOIR PROJECT-IDAHO
DELIVERIES OF STORED WATER
PLAN B
DRAWN: W.A.B.
SUBMITTED: F. M. Clinton
TRACED: V.H.H.
RECOMMENDED:
CHECKED: W.M.B.
APPROVED:
50-P-73
BOISE, IDAHO
JULY 22, 1946

that year under present operating conditions, so all deliveries to the new land would have been charged as stored water. A comparison of the total shortages on the existing projects together with the two projects of new land under present conditions and with Palisades Reservoir in operation and no winter diversions is shown in the following table:

Irrigation Season	Shortages with Present Storage Facilities and with Present Winter Diversions (Acre-feet)	Shortages with Palisades Reservoir in Operation and with Proposed Winter Water Conservation Program in Effect (Acre-feet)	Difference (Acre-feet)
1919	762,000	0	762,000
1924	605,000	0	605,000
1926	419,000	0	419,000
1931	2,132,000	0	2,132,000
1932	61,000	0	61,000
1933	567,000	0	567,000
1934	3,563,000	2,248,000	1,315,000
1935	1,214,000	783,000	431,000
1936	135,000	0	135,000
1937	519,000	0	519,000
1939	310,000	0	310,000
1940	789,000	0	789,000
1941	451,000	0	451,000
1942	138,000	0	138,000
Total	11,665,000	3,031,000	8,634,000
24-Year Average	486,000	126,000	360,000

It will be noted that the average decrease in shortages shown by the above table is greater than the increase in deliveries of stored water shown in Table 22. This difference is largely accounted for by the fact that the increase in usable river gains in the upper valley is effective in meeting irrigation requirements in that area. The average increase in stored water deliveries and the average decrease in shortages is a measure of the benefit that would be realized from placing Palisades Reservoir in operation and adoption of the proposed winter water conservation program.

TABLE 22

DELIVERIES OF STORED WATER TO THE SNAKE RIVER VALLEY WITH PALISADES AND WATER CONSERVATION AND UNDER PRESENT CONDITIONS

PLAN B - WITH DEVELOPMENT OF NEW LAND

Water Year	Delivery With Existing Storage Facilities and Present Winter Diversions (Acre-feet)	Delivery With Palisades Reservoir in Operation and With Proposed Winter Water Conservation Program in Effect (Acre-feet)	Difference (Acre-feet)
1919	2,470,000	2,982,000	512,000
1920	1,451,000	1,518,000	67,000
1921	1,527,000	1,527,000	0
1922	1,465,000	1,465,000	0
1923	1,415,000	1,415,000	0
1924	2,378,000	2,833,000	455,000
1925	803,000	803,000	0
1926	2,457,000	2,766,000	309,000
1927	892,000	892,000	0
1928	1,575,000	1,575,000	0
1929	1,848,000	1,848,000	0
1930	2,087,000	2,020,000	- 67,000
1931	1,900,000	3,632,000	1,732,000
1932	1,963,000	1,968,000	5,000
1933	2,008,000	2,348,000	340,000
1934	1,083,000	2,326,000	1,243,000
1935	1,364,000	1,776,000	412,000
1936	1,919,000	2,170,000	251,000
1937	2,013,000	2,382,000	369,000
1938	1,586,000	1,643,000	57,000
1939	2,156,000	2,309,000	153,000
1940	2,053,000	2,634,000	581,000
1941	1,826,000	2,196,000	370,000
1942	2,022,000	2,149,000	127,000
Average	1,761,000	2,049,000	288,000

The possible annual yield of each reservoir's storage right under Plan B was computed from the results of the operation studies of Plan B in the same manner as for Plan A and is shown in Table 23. These yields are shown graphically by the accompanying drawing entitled "Yield of Reservoir Storage Rights--Plan B." The increase in the yield of storage rights over that shown for Plan A is due mainly to the return flow from irrigation of new land in the Michaud Unit which increased the storable inflow to American Falls Reservoir. The extent of use of the total yield of the reservoir storage rights and the amount of hold-over storage actually used under Plan B is shown graphically by the accompanying drawing entitled "Yield of Storage Rights and Deliveries of Stored Water--Plan B." A comparison of this graph with the similar graph for Plan A will reveal that more use is made of the yield of the reservoir system when the demand for stored water is increased by placing the two projects of new land in operation. The existing projects would have to make more frequent and heavier drafts on the storage in Palisades Reservoir because they would not have the use of the 433,000 acre-feet of reserved space in American Falls Reservoir.

The same firm hydroelectric power output could have been maintained under Plan B as under Plan A. For all practical purposes, the secondary power output at the Palisades plant may be considered to be the same under either plan.

TABLE 23

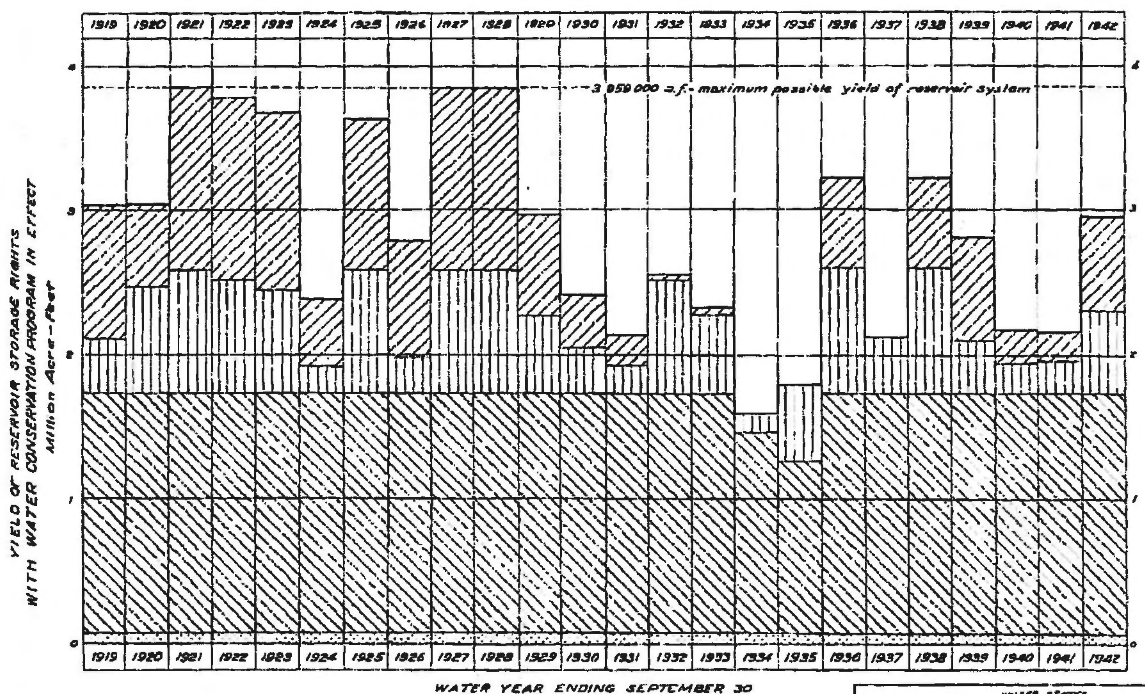
POSSIBLE YIELD OF RESERVOIR STORAGE RIGHTS WITH WATER CONSERVATION PROGRAM IN EFFECT

PLAN B

Units of 1,000 Acre-feet

Water Year	Jackson Lake Reservoir	Palisades Reservoir	American Falls Reservoir 1/	Lake Walcott	Total
1919	369	932	1,655	80	3,036
1920	728	584	1,655	80	3,047
1921	847	1,277	1,655	80	3,859
1922	773	1,277	1,655	80	3,785
1923	705	1,239	1,655	80	3,679
1924	181	466	1,655	80	2,382
1925	847	1,056	1,655	80	3,638
1926	245	801	1,655	80	2,781
1927	847	1,277	1,655	80	3,859
1928	847	1,277	1,655	80	3,859
1929	529	704	1,655	80	2,968
1930	310	372	1,655	80	2,417
1931	185	218	1,655	80	2,138
1932	769	45	1,655	80	2,549
1933	532	58	1,655	80	2,325
1934	127	0	1,378	80	1,585
1935	529	0	1,180	80	1,789
1936	847	641	1,655	80	3,223
1937	386	0	1,655	80	2,121
1938	847	639	1,655	80	3,221
1939	348	722	1,655	80	2,805
1940	189	244	1,655	80	2,168
1941	203	220	1,655	80	2,158
1942	555	665	1,655	80	2,955
Average	531	613	1,624	80	2,848
Percent of Capacity	63	48	98	100	74

1/ Does not include power water storage right of 45,000 acre-feet.



Palisades Reservoir

Jackson Lake Reservoir

American Falls Reservoir (not including power water storage right of 45000 a.f.)

Lake Walcott

NOTE

Yield of reservoir storage rights is based on operation studies with the proposed winter water conservation program in effect

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PALISADES RESERVOIR PROJECT-IDAHO

YIELD OF RESERVOIR STORAGE RIGHTS

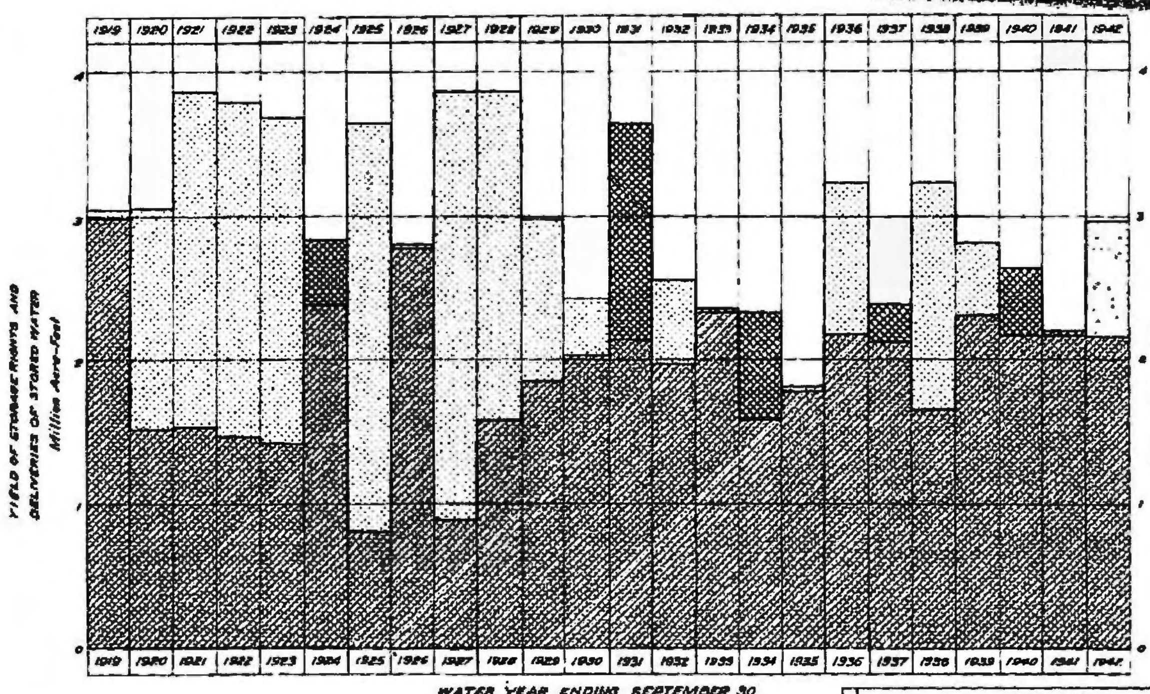
PLAN B

DRAWN: ______ SUBMITTED: F. M. Clinton

TRACED: ______ RECOMMENDED: Geo. H. Gerster

CHECKED: W.O.Y. APPROVED: ______

5.17-P-35 | BOISE, IDAHO. JAN 5, 1945



Yield of reservoir storage rights

Delivery of water stored during year

Delivery of holdover storage

NOTE

Yield of reservoir storage rights and deliveries of stored water from Snake River reservoir system are based on operation studies with proposed winter water conservation program in effect.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PALISADES RESERVOIR PROJECT - IDAHO

YIELD OF STORAGE RIGHTS AND DELIVERIES OF STORED WATER

PLAN B

DRAWN: B.M.B. SUBMITTED: F. M. Clinton

TRACED: W.L.B. B.M.B. RECOMMENDED: Geo. R. Carter

CHECKED: W.A.M. APPROVED: R. J. Newell

REVISED 7-18-46 W.W.B.

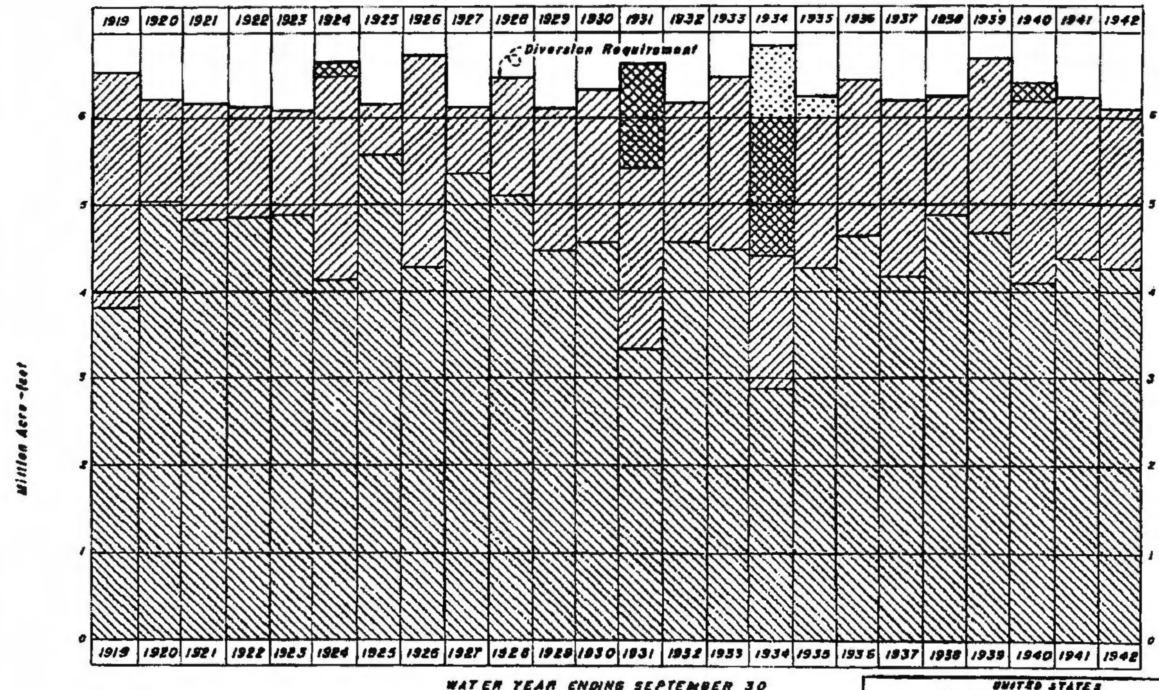
5.17-P-56 | BOISE, IDAHO. JAN. 11, 1946.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The advantages and disadvantages of Plan A and Plan B, from the standpoint of the water users on existing projects, can be appraised best by a comparison of the water supply available for those projects under each plan. In order to facilitate this comparison, the accompanying graphs showing the supply of natural flow, seasonal storage, and hold-over storage used and shortages suffered by the existing projects under each plan were prepared. These graphs and Tables 24 and 25, from which they were plotted, show that the existing projects would have had an adequate water supply under either plan in all years except 1934 and 1935. The shortage in 1934 under Plan B would have been about 1,357,000 acre-feet greater than that under Plan A. The 1935 shortage would have been increased by about 388,000 acre-feet as a result of developing the two projects of new land. The large increase in the 1934 shortage under Plan B is due to the fact that the existing projects would have had to make heavier drafts of their hold-over storage in 1931 and 1933 because they would not have had the use of the firm annual yield of the reserved space in American Falls Reservoir as in Plan A. In order to reduce the 1934 shortage by about 20 percent and the 1935 shortage by about seven percent of the diversion requirement, the water users on existing projects would have to increase their annual payment for storage facilities by about $60,000. Although it would be desirable to reduce the 1934 and 1935 shortages to those shown for Plan A, the economic feasibility of achieving this goal might be questionable when the frequency of occurrence of such dry years is considered. Such a condition has occurred only once during the 50-year period in which the flows of Snake River have been recorded, and studies of climatic cycles over long periods in the West indicate that it should not occur oftener than once in every 100 years. In order to provide protection against a recurrence of a shortage as severe as in the 1930--1940 period under Plan A, therefore, the water users would incur the cost of an additional 433,000 acre-feet of reservoir space which they might not use oftener than once in every 100 years. In all years of the period of study, except 1934 and 1935, the amount of water accruing to the Palisades storage right together with the accumulated hold-over storage would be sufficient to guarantee a full water supply for the existing projects. The Palisades delivery would thus be equal to the delivery from the reserved space in American Falls Reservoir in all years except 1934 and 1935, if both reservoirs were used to provide a supplemental supply of stored water for existing projects.

From the standpoint of the most efficient use of the water resources of the Snake River, it appears that Plan B is the more desirable. A comparison of the deliveries of stored water under each plan



Shortage

Holdover Storage

Water Stored during Year

Natural Flow

NOTE

Data are based on operation studies with Palisades Reservoir in operation and with the proposed winter water conservation program in effect.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PALISADES RESERVOIR PROJECT-IDAHO
WATER SUPPLY FOR EXISTING PROJECTS
PLAN A.

DRAWN W.W.S. SUBMITTED [illegible]
TRACED [illegible] RECOMMENDED [illegible]
CHECKED W.W.C. APPROVED [illegible]

5.17-P-84 BOISE, IDAHO - JULY 22, 1946

TABLE 24

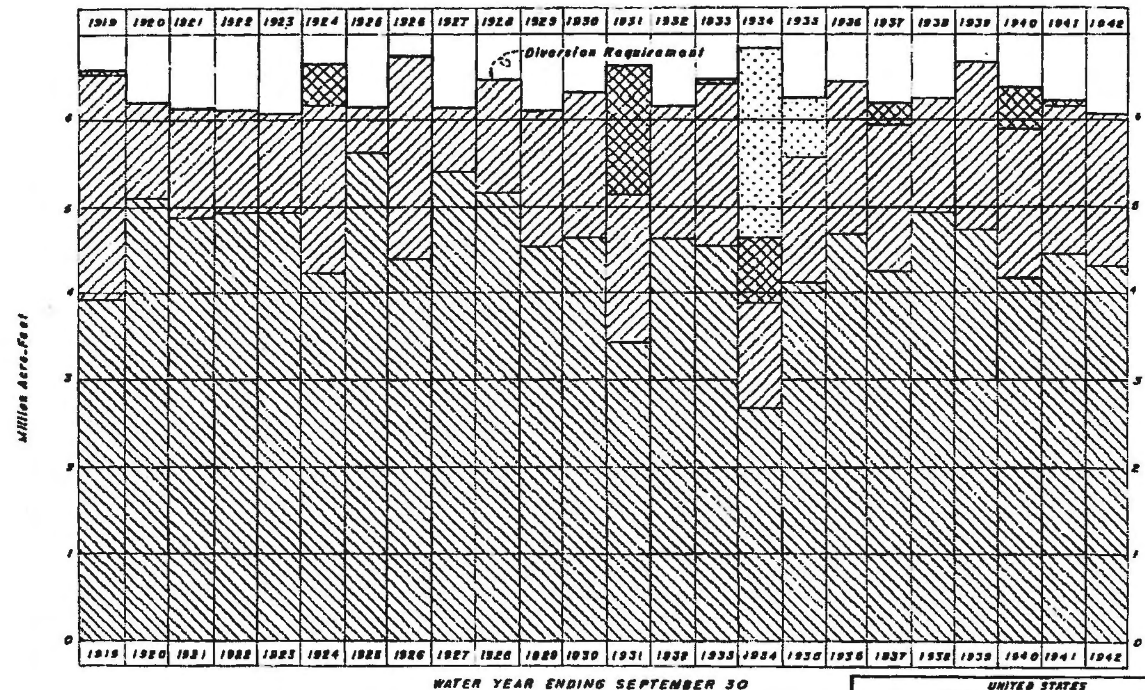
WATER SUPPLY FOR EXISTING PROJECTS

PLAN A

Units of 1,000 Acre-feet

Irrigation Season 1/	Diversion Requirement	Shortage	Stored Water Delivery		Delivery of Natural Flow
			Water Stored During Year	Holdover Storage	
1919	6,538	0	2,716	0	3,822
1920	6,206	0	1,174	0	5,032
1921	6,135	0	1,322	0	4,813
1922	6,111	0	1,260	0	4,851
1923	6,073	0	1,210	0	4,863
1924	6,642	0	2,325	188	4,129
1925	6,152	0	598	0	5,554
1926	6,732	0	2,446	0	4,286
1927	6,130	0	770	0	5,360
1928	6,469	0	1,370	0	5,099
1929	6,110	0	1,643	0	4,467
1930	6,311	0	1,754	0	4,557
1931	6,635	0	2,081	1,231	3,323
1932	6,174	0	1,607	0	4,567
1933	6,465	0	1,987	0	4,478
1934	6,817	825	1,532	1,591	2,869
1935	6,248	271	1,725	0	4,252
1936	6,431	0	1,809	0	4,622
1937	6,202	0	2,040	0	4,162
1938	6,253	0	1,381	0	4,872
1939	6,685	0	2,043	0	4,642
1940	6,391	0	2,111	203	4,077
1941	6,211	0	1,858	0	4,353
1942	6,072	0	1,831	0	4,241
Average	6,341	46	1,692	134	4,470

1/ May to September, inclusive, for Upper Valley; April to October, inclusive, for Lower Valley, except 1942, which does not include October.



Shortage

Holdover Storage

Water Stored during year

Natural Flow

NOTE

Data are based on operation studies with Palisades Reservoir in operation and with the proposed winter water conservation program in effect.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PALISADES RESERVOIR PROJECT–IDAHO
WATER SUPPLY FOR EXISTING PROJECTS
PLAN B

DRAWN W.W.S. SUBMITTED F. M. Clinton
TRACED E.L.M. RECOMMENDED Geo. H. Scott
CHECKED W.W.B. APPROVED R. J. Newell

517-P-65 BOISE, IDAHO JULY 25, 1946

TABLE 25

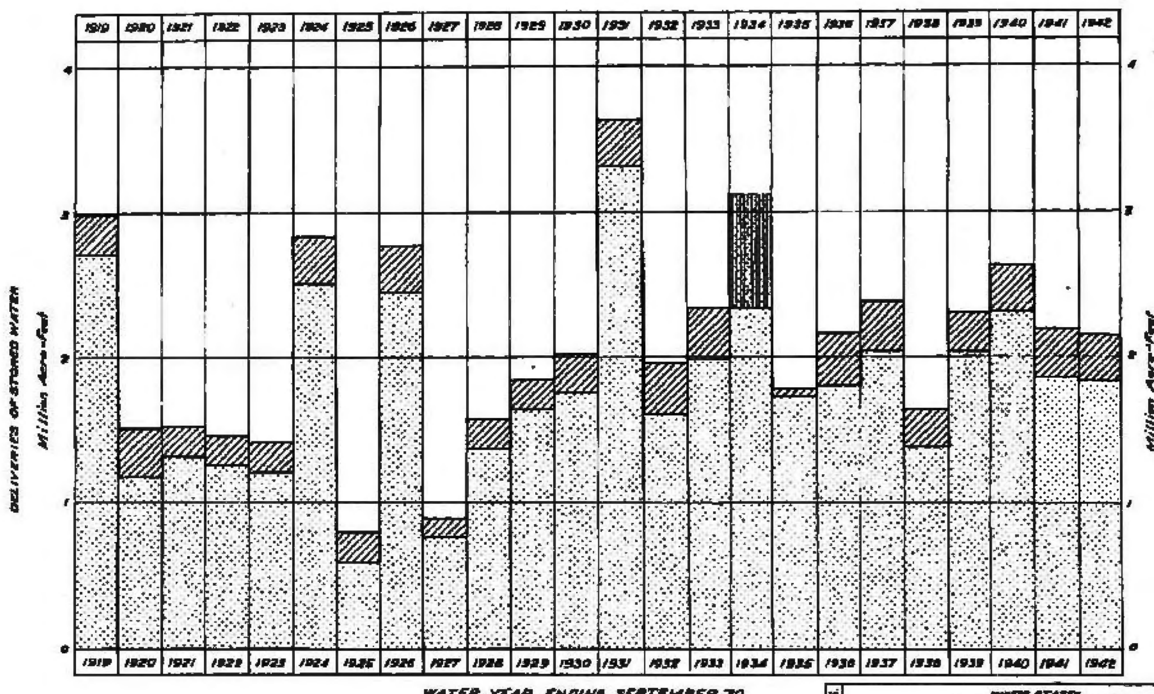
WATER SUPPLY FOR EXISTING PROJECTS

PLAN B

Units of 1,000 Acre-feet

Irrigation Season 1/	Diversion Requirement	Shortage	Stored Water Delivery: Water Stored During Year	Stored Water Delivery: Holdover Storage	Delivery of Natural Flow
1919	6,538	0	2,603	18	3,917
1920	6,206	0	1,102	0	5,104
1921	6,135	0	1,250	0	4,885
1922	6,111	0	1,188	0	4,923
1923	6,073	0	1,138	0	4,935
1924	6,642	0	1,949	456	4,237
1925	6,152	0	526	0	5,626
1926	6,732	0	2,338	0	4,394
1927	6,130	0	724	0	5,406
1928	6,469	0	1,298	0	5,171
1929	6,110	0	1,571	0	4,539
1930	6,311	0	1,659	0	4,652
1931	6,635	0	1,705	1,499	3,431
1932	6,174	0	1,535	0	4,639
1933	6,465	0	1,892	23	4,550
1934	6,817	2,182	1,224	735	2,676
1935	6,248	659	1,467	0	4,122
1936	6,431	0	1,737	0	4,694
1937	6,202	0	1,688	261	4,253
1938	6,253	0	1,309	0	4,944
1939	6,685	0	1,948	0	4,737
1940	6,391	0	1,735	471	4,185
1941	6,211	0	1,725	38	4,448
1942	6,072	0	1,759	0	4,313
Average	6,341	118	1,545	146	4,532

1/ May to September, inclusive, for Upper Valley; April to October, inclusive, for Lower Valley, except 1942, which does not include October.



Delivery of stored water under Plan A

Increase in delivery of stored water due to placing Plan B in operation.

Decrease in delivery of stored water due to placing Plan B in operation.

NOTE

All deliveries of stored water are based on operation studies with Palisades Reservoir in operation and with the proposed winter water conservation program in effect.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

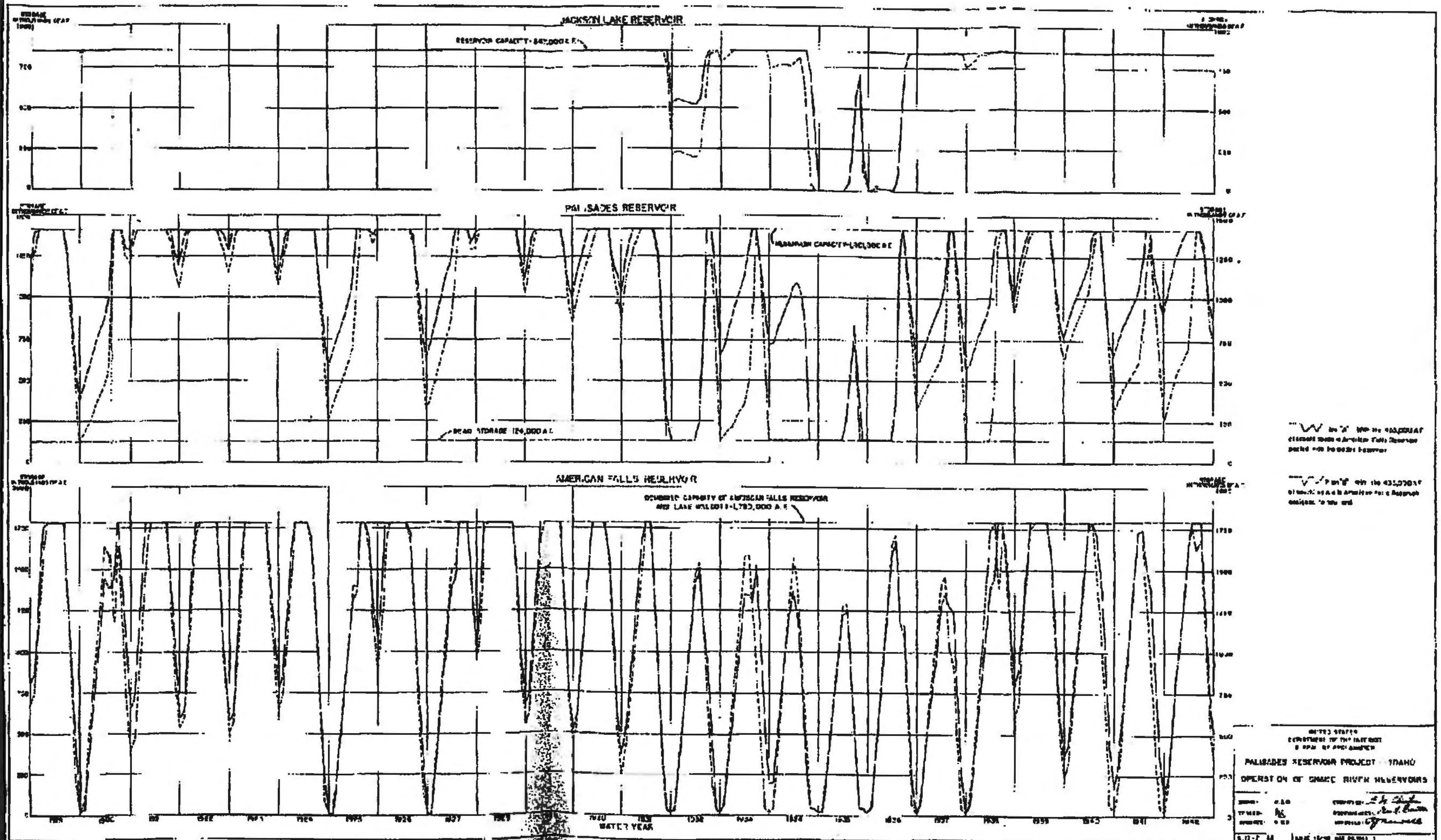
PALISADES RESERVOIR PROJECT - IDAHO

DELIVERY OF STORED WATER
PLAN A AND PLAN B

REVISED 7-18-46 W.W.S.

DRAWN: B.M.R. SUBMITTED: F. M. Clinton
TRACED: J.K.S.F.A. RECOMMENDED: [illegible]
CHECKED: [illegible] APPROVED: [illegible]

5.17-P-57 BOISE, IDAHO - JAN. 11, 1946


JACKSON LAKE RESERVOIR
PALISADES RESERVOIR
AMERICAN FALLS RESERVOIR
WATER YEAR
PALISADES RESERVOIR PROJECT — IDAHO
OPERATION OF SNAKE RIVER RESERVOIRS

PALISADES PROJECT

IDAHO-WYOMING

The Palisades project was found feasible and authorized by the Secretary on December 9, 1941, under the provisions of the Reclamation Project Act of 1939.

The project was reauthorized by the act of September 30, 1950 (64 Stat. 1083).

BUREAU OF RECLAMATION,
Washington, November 1, 1941.

The SECRETARY OF THE INTERIOR.

SIR: Under authority of the Reclamation Act of June 17, 1902 (32 Stat. 388), the Bureau of Reclamation conducted extensive studies of possibilities of alleviating severe water shortages and heavy crop losses which occur in the Upper Snake River Valley in low-water years. Crop losses in the 1,200,000 acres of land receiving water from the Snake River and its tributaries above Milner, Idaho, have ranged from $1,000,000 to $7,000,000 in years of critical shortage.

The report of the Bureau of Reclamation, which is attached, proposes the construction of the Palisades Dam Project, including a dam about 260 feet high and 2,200 feet long at the crest on the South Fork of the Snake River at the Palisades site about 50 miles east of Idaho Falls, Idaho, designed to create a reservoir of a capacity of 1,420,000 acre-feet; including at the dam a power plant with a capacity of 30,000 kilowatts or more, if summer water is used to produce a maximum amount of seasonal power, and transmission lines; and a water conservation program involving the drilling of wells and installation of appurtenances for rural domestic and stock water supplies, and other water conservation features and methods. A series of levees between Heise and Roberts, Idaho, will be required to complete the flood-control phase of the project.

The storage space is allocated as follows: The upper 500,000 acre-feet primarily for flood control; the next 800,000 acre-feet

EXHIBIT 3

primarily for irrigation use; and the lower 120,000 acre-feet for dead storage to provide power head. The proposed reservoir will provide a total space of 900,000 acre-feet for flood-control purposes when needed. The space available for irrigation purposes will provide an annual yield of 255,000 acre-feet of water from the surplus flow of the Snake River and through conservation of water now wastefully used.

The Palisades Dam project, as outlined, can be constructed at an estimated cost of $24,092,000 allocated as follows:

	Total construction cost	Allocation to		
		Irrigation	Flood control	Power development
Dam and reservoir	$18,125,000	$7,794,000	$7,431,000	$2,900,000
Power plant, etc.	2,811,000			2,811,000
Water-conservation program[1]	2,422,000	2,422,000		
Channel improvement[1]	734,000		734,000	
Total	24,092,000	10,216,000	8,165,000	5,711,000

[1] Expected to be undertaken individually.

The irrigators of the Upper Snake River Basin can repay the construction cost allocated to irrigation and pay the operation and maintenance cost of the irrigation feature of the project as contemplated by the reclamation laws.

The estimated annual revenues to be received from the sale of power from the Palisades project exceed the amount necessary to meet the requirements of subsection (c) of section 9 of the Reclamation Project Act of 1939 (53 Stat. 1187).

The benefits to be received from the flood-control features of the project exceed the estimated cost of these features. The report of the Bureau was submitted to the Chief of Engineers, War Department, for his opinion regarding the flood-control value of the Palisades Reservoir. In a letter dated May 2, he stated:

> The plans and estimates of costs and benefits are in full agreement with studies made by this Department, report upon which will soon be made to Congress. I accordingly wish to advise that construction of the Grand Valley Reservoir, substantially as outlined in the report of the Bureau of Reclamation, and its operation in such manner as to provide for the reservation of not less than 500,000 acre-feet of storage space primarily for flood-control use, would effectively control floods in the irrigated area east of Idaho Falls, and that in my opinion a charge of $7,431,000 toward the first cost of the reservoir, in the interest of flood control, is justified.

Growing defense needs in the area, as reflected in Federal Power Commission estimates, emphasize the need for this additional source of power. Possibilities connected with development of minerals, particularly phosphate, in the vicinity might soon render this project of strategic importance.

The annual benefits to be derived from the construction of the Palisades project exceed the annual costs and the project clearly meets all requirements of the Reclamation Act of June 17, 1902 (32 Stat. 388), and the Reclamation project Act of 1939 (53 Stat. 1187). The project is desirable in the public interest. Its success, however, depends on the conservation of 135,000 acre-feet of water now wastefully used, and on the willingness of the irrigators to pay $1 per acre-foot per annum for the stored water which they will use. These matters can be adjusted in future negotiations, and construction should not be initiated until appropriate assurances have been received. I, therefore, recommend that you find the project feasible. I further recommend that the finding and the report be transmitted to the Congress in compliance with the provisions of the Reclamation Project Act of 1939.

Respectfully,

(Signed) JOHN C. PAGE,
Commissioner.

THE SECRETARY OF THE INTERIOR,
Washington, December 9, 1941.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

SIR: I am submitting with this letter the Reclamation report on the Palisades Dam project on the South Fork of the Snake River near Idaho Falls, Idaho. The report consists of a letter, dated November 1, to me from the Commissioner, Bureau of Reclamation, the engineering and economic report transmitted with that letter, and this, the finding with respect to the feasibility of the project.

The Palisades Dam project is a multiple-purpose project involving major irrigation, flood control, and power benefits, and contemplating, as a part of the irrigation phase, the conservation of a large amount of water, which is now wastefully used. This conservation will be effected through a program of well drilling, and installation of appurtenances and other features to provide rural culinary and stock water.

The project is estimated to cost $24,092,000, including an item of $2,422,000 for water-conservation measures and another item of $734,000 for channel improvements. These two features are expected to be undertaken individually. The Palisades Dam and Reservoir will cost $18,125,000, and the power plant and transmission facilities, $2,811,000.

The total cost, when considered in relation to the services rendered by the project, logically can be broken down and is allocated as follows:

Irrigation	$10,216,000
Flood control	8,165,000
Power	5,711,000

IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT
OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

In Re SRBA **Case No. 39576**	Subcase No. 01-219 (Lake Walcott) Subcase Nos. 01-02064, 01-10042 (American Falls) Subcase Nos. 01-02068, 01-10043 (Palisades) Subcase Nos. 01-4055, 01-10044, 01-10045 (Jackson Lake) Subcase Nos. 21-2156, 21-10560 (Island Park) Subcase No. 21-4155 (Grassy Lake) Subcase No. 25-7004 (Ririe) **STIPULATION**

The undersigned parties and the Idaho Department of Water Resources ("Department")[1] (collectively, the "Parties"), by and through their counsel of record, hereby stipulate and agree as follows:

[1] The Department is not a "party" to the Snake River Basin Adjudication, but is included in the collective reference for convenience only. The Director signs this stipulation on behalf of the Department pursuant to his role as an independent expert and technical assistant to the Court. *See* Idaho Code § 42-1401B.

EXHIBIT 4

1. The following remarks should be included on the partial decrees for the following water rights:[2]

Remark	Applicable Water Rights
[Upstream Storage—In State] Place of use for storage is [insert name] Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range, 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.	01-219 (Lake Walcott) 01-2064, 01-10042 (American Falls) 01-2068, 01-10043 (Palisades) 21-2156, 21-10560 (Island Park) 25-7004 (Ririe)[3]
[Upstream Storage—Out of State] Storage water referenced herein may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range, 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.	01-4055, 01-10044, 01-10045 (Jackson Lake) 21-4155 (Grassy Lake)
[No Modification] This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.	01-10042 (American Falls) 01-10043 (Palisades) 21-2156, 21-10560 (Island Park) 21-4155 (Grassy Lake) 25-7004 (Ririe)

[2] For ease of reference titles in brackets have been provided for each remark but those titles will not be included on the water rights.
[3] On September 30, 2005, the Court entered a partial decree for Ririe reservoir. On August 29, 2012, counsel for the United States Bureau of Reclamation moved to set aside the partial decree. A hearing on the motion to set aside the partial decree is scheduled for September 12, 2012.

[No Modification to Storage Exchanges] This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, including but not limited to the contractual storage exchanges, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.	01-219 (Lake Walcott) 01-2064 (American Falls) 01-2068 (Palisades) 01-4055, 01-10044, 01-10045 (Jackson Lake)
[2006 Settlement/Minidoka Credit] The operation, use and administration of this water right is subject to the terms and conditions of the Settlement Agreement signed on February 14, 2006 with Minidoka Irrigation District, Burley Irrigation District, Twin Falls Canal Company, North Side Canal Company, and American Falls Reservoir District #2.	01-2064 (American Falls) 01-2068 (Palisades) 01-10045 (Jackson)
[Allocation of Storage] The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 01-00219, 01-2064, 01-2068, 01-04055, 01-10042, 01-10043, 01-10044, 01-10045, 21-02156, 21-04155, 21-10560, 25-07004.	01-219 (Lake Walcott) 01-2064, 01-10042 (American Falls) 01-2068, 01-10043 (Palisades) 01-4055, 01-10044, 01-10045 (Jackson Lake) 21-2156, 21-10560 (Island Park) 21-4155 (Grassy Lake) 25-7004 (Ririe)

[Ownership][4] The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.	01-219 (Lake Walcott) 01-10042 (American Falls) 01-10043 (Palisades) 01-4055, 01-10044, 01-10045 (Jackson Lake) 21-2156, 21-10560 (Island Park) 21-4155 (Grassy Lake) 25-7004 (Ririe)

2. Consistent with the temporary upstream, annual, and permanent storage exchange provisions in the Palisades Contracts[5], and historic administration of water rights in Water District 01, the Parties hereby stipulate to, and the Department concurs with, the elements of water right 01-219 for Lake Walcott Reservoir as set forth in Exhibit A and attached hereto.

3. Consistent with the temporary upstream, annual, and permanent storage exchange provisions in the Palisades Contracts, and historic administration of water rights in Water District 01, the Parties hereby stipulate to, and the Department concurs with, the elements of water right 01-2064 for American Falls Reservoir as set forth in Exhibit B and attached hereto. As indicated by the bracketed language "[insert ownership remark]" in Exhibit B, the Idaho Power Company has not resolved its objection concerning the precise wording of the Ownership remark for 1-

[4] The Idaho Power Company has not resolved its objection concerning the precise wording of the Ownership remark for 1-2064 (American Falls Reservoir). The City of Pocatello has not resolved its objection concerning the precise wording of the Ownership remark for 1-2068 (Palisades Reservoir). The City of Pocatello has not resolved its objection concerning the Name & Address element for 1-2068 (Palisades Reservoir). This Stipulation does resolve the Name & Address element and Ownership remark for the American Falls Reservoir and Palisades Reservoir winter water savings rights, 1-10042 and 1-10043, respectively.

[5] "Palisades Contracts" is a short-hand reference to the collection of individual contracts entered into between the United States Bureau of Reclamation and the spaceholders.

2064.

4. Consistent with the winter water savings and special priority provisions, the temporary upstream, annual, and permanent storage exchange provisions in the Palisades Contracts, and historic administration of water rights in Water District 01, the Parties hereby stipulate to, and the Department concurs with, the elements of water right 01-10042 for American Falls Reservoir as set forth in Exhibit C and attached hereto.

5. Consistent with the temporary upstream, annual, and permanent storage exchange provisions in the Palisades Contracts, and historic administration of water rights in Water District 01, and with the exception of the City of Pocatello, the Parties hereby stipulate to, and the Department concurs with, the elements of water right 01-2068 for Palisades Reservoir as set forth in Exhibit D and attached hereto. The City of Pocatello maintains its objections to the following elements: Name & Address, Purpose of Use, Period of Year, and Place of Use. As indicated by the bracketed language "[insert ownership remark]" in Exhibit D, the City of Pocatello has not resolved its objection concerning the precise wording of the Ownership remark for 1-2068.

6. Consistent with the winter water savings and special priority provisions, the temporary upstream, annual, and permanent storage exchange provisions in the Palisades Contracts, and historic administration of water rights in Water District 01, the Parties hereby stipulate to, and the Department concurs with, the elements of water right 01-10043 for Palisades Reservoir as set forth in Exhibit E and attached hereto.

7. Consistent with the temporary upstream, annual, and permanent storage exchange provisions in the Palisades Contracts, and historic administration of water rights in Water District 01, the Parties hereby stipulate to, and the Department concurs with, the elements of water rights

01-4055, 01-1044, and 01-10045 for Jackson Lake Reservoir as set forth in Exhibits F, G, and H, respectively, and attached hereto.

8. Consistent with the winter water savings and special priority provisions, the temporary upstream, annual, and permanent storage exchange provisions in the Palisades Contracts, and historic administration of water rights in Water District 01, the Parties hereby stipulate to, and the Department concurs with, the elements of water rights 21-2156 and 21-10560 for Island Park Reservoir as set forth in Exhibits I and J, respectively, and attached hereto.

9. Consistent with the temporary upstream storage provisions in the Palisades Contracts and historic administration of water rights in Water District 01, the Parties hereby stipulate to the elements of water right 21-4155 for Grassy Lake Reservoir as set forth in Exhibit K and attached hereto.

10. Consistent with the temporary upstream storage provisions in the Palisades Contracts and historic administration of water rights in Water District 01, the Parties hereby stipulate to the elements of water right 25-7004 for Ririe Reservoir as set forth in Exhibit L and attached hereto.

11. Other than: 1) the City of Pocatello's objections, and the responses filed thereto, concerning the Name & Address element, Purpose of Use element, Period of Use element, and Place of Use element for 1-2068, 2) the Idaho Power Company's objection, and the responses filed thereto, concerning the precise wording of the Ownership remark for 1-2064, 3) the City of Pocatello's objection, and the responses filed thereto, concerning the precise wording of the Ownership remark for and 1-2068, 4) the objections filed by Northside and Twin Falls canal companies, and A&B, Burley, Falls, Milner, and Minidoka irrigation districts, and the responses filed thereto, concerning a "refill" remark for 1-2064, 1-2068, 1-10042, and 1-10043, 5) further

proceedings on the *Amended Order Granting United States' Motion, Certification, and Partial Special Master Report and Recommendation* (Sept. 14, 2012), and 6) any issues arising in the Basin-Wide 17 proceeding or any other storage water right basin-wide issue; the Parties agree, and the Department concurs, that this Stipulation and the attached Exhibits is a complete resolution of the water right elements and remarks of the water rights listed in the caption above.

12. The water right descriptions for 1-10042 and 1-10043, as attached to this Stipulation as Exhibits C and E, supersede and replace the agreement set forth in Paragraph A.1.a in the *Stipulation to Resolve Certain Objections*, filed with the Court on January 26, 2012 (Subcase Nos. 1-2064 et al.). This stipulation supersedes and replaces the agreement set forth in the *Unified Stipulation*, filed with the Court on August 22, 2012 (Subcase Nos. 1-2064 et al.).

13. The Parties agree, and the Department concurs, that this Stipulation has been reached in the process of good faith negotiations for the purpose of resolving legal disputes, including pending litigation, without any determination on the merits. The Parties agree, and the Department concurs, that nothing herein or resulting herefrom shall constitute an admission against interest or be used in any proceeding as legal support or precedent, except as to effectuate this specific stipulation. Each party stands by its claims, objections, and/or responses and intends merely to avoid litigation and settle this matter. The claims, objections, and responses filed in the above referenced subcases identify the parties to the individual subcases.

14. The Parties represent and acknowledge that each of the undersigned is authorized to execute this Stipulation on behalf of the party they represent.

IDAHO POWER COMPANY	**FREMONT-MADISON ET AL.** **RIGBY ANDRUS & RIGBY CHTD.**
9/24/12 James C. Tucker Date Attorney for Idaho Power Company	9-24-12 [illegible] Date Attorney for Fremont-Madison Irrigation District, Idaho Irrigation District, and [illegible] Irrigation Company
CAPITOL LAW GROUP PLLC	**FLETCHER LAW OFFICE**
9/24/12 C. Thomas Arkoosh Date Attorney for American Falls Reservoir District #2	9/24/12 W. Kent Fletcher Date Attorney for Minidoka Irrigation District
BARKER ROSHOLT & SIMPSON LLP	
9/24/12 Travis L. Thompson Date Attorney for A&B Irrigation District, Burley Irrigation District, Milner Irrigation District, North Side Canal Company, and Twin Falls Canal Company	9/24/12 [illegible] Date Attorney for A&B Irrigation District, Burley Irrigation District, and [illegible] Irrigation District
IDAHO ATTORNEY GENERAL'S OFFICE	**RACINE OLSON NYE BUDGE & BAILEY**
[illegible] Michael C. Orr Date Deputy Attorney General	9-24-12 Candice M. McHugh Date Attorney for Ground Water Districts

BEEMAN & ASSOCIATES, PC

____
Josephine P. Beeman Date
Attorneys for City of Pocatello

IDAHO DEPARTMENT OF WATER RESOURCES

for Carter Fritschle 9-24-12
Gary Spackman Date
Director

9/25/12
Chris M. Bromley Date
Deputy Attorney General, IDWR

CERTIFICATE OF SERVICE

I certify that on September 25, 2012, I served true and correct copies of the foregoing STIPULATION as follows:

Via First Class U.S. Mail, pre-paid:

Clerk of the District Court - Hand - Delivered
Snake River Basin Adjudication
253 Third Avenue North
Twin Falls, ID 83303-2707

C. Thomas Arkoosh
Capitol Law Group, PLLC
P.O. Box 2598
Boise, ID 83701-2598

John K. Simpson
Travis L. Thompson
Paul L. Arrington
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Randall C. Budge
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Chief, Natural Resources Division
State of Idaho
Office of the Attorney General
P.O. Box 44449
Boise, ID 83711-4449

United States Department of Justice
Environment and Natural Resources Div.
550 West Fort Street, MSC 033
Boise, ID 83724

Director of IDWR
Idaho Water Center
P.O. Box 83720
Boise, ID 83720-0098

Signature of Person Mailing this Document

EXHIBIT A
(Lake Walcott, 1-219)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/5/2012

RIGHT NUMBER: 1-219

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
SNAKE RIVER	COLUMBIA RIVER

QUANTITY: 95,200.000 AFY ~~41,700.000 AFY~~

Total reservoir capacity is 210,000 acre feet when filled to elevation 4245 and measured at the upstream face of the dam.

PRIORITY DATE: 12/14/1909

POINT OF DIVERSION:

T09S R25E S1 Lot 3 NESW
Within MINIDOKA & CASSIA Counties

~~T09S R25E S1 Lot 3 NENESW~~
~~Within MINIDOKA County~~

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:	Quantity:
IRRIGATION STORAGE	01/01 12/31	95,200.00 AFY ~~41,700.00 AFY~~
IRRIGATION FROM STORAGE	03/15 11/15	95,200.00 AFY ~~41,700.00 AFY~~

PLACE OF USE:

Place of use for irrigation from storage is within the following counties: Minidoka and Cassia.

Place of use for storage is Lake Walcott, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

~~Place of use for irrigation storage is Lake Walcott, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Department of Water Resources, the Water District advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.~~

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, including but not limited to the contractual storage exchanges, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

The operation, use and administration of this water right is subject to the terms and conditions of the Settlement Agreement signed on February 14, 2006 with Minidoka Irrigation District, Burley Irrigation District, Twin Falls Canal Company, North Side Canal Company and American Falls Reservoir District #2.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

~~Although the name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address section of this partial decree, the ownership of this water right is divided. The United States Bureau of Reclamation holds nominal legal title. Beneficial or equitable title to this water right is held in trust by the irrigation organizations, in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations, for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations pursuant to Idaho law. As a matter of law, this interest is appurtenant to the lands within the boundaries of or served by such irrigation organization. The ownership of this water right is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.~~

~~The Director of the Idaho Department of Water Resources shall determine what part of the water flowing in the Snake River at the Minidoka and Milner Dams is storage waters and what part is natural flow. The amount of natural flow shall be determined as such natural flow would be, if unaffected by the diversions or acts of the parties to Twin Falls Canal Co v Foster, Decree (4th Jud. Dist., Twin Falls Co., June 20, 1913). The natural flow to which the Twin Falls Canal Company and the Northside Canal Company are entitled shall be measured at the Milner Dam.~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - Decreed

EXHIBIT B
(American Falls Reservoir, 1-2064)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/20/2012

RIGHT NUMBER: 1-2064

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
SNAKE RIVER	COLUMBIA RIVER

QUANTITY: 1,540,600.000 AFY ~~1,672,590.000 AFY~~

The American Falls Reservoir was originally licensed for a total quantity of 1,700,000 acre-feet. For purposes of administration, however, water right nos. 1-2064 and 1-10042 shall be limited to a total combined quantity equal to the active capacity of the water volume storable in American Falls Reservoir when filled to elevation 4354.5 and measured at the upstream face of the dam.

~~Total reservoir capacity is 1,672,590 acre feet when filled to elevation 4354.5 and measured at the upstream face of the dam.~~

PRIORITY DATE: 03/30/1921

~~The appropriator shall exercise this right in a manner that recognizes the historic practice that the use of water for power generation is incidental to the rights of others to the use of water for other purposes. The appropriator shall not make a delivery call for hydropower generation except as against junior hydropower rights.~~

POINT OF DIVERSION:

T07S R31E S30 SWSE
Within POWER County

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:		Quantity:
IRRIGATION STORAGE	01/01	12/31	1,495,600.00 AFY ~~1,628,316.00 AFY~~
IRRIGATION FROM STORAGE	03/15	11/15	1,495,600.00 AFY ~~1,628,316.00 AFY~~
POWER STORAGE	01/01	12/31	45,000.00 AFY ~~295,163.00 AFY~~
POWER FROM STORAGE	01/01	12/31	45,000.00 AFY ~~295,163.00 AFY~~

~~The diversion and release of storage for power purposes under this water right is subject to those conditions contained in contract nos. Ilr-733 and Ilr-801 between the United State Bureau of Reclamation and Idaho Power Company.~~

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

PLACE OF USE:

Place of use for storage is American Falls Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, Teton, and Elmore.

~~Place of use for irrigation storage and power storage is American Falls Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range, 21E, sections 28 and 29, when determined by the Department of Water Resources, the Water District advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.~~

~~Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, and Elmore.~~

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

[Insert ownership remark]

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, including but not limited to the contractual storage exchanges, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

The operation, use and administration of this water right is subject to the terms and conditions of the Settlement Agreement signed on February 14, 2006 with Minidoka Irrigation District, Burley Irrigation District, Twin Falls Canal Company, North Side Canal Company and American Falls Reservoir District #2.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

~~The delivery of water to this right may be subject to procedures described in the United States Bureau of Reclamation "space holder" contracts and the Burley Irrigation Dist. v. Eagle, Supplemental Decree (Idaho 5th Jud. Dist., July 10, 1968) and Aberdeen-Springfield Canal Co. v. Eagle, Supplemental Decree (Idaho 7th Jud. Dist., March 12,~~

~~1969) together with the natural flow and storage deliveries as calculated by the Idaho Department of Water Resources.~~

~~Although the name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address section of this partial decree, the ownership of this water right is divided. The United States Bureau of Reclamation holds nominal legal title. Beneficial or equitable title to this water right is held in trust by the irrigation organizations, in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations, for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations pursuant to Idaho law. As a matter of law, this interest is appurtenant to the lands within the boundaries of or served by such irrigation organization. The ownership of this water right is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.~~

~~A portion of this right is designated as the first to fill for the benefit of the contract holders as provided in the provisions for saving winter water as recognized in the Burley Irrigation Dist. v. Eagle, Supplemental Decree (Idaho 5th Jud. Dist., July 10, 1968) and Aberdeen-Springfield Canal Co. v. Eagle, Supplemental Decree (Idaho 7th Jud. Dist., March 12, 1969).~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - License

Right no. 1-2064 has been split into water right nos. 1-2064 and 1-10042.

Pursuant to the last survey conducted by the United States Bureau of Reclamation in 1977, the current active storage capacity of the American Falls Reservoir was 1,672,590 acre feet (1,515,760 acre feet under water right no. 1-2064 and 156,830 acre feet under water right no. 1-10042).

Right includes accomplished change in purpose of use pursuant to Section 42-1425, Idaho Code.

Storage for power under this right is 2.6471% of the active storage capacity of the reservoir, which is approximately 45,000 acre-feet.

EXHIBIT C
(American Falls Reservoir WWS, 1-10042)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/20/2012

RIGHT NUMBER: 1-10042

NAME AND ADDRESS: UNITED STATES OF AMERICA ACTING THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE: SNAKE RIVER TRIBUTARY: COLUMBIA RIVER

QUANTITY: 159,400.00 AFY

The American Falls Reservoir was originally licensed for a total quantity of 1,700,000 acre-feet. For purposes of administration, however, water right nos. 1-2064 and 1-10042 shall be limited to a total combined quantity equal to the active capacity of the water volume storable in American Falls Reservoir when filled to elevation 4354.5 and measured at the upstream face of the dam.

PRIORITY DATE: 03/30/1921

The storage of water under this right shall be administered with a priority date of 03/29/1921.

POINT OF DIVERSION: T07S R31E S30 SWSE Within POWER County

PURPOSE AND PERIOD OF USE:

PURPOSE OF USE	PERIOD OF USE	QUANTITY
IRRIGATION FROM STORAGE	03/15 11/15	159,400.00 AFY
IRRIGATION STORAGE	01/01 12/31	159,400.00 AFY

PLACE OF USE:

Place of use for storage is American Falls Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, Teton, and Elmore.

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

This decree does not alter, amend, or modify the contracts entered into between various federal contractors and the United States Bureau of Reclamation, as amended, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

EXPLANATORY MATERIAL: BASIS OF CLAIM - License

Pursuant to the last survey conducted by the United States Bureau of Reclamation in 1977, the current active storage capacity of the American Falls Reservoir was 1,672,590 acre feet (1,515,760 acre feet under water right no. 1-2064 and 156,830 acre feet under water right no. 1-10042).

Right no. 1-2064 has been split into water right nos. 1-2064 and 1-10042.

EXHIBIT D
(Palisades Reservoir, 1-2068)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/20/2012

RIGHT NUMBER: 1-2068

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
SNAKE RIVER	COLUMBIA RIVER

QUANTITY: 940,400.000 AFY ~~1,200,000.000 AFY~~

Total reservoir active capacity is 1,200,000 acre feet when filled to elevation 5620 and measured at the upstream face of the dam.

PRIORITY DATE: 07/28/1939

~~The appropriator shall exercise this right in a manner that recognizes the historic practice that the use of water for power generation is incidental to the rights of others to the use of water for other purposes. The appropriator shall not make a delivery call for hydropower generation except as against junior hydropower rights.~~

The United States, after consultation with the Watermaster and the Water District 1 Advisory Committee, may release stored water from Jackson Lake and Palisades reservoirs for the maintenance of power production at Palisades Dam powerplant and may store such water in American Falls Reservoir. The release of such water will be confined, however, when it appears to the Secretary that American Falls, Palisades, and Jackson Lake reservoirs will fail to fill, to not more than 1,000 cfs for minimum firm power production and that amount which can be stored in American Falls Reservoir; and no such release shall be made that will preclude the later delivery of water, by exchange or otherwise, to the upper valley entities entitled thereto. "Upper valley entities" shall mean those reservoir spaceholders diverting from the Snake River and its tributaries above American Falls Dam.

POINT OF DIVERSION:

~~T01S R45E S17 Lot 1 NENE~~
~~Within BONNEVILLE County~~
~~T01S R45E S17 Lot 2 NWNE~~
~~Within BONNEVILLE County~~
~~T01S R45E S17 Lot 3 SWNE~~
~~Within BONNEVILLE County~~

T01S R45E S17 SENE
Within BONNEVILLE County

~~T01S R45E S17 Lot 4 SENE~~
~~Within BONNEVILLE County~~

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:		Quantity:
IRRIGATION STORAGE	01/01	12/31	940,400.00 AFY ~~1,200,000.00 AFY~~
IRRIGATION FROM STORAGE	03/15	11/15	940,400.00 AFY ~~1,200,000.00 AFY~~
POWER STORAGE	01/01	12/31	940,400.00 AFY ~~1,200,000.00 AFY~~
POWER FROM STORAGE	01/01	12/31	940,400.00 AFY ~~1,200,000.00 AFY~~

PLACE OF USE:

~~Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, and Elmore.~~

Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, Teton, and Elmore.

Place of use for storage is Palisades Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

~~Place of use for irrigation storage and power storage is Palisades Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range, 21E, sections 28 and 29, when determined by the Department of Water Resources, the Water District advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximise the storage of water upstream of Milner Dam.~~

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

The operation, use and administration of this water right is subject to the terms and conditions of the Settlement Agreement signed on February 14, 2006 with Minidoka Irrigation District, Burley Irrigation District, Twin Falls Canal Company, North Side Canal Company and American Falls Reservoir District #2.

This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, including but not limited to the contractual storage exchanges, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

[Insert ownership remark]

~~The delivery of water to this right may be subject to procedures described in the United States Bureau of Reclamation "space holder" contracts and the Burley Irrigation Dist. v. Eagle, Supplemental Decree (Idaho 5th Jud. Dist., July 10, 1968) and Aberdeen-Springfield Canal Co. v. Eagle, Supplemental Decree (Idaho 7th Jud. Dist., March 12, 1969) together with the natural flow and storage deliveries as calculated by the Idaho Department of Water Resources.~~

~~A portion of this right is designated as the first to fill for the benefit of the contract holders as provided in the provisions for saving winter water as recognized in the Burley Irrigation Dist. v. Eagle, Supplemental Decree (Idaho 5th Jud. Dist., July 10, 1968) and Aberdeen-Springfield Canal Co. v. Eagle, Supplemental Decree (Idaho 7th Jud. Dist., March 12, 1969).~~

~~Although the name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address section of this partial decree, the ownership of this water right is divided. The United States Bureau of Reclamation holds nominal legal title. Beneficial or equitable title to this water right is held in trust by the irrigation organizations, in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations, for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations pursuant to Idaho law. As a matter of law, this interest is appurtenant to the lands within the boundaries of or served by such irrigation organization. The ownership of this water right is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - License

Right no. 1-2068 has been split into water right nos. 1-2068 and 1-10043.

EXHIBIT E
(Palisades Reservoir
WWS, 1-10043)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/20/2012

RIGHT NUMBER: 1-10043

NAME AND ADDRESS: UNITED STATES OF AMERICA ACTING THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE 3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE: SNAKE RIVER TRIBUTARY: COLUMBIA RIVER

QUANTITY: 259,600.00 AFY

Total reservoir active capacity is 1,200,000 acre feet when filled to elevation 5620 and measured at the upstream face of the dam.

PRIORITY DATE: 07/28/1939

The United States, after consultation with the Watermaster and the Water District 1 Advisory Committee, may release stored water from Jackson Lake and Palisades reservoirs for the maintenance of power production at Palisades Dam powerplant and may store such water in American Falls Reservoir. The release of such water will be confined, however, when it appears to the Secretary that American Falls, Palisades, and Jackson Lake reservoirs will fail to fill, to not more than 1,000 cfs for minimum firm power production and that amount which can be stored in American Falls Reservoir, and no such release shall be made that will preclude the later delivery of water, by exchange or otherwise, to the upper valley entities entitled thereto. "Upper valley entities" shall mean those reservoir spaceholders diverting from the Snake River and its tributaries above American Falls Dam.

The storage of water under this right shall be administered with a priority date of 03/29/1921.

POINT OF DIVERSION: T01S R45E S17 SENE Within BONNEVILLE County

PURPOSE AND PERIOD OF USE:

PURPOSE OF USE	PERIOD OF USE	QUANTITY
IRRIGATION STORAGE	01/01 12/31	259,600.00 AFY
IRRIGATION FROM STORAGE	03/15 11/15	259,600.00 AFY
POWER STORAGE	01/01 12/31	259,600.00 AFY
POWER FROM STORAGE	01/01 12/31	259,600.00 AFY

PLACE OF USE:

Place of use for storage is Palisades Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, Teton, and Elmore.

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

This decree does not alter, amend, or modify the contracts entered into between various federal contractors and the United States Bureau of Reclamation, as amended, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

EXPLANATORY MATERIAL: BASIS OF CLAIM - License

Right no. 1-2068 has been split into water right nos. 1-2068 and 1-10043.

EXHIBIT F
(Jackson Lake, 1-4055)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/20/2012

RIGHT NUMBER: 1-4055

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
SNAKE RIVER	COLUMBIA RIVER

QUANTITY: 298,981.000 AFY ~~299,000.000 AFY~~

The quantity for this water right represents the maximum quantity of storage water that may be put to beneficial use under this right after the storage released from Jackson Lake enters the State of Idaho.

~~The quantity for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

PRIORITY DATE: 08/23/1906

The priority date for this water right represents the priority associated with the storage water put to beneficial use under this right after storage released from Jackson Lake enters the State of Idaho.

~~The priority date for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

POINT OF DIVERSION:

T03S R46E S10 SWNE
Within BONNEVILLE County

The point of diversion shown above is where the Snake River enters the State of Idaho, recognizing, however, the storage water is physically stored in and released from Jackson Lake which is located within the State of Wyoming.

~~The point of diversion is the outlet at Jackson Lake Reservoir Dam.~~

~~The point of diversion for this water right is in Wyoming, T45N, R114W, S18, SESW, P.M.~~
~~The point of diversion shown above is where the Snake River enters Idaho.~~

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:		Quantity:
~~IRRIGATION STORAGE~~	~~01/01~~	~~12/31~~	~~299,000.00 AFY~~
IRRIGATION FROM STORAGE	03/15	11/15	~~299,000.00 AFY~~ 298,981.00 AFY

PLACE OF USE:

Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, Teton, and Elmore.

~~Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, and Elmore.~~

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, including but not limited to the contractual storage exchanges, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

Storage water referenced herein may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

The storage of water for irrigation purposes occurs within the State of Wyoming pursuant to the laws of that state and consistent with federal law, which provides for the operation of the Minidoka Project consistent with existing federal law and contracts entered into between spaceholders and the United States.

~~This water right is also recorded as The State of Wyoming Certificate of Construction of Reservoir, Certificate No. R-6, Permit No. 894 Res.~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - Beneficial Use ~~BASIS OF CLAIM -- License~~

Water is stored in Jackson Lake in the State of Wyoming pursuant to Certificate No. R-6, Permit Nos. 894 Res., 1903 Res., 2185 Res., 2894 Res., and 2895 Res.

EXHIBIT G
(Jackson Lake, 1-10044)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/20/2012

RIGHT NUMBER: 1-10044

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
SNAKE RIVER	COLUMBIA RIVER

QUANTITY: 138,829.000 AFY ~~93,990.000 AFY~~

The quantity for this water right represents the maximum quantity of storage water that may be put to beneficial use under this right after the storage released from Jackson Lake enters the State of Idaho.

~~The quantity for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

PRIORITY DATE: 08/18/1910

The priority date for this water right represents the priority associated with the storage water put to beneficial use under this right after storage released from Jackson Lake enters the State of Idaho.

~~The priority date for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

POINT OF DIVERSION:

T03S R46E S10 SWNE
Within BONNEVILLE County

The point of diversion shown above is where the Snake River enters the State of Idaho, recognizing, however, the storage water is physically stored in and released from Jackson Lake which is located within the State of Wyoming.

~~The point of diversion for this water right is in Wyoming, T45N, R114W, S18, SESW, P.M.~~
~~The point of diversion shown above is where the Snake River enters Idaho.~~

~~The point of diversion is the outlet at Jackson Lake Reservoir Dam.~~

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:		Quantity:
~~IRRIGATION STORAGE~~	~~01/01~~	~~12/31~~	~~93,990.00 AFY~~
IRRIGATION FROM STORAGE	03/15	11/15	~~93,990.00 AFY~~ 138,829.00 AFY

PLACE OF USE:

~~Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, and Elmore.~~

Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, Teton, and Elmore.

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

Storage water referenced herein may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, including but not limited to the contractual storage exchanges, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

The storage of water for irrigation purposes occurs within the State of Wyoming pursuant to the laws of that state and consistent with federal law, which provides for the operation of the Minidoka Project consistent with existing federal law and contracts entered into between spaceholders and the United States.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

~~This water right is also recorded as The State of Wyoming Certificate of Construction of Reservoir, Certificate No. R-6, Permit No.1903 Res.~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - Beneficial Use ~~BASIS OF CLAIM - License~~

Water is stored in Jackson Lake in the State of Wyoming pursuant to Certificate No. R-6, Permit Nos. 894 Res., 1903 Res., 2185 Res., 2894 Res., and 2895 Res.

EXHIBIT H
(Jackson Lake, 1-10045)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/20/2012

RIGHT NUMBER: 1-10045

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source: SNAKE RIVER

Tributary: COLUMBIA RIVER

QUANTITY:

409,190.000 AFY ~~100,000.000 AFY~~

The quantity for this water right represents the maximum quantity of storage water that may be put to beneficial use under this right after the storage released from Jackson Lake enters the State of Idaho.

~~The quantity for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

PRIORITY DATE: 05/24/1913

The priority date for this water right represents the priority associated with the storage water put to beneficial use under this right after storage released from Jackson Lake enters the State of Idaho.

~~The priority date for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

POINT OF DIVERSION:

T03S R46E S10 SWNE
Within BONNEVILLE County

The point of diversion shown above is where the Snake River enters the State of Idaho, recognizing, however, the storage water is physically stored in and released from Jackson Lake which is located within the State of Wyoming.

~~The point of diversion for this water right is in Wyoming, T45N, R114W, S19, SESW, P.M.~~
~~The point of diversion shown above is where the Snake River enters Idaho~~

~~The point of diversion is the outlet at Jackson Lake Reservoir Dam.~~

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:	Quantity:
~~IRRIGATION STORAGE~~	~~01/01 12/31~~	~~100,000.00 AFY~~
IRRIGATION FROM STORAGE	03/15 11/15	~~100,000.00 AFY~~ 409,190.00 AFY

PLACE OF USE:

~~Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, and Elmore.~~

Place of use for irrigation from storage is within the following counties: Fremont, Madison, Jefferson, Bonneville, Bingham, Bannock, Power, Minidoka, Cassia, Lincoln, Jerome, Twin Falls, Gooding, Teton, and Elmore.

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

This decree does not alter, amend, or modify the contracts entered into between the various federal contractors and the United States Bureau of Reclamation, as amended, including but not limited to the contractual storage exchanges, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

Storage water referenced herein may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

The storage of water for irrigation purposes occurs within the State of Wyoming pursuant to the laws of that state and consistent with federal law, which provides for the operation of the Minidoka Project consistent with existing federal law and contracts entered into between spaceholders and the United States.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

The operation, use and administration of this water right is subject to the terms and conditions of the Settlement Agreement signed on February 14, 2006 with Minidoka Irrigation District, Burley Irrigation District, Twin Falls Canal Company, North Side Canal Company and American Falls Reservoir District #2.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

~~This water right is also recorded as The State of Wyoming Certificate of Construction of Reservoir, Certificate No. R-6, Permit No.2895 Res.~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - Beneficial Use ~~BASIS OF CLAIM - License~~

Water is stored in Jackson Lake in the State of Wyoming pursuant to Certificate No. R-6, Permit Nos. 894 Res., 1903 Res., 2185 Res., 2894 Res., and 2895 Res.

EXHIBIT I
(Island Park Reservoir, 21-2156)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/5/2012

RIGHT NUMBER: 21-2156

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
HENRYS FORK	SNAKE RIVER

QUANTITY: 90,000.000 AFY ~~114,000.000 AFY~~

Total reservoir capacity is 135,000 acre feet when filled to elevation 6303 and measured at the upstream face of the dam.

~~45,000 acre-feet of this right is designated as the first to fill as specified in the provisions for winter power operation at the Minidoka powerplant as provided for by Bureau of Reclamation Contract No. 14-06-100-1833, incorporated by reference in the Burley Irrigation Dist. v. Eagle, Supplemental Decree (Idaho 5th Jud. Dist., July 10, 1968) and Aberdeen-Springfield Canal Co. v. Eagle, Supplemental Decree (Idaho 7th Jud. Dist., March 12, 1969)~~

~~Total reservoir capacity is 135,000 acre feet when filled to elevation 6302 and measured at the upstream face of the dam.~~

PRIORITY DATE: 03/14/1935

POINT OF DIVERSION:

T13N R43E S28 Lot 3
Within FREMONT County

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:	Quantity:
IRRIGATION STORAGE	01/01 12/31	90,000.00 AFY ~~114,000.00 AFY~~
IRRIGATION FROM STORAGE	04/01 10/31 ~~04/01 11/01~~	90,000.00 AFY ~~114,000.00 AFY~~

PLACE OF USE:

The boundary encompassing the place of use for this water right is described with a digital boundary as defined by I.C. Section 42-202B(2) and authorized pursuant to I.C. Section 42-1411(2)(h). The data comprising the digital boundary are incorporated herein by reference and are stored on a CD-ROM disk issued in duplicate originals on file with the SRBA District Court and the Idaho Department of Water Resources. A map depicting the place of use is attached hereto to illustrate the place of use described by the digital boundary.

Place of use does not include federal public lands unless authorized in writing by the United States Bureau of Reclamation.

Place of use for irrigation from storage is within the boundary of Fremont Madison Irrigation District pursuant to Section 43-323, Idaho Code.

Place of use for irrigation storage is Island Park Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

~~Place of use for irrigation storage is Island Park Reservoir.~~

~~Place of use for irrigation from storage is within the following counties: Fremont, Teton, and Madison.~~

~~Place of use does not include federal public lands~~

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

This decree does not alter, amend, or modify the contracts entered into between various federal contractors and the United States Bureau of Reclamation, as amended, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

~~Although the name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address section of this partial decree, the ownership of this water right is divided. The United States Bureau of Reclamation holds nominal legal title. Beneficial or equitable title to this water right is held in trust by the irrigation organizations, in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations, for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations~~

~~pursuant to Idaho law. As a matter of law, this interest is appurtenant to the lands within the boundaries of or served by such irrigation organization. The ownership of this water right is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.~~

~~A portion of this right is designated as the first to fall as provided in the provisions for winter power operation at the Minidoka powerplant as recognized in the Burley Irrigation Dist. v. Eagle, Supplemental Decree (Idaho 5th Jud. Dist., July 18, 1968) and Aberdeen-Springfield Canal Co. v. Eagle, Supplemental Decree (Idaho 7th Jud. Dist., March 12, 1969)~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - License

~~Place of use is also known as Fremont Madison Irrigation District.~~

EXHIBIT J
(Island Park Reservoir, 21-10560)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/5/2012

RIGHT NUMBER: 21-10560

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
HENRYS FORK	SNAKE RIVER

QUANTITY:

45,000.000 AFY ~~21,000.000 AFY~~

Total reservoir capacity is 135,000 acre feet when filled to elevation 6303 and measured at the upstream face of the dam.

~~Total reservoir capacity is 135,000 acre feet when filled to elevation 6302 and measured at the upstream face of the dam.~~

PRIORITY DATE: 06/12/1940

The storage of water under this right shall be administered with a priority date of 03/29/1921.

POINT OF DIVERSION:

T13N R43E S28 Lot 3
Within FREMONT County

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:		Quantity:
IRRIGATION STORAGE	01/01	12/31	45,000.00 AFY ~~21,000.00 AFY~~
IRRIGATION FROM STORAGE	04/01	10/31	45,000.00 AFY ~~21,000.00 AFY~~

PLACE OF USE:

Place of use for irrigation storage is Island Park Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

Place of use does not include federal public lands unless authorized in writing by the United States Bureau of Reclamation.

Place of use for irrigation from storage is within the boundary of Fremont Madison Irrigation District pursuant to Section 43-323, Idaho Code.

The boundary encompassing the place of use for this water right is described with a digital boundary as defined by I.C. Section 42-202B(2) and authorized pursuant to I.C. Section 42-1411(2)(h). The data comprising the digital boundary are incorporated herein by reference and are stored on a CD-ROM disk issued in duplicate originals on file with the SRBA District Court and the Idaho Department of Water Resources. A map depicting the place of use is attached hereto to illustrate the place of use described by the digital boundary.

~~Place of use for irrigation storage is Island Park Reservoir.~~

~~Place of use for irrigation from storage is within the following counties: Fremont, Teton, and Madison.~~

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

This decree does not alter, amend, or modify the contracts entered into between various federal contractors and the United States Bureau of Reclamation, as amended, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

~~Although the name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address section of this partial decree, the ownership of this water right is divided. The United States Bureau of Reclamation holds nominal legal title. Beneficial or equitable title to this water right is held in trust by the irrigation organizations, in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations, for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations pursuant to Idaho law. As a matter of law, this interest is appurtenant to the lands within the boundaries of or served by such irrigation organization. The ownership of this water right is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - License

While the United States has the privilege to use 2,700 cfs for the development of power under water right nos. 1-217 and 1-218, it will be the objective of the United States in the operation of the Minidoka powerplant to limit the exercise of water right nos. 1-217 and 1-218 for power production at the Minidoka powerplant whenever operation of the Minidoka powerplant to the full extent of these water rights for power production would result in loss of water otherwise storable in the reservoir system. Accordingly, except as it is determined by the Secretary that additional water may be passed through Minidoka Dam without the loss of water that could be stored in the reservoir system, the United States will limit the release of water through the Minidoka Dam. To the extent that it is practicable to do so, the Watermaster and the Water District 1 Advisory Committee will be informed in advance of any plans for the release of water in excess of the foregoing limitation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

This right is designated as the first to fill as specified in the provisions for winter power operation at the Minidoka powerplant as provided for by Bureau of Reclamation Contract No. 14-06-100-1833.

This right is a combination of all of former right no. 21-2157 and 24,000 acre-feet of right no. 21-2156.

~~Place of use is also known as Fremont Irrigation District.~~

EXHIBIT K
(Grassy Lake Reservoir, 21-4155)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/10/2012

RIGHT NUMBER: 21-4155

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
CASCADE CREEK	FALL RIVER
Source:	Tributary:
GRASSY SPRING	~~FALLS RIVER~~ FALL RIVER

QUANTITY:

15,204.000 AFY

The quantity for this water right represents the maximum quantity of storage water that may be put to beneficial use under this right after the storage released from Grassy Lake enters the State of Idaho.

~~The quantity for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

PRIORITY DATE: 02/13/1936

The priority date for this water right represents the priority associated with the storage water put to beneficial use under this right after storage released from Grassy Lake enters the State of Idaho.

~~The priority date for this water right must be determined by the state of Wyoming. The listing of this element is for informational purposes only.~~

POINT OF DIVERSION:

T09N R46E S17 Lot 3
Within FREMONT County

~~T09N R46E S17 Lot 3 NESW~~
~~Within FREMONT County~~
~~T09N R46E S17 Lot 3 NESW~~
~~Within FREMONT County~~

The point of diversion shown above is where Fall River enters the State of Idaho, recognizing, however, the storage water is physically stored in and released from Grassy Lake which is located within the State of Wyoming.

~~The point of diversion for this water right is in Teton County, Wyoming, lot 4 swsw, sec. 8, T. 48N, RG. 116W, 6th PM.~~
~~The point of diversion shown above is where the conveyance system enters Idaho.~~

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:	Quantity:
~~IRRIGATION STORAGE~~	~~01/01 12/31~~	~~15,204.00 AFY~~
IRRIGATION FROM STORAGE	04/01 10/31	15,204.00 AFY

PLACE OF USE:

Place of use for irrigation from storage is within the boundary of Fremont Madison Irrigation District pursuant to Section 43-323, Idaho Code.

Place of use does not include federal public lands unless authorized in writing by the United States Bureau of Reclamation.

The boundary encompassing the place of use for this water right is described with a digital boundary as defined by I.C. Section 42-202B(2) and authorized pursuant to I.C. Section 42-1411(2)(h). The data comprising the digital boundary are incorporated herein by reference and are stored on a CD-ROM disk issued in duplicate originals on file with the SRBA District Court and the Idaho Department of Water Resources. A map depicting the place of use is attached hereto to illustrate the place of use described by the digital boundary.

~~Place of use for irrigation from storage is within the following counties: Fremont, Madison, and Teton.~~

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

The storage of water for irrigation purposes occurs within the State of Wyoming pursuant to the laws of that state and consistent with federal law, which provides for the operation of the Minidoka Project consistent with existing federal law and contracts entered into between spaceholders and the United States.

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

Storage water referenced herein may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

This decree does not alter, amend, or modify the contracts entered into between various federal contractors and the United States Bureau of Reclamation, as amended, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

~~This water right is also recorded as Wyoming Certificated Water Right No. 24136-R.~~

~~Although the name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address section of this partial decree, the ownership of this water right is divided. The United States Bureau of Reclamation holds nominal legal title. Beneficial or equitable title to this water right is held in trust by the irrigation organizations, in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations, for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations pursuant to Idaho law. As a matter of law, this interest is appurtenant to the lands within the boundaries of or served by such irrigation organization. The ownership of this water right is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.~~

EXPLANATORY MATERIAL: BASIS OF CLAIM - Beneficial Use

~~Place of use is within the boundaries of Fremont-Madison Irrigation District.~~

This water right is also recorded as Wyoming Certificated Water Right No. 4631-R.

EXHIBIT L
(Ririe Reservoir, 25-7004)

IDAHO DEPARTMENT OF WATER RESOURCES RECOMMENDED
WATER RIGHTS ACQUIRED UNDER STATE LAW

9/5/2012

RIGHT NUMBER: 25-7004

NAME AND ADDRESS:

UNITED STATES OF AMERICA ACTING
THROUGH
BUREAU OF RECLAMATION
REGIONAL DIRECTOR PN CODE-3100
1150 N CURTIS RD STE 100
BOISE ID 83706-1234

SOURCE:

Source:	Tributary:
WILLOW CREEK	SNAKE RIVER

QUANTITY:

90,500.000 AFY

The reservoir storage capacity is 90,500 acre feet when filled to elevation 5112.8 and measured at the upstream face of the dam.

PRIORITY DATE: 06/16/1969

POINT OF DIVERSION:

T03N R40E S22 NWNW
Within BONNEVILLE County

PURPOSE AND PERIOD OF USE:

Purpose of use:	Period of use:	Quantity:
IRRIGATION STORAGE	01/01 12/31	80,500.00 AFY
IRRIGATION FROM STORAGE	04/01 10/31	80,500.00 AFY
WILDLIFE STORAGE	01/01 12/31	10,000.00 AFY

PLACE OF USE:

Place of use for irrigation storage and wildlife storage is Ririe Reservoir.

Place of use for storage is Ririe Reservoir, provided, however, that water under this right may be temporarily held in the unoccupied space of any of the reservoirs upstream of Milner Dam, located at township 10S, range 21E, sections 28 and 29, when determined by the Water District 01 Watermaster as supervised by the Director of the Department of Water Resources, the Water District 01 advisory committee, and the United States Bureau of Reclamation that such temporary storage will maximize the storage of water upstream of Milner Dam.

The place of use for irrigation from storage is upon lands located along the Snake River and its tributaries in Eastern Idaho within the Minidoka Federal Reclamation Project as listed in Storage Contract 4-07-10-W0999 dated March 31, 1994, between the United States and Mitigation, Inc.

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

The name of the United States of America acting through the Bureau of Reclamation appears in the Name and Address sections of this partial decree. However, as a matter of Idaho Constitutional and Statutory Law, title to the use of the water is held by the consumers or users of the water. The irrigation organizations act on behalf of the consumers or users to administer the use of the water for the landowners in the quantities and/or percentages specified in the contracts between the Bureau of Reclamation and the irrigation organizations for the benefit of the landowners entitled to receive distribution of this water from the respective irrigation organizations. The interest of the consumers or users of the water is appurtenant to the lands within the boundaries of or served by such irrigation organizations, and that interest is derived from law and is not based exclusively on the contracts between the Bureau of Reclamation and the irrigation organizations.

The allocation of storage to federal contractors and the location of that storage, including carryover storage, in the reservoir system shall be determined by the United States Bureau of Reclamation pursuant to federal reclamation law and contracts entered into between the United States and federal contractors. The Water District 01 Watermaster as supervised by the Director of the Department of Water Resources shall distribute the stored water in accordance with allocation instructions from the United States Bureau of Reclamation. "Reservoir system" shall mean all Federal reservoirs on the Snake River and its tributaries down to and including Lake Walcott, which store and distribute water pursuant to water right nos. 1-219, 1-2064, 1-2068, 1-4055, 1-10042, 1-10043, 1-10044, 1-10045, 21-2156, 21-4155, 21-10560, and 25-7004.

This decree does not alter, amend, or modify the contracts entered into between various federal contractors and the United States Bureau of Reclamation, as amended, in connection with the Palisades project and the Minidoka project, which contracts remain binding among the parties.

EXPLANATORY MATERIAL: BASIS OF CLAIM - License

Wildlife storage (inactive storage) shall not be released from storage for a beneficial use.

Use of water under this right will be regulated by a watermaster with responsibility for the distribution of water among appropriators within a water district. At the time of this approval, this water right is within State Water District No. 01.

The storage of water under this right is contingent upon continued certification by the Department of Water Resources under the dam safety provisions of the Idaho Code, authorizing storage.

Permanent measuring devices must be maintained in such a manner that the amount of water entering the reservoir and the amount of water released from the reservoir can be measured.

Water stored under this right and conveyed to downstream lands is subject to a shrinkage loss as determined by the watermaster.

IDAHO
STATE WATER PLAN

IDAHO WATER RESOURCE BOARD

November 2012

EXHIBIT 5

BEFORE THE WATER RESOURCE BOARD

OF THE

STATE OF IDAHO

IN THE MATTER OF THE	)	A RESOLUTION
	)	
IDAHO STATE WATER PLAN	)	

WHEREAS, the Idaho Water Resource Board (Board) conducted public meetings to gather public input concerning policies contained in the Idaho State Water Plan ; and,

WHEREAS, the Board, based on input from the public, has proposed changes to existing policies and suggested new policies; and,

WHEREAS, the Board has provided a 90-day public comment period and has conducted seven public meetings and hearings providing opportunities for public input; and,

WHEREAS, the Board has reviewed the public record consisting of oral testimony and written comments and has modified their proposed changes accordingly.

NOW, THEREFORE, BE IT RESOLVED that, having considered the proposed revised Idaho State Water Plan and the public record, the Board hereby adopts the Idaho State Water Plan dated November 2012 and directs that it be provided to the Idaho Legislature for their consideration.

PASSED AND APPROVED this 28th day of November, 2012.

TERRY T. UHLING, Chairman
Idaho Water Resource Board

ATTEST: BOB GRAHAM, Secretary

Attachment No. 9, Meeting No. 9-12
Idaho Water Resource Board

State of Idaho

THE STATE WATER PLAN

C.L. "Butch" Otter, Governor

Idaho Water Resource Board

Terry T. Uhling
Chairman

Roger W. Chase
Vice-Chairman

Robert Graham
Secretary

Vince Alberdi
Leonard Beck
Charles "Chuck" Cuddy
Peter Van Der Meulen
Jeff Raybould

Idaho Water Resource Board
November 2012

Former members of the Idaho Water Resource Board

Vic Armacost, New Meadows
Robert M. Bandy, Priest River
Brent J. Bell, Rexburg
Mary T. Brooks, Boise
Jack Buell, St. Maries
Gary Chamberlain, Challis
George Crookham, Caldwell
Sally L. Cupan, Sandpoint
J. David Erickson, Buhl
Leonard E. Graham, Rigby
Gene M. Gray, Payette
Robert M. Hammes, St. Maries
M. Reed Hansen, Idaho Falls
Kenneth E. Hungerford, Moscow
Franklin Jones, Boise
Joseph L. Jordan, Boise
Dr. Evan Kackley, Soda Springs
Donald R. Kramer, Castleford
Ferris M. Kunz, Montpelier
William J. Lanting, Twin Falls
Charles J. Marshall, Jerome
Herman J. McDevitt, Pocatello
Joe Nettleton, Murphy
Thomas Olmstead, Twin Falls
Arlie Parkins, Marsing
Clarence Parr, Heyburn
William S. Platts, Boise
Erval Rainey, Sandpoint
Scott Reed, Coeur d'Alene
Edward Reichert, Filer
Jerry Rigby, Rexburg
F. Dave Rydalch, St. Anthony
D. Mike Satterwhite, Lewiston
Edwin Schlender, Malta
James Shawver, Eden
LeRoy Stanger, Idaho Falls
Claude Storer, Idaho Falls
John F. Streiff, Lewiston
Richard W. Wagner, Lewiston
J.D. Williams, Boise
D. Richard Wyatt, Lewiston
George L. Yost, Emmett

To the Citizens of Idaho:

Water is the lifeblood of Idaho. The optimum use of our water will keep Idaho a vital and prosperous state as we grow and change in the future. The Idaho State Water Plan is a dynamic set of policies which guides our use, management, development, and conservation of water for all citizens.

This is the fifth revision of the State Water Plan since the first plan was adopted in 1976. Each revision reflects the changing landscape of water in Idaho. Many changes have occurred since the last Plan was adopted in 1996 and this revision reflects those changes. For the first time, this Plan includes implementation strategies and milestones which will guide the execution of the policies and evaluate the effectiveness of each policy.

Competing demands for water has increased conflicts, with a positive result of innovative solutions. These solutions demonstrate that the water resources of Idaho can meet emerging water demands while respecting existing water users. As water demands increase, it is critical that we use the technical tools available to assess strategies to plan for meeting our water needs. Understanding the complexity and interaction of our water resources and using that knowledge to manage water is crucial to using our water resources effectively.

The policies and actions in this Plan reflect a keen awareness of the uncertainty of future conditions of water supply and demand. The intent of the Plan is to establish policies and actions which can adapt to changing circumstances.

Public involvement has been and continues to be a cornerstone of developing the Idaho State Water Plan. The Idaho Water Resource Board appreciates your participation and interest in ensuring that Idaho's water is meeting our needs and making our state the best it can be.

Sincerely,

Terry Uhling
Chairman

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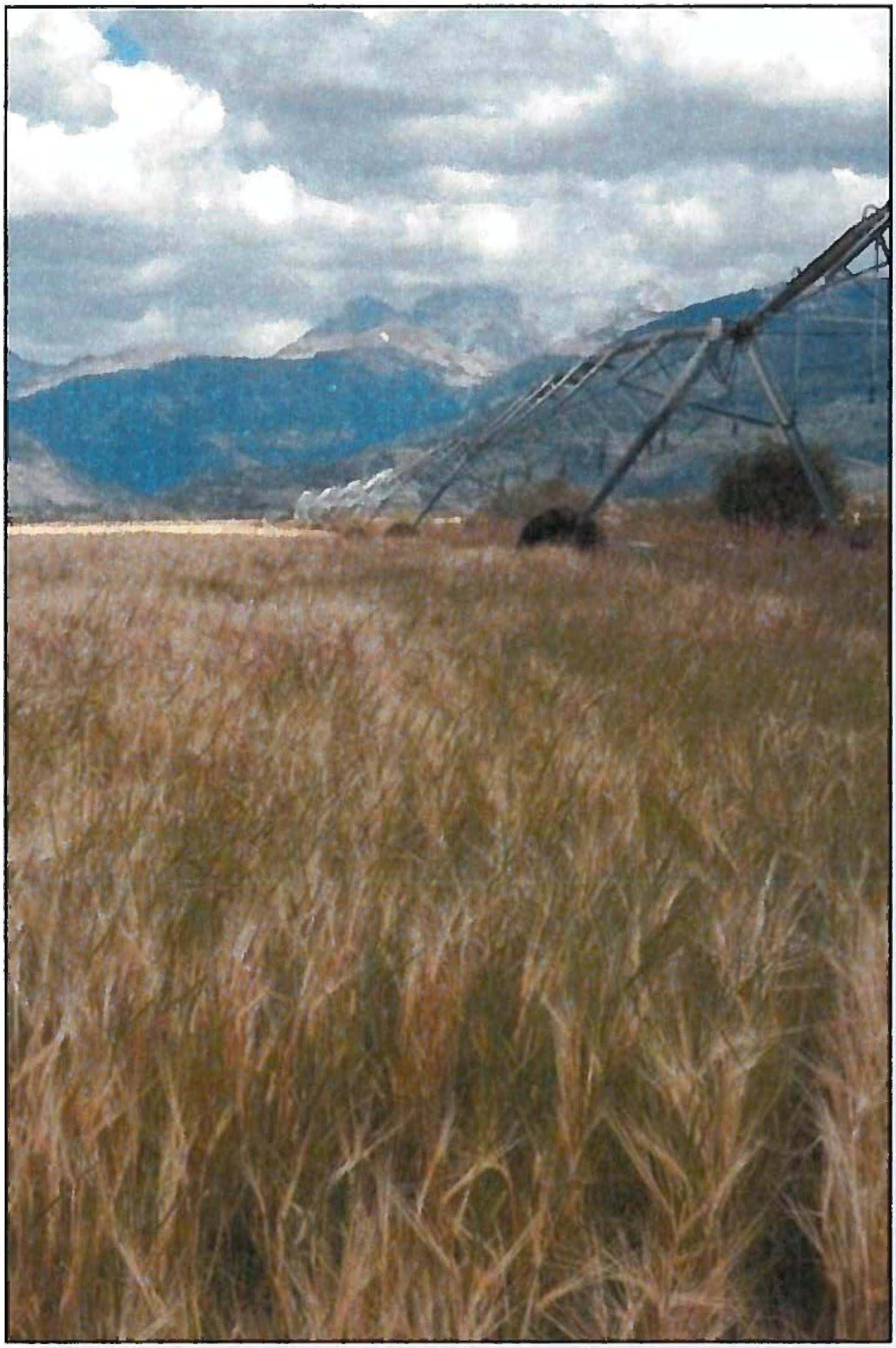

Photo: Wheat Field
Photo Courtesy of Idaho Department of Agriculture

THE WATER PLANNING PROGRAM

The Idaho Comprehensive State Water Plan ("State Water Plan" or "Plan") was adopted by the Idaho Water Resource Board ("Idaho Water Resource Board" or "Board") to guide the development, management, and use of the state's water and related resources. The wise use and management of the state's water is critical to the state's economy and to the welfare of its citizens. The Plan seeks to ensure that through cooperation, conservation, and good management, future conflicts will be minimized and the optimum use of the state's water resources will benefit the citizens of Idaho. The Plan is subject to change so as to be responsive to new opportunities and needs.

Constitutional Authority

Article XV, section 7 of the Idaho Constitution provides the authority for the preparation of a State Water Plan. This constitutional amendment was adopted in November 1964 following a statewide referendum and states:

> *There shall be constituted a Water Resource Agency, composed as the Legislature may now or hereafter prescribe, which shall have power to formulate and implement a state water plan for optimum development of water resources in the public interest; to construct and operate water projects; to issue bonds, without state obligation, to be repaid from revenues of projects; to generate and wholesale hydroelectric power at the site of production; to appropriate public waters as trustee for Agency projects; to acquire, transfer and encumber title to real property for water projects and to have control and administrative authority over state land required for water projects; all under such laws as may be prescribed by the Legislature.*

Article XV, section 3 of the Idaho Constitution provides for the appropriation and allocation of water. Section 3 provides that:

> *The right to divert and appropriate the unappropriated waters of any natural stream to beneficial uses, shall never be denied, except that the state may regulate and limit the use thereof for power purposes. Priority of appropriation shall give the better right as between those using the water; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall (subject to such limitations as may be prescribed by law) have the preference over those claiming for any other purpose; and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes. And in any organized mining district those using the water for mining purposes or milling purposes connected with mining have preference over those using the same for manufacturing or agriculture purposes. But the usage by such subsequent appropriators shall be subject to such provisions of law regulating the taking of private property for public and private use, as referred to in section 14 of article I of this Constitution.*

Legislative Authority

Article XV, section 7 of the Idaho Constitution provided for the creation of a "Water Resource Agency" but did not establish the agency. In 1965, the 38th legislature established the Idaho Water Resource Board, and directed that (as amended):

> *The board shall, subject to legislative approval, progressively formulate, adopt and implement a comprehensive state water plan for conservation, development, management and optimum use of all unappropriated water resources and waterways of this state in the public interest... In adopting a comprehensive state water plan the board shall be guided by these criteria:*
>
> > *(a) Existing rights, established duties, and the relative priorities of water established in article XV, section 3, of the constitution of the state of Idaho, shall be protected and preserved;*
> > *(b) Optimum economic development in the interest of and for the benefit of the state as a whole shall be achieved by integration and coordination of the use of water and the augmentation of existing supplies and by protection of designated waterways for all beneficial purposes;*
> > *(c) Adequate and safe water supplies for human consumption and maximum supplies for other beneficial uses shall be preserved and protected;*
> > *(d) Subject to prior existing water rights for the beneficial uses now or hereafter prescribed by law, minimum stream flow for aquatic life, recreation and aesthetics and the minimization of pollution and the protection and preservation of waterways in the manner hereafter provided shall be fostered and encouraged and consideration shall be given to the development and protection of water recreation facilities;*
> > *(e) Watershed conservation practices consistent with sound engineering and economic principles shall be encouraged.*

Idaho Code § 42-1734A(1).

These criteria recognize that exclusive authority over the appropriation of public surface and ground waters of the state is vested in the Department of Water Resources ("Department") [Idaho Code § 42-201(7)] and require that the Plan be consistent with state law.

To assist the Board in its duties, the legislature also provided for the Director of the Department:

> *To perform administrative duties and such other functions as the Board may from time to time assign to the Director to enable the Board to carry out its powers and duties.*

Idaho Code § 42-1805(6).

Article XV, section 7 was amended by the electorate during the general election of November 6, 1984. The amendment provides that:

> *The Legislature of the State of Idaho shall have the authority to amend or reject the state water plan in a manner provided by law. Thereafter any change in the state water plan shall be submitted to the Legislature of the State of Idaho upon the first day of a regular session following the change and the change shall become effective unless amended or rejected by law within sixty days of its submission to the Legislature.*

Chapter 17 of Title 42, Idaho Code, was amended in 1988 to designate the Plan as the Comprehensive State Water Plan Part A. Plans developed for specific geographic areas became components of the Comprehensive State Water Plan Part B.

> *The board may develop a comprehensive state water plan in stages based upon waterways, river basins, drainage areas, river reaches, ground-water aquifers, or other geographic considerations.*

Idaho Code § 42-1734A(2).

> *As part of the comprehensive state water plan, the board may designate selected waterways as protected rivers as provided in this chapter.*

Idaho Code § 42-1734A(1).

Legislation in 2008 provided for the development of a statewide comprehensive aquifer management planning and management effort and fund. Idaho Code §§ 42-1779 and 42-1780.

> *Pursuant to the provisions of Idaho law and legislative funding approval, the Idaho water resource board and the Idaho department of water resources shall conduct a statewide comprehensive aquifer planning and management effort over a ten (10) year period of time beginning in fiscal year 2009.*

Idaho Code § 42-1779.

Idaho Water Resource Board Programs

Pursuant to its constitutional and statutory authorities, the Board:

1. Formulates, adopts, and implements the State Water Plan, River Basin Plans, and Comprehensive Aquifer Management Plans ("CAMPs").

2. Designates natural and protected rivers and files applications for and holds minimum stream flow water rights.

3. Provides financial assistance for water development and conservation projects in the form of revenue bonds, loans, and grants.

4. Establishes programs that address specific water resource issues at the direction of the Idaho legislature.

5. Adopts rules governing:
    - Well Construction
    - Well Driller Licensing
    - Construction and Use of Injection Wells
    - Drilling for Geothermal Resources
    - Mine Tailings Impoundment Structures
    - Safety of Dams
    - Stream Channel Alteration

    The Department administers these programs.

6. Hears appeals challenging the Department's administrative decisions pursuant to programs administered under the Board's administrative rules.

7. Administers the Idaho Water Supply Bank.

8. At the request of the Governor, appears on behalf of and represents the state in proceedings, negotiations, or hearings involving the federal government, Indian tribes, or other states.

9. Files applications and obtains permits to appropriate, store, or use unappropriated waters, and acquires water rights subject to the provisions of applicable law.

10. Investigates, undertakes, and promotes water resource projects deemed to be in the public interest. While all state agencies are required to exercise their duties in a manner consistent with this Plan [Idaho Code § 42-1734B], the Plan contemplates the implementation of water resource projects through cooperation and collaboration with the numerous units of state and local governments with statutory responsibilities for the conservation of Idaho's water resources.

11. Cooperates and enters into contracts with federal, state, and local units of governmental and private entities for water studies, planning, research, and activities.

12. Studies water pollution and advises the Idaho State Board of Environmental Quality regarding the establishment of water quality criteria in the context of the optimum development of the state's water resources.

13. Formulates and recommends legislation for water resource conservation, development, and utilization.

Comprehensive State Water Plan Formulation

Formulation of the State Water Plan is a dynamic process. Adoption of The State Water Plan – Part One, The Objectives, in 1974, and The State Water Plan - Part Two, in 1976, provided an initial state water policy. The purpose of Part One was to identify and define policies and objectives adopted by the Board to govern the planning, development, and conservation of the state's water and related lands. Part Two identified and evaluated projects and programs necessary to implement the objectives of Part One and delineated those areas where legislative action was required, identified the programs to be implemented by the Board, and described programs requiring the cooperation of public and private interests. The Plan was updated and re-adopted in 1982 and was amended in 1985 in connection with the Swan Falls settlement. The Plan was revised in 1986, 1992, and 1996 to reflect changing social and economic conditions and water resource needs. The Plan continues to evolve and provides a framework for the adoption and implementation of policies, programs, and projects that develop, utilize, conserve, and protect the state's water supplies.

Planning Process

The planning process encompasses five steps:

1. A comprehensive public involvement program to determine public views and interests regarding resource problems, needs, and opportunities as they relate to water use and management;

2. An ongoing evaluation of the state's water resources and uses and estimation of the future availability and demands on the resource;

3. A comprehensive evaluation of the effects resulting from the development and protection of the state's water resources;

4. Adoption of the Plan by the Board as required by Article XV, section 7 of the Idaho Constitution; and

5. Approval by the Idaho legislature as provided by law.

Public involvement is an essential part of the planning process. Scoping meetings, comment periods, and formal hearings provide opportunity for public input during plan development. After adoption and approval, public comment on the effectiveness of the Plan is encouraged.

COMPREHENSIVE STATE WATER PLAN

The Comprehensive State Water Plan represents the state's position on water development, management, and conservation. Accommodating Idaho's growing and changing water needs and the increasing demands on both surface and ground water presents a significant challenge. The Plan seeks to meet that challenge through the establishment of policies on water development, management, and conservation with accompanying strategies that may be implemented as funds become available and milestones which will assist in ongoing Plan review.

Objectives

The following objectives of the State Water Plan are formulated for the conservation, development, management, and optimum use of all unappropriated water resources and waterways of this state in the public interest. Idaho Code § 42-1734A.

1. **Water Management** - Encourage the quantification of water supplies, water uses, and water demands for all water rights within the state. Encourage integrated, coordinated, and adaptable water resource management and the prudent stewardship of water resources.

2. **Public Interest** - Ensure that the needs and interests of the public are appropriately considered in decisions involving the water resources of the state.

3. **Economic Development** - Encourage and support economic development through the optimum use of water resources. Promote the integration and coordination of the use of water, the augmentation of existing supplies, and the protection of designated waterways for all beneficial purposes. Idaho Code § 42-1734A(1)(b).

5. **Environmental Quality** - Maintain, and where possible enhance water quality and water-related habitats. Study and examine the quality of rivers, streams, lakes, and ground water [Idaho Code § 42-1734(15)], and ensure that due consideration is given to the needs of fish, wildlife, and recreation in managing the water resources of the state. Where appropriate, initiate state protection of waterways or water bodies with outstanding fish and wildlife, recreation, geologic, or aesthetic values.

6. **Public Safety** - Encourage programs ensuring that life and property within the state are not threatened by the management or use of the state's water resources.

Policies

A main goal of this document is to help water managers, planners, and users formulate management strategies and policies needed to meet growing and changing water use needs.

The Board adopts the following policies for the conservation, development, management, and optimum use of all the unappropriated water resources and waterways of this state in the public interest. Idaho Code § 42-1734A.

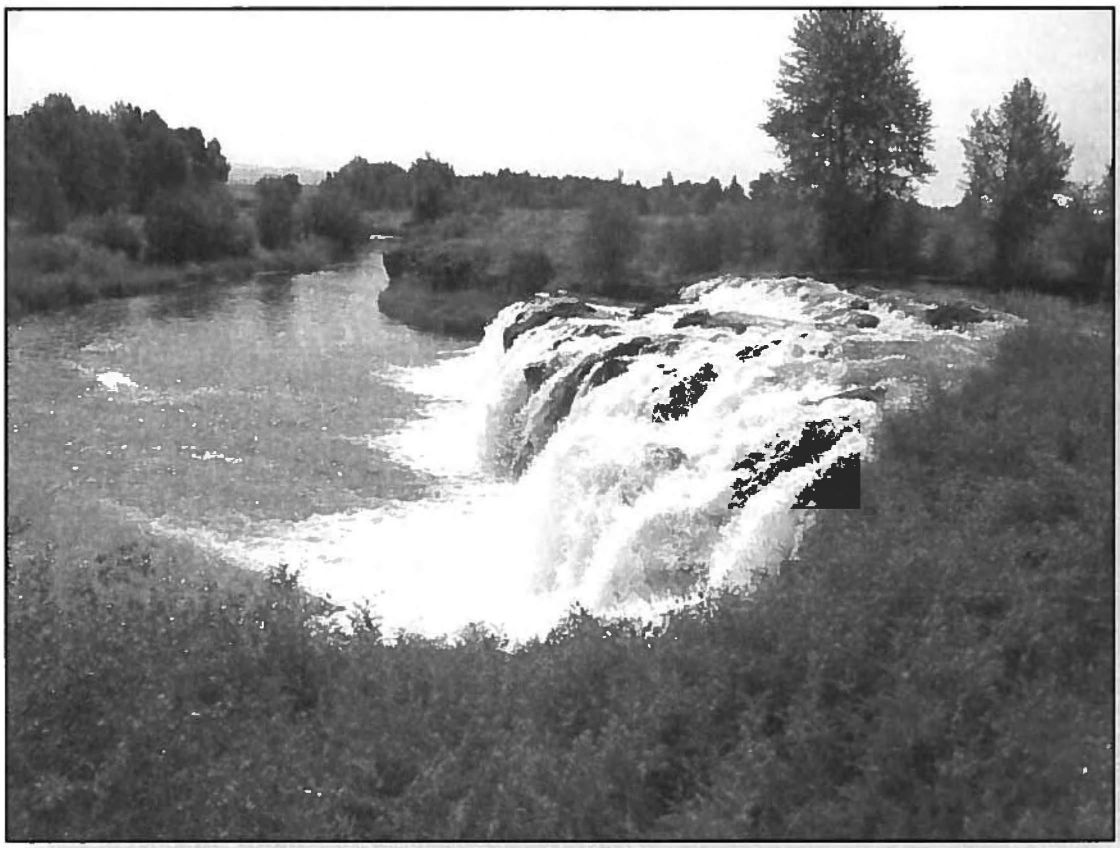

Photo: Falls on the Teton River in Eastern Idaho (*IDWR Photo*)

1. OPTIMUM USE

It is in the public interest to establish policies, initiatives, and programs that lead to optimum use of the water resources of the state. Water is essential to the vitality and prosperity of the state.

1A - STATE SOVEREIGNTY

The State asserts sovereignty over the development and use of Idaho's water resources for the benefits of its citizens. Any action by the federal government or other states that would impair Idaho's sovereignty over its water resources is against state policy.

Discussion:

The Idaho Water Resource Board is responsible for the formulation of state water policy through the State Water Plan. The state's position on existing and proposed federal policies and actions affecting Idaho's waters is coordinated by the Board to ensure the state retains its sovereign right to control its water resources. Idaho Code § 42-1734B(4). The State Water Plan is filed with the Federal Energy Regulatory Commission ("FERC"), the Pacific Northwest Electric Power and Conservation Planning Council, and other federal agencies as Idaho's plan for the conservation, development, management and optimum use of the state's water resources. Idaho Code § 42-1734C.

Implementation Strategies:

- Take legal action when necessary to protect the state's sovereignty over its water resources.
- Implement and maintain cooperative water resource agreements and partnerships with neighboring states, the federal government, and Indian tribes for the benefit of Idaho's citizens.
- Work with the office of the Governor, state agencies, and the legislature to ensure the development and implementation of a unified state position on water resource issues.

Milestones:

- Partnerships established with neighboring states, federal agencies, and Indian tribes to anticipate and plan for water resource conflicts that may occur.
- Protocols established ensuring coordination of the state's position on water resource issues.

1B - BENEFICIAL USE OF WATER

The concept of beneficial use must necessarily evolve with changing conditions.

Discussion:

Idaho Code § 42-104 provides that an appropriation of water must be for "some useful or beneficial purpose" but does not define beneficial purpose. Except for the constitutionally protected beneficial uses which are domestic, agricultural, manufacturing, and mining, the concept of what constitutes a beneficial use of water has evolved over time based upon societal needs. For example, use of water for hydropower, the protection of fish and wildlife habitat, aquatic life, recreation, aesthetics, municipalities, navigation, water quality, and managed ground water recharge are recognized as beneficial uses. A broad definition of beneficial use has and will continue to allow for the optimum use of the state's water resources.

Implementation Strategies:

- Review existing state policies and programs to ensure that traditional and emerging water use needs are recognized as beneficial uses of water.
- Establish or participate in local and regional advisory groups to formulate recommendations regarding traditional and emerging water use needs and priorities.

Milestones:

- Policies and rules revised to accommodate emerging water use needs.
- Reports submitted on advisory group recommendations.
- Statutory and/or regulatory changes made to accommodate emerging beneficial uses of water.

1C – CHANGE IN USE

Changes in the use of a water right should be allowed to meet changing needs and to provide for optimum use of the state's water resources.

Discussion:

The demand for water increases every year while the volume of unappropriated water within the state continually decreases. Many basins do not provide a dependable water supply for current uses. Allowing for changes in the use of water rights provides flexibility in water allocation to meet changing conditions. Idaho Code §§ 42-108 and 42-222 provide for changes in point of diversion, place of use, period of use, or nature of use with the approval of the Department, while also providing for the protection of other water users, the agricultural base of a region, and the local public interest. Pursuant to state law, priority dates are retained when other water right holders are not injured. The Board is responsible for the implementation of voluntary programs also designed to meet changing water use needs.

Implementation Strategies:

- Review existing statutes and regulations and recommend revisions as necessary to establish a more efficient process for changes in the use of water rights.
- Review Department policies and procedures and recommend revisions as necessary to implement a more efficient process for changes in the use of water rights.

Milestones:

- Number of changes in the use of water rights that meet emerging needs.

1D - WATER SUPPLY BANK

The sale or lease of water is critical to the efficient management and optimal use of the state's water resources. Thus, use of the state's Water Supply Bank should be expanded to meet traditional and emerging needs for water.

Discussion:

As the state approaches the time when there is little or no unappropriated water, the Water Supply Bank, established by Idaho Code § 42-1761, provides an efficient mechanism for the sale or lease of water from natural flow and storage. The purpose of the Water Supply Bank is to obtain the highest duty of water, provide a source of adequate water supplies to benefit new and supplemental water users, and provide a source of funding for improving water use facilities and efficiencies. By aggregating water available for lease, rental pools operating under the authority of the Water Supply Bank can supply the water needs of many users, provided there is no injury to other right holders, or enlargement of the use of the water rights, and the change is in the local public interest. Idaho Code § 42-1763.

Photo: Shoshone Falls near Twin Falls (*IDWR Photo*)

The Idaho Water Resource Board has adopted rules governing the sale or lease of water through the Water Supply Bank. IDAPA 37.02.03. Pursuant to state law, the Board has authorized local entities to operate storage and natural flow rental pools in numerous water districts that meet regional needs. The Shoshone-Bannock Tribes are also authorized by the state to operate a storage water rental pool.

The scope of existing and future water use needs requires further development of flexible water banking systems that address local water use needs and ensure the optimum use of the state's water resources. The Water Supply Bank should provide for efficient mechanisms that are responsive to traditional and emerging needs for water.

Implementation Strategies:

- Monitor existing procedures, statutes, and rules of the Water Supply Bank to determine whether additional strategies are needed to meet current and future water use demands.
- Establish through state action, natural flow and storage rental pools in basins where local water users have identified the need for rental pools.
- Develop a public information and education program to promote use of the Water Supply Bank.

Milestones:

- Increased use of the Water Supply Bank.
- New storage and natural flow rental pools established.
- Efficient mechanisms in place that facilitate the optimum use of water.

1E - CONJUNCTIVE MANAGEMENT

Where a hydraulic connection exists between ground and surface waters, they should be conjunctively managed to maintain a sustainable water supply.

Discussion:

Region-specific factors impact the available supply of ground and surface water and effect changes in regional water budgets. This can result in insufficient water supplies to satisfy beneficial uses and may result in increased administrative curtailment, conflict among water users, and litigation.

This policy addresses conjunctive management and not water rights administration. Water rights administration is the enforcement of the relative rights of water right holders under the prior appropriation doctrine. By comparison, conjunctive management encompasses actions other than water rights administration that can be taken to optimize the benefits and value of Idaho's water resources. While conjunctive management is not a substitute for water rights administration, the legislature has determined that it is in the public interest to adopt plans and policies that facilitate and encourage a resolution of conflicts that occur in water basins where there is a hydraulic connection between ground and surface waters. Quantification and monitoring is a key component of conjunctive management and necessary for the development of plans and projects designed to maintain a stable balance between supply and demand.

Implementation Strategies:

- Continue to quantify the hydraulic relationship between ground and surface water supplies in designated river basins.
- Develop prioritized list of basins where additional technical information is needed to assess ground and surface water interaction.
- Develop enhanced technical tools for evaluating the interaction between surface and ground water resources for use in planning.
- On a continuing basis, assess conditions and trends of ground water levels in primary aquifers to estimate the rate of future aquifer recharge and withdrawal under various climatic conditions.
- Procure funding for studies and project implementation.

Milestones:

- Number of studies initiated and completed to quantify ground water/surface water relationships.
- Increased effectiveness of technical tools used to evaluate the hydraulic relationship between ground water and surface water and other water supply data.
- Region-specific projects implemented that contribute to a stable balance between supply and demand.

1F - GROUND WATER WITHDRAWAL

Withdrawals from an aquifer should not exceed the reasonably anticipated average rate of future natural recharge to that aquifer.

Discussion:

Idaho Code § 42-226 protects senior ground water appropriators in the maintenance of reasonable pumping levels in order to obtain full economic development of the state's underground water resources. The Director of the Department is authorized to establish reasonable ground water pumping levels when necessary to protect prior appropriations of ground water. Idaho Code § 42-237a provides that the Director may prohibit or limit the withdrawal of water from a well if withdrawal would result in diversion of the ground water supply at a rate beyond the reasonably anticipated average rate of future natural recharge. The Director may allow withdrawals to exceed natural recharge if a program exists to increase recharge or decrease withdrawals and senior water rights are protected. Idaho Code §§ 42-233a and 42-233b authorize the Director to designate areas as either Critical Ground Water Areas or Ground Water Management Areas. Designating a ground water basin as a Critical Ground Water Area or Ground Water Management Area provides management options to prevent excessive withdrawals from an aquifer. Where such designations are made, the Department requires additional measurement and reporting to determine available ground water supplies and use.

The comprehensive aquifer management planning initiated by the Idaho Water Resource Board discussed in Policy 1E provides opportunities for stakeholder participation in ground water management. Local advisory committees help the Board establish goals, objectives, and strategies to maximize available water supplies and assist with plan implementation. Public participation is key to the development of innovative approaches for meeting current and future demands on the state's ground water resources.

Implementation Strategies:

- Monitor ground water levels to estimate the rate of future natural aquifer recharge and withdrawal under various climate conditions.
- Develop region-specific water budgets for aquifers.
- Establish local advisory committees and solicit recommendations for ground water management.
- Identify opportunities for conducting cooperative ground water studies with state, federal and local agencies.
- Implement management strategies to maximize available water supply.

Milestones:

- Number of water budgets developed.
- Number of advisory committees active in ground water management and critical ground water areas.
- Number of ground water management plans adopted for all administratively designated areas.
- Number of basins with adequate monitoring networks.

Photo: Alfalfa field near Glenns Ferry
Photo Courtesy of Idaho Department of Agriculture

1G - INTERSTATE AQUIFERS

Cooperative arrangements with neighboring states should be developed for shared aquifers to avoid water supply conflicts and to optimize utilization of the resource for the citizens of Idaho.

Discussion:

The growing demand for water increases competition between states with shared aquifers. Cooperative agreements to jointly develop, manage, and protect shared aquifers are necessary to avoid water supply conflicts, to ensure economic development, and to provide a mechanism for the exchange of technical information.

Implementation Strategies:

- Establish cooperative agreements with neighboring states to gather data and conduct studies to assess ground water conditions and trends.
- Develop coordinated aquifer management plans with neighboring states that resolve interstate conflict and protect Idaho's water supplies.

Milestones:

- Approval and implementation of cooperative agreements, which may include coordinated aquifer management plans, that ensure Idaho's water supply meets current and future needs.
- Cooperative technical studies conducted.

1H - QUANTIFICATION AND MEASUREMENT OF WATER RESOURCES

Quantification and measurement of Idaho's water supply and use is essential for sound water resource planning, management, and administration.

Discussion:

The Director of the Department is required to maintain an inventory of the state's water resources. Idaho Code § 42-1815. The measurement of water availability and use is necessary to administer and regulate existing water uses and to promote optimal water resource planning and management.

Chapters 6 and 7, Title 42, Idaho Code, provide for water use measurement and reporting throughout the state. New instrument technologies for the measurement of water availability and use will continue to improve the accessibility and reliability of data collection and interpretation. These new technologies, such as automated electronic data recording equipment and transfer of data through wireless systems provide transparency and instantaneous access to data, improve calibration of models used for administration and planning, and educate the public about regional and statewide water use.

Implementation Strategies:

- Assess existing measurement network and facilities and develop plan for improving data collection and reporting.
- Prioritize projects for conversion to automated electronic data collection and reporting systems.
- Provide technical assistance and participate in securing funding for improved measurement and reporting systems.

Milestones:

- Number of assessments completed.
- Number of automated data collection systems in use.
- Number of improved measurement and reporting strategies implemented.

1I - AQUIFER RECHARGE

Aquifer recharge should be promoted and encouraged, consistent with state law.

Discussion:

Managed aquifer recharge: Managed recharge projects may be an appropriate means for enhancing ground and surface water supplies, providing mitigation for junior ground water depletions, or to help maintain desirable aquifer levels. In addition, managed recharge may help optimize existing water supplies by changing the timing and availability of water supplies to meet demand. Managed recharge may also be used as an adaptive mechanism for minimizing the impacts of variability in climate conditions. Idaho Code § 42-234(4) requires that managed recharge projects do not injure existing water rights and gives the Director authority to approve, disapprove, or require alterations in the methods employed to achieve ground water recharge. The effects on ground water and surface water budgets from managed recharge projects must be monitored to determine the effectiveness of such projects after implementation..

The Board supports and assists in the development of managed recharge projects that further water conservation and increase water supplies available for beneficial use. Projects involving the diversion of natural flow water appropriated pursuant to Idaho Code § 42-234 for managed recharge in excess of ten thousand (10,000) acre-feet on an average annual basis must be submitted to the Idaho Water Resource Board for approval prior to construction. Idaho Code § 42-1737.

Aquifer storage and recovery: The use of managed recharge to store surface water in a confined underground area could be an important element in meeting future water use needs. Further understanding of the economic, legal, ecological, and technical feasibility of using confined underground aquifers for water storage in Idaho is required for the purpose of policy development and planning and to avoid injury to existing water rights.

Incidental aquifer recharge: The incidental recharge of aquifers occurring "as a result of water diversion and use that does not exceed the vested water right of water right holders is in the public interest." Idaho Code § 42-234(5)]. Incidental recharge may be an important component of some aquifer water budgets.

Implementation Strategies:

- Cooperate with public and private entities to develop, implement, and evaluate managed recharge projects.
- Identify and propose changes to statutes, rules, and policies that will assist the development and implementation of managed recharge projects.
- Identify river basins where the use of managed recharge projects should be evaluated as a potential strategy for addressing increased demand on water supplies.
- Monitor and evaluate recharge projects to document effects on water supply and water quality.
- Appoint an Aquifer Storage and Recovery Task Force.

Milestones:

- Managed recharge projects that optimize water supplies implemented.
- Effects of managed recharge projects on water supply and water quality documented.
- Aquifer Storage and Recovery Task Force recommendations submitted.

1J - WATER QUALITY

The citizens of Idaho will be best served by a cooperative effort involving public and private entities to assure that the state's surface and ground water sources meet state water quality standards and maintain designated beneficial uses.

Discussion:

Water quality impacts the usability of water for a variety of purposes and it is essential that the quality of Idaho's water resources be protected for public safety and economic stability and growth. The Department of Environmental Quality ("DEQ") is the lead state agency charged with maintaining and improving surface and ground water quality through regulatory and permitting programs and coordination with other state agencies. DEQ's Surface Water Program measures and assesses the levels of pollutants in surface waters. Pursuant to the Ground Water Quality Protection Plan, adopted by the legislature in 1992, the Department administers a statewide ambient ground water quality monitoring network and the Environmental Data Management System. The system collects, and makes available to the public, data obtained from ground water monitoring networks across the state.

When water quality fails to meet state standards, DEQ works with communities, industry, agricultural interests, state and federal agencies, and other stakeholders to develop water quality improvement plans, known as total daily maximum loads or TMDLs. These plans outline actions needed to restore impaired water bodies so that they support designated uses.

The use of water flow to dilute pollution is not a substitute for adequate water quality treatment. The Idaho Agriculture Pollution Abatement Plan ("Ag Plan") is a guidance document that describes the state's process for the control and abatement of agricultural nonpoint source pollution as it relates to water quality. The Ag Plan provides for the review and identification of specific watershed management strategies that contribute to the full support of beneficial uses through enhancement and maintenance of the quality of surface and ground water, to the extent they are impacted by nonpoint source agricultural pollutants. Water quality improvement strategies for non point sources are implemented through voluntary programs. Numerous state agencies and local units of government participate in plan implementation, including: the Idaho Soil and Water Conservation Commission, DEQ, Soil Conservation Districts, Idaho State Department of Agriculture ("ISDA"), University of Idaho – Cooperative Extension System, the Department, the Board, IDFG, the Idaho Department of Lands, and the Office of Species Conservation ("OSC"). Where the quality of surface and ground water depends on land and water-use practices within a watershed, water users, land managers, state and federal agencies, and other units of local government are working together to implement through voluntary mechanisms best management practices and other strategies that reduce impairments to beneficial uses.

Implementation Strategies:

- Coordination and integration of monitoring programs with public and private entities.
- Ongoing analysis of statewide water quality monitoring programs to identify need for modifications.
- Participate with state agencies to integrate water management programs and policies that promote the improvement of the quality of the state's surface and ground water through voluntary mechanisms.
- Ongoing monitoring of baseline conditions and trends.

Milestones:

- Collaborative projects implemented that protect and enhance the water quality of the state's surface and ground water.

1K - COMPREHENSIVE AQUIFER MANAGEMENT PLANS

The Idaho Water Resource Board will complete and implement comprehensive aquifer management plans to address the changing demands on the state's water supply.

Discussion:

Idaho Code §§ 42-1779 and 42-1780 established the Statewide Comprehensive Aquifer Planning and Management Program and the Aquifer Planning and Management Fund, which are designed to provide the Board and the Department with the necessary information to develop comprehensive aquifer management plans, ("CAMPs") throughout the state. The program will be implemented in three phases. First, technical information describing the hydrology of the ground and surface water systems and the relationship between surface and ground water in a designated basin will be compiled. Second, the Board, with the assistance of an advisory committee, will develop a management plan, based on an assessment of current and projected water uses and constraints, to address water supply and demand issues specific to each basin. Finally, the Board will be responsible for implementing the CAMPs to obtain sustainable water supplies and provide for the optimum use of a region's water resources.

Idaho's first CAMP was developed for the Eastern Snake River Plain Aquifer ("ESPA CAMP"). The ESPA CAMP was adopted by the Idaho Water Resource Board and approved by the legislature in 2009. The ESPA CAMP sets forth actions designed to stabilize and improve spring flows, aquifer levels, and river flows across the Eastern Snake River Plain. The ESPA CAMP uses a phased approach to achieve a designated water budget change through a mix of management actions, including but not limited to, aquifer recharge, ground-to-surface water conversions, and demand reduction strategies. The Board is responsible for implementation of the plan with the assistance of an advisory committee made up of representatives of stakeholders who rely upon the Eastern Snake River Plain Aquifer to supply water for beneficial use.

Statewide comprehensive aquifer planning was initiated in 2008. The Rathdrum Prairie plan was completed in 2011 and the Treasure Valley plan is expected to be completed in 2012. Additional aquifers will be designated for the development of comprehensive plans as funding and conditions allow.

Implementation Strategies:

- Develop and implement CAMPs for selected basins that establish goals, objectives, and implementation strategies to maximize available water supplies.
- Secure funding for technical studies and planning activities.

Milestones:

- Number of CAMPs completed.
- Number of CAMPs implemented.

1L - SURFACE WATER SUPPLY ENHANCEMENT

Surface water development will continue to play an important role in meeting Idaho's future water needs.

Discussion:

Future economic development, population growth, and evolving priorities will bring additional demands on Idaho's water resources, and surface water development will continue to play an important role in the state's future. The construction of new reservoirs, enlargement of existing reservoirs, and development of off-stream storage sites could increase water supplies necessary to meet increased demand. These strategies are also important for flood management, hydropower generation, and recreation use.

Engineering, economic, legal, political, and environmental issues associated with water development projects affect decisions concerning the construction of reservoir facilities. In addition, changes in climate conditions will likely be an important factor in determining the costs and benefits of additional storage. As required by Idaho Code § 42-1736B(3)(c), the Idaho Water Resource Board maintains an inventory of potential storage sites. An inventory of reservoir sites with apparent high potential for development is set forth in Table 1.

Implementation Strategies:

- Concentrate assessment and evaluation of potential storage facilities on projects with the highest potential for development. Major considerations in defining high-potential projects are: cost per unit of storage, extent of public support, environmental considerations, adequacy of existing information and studies, extent and availability of funding sources for evaluation and assessment, and expected benefits that would accrue from the development of additional storage.
- Review inventory and prioritize potential projects annually.
- Initiate feasibility/construction design studies for sites determined to be high priority.
- Identify potential funding sources for project evaluation and construction.
- Develop collaborative processes and partnerships with private entities, concerned stakeholders, local governments, and federal agencies to evaluate, design, and construct water storage projects.
- Provide recommendations regarding potential storage sites to private and public entities to ensure that land and resource development associated with these sites is consistent with the State Water Plan.

Milestones:

- Complete annual review of potential storage site inventory and revise as appropriate.
- Initiate construction of additional storage to meet current and expected needs by 2025.

Table 1 Reservoir Sites with Apparent High Potential for Development

Potential Reservoir	Stream	Reservoir Capacity (AF)	Potential Purpose	Status of Study
Upper Snake Minidoka (enlargement)	Snake River	67,000	Irrigation, Power, Flood Control, Flow Augmentation, Recharge, Recreation	*Minidoka Dam Raise Special Study* (USBOR, Dec. 2009). Raise determined to be feasible. No action by the IWRB at this time.
Teton (or alternative)	Teton River	300,000	Irrigation, Power, Flood Control, Flow Augmentation, Recreation	*Henrys Fork Basin Study* ongoing. Multiple on- and offstream sites within basin under consideration.
Southwest Idaho Twin Springs (or alternative)	Boise River	70,000 to 300,000	Irrigation, Power, Flood Control, Flow Augmentation, Recreation	*Lower Boise Interim Feasibility Study* ongoing. Three sites prioritized for further analysis: (1) replacement of existing Arrowrock Dam, (2) new dam at Alexander Flats site, and (3) new dam at Twin Springs site.
Lost Valley (enlargement)	Lost Valley Creek	20,000 (increase)	Irrigation, Recreation	Not currently under investigation.
Galloway	Weiser River	900,000	Irrigation, Power, Flood Control, Flow Augmentation, Recreation	Weiser-Galloway Studies currently ongoing: *Geologic Investigation and Analysis Project* and *Snake River Operational Analysis Project.*
Bear Caribou	Bear River	48,000	Irrigation, Power, Flood Control, Recreation	Last study update completed in 1996. Not currently under investigation.

1M - WEATHER MODIFICATION

Weather modification offers the possibility of augmenting water supplies.

Discussion:

Weather modification, primarily winter cloud seeding to increase snowpack, has been practiced in Idaho and across the western states for many years. Increasing challenges, including a changing climate, growing population, and water allocation conflicts related to the presence of threatened and endangered species magnify pressures on a variable water supply. While the specific water quantities resulting from weather modification remain unknown, additional investigation should be conducted and pilot projects implemented to determine where and under what circumstances weather modification is a feasible strategy for increasing water supplies. A number of cloud seeding programs and studies have been conducted in Idaho with positive overall results, including programs funded by the Board and Idaho Power Company.

Weather modification has the potential to raise legal issues related to the effect of weather modification activities outside state boundaries, potential adverse environmental effects, and intergovernmental conflicts where projects occur on or near public lands. Addressing these issues through legislation, rulemaking, and interstate agreements will help avoid future conflicts and litigation.

Under Idaho law, any person who intends to conduct weather modification activities is required to register with the ISDA and file a log of activities upon completion of the program. Idaho Code §§ 22-3201, 22-3202. Idaho law also provides for the creation of weather modification districts. Idaho Code §§ 22-4301, 22-4302.

Implementation Strategies:

- Support the continued evaluation of existing weather modification projects.
- Develop criteria for the development and implementation of additional weather modification projects.
- Collect baseline data and continue effectiveness research.
- Coordinate weather modification research and pilot projects with neighboring states.
- Ensure that state-funded projects are scientifically sound and include robust monitoring and evaluation components.

Milestones:

- Number of weather modification projects implemented that increase water supply.
- Increase in annual runoff resulting from weather modification projects.

- Increase in baseline data and effectiveness research.
- Agreements in place with neighboring states and federal agencies addressing research and implementation of weather modification projects.

1N - HYDROPOWER

Appropriation of water for hydropower should be subordinated to subsequent upstream beneficial uses to assure an adequate supply of water for all future beneficial uses and minimum stream flows for hydropower projects should be established by state action.

Discussion:

The relationship of hydropower water rights to future upstream uses was the subject of an ongoing debate from statehood until the 1985 Swan Falls Settlement, when the Idaho legislature enacted Idaho Code § 42-203B to resolve the debate. Pursuant to section 3 of Article XV of the Idaho Constitution, the legislature determined that it was in the public interest to specifically implement the state's power to regulate and limit the use of water for power purposes. Through enactment of Idaho Code § 42-203B, the legislature sought to avoid future Swan Falls-like controversies by creating a framework for balancing the use of water for hydropower and other beneficial uses. This framework provides for the subordination of appropriations of water for hydropower purposes to assure an adequate supply of water for all future upstream beneficial uses. The framework also provides for protection of base flows for hydropower and other instream uses through minimum stream flows established by state action. The establishment of minimum stream flows through an open and transparent public process ensures a balance between sustaining economic growth, maintaining reasonable electric rates, protecting and preserving existing water rights, and protecting water quality and other environmental values.

Small hydropower projects using existing water flows and infrastructure can be cost-effective and provide for the optimum utilization of the water resource. Recognizing the benefits of such projects, loans are available through the Board's programs to study the feasibility and for development of such projects. The FERC provides a permitting exemption to certain qualifying facilities. The National Hydropower Association's Small Hydro Council recently issued a set of recommendations that would streamline FERC's conduit and small hydropower permitting process.

Implementation Strategies:

- Ensure that all future applications, permits and licenses for the appropriation of water for hydropower purposes contain a subordination provision.
- Establish minimum stream flows through state action to protect base flows for future hydropower water rights as necessary.
- Define, through agreements with the holders of existing hydropower water rights, the relationship between such rights and existing and future depletionary water rights.

Milestones:

- Execution of subordination agreements and establishment of minimum stream flows through state action for existing hydropower facilities.
- Loans provided to study the feasibility and development of small hydropower projects.

Photo: Swan Falls Dam (*photo by IDWR Dam Safety Program)*

2. CONSERVATION

The Conservation policies focus on careful planning and prudent management of Idaho's water. The policies in this section encourage water conservation practices and efficient management of water resources for the benefit of Idaho citizens. Conservation and water efficiency practices should be implemented through voluntary, market-based programs, when economically feasible.

2A - WATER USE EFFICIENCY

Water conservation and water use efficiency should be promoted.

Discussion:

The legislature, in Idaho Code § 42-250(1) determined that voluntary water conservation practices and projects can advance the policy of the state to promote and encourage conservation, development, augmentation, and utilization of Idaho's water resources. "Water conservation practice" means any practice, improvement, project, or management program that results in the diversion of less than the authorized quantity of water while maintaining the full beneficial use(s) of the water right. Idaho Code § 42-250(2). Water conservation practices include, but are not limited to, practices that reduce consumptive use as defined in Idaho Code § 42-220B, reductions in conveyance losses, and reductions in surface and seepage losses occurring at the place of use. Idaho Code § 42-223 encourages conservation of water resources by providing that no portion of any water right shall be lost or forfeited for nonuse if the nonuse results from a water conservation practice which maintains the full beneficial use(s) authorized by a water right. As water efficiencies increase, conserved water may be available to supply existing uses, new demands, or improve instream flows. Conservation and water efficiency practices may offset the need for new water supply enhancement projects. Policies that promote water conservation and efficiency should be encouraged, where such practices do not result in adverse consequences to other users of the resource.

Photo: Idaho Irrigation (*IDWR Photo*)

Implementation Strategies:

- Review existing laws and regulations and identify inconsistencies or constraints to implementing water efficiency practices.
- Develop partnerships with local, state, and federal governments and non-governmental organizations to coordinate and support water conservation programs.
- Establish a public information program and conservation guidelines for a range of water uses.
- Evaluate opportunities for conservation and water efficiency practices in conjunction with the evaluation of new water supply enhancement facilities, including existing and new water metering for all municipalities that provide public drinking water and water for other uses.
- Identify localized opportunities for water conservation.

Milestones:

- Number of conservation guidelines implemented.
- Number of partnerships developed to coordinate water conservation.
- Number of water use efficiency practices implemented.
- Effects of conservation efforts quantified.

2B - FEDERALLY LISTED AND OTHER AQUATIC SPECIES

The state asserts primacy over the management of its fish and wildlife and water resources. Accordingly, any reintroduction or introduction of federally listed species or other aquatic species without state consultation and approval is against the policy of the State of Idaho because it would impair or impede the state's primacy over its water resources.

Discussion:

The intersection between state water rights and the Endangered Species Act ("ESA") requires development of integrated solutions to water allocation conflicts. Pursuant to Idaho Code § 36-103, the Idaho Fish and Game Commission, through the IDFG, is responsible for the preservation, protection, perpetuation, and management of all wildlife, including aquatic species, within Idaho. IDFG also maintains a list of Species of Greatest Conservation Need, species that are low in numbers, limited in distribution, or have suffered significant habitat losses. The OSC is responsible for the coordination of all state activities affecting endangered, threatened, and candidate species, and species petitioned to be listed under the ESA, and rare and declining species. Idaho Code § 67-818. OSC coordinates state implementation and response to federal recovery plans and participates in regional efforts with state and federal agencies and tribes on issues related to such species. Idaho Code § 67-818. Pursuant to Chapter 19, Title 22, Idaho Code, the ISDA is responsible for the regulation of aquatic invasive species. All activities related to the introduction or reintroduction of aquatic species that would affect Idaho's fish and wildlife and water resources should be coordinated through these agencies, including species listed under the ESA.

In enacting the ESA, Congress contemplated a state-federal alliance to advance the recovery of listed species and provided for the development of state-led recovery efforts. Congress has directed federal agencies to "cooperate with state and local agencies to resolve water resource issues in concert with conservation of endangered species." 16 U.S.C. § 1531(c)(2). Cooperative community-based conservation programs can be more effective in providing on-the-ground habitat benefits than enforcement actions. With site-specific information about water and land use practices and habitat requirements, targeted and effective conservation strategies can be developed and implemented that protect private property rights and assure state primacy over water resources while, at the same time, providing natural resource protection.

The Idaho Water Resource Board holds minimum stream flow water rights for 205 river reaches important to ESA-listed species and established as part of the Snake River Water Rights Settlement Act of 2004 ("2004 Snake River Water Rights Agreement"). The minimum stream flow water rights provide significant protection for ESA-listed species in the Salmon and Clearwater River basins. The water rights for streams in watersheds with substantial private land ownership and private water use were established after consultation with local communities. Where the minimum stream flow water rights are higher than existing flows, the state works with water users on a voluntary basis to rent or otherwise acquire water to return to the streams. The Water Supply Bank and Idaho Water Transactions Program are used to achieve these objectives. In conjunction with the minimum stream flows, the state agreed to work with local stakeholders and communities to address habitat concerns on a limited number of streams with degraded habitat. The work plans include measures to remove barriers to fish passage, revegetate stream banks, and restore wetlands to proper functioning. These programs also assist in the implementation of the Columbia Basin Fish Accords in which the state, the Bonneville Power Administration, and the U.S. Army Corps of Engineers ("USACE") agreed to address issues associated with the direct and indirect effects of the Federal Columbia River Power System and U.S. Bureau of Reclamation's ("USBOR") Upper Snake River Project on the fish and wildlife resources in the Columbia River Basin. As discussed in Policy 6B, these projects target flow-related limiting factors in the Lemhi and Pashimeroi rivers.

The 2004 Snake River Water Rights Agreement also provides for the development of agreements to assist in the recovery of ESA-listed species, under Section 6 of the ESA. The plans are to be developed in collaboration with local landowners and water users, affected Indian tribes, and state and federal natural resource agencies. Section 6 agreements will provide incentives for conservation through the granting of incidental take coverage to participants in the program. Such agreements would provide participating water users with protection against uncertainty and regulatory delays while contributing to the recovery of listed species. Section 6 of the ESA may also provide opportunities for the implementation of voluntary conservation plans developed in collaboration with local water users and stakeholders in other regions of the state. The Board, in collaboration with other state agencies and local units of government, develops local and regional conservation strategies that contribute to the recovery of ESA-listed species and Species of Greatest Conservation Need.

Implementation Strategies:

- Participate in the development and implementation of habitat conservation plans pursuant to Section 6 agreements.
- Collaborate with OSC, IDFG, other state and federal agencies, affected Indian tribes, local units of government and local stakeholders to develop and implement conservation programs that preclude the need for listing of species and contribute to listed species' recovery.
- Coordinate with OSC and IDFG to integrate water resource programs with species protection and recovery, including the establishment of minimum stream flows and state designation of protected rivers.

Milestones:

- Number of Section 6 agreements implemented.
- Number of voluntary conservation agreements and measures implemented.
- Number of strategies implemented that preclude the need for listing under the ESA and result in listed species' recovery.

2C – MINIMUM STREAM FLOWS

The Idaho Water Resource Board will exercise its authority to establish and to protect minimum stream flow water rights on those water bodies where it is in the public interest to protect and support instream uses.

Discussion:

Minimum stream flows protect and support many nonconsumptive beneficial uses of water such as fish and wildlife habitat, aquatic life, recreation and aesthetic values, transportation, navigation, hydropower generation, and water quality. These uses contribute to Idaho's economy and the well being of its citizens.

In 1925 and 1927, the legislature declared that the preservation of certain lakes for scenic beauty, health, and recreation was a beneficial use of water. In 1971, the legislature authorized the first formal appropriation of minimum stream flows by directing the Idaho Department of Parks and Recreation to appropriate a specific reach of Niagara Springs in the Malad Canyon area for instream flow purposes. The 1976 State Water Plan called for, and eventually legislation was enacted, creating a state-wide minimum stream flow program. Chapter 15, Title 42, Idaho Code, authorizes the Idaho Water Resource Board to appropriate the minimum flow of water required to protect designated uses if the appropriation is in the public interest and will not interfere with any vested water right, permit, or water right application with a senior priority. Idaho currently has 297 licensed or permitted water rights for minimum stream flow purposes, including six minimum lake level water rights held by the state. At the legislature's direction, 205 of the minimum stream flow water rights were adopted pursuant to the 2004 Snake River Water Rights Agreement which, as discussed more fully in Policy 6B, provided a programmatic approach to addressing the needs of species listed under the ESA. Similarly, the legislature has authorized the Board to appropriate minimum stream flow water rights in the Lemhi and Wood River basins where the rights are maintained through operation of a Water Supply Bank. These locally managed programs are used to maintain or enhance instream flow in a manner that respects water use practices and addresses community concerns.

The Water Supply Bank and local rental pools are tools that can be used to improve instream flows through voluntary cooperation and to meet local needs. It is important to monitor existing mechanisms for establishing local rental pools to determine whether additional strategies are required to meet local needs. It is also important to monitor whether existing mechanisms for meeting instream flow needs are adequate.

Implementation Strategies:

- Monitor whether existing mechanisms for meeting instream flow needs are adequate.
- Coordinate with state and federal agencies and stakeholders to identify potential minimum stream flow needs.
- Submit applications for minimum stream flow water rights that are in the public interest.
- Monitor existing mechanisms for establishing local rental pools to determine whether additional strategies are required to meet local needs.
- Establish local rental pools to meet instream flow needs as requested.

Milestones:

- Annual inventories of minimum flow water rights completed.
- Minimum stream flow water rights established.
- Instream flow needs met.

2D - STATE PROTECTED RIVER SYSTEM

The Idaho Water Resource Board will exercise its authority to protect the unique features of rivers where it is in the public interest to protect recreational, scenic, and natural values.

Discussion:

Idaho Code § 42-1734A(1) authorizes the Board to protect highly valued waterways as state protected rivers. The authority to designate "protected rivers" derives from the state's ownership of the beds of navigable streams and the state's right to regulate all waters within the state. The Idaho Water Resource Board has consistently recognized the value of free-flowing waterways by designating specific streams and rivers as natural or recreational rivers.

Although rivers can be protected under the federal Wild and Scenic Rivers Act, the Board works with federal officials to seek protection of streams and rivers through the Comprehensive State Water Planning process. The state planning process ensures coordinated and efficient water planning for Idaho rivers and streams and avoids potential state/federal sovereignty conflicts.

Implementation Strategies:

- Coordinate with local governments and federal agencies to identify specific waterways for consideration as protected rivers.
- Develop priority list of potential rivers for consideration in comprehensive basin planning.
- Establish agency policy and procedures to ensure requirements of the protected rivers program are addressed when the Department reviews water right permit applications and stream channel alteration permits.
- Ensure that permits issued include provisions for the protection, restoration, or enhancement of designated river reaches.

Milestones:

- Ongoing review of state rivers and streams to determine whether they should be designated as part of the protected river system.
- Number of state/federal agreements to coordinate river planning implemented.
- Designation of streams or rivers determined to warrant protected status.

2E - RIPARIAN HABITAT AND WETLANDS

Protecting the ecological viability of riparian habitat and wetlands within the state is a critical component of watershed planning.

Discussion:

Functional riparian zones and wetlands contribute to water quality protection, storm water control, and ground water protection and provide important habitat for fish and wildlife. Riparian and wetlands areas provide support to numerous species across much of the state. Riparian zones and wetlands should be protected to preserve their ecological values and functions. The Board supports voluntary efforts to restore riparian zones and wetlands.

The integration of water resource and land use planning activities that affect riparian zones and wetlands requires coordination among various local, regional, and state authorities. The Department regulates the alteration of stream channels and stream beds below the mean high watermark. Idaho Code §§ 42-3801 - 42-3812. Local governments are authorized to regulate land use and development. The DEQ administers the state's Nonpoint Source Management Program which is based upon strong working partnerships and collaboration with state, tribal, regional, and local entities, private sector groups, citizens' groups, and federal agencies and the recognition that a successful program must be driven by local wisdom and experience.

In 2008, the Idaho Wetlands Working Group developed a Draft Wetlands Conservation Strategy that sets out a framework for protecting, restoring, and enhancing wetlands through collaborative, voluntary approaches. The Board supports voluntary watershed-based conservation strategies for the protection of riparian and wetland areas above the mean high water mark developed and implemented through collaboration with water users, land managers, local governments, and state and federal agencies.

Implementation Strategies:

- Support collaborative watershed planning and the implementation of voluntary strategies to protect Idaho's wetlands and riparian areas.
- Support the development of guidelines and strategies to assist in the implementation of projects that protect, restore, and enhance wetlands and riparian areas.
- Evaluate whether the Stream Channel Protection Act, [Idaho Code §§ 42-3801 - 42-3812], adequately assists in the protection of wetlands and riparian areas and propose statutory changes as appropriate.
- Assist state and federal agencies and stakeholders in the acquisition of funding for project implementation.

Milestones:

- Project and funding proposals submitted.
- Projects implemented.

2F - STREAM CHANNEL REHABILITATION

The Idaho Water Resource Board will support cost-effective stream channel rehabilitation where past activities adversely affect or could affect the ecological goods and services of the state's watersheds.

Discussion:

Functional stream channels provide ecological goods and services desired by the public. Ecological goods are those qualities that have economic value, such as timber resources, habitat that supports fishing and hunting, and aesthetic qualities of landscapes that would attract tourists. Ecological services include systems that best manage water resources, such as the regulation of runoff and flood waters, or the stabilization of landscapes to prevent erosion. Damage and destruction of stream channels can result from natural and human-caused changes and disturbances. Where current practices, legacy effects of past activities, or natural disturbances threaten public safety, private property, or the overall quality and quantity of water produced in the affected watershed, it is in the state's interest to take remedial action in a cost-effective manner. In many instances, historical targets for restoration are not practical and therefore restoration efforts should be designed to be sustainable in a rapidly-changing environment. Preventing damage to a stream channel and adjacent property is more cost effective than restoration. In addition, it is in the state's interest to ensure that the stream channels of the state and their environments are protected and restored through the implementation of voluntary restoration projects.

Implementation Strategies:

- Conduct a statewide inventory of streams where natural events or human activities have altered channels and the disturbances threaten the public safety, private property, or other water resource values.
- Conduct cost/benefit analyses for rehabilitation of affected streams.
- Prioritize projects.
- Obtain funding for restoration of prioritized streams.

Milestones:

- Inventory conducted.
- Cost/benefit analyses conducted and priorities established.
- Funding obtained.
- Projects implemented.

2G - SAFETY MEASURES PROGRAM

Owners of water distribution and storage facilities are encouraged to establish or continue safety initiatives including construction and maintenance of safety features and development of public awareness programs to educate residents about hazards associated with these facilities.

Discussion:

Fatal accidents occur in waterways at or near water distribution and storage facilities in Idaho because of the inherent dangers of these facilities. With the increasing urbanization of rural areas, there has been a greater effort to provide public awareness programs and, where feasible, implement measures designed to prevent such occurrences. The Idaho Water Resource Board supports these voluntary initiatives.

Implementation Strategies:

- Secure and provide funding for the construction and maintenance of safety features at water distribution and storage facilities.

- Encourage the implementation of public safety awareness programs.

Milestones:

- Reduced number of accidents associated with water distribution and storage facilities.

2H - FLOOD HAZARD AREAS

Protection of floodplains through effective floodplain management and pre-disaster mitigation is essential to reducing and preventing flood damages.

Discussion:

Floods are the most frequent and costly disasters in Idaho and can occur in most any area of the state. With population growth, there will be increased interest in the development of lands subject to periodic flooding. The Federal Emergency Management Agency ("FEMA") administers the National Flood Insurance Program ("NFIP"), which many Idaho communities have joined by adopting and enforcing flood damage prevention ordinances. Although FEMA has prepared Flood Insurance Rate Maps ("FIRMs") for some of the waterways within Idaho, the majority of FIRMs are more than 20 years old and require updating. In order to create safer communities and reduce the loss of life and property due to flood events, local governments are encouraged to use land use controls, building practices, and other tools to protect the natural function of floodplains. Land use controls on additional development in flood plains can also preserve storage water supplies by reducing the need for additional flood control releases.

Implementation Strategies:

- Assist local governments in securing funding to update or develop digital FIRMs.
- Provide technical information on flood plain management and flood risk to elected officials, public and private organizations, and land developers.

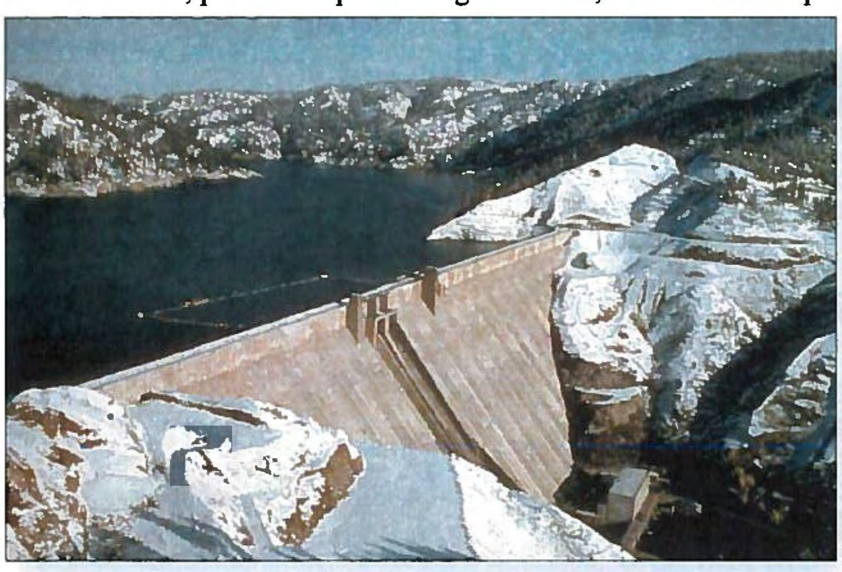

Photo: Dworshak Dam on the North Fork of the Clearwater River
(IDWR Photo)

Milestones:

- Increased participation in NFIP by communities.
- Decreasing trends in annual flood damages.

2I - FLOOD DAMAGE REDUCTION LEVEE REGULATION

Levees should be designed, constructed, and maintained to meet the intended purpose of reducing water and flood damage for the useful life of the levee.

Discussion:

Pursuant to Idaho Code § 42-1717, the Department regulates nearly 600 water storage dams and more than 20 mine tailing impoundment structures throughout the state. Levees are exempted by statute from the Department's dam safety regulations, and the construction, maintenance, and safety of levees is, for the most part, left to local entities. Presently, there is no state agency that is authorized to regulate levees for the protection of public health or safety.

The Board supports the development of a comprehensive state program governing the design, construction, and maintenance of new flood reduction levees, and the periodic safety inspection of existing levees. A state flood reduction levee program should focus on the use of sound technical practices in levee design, construction, and operation. This should include the establishment of a safety program that helps ensure public education and awareness of the capacities and limitations of levees during flood events.

Implementation Strategies:

- Develop a state safety program to regulate the design, construction, and maintenance of new flood reduction levees.
- Investigate the implementation of a state levee safety program consistent with the standards and guidelines recommended by the Draft National Levee Safety Program.
- Provide testimony upon request to the legislature regarding the benefits offered to Idaho citizens resulting from implementation of a state levee safety inspection program.
- Participate in the development of a National Levee Safety Program with other state and federal agencies, as appropriate.
- In the event a National Levee Safety Program is adopted, obtain certification as a state levee safety program and assist with development of levee criteria for use by the states and the federal government.

Milestones:

- State levee safety program established.
- Levee failures in Idaho decreased.
- Reduction in property loss resulting from levee failures.

3. MANAGEMENT

The Management policies focus on maintaining and enhancing administrative programs and practices related to current and future demands on Idaho's water and energy resources.

3A - REVIEW OF FEDERAL RESERVOIR WATER ALLOCATION

It is in the state's interest that proposed water allocations and reallocations of water in federal reservoirs be consistent with the State Water Plan.

Discussion:

Historically, the Board has reviewed federal water allocations proposed by the USBOR to determine whether the proposed allocations are consistent with state water resource planning and management objectives. In 1988, this cooperative arrangement was formalized through an agreement providing for Idaho Water Resource Board review of proposed water allocations from federal reservoirs in excess of 500 acre-feet annually, within an existing approved water right not otherwise reviewable by the Department. This state and federal partnership ensures that water resource and management issues are addressed in a comprehensive way, thereby providing for optimal use of the state's resources. It will become even more important to coordinate state and federal management strategies as demands on the state's water supply increase.

Implementation Strategies:

- Review status of existing cooperative agreements related to review of proposed allocations and revise accordingly.
- Identify opportunities for additional agreements providing for review of proposed allocations.
- Work with the USACE to determine if cooperative agreements addressing water allocations in other parts of the state would be in the state's interest.

Milestones:

- Existing agreements maintained and revised as necessary.
- Additional cooperative agreements executed that promote optimal use of the state's water resources.

Photo Courtesy of Idaho Department of Agriculture

3B - HYDROPOWER SITING

The expansion of hydropower capacity and generation consistent with the state water plan can help meet the need for affordable and renewable energy resources.

Discussion:

Hydropower provides a clean, efficient, and renewable energy source and has contributed significantly to the state's energy supply. The state and region's power demand is expected to increase substantially over the next several decades as the population continues to grow. Although most cost effective and flexible sites have been developed, there will be opportunities for increasing hydroelectric generating capacity, while preserving environmental protection. These include enhancing incremental capacity at existing sites through new technologies that yield greater energy efficiency, adding generation capacity at existing dams, and the development of generation capacity in conjunction with the construction of new water storage projects. Development of small hydropower generation at existing facilities is also an important strategy for contributing to the state's energy supply. The Board provides loans to assist irrigation entities interested in studying the feasibility and development of such projects.

The 2012 Idaho Energy Plan recommends that energy conservation and energy efficiency should be the highest priority resource. The 2012 Idaho Energy Plan also recommends development of in-state renewable resources that will contribute to a secure, reliable energy system for the state. The Board supports the promotion of a more efficient use of energy throughout Idaho's economy, implementation of efficiency improvements at existing sites, and retrofitting existing dams. Hydropower development should be considered when planning new water storage projects. Feasibility studies for new storage projects should include evaluation of the costs, benefits, and adverse consequences of hydropower generation.

Under 16 U.S.C. § 803, the FERC must determine that proposed projects are consistent with Idaho's comprehensive water plans when making licensing decisions. The Board will review hydropower development proposals to determine whether they are consistent with the State Water Plan, including the comprehensive basin and river plans, which address region-specific siting issues. The Board agrees with the 2012 Idaho Energy Plan recommendation to establish an Energy Facility Site Advisory Team that would provide technical expertise and assistance upon request from local officials considering energy facility siting proposals.

Implementation Strategies:

- Provide information and technical assistance to local communities through participation in an Energy Facility Site Advisory Team.
- Include evaluation of hydropower generation potential in feasibility studies for water storage projects.

- Provide information and technical assistance to proponents of projects that increase energy efficiency, increase generation capacity, or retrofit existing dams or other facilities for hydroelectric generation.

Milestones:

- Hydropower siting proposals and projects comply with the State Water Plan.
- Efficiency improvements implemented at existing hydropower facilities.
- Generation capacity increased at existing hydropower projects, while protecting the environment.
- Existing dams retrofitted with generation capacity, while protecting the environment.
- Development of small hydropower generation at existing facilities, while protecting the environment.

3C - RESEARCH PROGRAM

Focused research is necessary to support water resource planning and collaborative solutions that address changing demands on the state's water supplies.

Discussion:

Research and data gathering are essential to the state's efforts to meet future water challenges in a sustainable way. Adequate data on water availability, use and efficiencies, surface and ground water interaction and relationships, and emerging water management technologies is needed to help water managers and end users make sound decisions and develop adaptive strategies for responding to the impacts of climate variability. Data collection and research is conducted by numerous public and private entities. A cooperative exchange of information contributes to more efficient use of limited financial resources for research and monitoring necessary to further the state's water supply objectives. Research priorities include: water use efficiency; water use monitoring; ground and surface water relationships, specifically the timing and spatial distribution of pumping and recharge efforts; ground water flow models; and system operation modeling methods for Idaho river basins. Environmental considerations should be addressed as studies are designed and implemented.

Implementation Strategies:

- Facilitate coordination and dissemination of research and data among state and federal agencies, local units of government, universities, and private entities.
- Identify and prioritize research needs.
- Identify dedicated funding sources for basic and applied research.

Milestones:

- Cooperative research activities implemented.
- Completed research projects.
- Application of research results to planning and management.

3D - FUNDING PROGRAM

Funding mechanisms to support the development, preservation, conservation, and restoration of the water resources of the state should be based on flexible strategies that provide equitable benefits.

Discussion:

The water resources of the state are essential to Idaho's economy and its citizens. There is no single strategy for successfully financing water resource projects. Instead, funding mechanisms for water planning and management should be based on flexible strategies that are broad-based and provide equitable benefits. Strategies for financing water resource programs may include state appropriations, the establishment of water management improvement or conservancy districts, targeted user fees, the development of a state water fund supported by power franchise fees, targeted sales, property, or special product and services taxes, and revenue bonds. While the existing institutional and legal framework may be adequate for some projects, it is important to develop innovative approaches that are responsive to future needs. Transparency and clarity about the intent and limitations of any particular funding strategy will help ensure that a strategy is used and evaluated appropriately. Projects proposed for funding must be in the public interest and in compliance with the State Water Plan.

The Board's Revolving Development Fund and Water Management Account are supported by appropriations from the state's general fund, federal funds, and other revenue sources. These programs have and will continue to provide financial assistance to project sponsors for water development and conservation, system rehabilitation, and treatment projects. The Board is also authorized to finance water projects with revenue bonds. The issuance of revenue bonds does not constitute a general obligation of the state or the Idaho Water Resource Board.

Sources of funding for programs focused on the protection and restoration of species listed under the ESA include 2004 Snake River Water Rights Agreement appropriations, the Columbia Basin Water Transaction Program, the Pacific Coast Salmon Recovery Fund, and the 2008 Columbia Basin Fish Accords.

The ESPA CAMP provides for a water-user fee in conjunction with state appropriations. Implementation of strategies for addressing regional water use issues on the Eastern Snake River Plain Aquifer will assist in the development of comprehensive aquifer management implementation plans in other areas of the state.

The Board will continue to pursue opportunities for partnerships with the federal government and private entities to determine the feasibility of increasing water supplies through development of additional storage capacity. As discussed in Policy 4E, the Board has entered into agreements with the USACE and the USBOR for studies in the Boise River and Snake River basins. As demands increase on Idaho's water storage and delivery systems, the need for additional water storage feasibility studies and funding partnerships will be assessed.

Implementation Strategies:

- Review existing authorities and identify changes needed to optimize financing for water resource projects.
- Evaluate Idaho Water Resource Board financial program procedures to determine whether revisions are needed to improve efficiency and accessibility.
- Pursue opportunities for private funding partnerships.
- Pursue opportunities for local, federal, and intra-state funding partnerships and projects.

Milestones:

- Financial programs and funding strategies meet the future water resource needs of the state.

3E - WATER RESOURCE PLANNING PROGRAM

Comprehensive water planning will help ensure sufficient water supplies to satisfy Idaho's future water needs.

Discussion:

Idaho Code § 42-1734A(1) directs the Idaho Water Resource Board to formulate and adopt a comprehensive state water plan for conservation, development, management and optimum use of all unappropriated water resources and waterways of the state. The legislature also authorized the Idaho Water Resource Board to develop plans for specific geographical areas. Comprehensive plans for individual hydrologic river basins include state protected river designations and basin-specific recommendations concerning water use and resource values. Basin plans also assure that the state's interests will be considered in federal management agency decisions. Public review and comment ensures that the state water plan serves the public interest.

As demands for water increase, the need for water-related planning escalates. The planning process provides opportunities for involving all affected parties – water users, resource managers, and policymakers, identifies problems, alternatives, and solutions, and allows for continuous updating and revisions in light of new problems and opportunities.

In exercising its responsibilities for water resource planning, the Board will focus on the coordination of local, state and federal planning activities to minimize duplication and to promote the optimum use of Idaho's water resources.

Implementation Strategies:

- Review and update existing agreements for coordinated water resource planning.
- Develop new cooperative planning agreements.
- Secure funding to complete CAMPs for priority aquifers consistent with the schedule established by the Board.

Milestones:

- Cooperative planning agreements executed and implemented.
- Adoption of Treasure Valley and Rathdrum Prairie CAMPs.
- Completion and adoption of CAMPs for remaining priority aquifers.

3F - WATER RIGHTS ADJUDICATION

Adjudication of water rights through the state courts should be completed to fully define and quantify all state, tribal, and federal water rights.

Discussion:

The purpose of a general stream adjudication is to provide certainty and predictability in the administration and distribution of water diverting from hydraulically connected water sources. "A general adjudication is an action for both the judicial determination of the extent and priority of the rights of all persons to use water from any water system within the state of Idaho that is conclusive as to the nature of all rights to the use of water in the adjudicated water system, except as provided in section 42-1410, Idaho Code and for the administration of those rights." Idaho Code § 42-1401A(5). The need for a general adjudication of water rights in the Snake River Basin became apparent as the spring flows in the Thousand Springs reach began to decline and disputes arose over the availability of water supplies on the Snake River Plain. As part of the 1984 Swan Falls Agreement, the state agreed to commence the Snake River Basin Adjudication ("SRBA"), the largest legal proceeding in the history of the state. The SRBA is the cornerstone for the long-term management of the Snake River Basin within Idaho. At the conclusion of the SRBA, the state will have a listing of all water rights within the basin, which is the predicate for establishing water districts to administer all water rights. Pursuant to Idaho Code § 42-1734(3), the Idaho Water Resource Board is authorized to represent the state, when requested to do so by the Governor, in proceedings, negotiations, and hearings involving the federal government. In the SRBA, the Board coordinated state participation in the negotiation of federal reserved water rights, including tribal claims. Successful agreements were negotiated resolving federal reserved water right claims including those filed by the Shoshone-Bannock, Nez Perce, and Shoshone-Paiute tribes as well as the claims of numerous federal agencies. The final settlement of the Nez Perce

Tribe's claims reflected the tribe's and the state's shared interest in addressing environmental concerns and addressed the conflicting demands for consumptive and nonconsumptive uses. Consistent with state law, the Board should serve as the lead agency for coordinating state participation in all general stream adjudications.

On November 12, 2008, the district court ordered the commencement of an adjudication in the Coeur d'Alene Spokane River water system. Like the SRBA, the determination of all existing water rights from the water basins in Northern Idaho will provide the basis for administration of water rights.

Implementation Strategies:

- As requested by the Governor, provide coordination and negotiation of adjudication activities.
- As determined by state and local support, encourage general adjudications in unadjudicated basins in northern Idaho and the Bear River Basin in eastern Idaho.

Milestones:

- Issuance of final unified decree in the SRBA.
- Coeur d'Alene Spokane River Basin adjudication completed.

3G - CLIMATE VARIABILITY

Preparedness strategies should be developed to account for the impact of climate variability on the state's water supplies.

Discussion:

Evidence suggests that currently the Earth's climate is warming and that warming may continue into the foreseeable future. While recognizing the uncertainties inherent in climate prediction, it is important to anticipate how a warming climate can potentially affect water supplies and plan accordingly.

Climate experts are less confident about how continued warming will affect the overall amount of precipitation Idaho receives, but changes in seasonal stream flows and increased annual variability have been documented. It is expected that seasonal flows in snowmelt-fed rivers will occur earlier, summer and fall stream flows will be reduced, and water temperatures will increase. Increased precipitation in the form of rain and fewer, but more intense, storm events are expected to result in more severe droughts and greater flooding. Potential impacts could also include more evaporation, reduced ground water recharge, water quality challenges, reduced productivity of hydropower facilities, and irreversible impacts on natural ecosystems. Water resource managers must evaluate and plan for these possibilities.

Planning for the potential impacts of climate variability requires increased flexibility in water management and the identification of existing tools that can be adapted to address climate-induced changes in water supplies. Increased monitoring and data collection as well as conducting an initial vulnerability analysis for watersheds will help managers develop adaptive approaches to changes in the hydrologic regime that may accompany an increase in climate variability. Increasing public awareness and strengthening community and regional partnerships to manage shared water resources are proactive steps that should be taken now to provide for the optimum use of Idaho's water resources.

Implementation Strategies:

- Evaluate existing legal and institutional tools and constraints that can be adapted to provide flexibility for water resource managers.
- Implement a collaborative approach to the analysis of reservoir operation rule curves that adequately considers past and current hydrologic data.
- Pursue expansion and diversification of water supplies, including increased surface and ground water storage.
- Develop and update flood-risk assessments and environmental impact mitigation measures.
- Identify and implement adaptive mechanisms to address the impact of climate variability on water supplies.
- Establish stakeholder forums involving state and local water supply managers, scientists, state and federal agencies, and water users to enhance understanding about the science of climate variability, to share information about existing and potential tools for ameliorating the impact of climate variability, and to increase understanding of the challenges facing water users and managers.

Milestones:

- Completion and implementation of updated flood control rule curves.
- Construction or expansion of water supply projects.
- Finalization of risk assessment studies.
- Documentation of legal and institutional framework and water management tools that anticipate and respond to climate variability.
- Establishment of regional forums that encourage the development of collaborative programs and decision making.
- Funding mechanisms in place for climate variability preparedness and risk assessment.

4. SNAKE RIVER BASIN

The Snake River was described in the 1960s as "A Working River" by Senator (and former Idaho Governor) Len B. Jordan. This description accurately portrays the development of the river since the earliest settlement and irrigation of the semiarid lands of southern Idaho.

The Snake River has had – and continues to have – many competing demands for its water that affect the management of the river, among them: irrigation, hydroelectricity, municipal supply, flood control, recreation, fish, and wildlife management. Multiple governmental agencies regulate activities that affect the use of the waters of the Snake River, among them: the Idaho Water Resource Board (water policy), Idaho Department of Water Resources (water administration), U.S. Bureau of Reclamation (irrigation, water storage, and hydroelectricity), U.S. Army Corps of Engineers (flood control), National Marine Fisheries Service (anadromous fisheries management), U.S. Fish and Wildlife Service (resident fisheries), Bonneville Power Administration (federal power), and the Federal Energy Regulatory Commission (hydropower). The Snake River policies in this Plan provide essential guidance for the management of the Snake River in the public interest. When competing demands for Idaho's unappropriated water resources arise, the laws of the State of Idaho and the policies in this Plan establish the blueprint for management of the resource.

This plan sets forth ten Snake River Basin policies. Policy 4A describes the minimum stream flow management framework that provides for the optimum development of the water resources of the Snake River Basin. Policy 4B reaffirms the Milner Zero minimum average daily flow policy that guides the optimum development of unappropriated flows of the Snake River Basin above Milner Dam. Policy 4C addresses reallocation of Snake River trust water in the Milner to Murphy reach of the Snake River Basin. Policy 4D addresses conjunctive management of the Eastern Snake Plain Aquifer and the Snake River. Policy 4E addresses the need for development of storage in the Snake River Basin. Finally, Policies 4F through 4J set forth policies for agriculture, DCMI (domestic, commercial, municipal and industrial), hydropower, navigation, fish, wildlife, recreation, and scenic values.

Photo: Milner Dam
Photo Courtesy of IDWR Dam Safety Program

4A - SNAKE RIVER MINIMUM STREAM FLOWS

The main stem Snake River above Hells Canyon Dam will be managed to meet or exceed the following minimum average daily flows at the designated stream gaging stations:

Gaging Station	Minimum Average Daily Flow
Milner	0 cfs
Murphy	3,900 cfs (4/1 through 10/31) 5,600 cfs(11/1 through 3/31)
Weiser	4,750 cfs
Johnson Bar	5,000 cfs
Lime Point	13,000 cfs

These minimum stream flows provide the management framework for the optimum development of water resources of the Snake River Basin. The minimum stream flow water rights shall be administered in priority with other water rights.

Discussion:

Approximately 57%[1] of the surface area of the State of Idaho is within the Snake River Basin. Although the Snake River Basin represents 50% of the water resources of the State, it is the water supply for 76% of Idaho's population. Thus, the Snake River Basin is the backbone of Idaho's economy. Effective management of this resource is essential to protecting existing water rights, supporting agriculture, sustaining economic growth, maintaining base flows for hydropower generation, and preserving fish, wildlife, and other environmental values.

The Milner, Murphy and Weiser minimum stream flows have been an integral part of the State Water Plan since their adoption in 1976. They establish a balance between diversion of water for consumptive uses and preservation of Snake River flows for instream uses. The Johnson Bar and Lime Point minimum flows were added in 1978 and 1985, respectively, to address navigational concerns below the Hells Canyon Complex (HCC).

The Snake River minimum stream flow policy evolved over the course of the 20th Century in connection with efforts to reconcile the conflict between irrigation, which requires diverting water out of the stream, and hydropower, which relies on retaining water in the stream. A brief overview of the evolution of the Snake River minimum stream flow framework is provided as context for the Snake River policies that follow.

The inherent tension between diversion of water for consumptive uses and retention of flows for instream uses became apparent with the simultaneous development of the irrigable lands within the Snake River Basin and the development of the hydropower

[1] The Salmon and Clearwater Basins are not included in this calculation because they are treated as separate basins for purposes of the State Water Plan.

potential of the main stem Snake River. The inevitable conflict between these two uses was recognized as early as the 1889 Constitutional Convention, and the tension continued through the 20th Century.

The initial effort to create a balance between irrigation and hydropower development arose out of a 1920 plan prepared by the Board of Engineers "for the development of the remaining resources of the Snake River water supply on a broad and comprehensive basis which would insure to the state the maximum utility of the possibilities of the stream." Report of Board of Engineers (dated April 10, 1920). The Board of Engineers consisted of the State Commissioner of Reclamation and engineers representing the U.S. Reclamation Service and private irrigation interests. The plan was based on the physical division of the Snake River Basin at Milner Dam. Upstream from Milner Dam the Snake River is not deeply entrenched, but below the dam the river enters a deep canyon. This physical characteristic of the Snake River led the Board of Engineers to propose that the Snake River above Milner Dam be dedicated to irrigation because of the ease of diverting the flow through gravity irrigation. The Board of Engineers proposed that the main stem Snake River below Milner Dam should be devoted to hydropower because the flow of the river was largely inaccessible for agricultural development at that time.

The Board of Engineers' plan proposed the construction of storage capacity, to the extent economically feasible, to capture flows above Milner Dam for existing and future agricultural development. Because it would take a number of years to develop the water supply above Milner Dam for agricultural purposes, the Board of Engineers' report recommended hydropower water rights be conditioned to prevent them from interfering with future upstream development. This limitation on hydropower water rights was integral to the Board of Engineers' plan for the "maximum utility" and "greatest use" of the water resources of the Snake River. The Board of Engineers' viewed the plan as not greatly impacting hydropower development because the Snake River soon reconstituted itself downstream from Milner Dam from irrigation return flows, tributary springs, and surface water sources.

The physical differences in the reaches above and below Milner Dam, and the corresponding differences in existing and anticipated development above and below Milner Dam, evolved over time to the commonly-held view of the Snake as consisting of "two rivers." The "two rivers" concept recognizes that separating water administration at Milner Dam and precluding downstream calls for the water above Milner, the optimum development of the water supply above Milner Dam can be achieved. The "two rivers" concept has been repeatedly reaffirmed as part of every major Snake River water project and resolution of every major water controversy. For example, Idaho Power Company's "HCC" water rights were subordinated to upstream consumptive uses, consistent with the "two rivers" concept.

The "two rivers" concept was formally recognized in the 1976 State Water Plan, which set a "protected flow" of zero cfs at the Milner U.S.G.S. Gaging Station. The purpose for establishing a zero flow at Milner Dam was to allow for existing uses to be continued and for some new uses to be developed. The 1986 State Water Plan, however, recognized that the Milner zero minimum average daily flow policy meant "that river flows downstream from that point to Swan Falls Dam may consist almost entirely of ground-water discharge during portions of low-water years." The 1992 State Water Plan further clarified that the Milner zero minimum stream flow "is not a target or goal to be achieved, and may not necessarily be desirable." The 1996 State Water Plan was amended by the Idaho Legislature to provide that "the exercise of water rights above Milner Dam has, and may reduce flow at the dam to zero."

The 1976 State Water Plan established minimum average daily flows[2] at the Murphy gage of 3,300 cfs, and the Weiser gage of 4,750 cfs "to maintain water for production of hydropower and other main stem uses." In 1985, the Murphy minimum stream flow was increased to an average daily flow of 3,900 cfs during the irrigation season and 5,600 cfs during the non-irrigation season as part of the resolution of the Swan Falls controversy, which dealt with whether Idaho Power Company's hydropower water rights were subordinate to upstream uses. The 1986 State Water Plan described the Murphy and Weiser minimum stream flows as "management constraints" to "insure that minimum flow levels of Snake River water will be available for hydropower, fish, wildlife and recreational purposes." The 1986 Plan also recognized the hydraulic connection between the Eastern Snake Plain Aquifer and directed that it "be managed as an integral part of the river system."

In 1978, the Idaho Legislature established a minimum stream flow of 5,000 cfs at the Johnson Bar Gaging Station "to retain the stream flows and hydro-base." Chapter 345, 1984 Idaho Sess. L. 884, 886. As part of the Swan Falls Settlement, a minimum flow of 13,000 cfs was established at the Lime Point Gaging Station. These minimum stream flows were initially established to protect navigational flows below the HCC, but now serve to protect flows of the main stem Snake River below the HCC for instream uses. As discussed in Policy 4I, however, the Johnson Bar and Lime Point minimum stream flows are not enforceable against water rights diverting from the waters of the Snake River or surface or ground water tributary to the Snake River upstream of the HCC. Additionally, the Lime Point minimum stream flow cannot be enforced against water rights diverting waters of the Salmon River or surface or ground water tributary to the Salmon River.

To summarize, the Milner, Murphy and Weiser minimum stream flows establish the management framework for optimum development of the water resources of the Snake River Basin above the HCC. The Johnson Bar and Lime Point minimum stream flows protect main stem Snake River flows below the HCC for instream uses.

Implementation Strategies:

- Develop a monitoring program by 2014 to account for fluctuations resulting from the operation of Idaho Power Company's hydropower facilities in the calculation of the Murphy minimum average daily flow.
- Develop tools to predict Snake River flows at the Murphy Gage based on ESPA ground water level trends, precipitation patterns, new appropriations, and changes in conservation practices.

[2] An average daily flow is the average of multiple flow measurements taken during a 24-hour period.

- Develop by 2014 management scenarios to ensure that Snake River flows at the Murphy and Weiser Gages remain above established minimum stream flow levels.

Milestones:

- Snake River minimum stream flows maintained.
- Tools developed to predict Snake River flows at the Murphy Gage.
- Management strategy developed to ensure that Snake River minimum stream flows at the Murphy and Weiser Gages are maintained.

4B - SNAKE RIVER MILNER ZERO MINIMUM FLOW

Water resource policy, planning, and practice should continue to provide for full development of the Snake River above Milner Dam recognizing that the exercise of water rights above Milner Dam has and may reduce flow at the Dam to zero.

Discussion:

Idaho Code § 42-203B(2) provides that "[f]or the purpose of the determination and administration of rights to the use of the waters of the Snake River or its tributaries downstream from Milner Dam, no portion of the waters of the Snake River or surface or ground water tributary to the Snake River upstream from Milner Dam shall be considered." This provision was enacted in 1986 to confirm and clarify the Milner zero minimum stream flow and the "two rivers" concept. Policy 4B reaffirms the Milner zero minimum stream flow and the "two rivers" concept, which have appeared in each successive revision of the Idaho State Water Plan.

Figure 1 shows the annual volume of natural flow passing Milner Dam from 1980 through 2011. Because of year-to-year variability of the natural flow passing Milner Dam, the optimum development of the natural flow will be achieved through storage in surface water reservoirs above Milner Dam and in the ESPA.

Implementation of managed recharge will have an effect on the flow characteristics of the Snake River above and below Milner Dam. Accordingly, while the Eastern Snake Plain Aquifer Comprehensive Management Plan established a long-term annual hydrologic target of 150,000 to 250,000 acre-feet of managed recharge, this target should be phased in to allow for informed water management and planning." The Phase I managed recharge hydrologic target for the Snake River Basin above Milner is to recharge between 100,000 and 175,000 acre-feet on an average annual basis. Based upon data gathered during this initial phase of managed recharge, the Board will consider in 2019 whether to implement the ESPA long-term managed recharge hydrologic target.[3]

[3] The Board entered into a Memorandum of Agreement with Idaho Power Company as part of the 2009 Framework Reaffirming the Swan Falls Settlement dated May 6, 2009, that sets forth additional understandings between the Idaho Power Company and the Board regarding implementation of managed recharge.

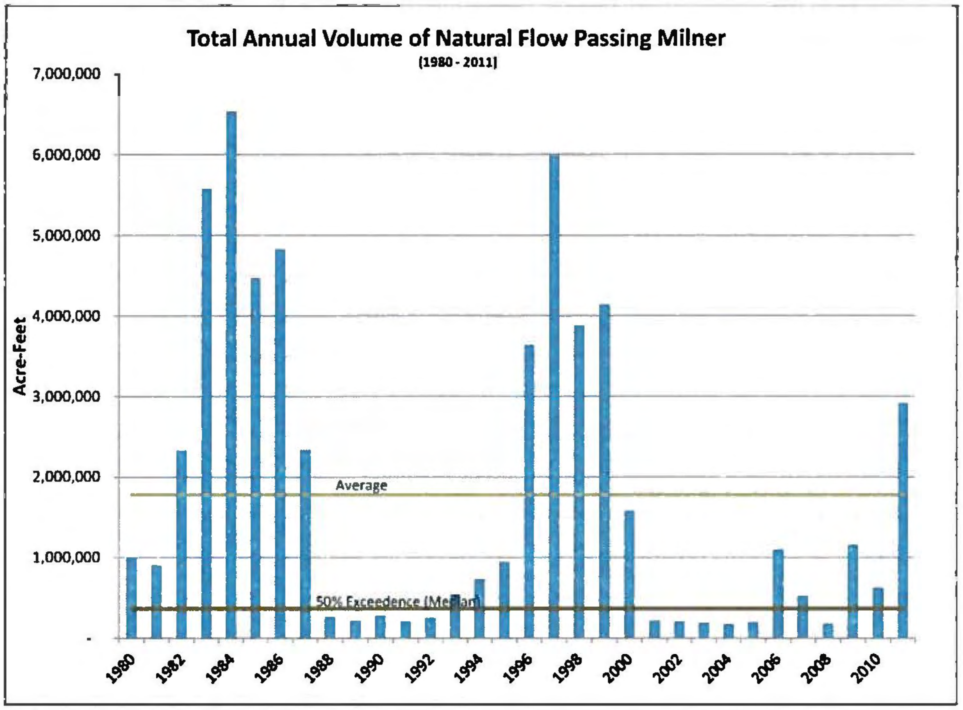

Figure 1 Total Annual Volume of Natural Flow Passing Milner Dam

As discussed in Policy 4E, development of new surface storage will take time. In the interim, the Board will cooperate with stakeholders to explore ways to optimize the management of flows that are currently passing over Milner Dam to first meet water supply needs above Milner Dam, and second to shape any remaining unappropriated flows for hydropower and other uses below Milner Dam.

Consistent with Idaho Code § 42-203B(2), no use of unappropriated flows passing Milner Dam by downstream users establishes a right to call on such flows now or in the future.

Implementation Strategies:

- Develop and maintain a reliable supply of water for existing uses and future beneficial uses above Milner Dam.
- Assess the feasibility of construction of new on-stream and off-stream storage in the Snake River Basin above Milner Dam.
- Implement a sustainable aquifer recharge program.
- Address water management and reservoir operation needs through the Upper Snake River Advisory Committee.
- Measurement and Monitoring Implementation Strategy:
  - Continuously improve the Eastern Snake River Aquifer Model ("ESPAM"), the Snake River Planning Model ("SRPM"), and the Snake River Water Right Accounting Program.

- Promote linkage of the models and their use in evaluation of impacts of various management decisions on Snake River flows, aquifer levels, and reservoir operations.
- Undertake measurement and monitoring of the combined river and aquifer system to facilitate water management and planning in the Snake River Basin above Milner Dam.
- Investigate, test, and adopt new water measurement and modeling methods and technologies that improve water management capabilities.

- Implement and maintain cooperative water resource agreements and partnerships with neighboring states, the federal government, and Indian tribes in managing the water resources of the Snake River above Milner Dam.

Milestones:

- Process in place that provides recommendations to optimize the management of the water resources and the reservoir system above Milner Dam.
- A managed aquifer recharge program above Milner Dam implemented that recharges between 100,000 and 175,000 acre-feet on an average annual basis by 2019 and data gathered to assess the efficacy of the program.
- Projects implemented that enhance the water supply above Milner Dam.

4C - REALLOCATION OF SNAKE RIVER TRUST WATER

Water made available for reallocation to new uses in the Snake River trust water area pursuant to Idaho Code § 42-203B shall be allocated in accordance with criteria established by Idaho Code §§ 42-203A and 42-203C.

Discussion:

The term "trust water" refers to water made available for future development as a result of the 1984 Swan Falls Settlement, which resolved the long-standing conflict between use of the flow of the Snake River for hydropower purposes and for agriculture and other depletionary uses. The details of this century-long conflict are chronicled in two Idaho Supreme Court decisions and the SRBA District Court's Memorandum Decision and Order on Cross-Motions for Summary Judgment dated April 18, 2008, and therefore, are not repeated here. A brief overview of the trust created by Idaho Code § 42-203B(2), however, is provided as context for this policy.

A core principle of the Swan Falls Settlement is that flows of the Snake River downstream from Milner Dam in excess of the Murphy minimum average daily flow of 3,900 cfs during the irrigation season and 5,600 cfs during the non-irrigation season are available for future development in accordance with state law. The Settlement, however, recognized development would occur over time and that in the interim it was in the public interest to allow Idaho Power Company to continue to use such flows up to the licensed amount of the hydropower water rights "pending approval of depletionary future beneficial uses."

These dual objectives were implemented through, a trust, established by Idaho Code § 42-203B(2), which operates for the joint benefit of Idaho Power Company and the people of the State of Idaho. The statutory trust consists of twenty-five hydropower water rights originally appropriated by Idaho Power Company for flows in excess of the Murphy minimum flow, and now held by the State, by and through the Governor. Idaho Power Company uses the flows available under the water rights held in trust for hydropower purposes until those flows are appropriated to new uses approved pursuant to state law, including Idaho Code §§ 42-203A and 42-203C. The "reallocation" is accomplished through subordination of the hydropower water rights held in trust to the new uses, pursuant to Idaho Code § 42-203B(2).

While the water made available for future development as a result of the trust is often referred to as "trust water," this term is a misnomer. The trust consists of "water rights" as opposed to "water." Trust Water is simply a shorthand term referring to flows above the minimum stream flow at the Murphy Gage, which were originally appropriated under water rights for hydropower generation at Idaho Power Company's facilities located between Milner Dam and the Murphy Gage. Additionally, the term refers only to water sources tributary to the Snake River below Milner Dam, as shown on Figure 2 (the "Trust Water Area").[4]

The Swan Falls Settlement and the implementing statutes did not attempt to define the specific amount of trust water available for future development. Rather, the availability of trust water is linked to the Murphy minimum flow and a number of other statutory factors. "The actual amount of development that can take place without violation of the [Murphy] minimum stream flows will depend on the nature and location of each new development, as well as the implementation of new practices to augment the stream flow."

Figure 2 Trust Water Area

[4] Pursuant to the Swan Falls Settlement and Idaho Code § 42-203B(2) "water rights for hydropower purposes on the Snake river or its tributaries downstream from Milner dam shall not place in trust any water from the Snake river or surface or ground water tributary to the Snake river upstream from Milner Dam." Thus, the hydropower water rights held in trust carry no right to seek administration of the rights to the use of the waters of the Snake or its tributaries upstream from Milner Dam.

Figure 3 shows the portions of the hydrograph at Murphy deemed to be "minimum stream flows" and "trust water." [5] A similar hydrograph was prepared in 1988 in connection with the implementation of the Swan Falls Settlement, and included the 1961 average daily flow at the Murphy Gage as representative of the then-existing low flow year. Figure 3 includes average daily flow data from 1984 through 2011 to show the relative change in flow at the Murphy Gage since implementation of the Swan Falls Settlement.

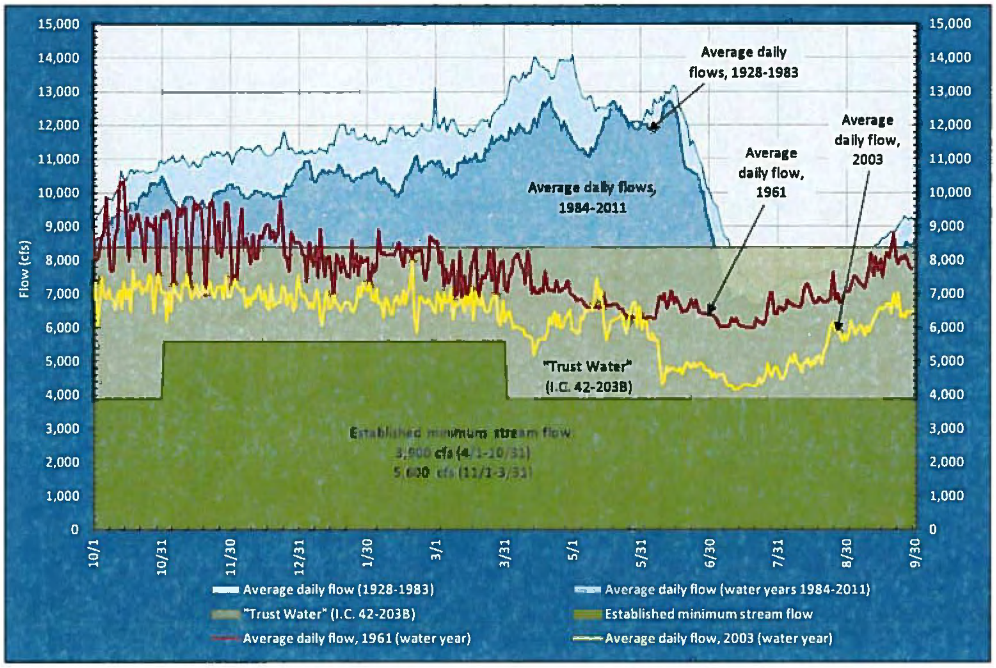

Figure 3 Swan Falls Trust Water Flows

While flows are beginning to approach the minimum average daily flow at the Murphy Gage at certain times in low flow years, Snake River flows in most years are significantly above the Murphy minimum average daily flow.

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[5] Figure 3 updates Figure 3 contained in the IDWR Policy and Implementation Plan for Processing Water Right Filings in the Swan Falls Area, dated November 3, 1988, which depicted water made available for appropriation above the Murphy Gage as a result of the Swan Falls Settlement. The 1988 graph plotted average monthly flows, but since that time, technology has made it easier to graph average daily flows. Thus, Figure 3 uses average daily flows as reported by the USGS to provide a more accurate depiction of flow conditions at the Murphy Gage. Specifically, Figure 2 shows average daily flows for 1961 and 2003 and the average of the average daily flows for the years 1928 through 1983 and 1984 through 2010. (The Swan Falls Settlement excludes fluctuations resulting from the operation of Idaho Power Company facilities from the calculation of the minimum average daily flow at Murphy. The methodology for calculating the minimum average daily flow is currently being refined.) The upper limit of the "trust water" portion of the hydrograph at any given location between Milner and Murphy is defined by the hydropower water rights held in trust by the State for the corresponding Idaho Power Company facility. Figure 3 applies only to Murphy, where trust water is limited to that flow between the Murphy minimum stream flow and 8,400 cfs, the amount of the Swan Falls hydropower water right held in trust. The "trust water" available at locations upstream from Murphy is the difference between the Murphy minimum stream flow and the amount of the water rights held in trust for each upstream facility.

The opportunity for further development of trust water is currently limited by three factors. First, there is uncertainty regarding the administration of surface and ground water rights other than hydropower. While the Swan Falls Settlement subordinated the use of the flows of the Snake River for hydropower purposes, it did not address the rights of other senior water right holders. Second, the amount of trust water that remains to be developed is uncertain because some trust water rights were issued for a term of years. Those permits are nearing the end of their terms and are subject to review by the Director. Third, in almost all cases, a moratorium precludes issuance of new water rights within the trust water area. Until these issues are resolved, it is not possible to make informed decisions regarding the allocation of any remaining trust water.

Implementation Strategies:

- Conduct hydrologic studies to determine the amount of additional development possible within the Murphy minimum stream flow constraint.
- Develop a conjunctive management plan setting forth measures necessary for future development of trust water.
- Review term limited trust water rights.

Milestones:

- Quantification of the amount of additional development possible within the Milner to Murphy reach of the Snake River consistent with maintaining the Murphy minimum stream flow.
- Adoption of a conjunctive management plan for the Milner to Murphy reach of the Snake River.
- Complete review term limited trust water rights.

4D - CONJUNCTIVE MANAGEMENT OF THE ESPA AND SNAKE RIVER

The Eastern Snake Plain Aquifer and the Snake River below Milner Dam should be conjunctively managed to provide a sustainable water supply for all existing and future beneficial uses within and downstream of the ESPA.

Discussion:

The ESPA is approximately the size of Lake Erie and underlies more than 10,800 square miles of southern Idaho, stretching from St. Anthony to King Hill. It is one of the largest and most productive aquifers in the world, estimated to contain 1 billion acre feet of water. Most of the ESPA is in direct hydraulic connection with the Snake River. The Snake River alternately contributes water to and receives water from the ESPA.

The volume of water stored in the ESPA derives from natural inputs (precipitation, tributary underflow, seepage from rivers) and from irrigation related inputs (seepage from canals and farm fields). The volume of water stored in the ESPA increased dramatically during the first half of the 20th century as large irrigation canals transported millions of acre feet of water from the Snake River out on to the Eastern Snake River Plain. Crops were irrigated by flood irrigation, and the water not consumed by the crops percolated into the ESPA as "incidental recharge. As a result, the groundwater table rose across the ESPA by as much as 30-50 feet. The flow of springs near American Falls and in the Thousand Springs reach also increased dramatically. Thousand Springs flows increased from 4,200 cfs prior to irrigation to about 6,800 cfs by the late 1950s. Since then spring flows have declined as a result of more efficient surface water irrigation practices, the termination of winter canal flows, ground water pumping, and drought. Spring flows in the Thousand Springs reach currently are about 5,200 cfs, a decline of just over 20% over the past sixty years. While spring discharges from the ESPA remain above pre-irrigation levels, the decline from peak levels has created conflicts between surface and groundwater users, and in some instances between senior and junior groundwater users.

In most years when irrigation demands exceed water being accumulated to upstream storage reservoirs, flows at Milner Dam are reduced to zero until the end of the irrigation season. At these times the Snake River flow at the Murphy Gage consists mostly of ESPA discharge from the Thousand Springs area.

Recognizing a hydraulic connection between the ESPA and the Snake River, the 1986 State Water Plan identified the need conjunctive management of ground and surface water resources. In recent years, the State has implemented scientific measures to increase knowledge of the hydraulic connection between the ESPA and the Snake River, and implemented measures to improve aquifer conditions in, and spring discharge from, the ESPA. Continuation of these efforts is fundamental to ensuring an adequate water supply for existing and future water demands within the Eastern Snake River Basin.

Conjunctive management of the Snake River Basin water resources is also key to meeting the Murphy minimum stream flows. The 1984 Swan Falls Settlement explicitly recognized effective water management of the ESPA and Snake River – and associated policies and recommendations laid out in the State Water Plan – as the means of ensuring the Murphy minimum average daily flow while optimizing the development of the Snake River Basin: "[t]he State Water Plan is the cornerstone of the effective management of the Snake River and its vigorous enforcement is contemplated as a part of the settlement." [6]

Building on the existing conjunctive management efforts, the Idaho Legislature in 2006, adopted Senate Concurrent Resolution 136, which requested the Idaho Water Resource Board to develop a CAMP for the Eastern Snake River Plain Aquifer. In January 2009, the Board adopted the ESPA CAMP the goal of which is to "[s]ustain the economic viability and social and environmental health of the Eastern Snake Plain by adaptively managing the balance between water use and supplies." The objectives of the plan are to

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[6] This policy addresses conjunctive management of the Eastern Snake River Aquifer and the Snake River and not water rights administration. Water rights administration is the enforcement of the relative rights of water right holders under the prior appropriation doctrine. As noted in Policy 1E conjunctive management is broader and encompasses actions that can be taken to optimize the benefits and value of Idaho's water resources. While conjunctive management is not a substitute for water rights administration, it is in the public interest to conjunctively manage the ESPA and the Snake River to lessen or obviate the need for broad-scale water rights administration to accomplish general water-management goals.

increase predictability for water users by managing for a reliable supply, creating alternatives to administrative curtailment, managing overall demand for water within the Eastern Snake Plain, increasing recharge to the aquifer, and reducing withdrawals from the aquifer.

The long-term objective of the ESPA CAMP is to effectuate a net annual ESPA water budget change of 600 thousand acre-feet (kaf) by the year 2030. This change is to be achieved through implementation of measures designed to reduce demand on and to augment the water supply of the ESPA. Approximately 100 kaf of demand reduction is to be achieved through groundwater to surface water conversions, and another 250-350 kaf of demand reduction is to be achieved through various measures designed to retire existing water rights. Aquifer recharge is expected to increase the ESPA water supply by 150-250 kaf.

The ESPA CAMP uses a phased approach to achieving the long-term change in the water budget. The goal of Phase I of the ESPA CAMP is to implement measures that will result in a net annual change in the ESPA water budget of between 200 kaf and 300 kaf. The recommended actions to achieve this change include ground- to-surface water irrigation conversions, managed aquifer recharge, and augmentation of supplies through demand reduction and weather modification. ESPA CAMP Phase I strategies are to be implemented by 2018 with ongoing monitoring and evaluation of the intended and unintended effects of the strategies. The Phase I monitoring and evaluation studies will be used to select, design, and implement Phase II strategies that will lead to an additional 300-400 kaf water budget change.

Policy 4D embraces the conjunctive management goals and objectives of the ESPA CAMP. Implementation of the ESPA CAMP will improve the opportunities to adaptively manage and optimize water supplies within and downstream of the ESPA, may result in: increased gains in some river reaches; improved storage carryover; increased aquifer levels; opportunities for municipal and industrial growth; reductions in overall consumptive use; increased spring discharge rates; and an ongoing public process for assessing the hydrologic, economic, and environmental issues related to the implementation of management strategies.

Most of the human made changes to the ESPA water balance during the past decades are reflected in current aquifer levels and spring flows. Continued changes in irrigation practices (e.g., conversion from gravity irrigation to sprinkler irrigation) and future climate variability, however, may create additional impacts to ESPA aquifer levels and aggregate spring discharge. Such impacts affect not only the ESPA area but also the Snake River downstream of the ESPA, because aggregate spring discharge from the Thousand Springs reach is the primary source of river flows in the Milner to Murphy reach during portions of some years.

To date, efforts to monitor and measure ESPA groundwater levels, diversion volumes, and river reach/gains have focused on the ESPA, individual springs discharging water from the ESPA, and reaches of the Snake River hydraulically-connected with the ESPA. Because of the importance of the ESPA discharge on downstream reaches of the Snake River, however, it is imperative that an enhanced spring-flow monitoring program be developed to provide the information necessary for identifying, tracking, and predicting future spring discharge trends. Such a monitoring program needs to include long-term measurements of aggregate annual spring discharge (as opposed to point-in-time discharge from individual springs) and ESPA ground water levels.

Sustaining Snake River minimum stream flows downstream of the ESPA may require short-term and long-term adaptive management measures. A monitoring program aimed at identifying long-term spring discharge trends in the Snake River Thousand Springs reach should be designed to support the development of one or more adaptive management "triggers" based on pre-determined observed or predicted change in aggregate spring discharge rate, aquifer levels, and/or Snake River flow. The triggers should be used to initiate adaptive management measures that address the cause – or impacts – of any unacceptable decline in Snake River flow downstream of the ESPA.

Monitoring efforts and adaptive management measures are crucial to sustaining the economic viability and social and environmental health of the ESPA and the Snake River. Successful adaptive management strategies, built on the principles of conjunctive management of ground and surface water, supported by scientific understanding and reliable data that take into account the complex and interrelated nature of Snake River subbasins, will accomplish two goals: 1) ensure an adequate and sustainable water supply for existing and future uses, and 2) reduce conflicts between ground and surface water users.

Implementation Strategies:

- Implement actions delineated in the ESPA CAMP that will enhance aquifer levels and spring flows.
- Continue existing efforts to measure and monitor ground and surface water diversions, water levels, spring discharge rates, and Snake River reach gains/losses, and quantify ground and surface water interactions.
- Develop and implement a monitoring program to better predict the occurrence and duration of future low flows in the Snake River.
- Create a working group to assist in the development of a spring monitoring program.
- Update the Snake River: Milner Dam to King Hill Part B State Water Plan to incorporate ESPA CAMP goals and objectives and to account for water management developments since its adoption.

Milestones:

- ESPA CAMP hydrologic conjunctive management targets met or exceeded.
- Snake River flows at the Murphy and Weiser Gages remain at or above established minimum stream flows.
- Reduced water-related conflict in the Snake River Basin.
- Revision of Part B of the State Water Plan.

4E - SNAKE RIVER BASIN NEW STORAGE

Development of new on-stream, off-stream, and aquifer storage is in the public interest; provided, however, applications for large surface storage projects in the Milner to Murphy reach of the Snake River should be required to mitigate for impacts on hydropower generation.

Discussion:

ESPA Managed Recharge Pilot program

Recharging aquifers as a water supply alternative has significant potential to address water supply needs, in addition to addressing conjunctive management issues. Pursuant to the ESPA CAMP, the Board is undertaking a five-year pilot program of managed aquifer recharge to the Eastern Snake Plain Aquifer. One of the potential benefits of managed recharge in the ESPA is increased water storage in the aquifer. Effectiveness monitoring and evaluation results will be used to select and design future managed recharge strategies and projects.

Surface Water Projects

New Snake River surface storage projects should be investigated and constructed if determined to be feasible. Although there are major dams and reservoirs designed for water storage, flow regulation, and flood control on the Snake River and its tributaries, their existing capacity is insufficient to provide the water supply and management flexibility needed for the myriad of existing and future beneficial uses.

Diversion of water from the main stem of the Snake River between Milner and the Murphy Gaging station for storage during the period November 1 to March 31 will have a significant impact on hydropower generation. Thus, any new storage projects in this reach should be coupled with provisions that mitigate for the impact of such storage depletions on hydropower generation. The term "mitigation" is defined as causing to become less harsh or hostile, and is used here rather than "compensate" which connotes equivalence. Methodology will be developed for use in calculating impacts on hydropower generation as part of any application to construct new storage within this reach of the Snake River.

A number of studies focusing on water storage as one potential measure for addressing water supply demand and flood risk reduction are underway. This section provides a brief description of the most significant studies that have been initiated or are in the planning process.

Henry's Fork Project/Teton River Basins

The Board and the U.S. Bureau of Reclamation are conducting a study of water resources in the Henry's Fork/Teton River Basins to develop alternatives for improving water supply conditions in the Eastern Snake Plain Aquifer and upper Snake River Basin. These alternatives include new water storage projects, enlargement of existing reservoirs, and conservation and water management strategies, including managed aquifer recharge and automated water delivery systems.

Minidoka Dam Enlargement

In the 1980s, the Bureau of Reclamation and irrigation districts initiated the required planning process and feasibility studies to replace the spillway and two canal headworks due to the state of deterioration and potential for ongoing damage to sections of the Minidoka Dam. In 2008, the Board partnered with the Bureau of Reclamation to also evaluate the structural raising of Minidoka Dam to accommodate a 5-foot rise in normal reservoir surface elevation, in conjunction with planned spillway repairs. The study found that a 5-foot rise is technically feasible, and would provide an additional 67,000 acre-feet of storage with an average annual yield of 33,000 acre-feet. Funding for the enlargement of Minidoka Dam, however, is currently not available. If economic or other conditions change, the Board will consider further evaluation of this storage option.

ESPA Managed Recharge Pilot program

Recharging aquifers as a water supply alternative has significant potential to address water supply needs, in addition to addressing conjunctive management issues. Pursuant to the ESPA CAMP, the Board is undertaking a five-year pilot program of managed aquifer recharge to the Eastern Snake Plain Aquifer. One of the potential benefits of managed recharge in the ESPA is increased water storage in the aquifer. Effectiveness monitoring and evaluation results will be used to select and design future managed recharge strategies and projects.

Lower Boise River Interim Feasibility Study

The lower Boise River corridor, from Lucky Peak Dam to its confluence with the Snake River has experienced rapid population growth and significant urban development over the past several decades. As a consequence, there is renewed interest in addressing water supply and flood control issues. Interest has also been expressed in environmental restoration, to include habitat preservation, aesthetics and recreation along the Boise River.

In 2009, the Board and the U.S. Army Corps of Engineers partnered to conduct an Interim Feasibility Study focused on water storage potential and flood reduction in the Boise River Basin. A preliminary analysis ranked an enlargement of Arrowrock Reservoir as the highest priority alternative, followed by the construction of a new reservoir at the Alexander Flat site and a new reservoir at the Twin Springs site. A preliminary analysis completed in 2011 concluded that based on existing information, raising Arrowrock Dam is technically feasible. The evaluation identified a number of uncertainties that will be addressed during future study and data collection efforts, as funding becomes available.

Weiser-Galloway Gap Analysis, Economic Evaluation and Risk-Based Cost Analysis (Gap Analysis)

Water storage on the Weiser River and at the Galloway site has been studied for decades. In 1954, the Corps received a study authorization resolution for the Galloway Project from the U.S. Senate Public Works Committee. In the early 1970s, federal lands for the potential Galloway dam and reservoir site were classified and withdrawn for hydropower purposes by the Federal Power Commission (now FERC). In 2008, Idaho House Joint Memorial 8 directed the Board to investigate water storage projects statewide, including the Weiser-Galloway Project. The Board and the Corps partnered to conduct a "Gap Analysis" which was completed in March 2011. The Gap Analysis was designed to inform decision makers of critical information gaps that need to be addressed before deciding whether to move forward with comprehensive new environmental, engineering, and economic feasibility studies. The analysis identified two critical information gaps that must be resolved before moving forward:

1. Determine the safety, suitability, and integrity of geologic structures at the potential dam and reservoir site.
2. Evaluate whether basin and system benefits would be realized by analyzing a series of system operating scenarios with a range of new storage options on the Weiser River. Potential benefits include flood risk reduction, hydropower, additional water storage, pump back, irrigation, recreation, and flow augmentation requirements for anadromous fish recovery. On July 29, 2011, the Idaho Water Resource Board authorized expenditure of up to $2 million to address these questions, and the required studies are currently underway.

Implementation Strategies:

- Implement a long-term managed aquifer recharge program to achieve an average annual recharge of 250,000 - 300,000 acre feet. In recognition that implementation of managed recharge will have an effect on the flow characteristics of the Snake River above and below Milner Dam and in order to confirm the relative merits of managed recharge, the Board's managed recharge program will be limited to not more than 175,000 acre-feet on an average annual basis until January 1, 2019.
- Evaluate the economic, social and environmental benefits and costs of the proposed surface projects.

Milestones:

- Aquifer recharge program implemented.
- Actions taken to determine feasibility of identified storage projects.

4F - SNAKE RIVER BASIN AGRICULTURE

Development of supplemental water supplies to sustain existing agricultural development is in the public interest.

Discussion:

Agricultural use accounts for about 85% of the total diversions of the water of the Snake River Basin. Approximately 3.4 million acres of land are irrigated with surface water and

1.13 million acres of land are irrigated with ground water. As discussed more fully in Policy 4B, it has been the policy of the State since the adoption of the first state water plan to encourage the development of on-stream and off-stream storage above Milner Dam to capture unappropriated flows to the extent economically feasible for existing and future agricultural development and other beneficial uses in the Snake River Basin above the Dam.

As a result of the Swan Falls Settlement, the flow of the Snake River between Milner Dam and the Murphy Gage in excess of the Murphy minimum stream flow is available for future agricultural and DCMI development. As discussed in Policy 4C, however, the opportunity for additional agricultural development of the waters of the Snake River and surface and ground water tributary to the Snake River between Milner Dam and the Murphy Gage is limited because of the conflicts over conjunctive management of Thousand Springs flows and a moratorium on the issuance of new permits within this reach of the Snake River issued on April 30, 1993.

In summary, agricultural development for the foreseeable future is likely to be limited because of the absence of a reliable water supply. To the extent new agricultural development occurs, it is likely to be located on streams tributary to the main stem Snake River. Appropriation of water for agriculture likely will be for a supplemental water supply to address existing water shortages.

Implementation Strategies:

- Identify and develop opportunities to acquire water to address existing agricultural water supply shortages.
- Encourage the more efficient use of existing water supplies where such action will provide water to address existing agricultural water supply shortages.

Milestones:

- Existing water supply maintained.
- Supplemental water supply developed.
- Enrollment of agricultural lands into Conservation Reserve Enhancement Program (CREP).
- Implementation of water conservation projects that reduce demand.
- Acres in agricultural production maintained.

4G - SNAKE RIVER DOMESTIC, COMMERCIAL, MUNICIPAL AND INDUSTRIAL USES (DCMI)

It is in the public interest to ensure the availability of water for future DCMI uses in the Snake River Basin.

Discussion:

While most DCMI water uses are largely nonconsumptive, future growth in Idaho's population and commercial and industrial expansion require a sustainable water supply.

Snake River Above the Murphy Gage

As discussed in Policy 4C, the flow of the Snake River between Milner Dam and the Murphy Gage is approaching the Murphy minimum flow of 3,900 cfs at certain times in low flow years. Implementation of the strategies in Policy 4D is essential to identifying the amount of trust water available to meet future DCMI uses in this reach of the Snake River.

Snake River Below the Murphy Gage

DCMI demands on the Snake River downstream of the Boise River drainage are anticipated to grow at a slow to moderate rate but the increased demands are not as pressing as in the lower Boise River area.

Boise River Basin

As discussed in Policy 4E, the lower Boise River area has experienced rapid population growth over the past several decades with land-use changing from agriculture to urban use. Water supply for DCMI uses is forecasted to be one of the most pressing water supply issues in this area. Additional DCMI demands are particularly pressing upstream of Star located on the Boise River.

The principle source of water for DCMI in the Boise River Basin is ground water, however, there is unappropriated water during the spring runoff that could be captured and stored. Thus, while increased demand for DCMI use may be partially met by water conservation and some decrease in or conversion from agricultural production, additional strategies, such as aquifer and surface water storage, efficient water marketing systems, and water re-use must be evaluated. Because the Treasure Valley water system is a complex system of ground and surface water, further studies are underway to determine the contribution of surface water to aquifer recharge and the importance of aquifer discharge to surface water systems.

Implementation Strategies:

- Maintain existing surface irrigation distribution system and establish dual-use residential systems to preserve incidental recharge to aquifers.
- Develop flexible water marketing tools to facilitate rental and/or acquisition of water rights for new uses on a willing buyer/willing seller basis. Water acquisition strategies, however, must account for any adverse hydrologic, economic, and social impacts.
- Evaluate opportunities to enhance water supplies including but not limited to, ground water conservation, additional storage, and water re-use.
- Support programs that protect water quality for DCMI use.

Milestones:

- Completion of water supply enhancement projects.
- Infrastructure in place to distribute surface irrigation water to lands undergoing conversion from agricultural to residential.

4H - SNAKE RIVER HYDROPOWER USE

Hydropower generation is a beneficial use of the flow of the Snake River, and it is in the public interest to protect the minimum average daily flows set forth in Policy 4A as a base flow for hydropower use.

Discussion:

The Snake River and related tributaries provide Idaho with significant hydropower energy resources. Hydropower generation is a beneficial use of the waters of the Snake River, supplying approximately 65% of the State's energy production and ensuring that Idaho electric rates are among the lowest in the nation. Through enactment of Idaho Code § 42-203B the State established the framework for balancing the use of the flow of the Snake River for hydropower and other instream purposes and the diversion of flow for depletionary uses.

As discussed in Policy 4C, the Swan Falls Settlement recognized the Snake River minimum stream flows set forth in Policy 4A provide an adequate base flow for hydropower use. While hydropower water rights in excess of the Murphy minimum average daily flow are subject to subordination to future consumptive uses approved in accordance with state law, the Swan Falls Settlement allows Idaho Power Company to use up to the decreed amount of the hydropower water rights held in trust by the State of Idaho for power generation pending reallocation of such flows for future consumptive uses.

The HCC, which represents the majority of Idaho Power's hydropower generation capacity, is the largest privately owned hydroelectric project in the United States. The FERC license for the HCC expired in 2005, and Idaho Power is currently operating the project under annual licenses while FERC processes Idaho Power's pending relicense application. The new license for the HCC will determine the operating conditions for the project and address the protection and enhancement of recreational, aesthetic, navigation, and fish and wildlife resources in the reach of the Snake River affected by the project. The Board is participating in the FERC licensing proceeding to ensure the new license for the HCC includes operational conditions that preserve and enhance the generation capacity of the project in a manner consistent with the State Water Plan.

Implementation Strategies:

- Develop technical tools capable of assessing the impact of actions within the Snake River hydrologic system on the minimum stream flows of the Snake River.

- Evaluate management and administrative activities to determine the intended and unintended consequences of meeting the minimum stream flows on the Snake River.

Milestones:

- Minimum flows are maintained for power generation.

4I - SNAKE RIVER NAVIGATION

The minimum stream flows set forth in Policy 4A are sufficient for commercial and recreational navigation on the Snake River.

Discussion:

Above Milner Dam the flow of the Snake River is completely regulated; therefore, no base flow for navigation is proposed for this reach of the Snake River. The Murphy and Weiser minimum stream flows set forth in Policy 4A provide a sufficient base flow for recreational and commercial navigation in the Snake River between Milner Dam and the Hells Canyon Dam.

Below HCC, the Snake River flows into a steep and spectacular gorge that cuts through the Salmon River Mountains and Blue Mountains of Idaho and Oregon. Hells Canyon is one of the most rugged and treacherous portions of the Snake River. The river flows 8,000 feet below the He Devil Peak of Idaho's Seven Devils Mountains. The Salmon River is a major tributary in this reach of the Snake River.

The Hells Canyon reach of the Snake River below the HCC provides unique recreational opportunities, including rafting, fishing, private and commercial jet boating, hiking, camping, and wildlife viewing. The area is a tourist destination that positively contributes to the local and regional economy. As such, providing adequate navigation conditions for private and commercial boating below the HCC is in the public interest.

Photo: Rafting on the Snake River in Hells Canyon
(Photo Courtesy of IDWR Staff)

The license issued by the Federal Power Commission for the HCC in 1955 addressed navigational flows below the HCC. Article 43 of the power HCC license provides that:

> *The project shall be operated in the interest of navigation to maintain 13,000 cfs flow in the Snake River at Lime Point (river mile 172) a minimum of 95 percent of the time, when determined by the Chief of Engineers to be necessary for navigation. Regulated flows of less than 13,000 cfs will be limited to the months of July, August, and September, during which time operation of the project would be in the best interest of power and navigation, as mutually agreed to by the Licensee and the Corps of Engineers. The minimum flow during periods of low flow or normal minimum plant operations will be 5,000 cfs at Johnson's Bar, at which point the maximum variation in river stage will not exceed one foot per hour. These conditions will be subject to review from time to time as requested by either party . . . .*

This license article has governed navigation flows since the original licensing of the HCC in 1955.

In the 1976 State Water Plan, the Board concluded that there was sufficient water in excess of the minimum flows established at the Milner, Murphy, and Weiser gaging stations to provide for additional uses and development and also allow for the navigation flow targets in Article 43 of the HCC license to be met without significantly affecting hydropower production. Based upon these conclusions, the 1976 State Water Plan found providing flows consistent with Article 43 was in the public interest. The 1976 Plan, however, did not establish minimum stream flows at Johnson Bar or Lime Point.

In 1978, the Idaho Legislature, through enactment of Idaho Code § 42-1736A, created a minimum stream flow at Johnson Bar to provide for "stream flows and hydro-power base" below the HCC. Through the adoption of the 1986 Idaho State Water Plan a minimum stream flow was established at Lime Point. Both minimum stream flows were recognized as providing a sufficient base flow for recreational and commercial navigation below the HCC. Consistent with the HCC FERC license, the Johnson Bar and Lime Point minimum stream flows, however, are subordinated to upstream consumptive uses above the HCC and carry no right to seek the release of water from the HCC other than that required to be released by the terms of the FERC license.

As discussed in Policy 4F, FERC is in the process of relicensing the HCC. Various state and federal agencies exercise jurisdiction over resources in Hells Canyon and each of these agencies, together with private interests are parties to the HCC relicensing proceedings pending before FERC. Section 10(a)(1) of the Federal Power Act requires that a FERC licensed project "be best adapted to a comprehensive plan for improving and developing a waterway"; which requires a balancing of public interest factors. The FERC will set forth navigational flow conditions in the final license for the HCC. The Board will participate in the FERC relicensing process to ensure navigational flow conditions are consistent with the State Water Plan.

Implementation Strategies:

- Participate with state and federal agencies in FERC relicensing proceedings to ensure the new FERC license for the HCC is consistent with the State Water Plan.

Milestones:

- When issued, FERC license consistent to Idaho State Water Plan.

4J - SNAKE RIVER FISH, WILDLIFE, RECREATION, AND SCENIC RESOURCES

The minimum stream flows set forth in Policy 4A provide adequate flows for Snake River fish, wildlife, recreation, and scenic values in the main stem Snake River below Milner Dam. Protection for fish, wildlife, recreation, and scenic uses in tributaries to the Snake River should be addressed through Part B of the State Water Plan and the establishment of minimum stream flows pursuant to Chapter 15, Title 42, Idaho Code. The Board finds that implementation of the collaborative agreements provide benefits for fish, wildlife, recreation, and scenic values.

Discussion:

In addition to the Policy 4A main stem Snake River minimum stream flows, over fifty minimum stream flows have been established in the Snake River Basin above the HCC and protected rivers have been designated through the adoption of Part B state water plans. Additional protections for fish, wildlife, recreation, and scenic resources in Snake River tributary streams should be pursued through the Board's minimum stream flow and water planning processes.

The State has entered into a number of voluntary agreements that benefit fish, wildlife, recreation, and scenic values while protecting existing water rights and uses and providing for economic stability. The agreements described below.

Snake River Flow Augmentation

The State of Idaho, as part of the 2004 Snake River Water Rights Agreement, established a flow augmentation program that provides water for salmon and steelhead listed under the ESA. Pursuant to the provisions of the biological opinion for the Federal Columbia River Power System ("FCRPS"), and the 2004 Snake River Water Rights Agreement, the U.S. Bureau of Reclamation annually seeks to rent up to 487,000 acre-feet of water from willing lessors in Idaho for Snake River flow augmentation to assist in offsetting the impact of the FCRPS. Although flow augmentation from the upper Snake River has proven to be controversial because of the uncertainty regarding specific benefits to ESA-listed fish, the State of Idaho cooperates with the federal program (see Idaho Code § 42-1763B) as a means of providing incidental take coverage for U.S. Bureau of Reclamation project operations in Idaho.

This flow augmentation program consists of two tiers. Tier 1 minimum flows are those established through implementation of the Swan Falls Settlement. Tier 2 provides for the rental of up to 427,000 acre feet of storage water in accordance with the provisions of Idaho Code § 42-1736B and the Snake River flow component of the 2004 Snake River Water Rights Agreement. The 2004 Snake River Water Rights Agreement also allows for the United States to rent up to 60,000 acre feet of consumptive natural flow water rights through the Board's water bank in accordance with state law. The Board acquired the natural flow water rights of the Bell Rapid's irrigation project and is leasing a portion of those water rights to the U.S. Bureau of Reclamation to provide the 60,000 acre feet of natural flow water. The rental agreement provides that "protection of the Leased Water . . . will result in the protection of 48,320 acre-feet during the period of April 10 through August 31 of each year for the term of the Agreement."

The state agreed to the implementation of the flow augmentation program for the term of the Biological Opinion as a means of protecting existing water rights and uses and providing for economic stability. It is important, however, that evaluation of the efficacy of flow augmentation be conducted in conjunction and/or cooperation with other State and Federal agencies and regional interests.

Hells Canyon National Recreation Area

The early controversy over the development of Hells Canyon gave rise to emerging concerns about the preservation of the region's natural features and ultimately led to enactment of the Hells Canyon National Recreation Area Act of 1975, which precluded future hydropower development in the Hells Canyon reach of the Snake River. The Act also designated the Snake River as "wild" (Hells Canyon Dam to Pittsburg Landing) and "scenic" (Pittsburg Landing to 37 miles south of Lewiston) to preserve the free-flowing character and unique environment while providing for continued public use. While providing protection to these important resources, the Act also protects present and future uses of the waters of the Snake River for consumptive or non-consumptive beneficial uses, including domestic, municipal, stock water, irrigation, mining, power, and industrial uses. The Act specifically provides that no flow requirements of any kind may be imposed on the waters of the Snake River below Hells Canyon Dam under the provisions of the Act, or any rules, regulations, or guidelines adopted pursuant to the Act. Pursuant to an agreement between the state and the federal government, the United States' federal reserved water rights associated with the HCNRA are limited to the tributary streams of the Snake River within the HCNRA. The decrees quantifying the federal reserved water rights on streams tributary to the main stem Snake River contain subordination provisions that protect existing rights and allow for a limited amount of future development on the tributary streams.

Owyhee Initiative

In 2009, Congress enacted the Owyhee Public Land Management Act, Pub. L. 111-11, 123 Stat. 1037. This Act set aside certain lands in southwestern Idaho as wilderness. The Act was the result of a collaborative effort initiated by the Owyhee County Commissioners to resolve decades-old land management issues in Owyhee County. The goal was to develop and implement a landscape-scale program that preserves the natural character of the area while providing for economic stability and growth. Central to local support for enactment of the Act was the 2006 Owyhee Initiative Water Rights Agreement, which provided for a balance between instream and out-of-stream water uses within the Owyhee River Basin. The 2006 Agreement recognizes the ecological importance of stream and river flows in this arid region and recognizes local citizens' desire to maintain and protect their current way and quality of life. The 2006 Agreement calls for memorializing this balance through subordination language in the decreed federal reserved water rights for the designation of river segments that sets aside a certain amount of water for future development. The Agreement was signed by a local collaborative group that included ranchers, conservationists, landowners, business interests, outfitters, and off-road recreationists. Implementation of this water rights agreement will provide additional fish and wildlife benefits for the Owyhee River Basin.

Implementation Strategies:

- Maintain existing minimum stream flows and evaluate the need for additional minimum stream flows.
- Ensure the flow augmentation plan of the 2004 Snake River Water Rights Agreement is implemented consistent with the Agreement.
- In conjunction and/or cooperation with other state and federal agencies and regional interests, evaluate the efficacy of the flow augmentation program.
- Ensure the federal reserved water rights decreed as part of the implementation of the Owyhee Public Land Management Act contain subordination provisions consistent with the 2006 Owyhee Initiative Water Rights Agreement.
- Ensure new appropriations of water are consistent with the subordination provisions of the reserved water rights for the HCNRA and the Owyhee wild and scenic rivers.

Milestones:

- Minimum stream flows maintained and new minimum stream flows are established as needed.
- Snake River flow augmentation is conducted in accordance with the terms of the 2004 Snake River Water Rights Agreement.
- Flow augmentation evaluation studies underway or completed.
- Federal reserved water rights decreed for Owyhee wild and scenic rivers contain subordination provisions consistent with the 2006 Owyhee Water Rights Agreement.
- New appropriations of water in the streams tributary to the Snake River within the Hells Canyon National Recreation Area satisfy the subordination requirements contained in the federal reserved water right decrees.
- New appropriations within the Owyhee River Basin satisfy the subordination requirements contained in the federal reserved water right decrees for the Owyhee wild and scenic river reaches.

5. BEAR RIVER BASIN

5A - BEAR RIVER COMPACT IN THE BEAR RIVER BASIN

Water use and management in the Bear River Basin shall conform to the allocations agreed to in the Bear River Compact.

Discussion:

The original Bear River Compact was signed into law on March 17, 1958, and amended on February 8, 1980. Idaho Code § 42-3402. The Compact was negotiated to provide for the efficient use of water for multiple purposes, to permit additional development, to promote interstate comity, and to accomplish the equitable apportionment of the waters of the Bear River among Idaho, Utah, and Wyoming. Water allocations for the Bear River Basin were adopted in 1978. The Compact is administered by an interstate administrative agency, the Bear River Commission, which is comprised of three members from each state and a non-voting federal chairman. The Bear River Commission must review the Compact at intervals of not more than twenty years and may propose amendments.

The Compact divides the Bear River into three divisions and treats allocation differently in each. The Upper Division of the river extends from its source in the Uinta Mountains, to and including Pixley Dam Wyoming. The Central Division includes the portion of the Bear River from Pixley Dam to, and including Stewart Dam. The Lower Division of the Bear River includes the flow from Stewart Dam to the Great Salt Lake and encompasses Bear Lake and its tributary drainage. The Compact makes allocations for the diversions of surface water, the storage of water above Bear Lake, ground water depletion, and future development. The allocation provisions for the three divisions of the Bear River apply only during times of shortage.

Idaho and Utah are implementing conjunctive management of surface and ground water. Idaho's Bear River Conjunctive Management Plan guides the development of ground water in the Bear River Ground Water Management Area. Although initial estimates of ground water depletions in the Lower Division indicate equal depletions in Idaho and Utah, the Idaho Water Resource Board encourages the Bear River Commission to prioritize additional studies to determine the effects of ground water use on the Bear River system.

Implementation Strategies:

- Encourage and assist the Bear River Commission to initiate further study and consideration of the effects of ground water use on Bear River surface flow.
- Ongoing review of Bear River Compact implementation and related issues, including depletion calculation procedures.

Milestones:

- Studies completed on the interaction between ground water and surface water in the Bear River Basin.

5B - BEAR RIVER BASIN WATER MANAGEMENT IN THE BEAR RIVER BASIN

The Idaho Water Resource Board supports enhancing water supplies, increasing water use efficiency, and implementing water supply bank mechanisms to help meet future water needs in the Bear River Basin.

Discussion:

The Bear River Compact designates how the undeveloped water supplies of the Bear River are to be allocated among Idaho, Utah, and Wyoming. The Compact allocates a first right to development and depletion of water not currently allocated in the Lower Division to Idaho, in the amount of 125,000 acre feet. In addition to the efficient use of existing developed water supplies, the state should move forward with the development of Idaho's depletion allocations as provided for in the Compact.

Ground water is available for development, but its development cannot injure existing senior water rights. In 2001, the Department established the Bear River Ground Water Management Area and created an advisory committee to provide guidance in the preparation of a ground water management plan. The Bear River Ground Water Management Plan, adopted in 2003, provides for managing the effects of ground water withdrawals to accommodate projected growth and water demand in the Bear River Basin, while protecting senior priority surface and ground water rights from injury. In addition to the use of mitigation plans that protect existing rights, the plan encourages flexible strategies for making water available for new development including new surface storage, ground water recharge projects, and transfers of existing rights through water banking and other marketing mechanisms. The ground water management plan encourages the wise use of available water supplies and continues the involvement of a local advisory committee in the development of management policies for the area. To address declining ground water levels, the Bear River Basin has been designated as a priority basin for the development and implementation of a comprehensive aquifer management plan.

Idaho Code § 42-1765 authorizes the Idaho Water Resource Board to create a local rental pool to facilitate marketing of stored water. A Bear River rental pool would provide the advantage of being locally managed and controlled, with the flexibility to develop specific procedures designed to address special conditions existing in the basin. Use of water supply banks also provides protection from forfeiture for unused water rights in Idaho and a source of funding for improving water management. Cooperation between Idaho, Utah, and PacifiCorp will be required to establish a storage rental pool for Bear Lake.

Implementation Strategies:

- Initiate further discussion concerning the development of a Bear River storage water rental pool with the Bear River Commission, Utah, and PacifiCorp.
- Develop strategies to improve water supplies and reduce demand through the implementation of a CAMP, in coordination with Utah, Wyoming, and PacifiCorp.

Milestones:

- Bear River Basin comprehensive aquifer management planning underway.
- Strategies developed to meet future water needs.
- Local storage rental pool established.
- Development of Idaho's depletion allocation.

5C - INTERSTATE WATER DELIVERY IN THE BEAR RIVER BASIN

Idaho water users in the Lower Division of the Bear River Basin must be protected from inequitable water allocation in the event of a water emergency and the scheduling of interstate water deliveries.

Discussion:

The Bear River Compact authorizes the Bear River Commission to implement a water delivery schedule in the Lower Division without regard to state boundaries if the Bear River Commission finds that a "water emergency" exists. Idaho Code § 42-3402. This provision was intended to apply only to true emergency conditions which must be determined using comprehensive accounting processes. Idaho and Utah have developed separate, but similar water accounting models that incorporate the rights identified in the Commission Approved Lower Division Water Delivery Schedule. Absent a water emergency, Idaho water users are not required to accept delivery based upon interstate accounting allocation. Both states, however, have worked to reconcile their respective accounting models to reduce conflict over water delivery.

The "Bear Lake Settlement Agreement" was signed and voluntarily adopted by Lower Division water users and PacifiCorp in 1995 and amended in 2004. The agreement established, among other things, an "Irrigation Water Allocation and Lake Recovery Proposal" for Bear Lake. The proposal provides for an "Annual Allocation" which represents the total, estimated quantity of water available to be delivered to storage contract holders. This agreement and the state water accounting models have resulted in a process by which Lower Division water users have voluntarily agreed to water delivery by water right priority without regard to state boundaries.

Implementation Strategies:

- Continue work with Utah and Lower Division water users to improve water right accounting models.

- Facilitate and promote improved water delivery and measurement, including gage and diversion automation.

Milestones:

- Continued cooperation in interstate water administration.
- Completion of technical upgrades to water delivery and measurement infrastructure.

5D - BEAR LAKE IN THE BEAR RIVER BASIN

The outstanding recreational, aesthetic, and fish and wildlife resource values of Bear Lake should be preserved, while recognizing the existing storage allocations for irrigation and hydroelectric power generation.

Discussion:

Bear Lake, noted for its unique coloration and endemic fish species, provides an abundance of recreational opportunities. To protect these values, the Idaho Water Resource Board obtained a minimum lake level water right for Bear Lake of 5902 feet.

The 2004 Amended and Restated Bear Lake Settlement Agreement between PacifiCorp and several water users and private interests confirmed that Bear Lake must be operated primarily as a storage reservoir to satisfy contracts for existing irrigation uses and flood control needs in the three states, with the use of water for hydropower generation being incidental to other purposes. Bear Lake storage is allocated based on lake elevation with reduced allocations occurring when Bear Lake falls below the irrigation reserve of 5914.7 feet. The settlement agreement also provides for a portion of the active storage in Bear Lake to be voluntarily retained to enhance recreation and water quality values.

Pursuant to the 2002 Settlement Agreement Resolving the Relicensing of the Bear River Hydroelectric Projects and the FERC licenses issued for PacifiCorp's Bear River projects, protection, mitigation, and enhancement measures are being implemented to benefit fish and wildlife and recreational resources in the Bear River Basin. The settlement agreement established a committee to guide implementation of these measures, with a primary focus on protecting and improving habitat for Bonneville Cutthroat Trout. The settlement agreement confirms that PacifiCorp's ability to regulate Bear Lake reservoir levels and provide instream flows at the projects for these purposes is restricted by and subject to historic practices, water rights, and flood control responsibilities that are memorialized in water contracts, water agreements, and judicial decrees and opinions.

The Bear River Compact provides for cooperation with state and federal agencies in matters relating to water pollution of interstate significance. The Idaho Water Resource Board supports the Bear River Commission's efforts to develop opportunities for more integrated watershed management throughout the basin.

Implementation Strategies:

- Cooperate with the Bear River Commission to address interstate issues of concern related to Bear Lake, including water quality, threatened or endangered species and species of special concern, and recreation.

Milestones:

- Bear Lake operations are consistent with 2004 Bear Lake Settlement Agreement.
- Cooperative programs addressing interstate issues of concern related to water quality, recreation, and sensitive species implemented.

Photo: Last Chance Canal over the Bear River *(Photo Courtesy of Liz Cresto)*

6. SALMON/CLEARWATER RIVER BASINS

6A - CONSERVATION PLANS IN THE SALMON/CLEARWATER RIVER BASINS

Voluntary, community-based conservation plans and strategies for the benefit of ESA-listed species and other species of concern are key components of water planning and management in the Salmon and Clearwater River Basins.

Discussion:

The Salmon and Clearwater River basins support a thriving agricultural industry and significant tourism. Because a number of fish species in the Salmon and Clearwater River basins have been listed as threatened or endangered under the ESA, numerous programs are being implemented to improve fish habitat, while protecting existing water rights. A significant portion of freshwater habitat important to ESA-listed fish is located on private lands. As a consequence, local support is key to implementing conservation measures that advance species' recovery. Federal agencies are encouraged to cooperate with state and local landowners to develop voluntary, incentive-based conservation plans. Any water required for instream uses must be obtained in compliance with state law.

In the Snake River Basin Adjudication, the state entered into two agreements that provide for water management within the basin that supports agricultural-based communities, while encouraging the voluntary implementation of flow-related conservation measures that improve instream conditions for ESA-listed fish. The agreements are based upon improving instream flow conditions pursuant to state law.

- **2004 Snake River Water Rights Agreement**

The 2004 Snake River Water Rights Agreement resolved all of the issues related to the Nez Perce Tribe's water right claims in the SRBA. In the Salmon and Clearwater basins, the primary goal of the settlement agreement provisions is to conserve and enhance fish habitat in order to address ESA concerns. There are three cornerstones to such efforts: the establishment of state minimum flows, the establishment of a voluntary forestry program with standards to improve fish habitat, and the establishment of voluntary programs by irrigators and other water users to improve instream flow.

The state and local water users are working with the federal agencies, tribes, and other stakeholders to advance the recovery of listed species through the development of conservation agreements under Section 6 of the ESA. In coordination with the OSC, the state has begun early implementation of voluntary conservation measures that provide immediate benefits to ESA-listed fish and provide the foundation for implementation of long-range plans.

As a result of the 2004 Snake River Water Rights Agreement, the Idaho Water Resource Board holds minimum stream flow water rights on 205 streams that provide significant protection for steelhead, salmon, and bull trout. Most of the streams flow through federal public lands and have minimal use. Twenty-four streams, however, are in basins with substantial private ownership and significant private water use. The flows for those streams were established after consultation with local communities. Where the minimum stream flow water rights are higher than existing flows, the Idaho Water Resource Board works with water users on a voluntary basis to rent or otherwise acquire water to return to streams, in accordance with state law.

- **Wild and Scenic Rivers Agreement**

The Wild and Scenic Rivers Agreement resolved issues related to federal reserved water right claims filed by the federal government under the Wild and Scenic Rivers Act. The agreement provides for the quantification of the wild and scenic federal reserved water rights and state administration of those rights. To protect existing rights and allow for some future development, the United States agreed to subordinate the federal rights to certain existing and future water right uses.

Implementation Strategies

- Ensure that the water right application review process considers basin conservation plans and limiting factors for ESA-listed fish.
- Ensure that the stream channel alteration permit process considers basin conservation plans and limiting factors for ESA-listed fish.
- Develop flow-limited reach GIS maps for use in water administration.
- Continue early implementation of conservation measures.
- Develop and implement conservation projects and plans based on local problem-solving and support.

Milestones

- Conservation measures implemented.
- Conservation plans approved pursuant to Section 6 of the ESA and implemented.
- Approved water right transfers address limiting factors for ESA-listed fish.
- Water right permits address limiting factors for ESA-listed fish.
- Flow-limited reach GIS maps completed and in use.

6B - INSTREAM FLOW PROGRAM IN THE SALMON/CLEARWATER RIVER BASINS

The Idaho Water Resource Board will promote, provide, and where possible, expand opportunities for voluntary, market-based transactions to improve instream flow for the benefit of ESA-listed aquatic species.

Discussion:

The Idaho Water Resource Board administers and participates in a variety of programs to improve instream flows throughout the Salmon and Clearwater River basins. This programmatic approach to addressing the needs of ESA-listed and other sensitive species includes a suite of water supply acquisition tools including short and long-term leases, permanent purchases, partial season leases, diversion reduction agreements, and water use efficiency measures, all of which are market-based and voluntary. The Board works collaboratively with organizations committed to voluntary, market-based conservation strategies, such as conservation easements, to maximize instream flow programs. These partnerships benefit targeted fish species and support local economies.

- **Columbia Basin Water Transaction Program**

The Columbia Basin Water Transactions Program was initiated in 2002 to support innovative, voluntary, grassroots strategies to improve flows in the Columbia River Basin's streams and rivers. The majority of funding is provided by the Bonneville Power Administration in cooperation with the Northwest Power and Conservation Council. Continued implementation of the Columbia Basin Water Transactions Program in the Salmon and Clearwater basins will keep agriculture productive and improve instream flows for ESA-listed and other sensitive fish species.

- **Section 6 Conservation Fund**

Section 6 of the ESA directs "that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species." 16 U.S.C.A. § 1531(C)(2). Pursuant to the 2004 Snake River Water Rights Agreement of 2004, in addition to the establishment of minimum stream flow water rights, the state agreed to work with local stakeholders and communities to develop work plans for addressing limiting factors for fish on streams with degraded habitat. The state also agreed to develop cooperative agreements under Section 6 of the ESA with the assistance of local land owners, federal agencies, and tribes to establish long-term conservation goals and conservation measures that will contribute to the recovery of anadromous and resident fish in the Upper Salmon River Basin. The Board's instream flow programs are central to the development and implementation of Section 6 Conservation Plans.

- **Pacific Coast Salmon Restoration Fund**

The Pacific Coast Salmon Restoration Fund provides grants to state agencies and treaty Indian tribes for salmon recovery efforts. The Idaho Water Resource Board works with agencies, tribes, and stakeholders to use Pacific Coast Salmon Restoration Fund monies for early implementation of conservation measures in the basins.

- **2008 Columbia Basin Fish Accords**

The Columbia Basin Fish Accords are designed to supplement biological opinions for listed salmon and steelhead and the Northwest Power and Conservation Council's fish and wildlife program. The agreement between the state of Idaho, the Bonneville Power Administration, the USACE, and the USBOR addresses issues associated with the direct and indirect effects of construction, inundation, operation and maintenance of the Federal

Columbia River Power System, and USBOR's Upper Snake River Project on the fish and wildlife resources in the Columbia River Basin.

Under the agreement, the Bonneville Power Administration committed to funding a suite of habitat quality improvement projects designed to address limiting factors within the basins affecting ESA-listed salmon and steelhead. The Idaho Water Resource Board uses these funds to develop projects that improve instream flow and freshwater survival of ESA-listed salmon and steelhead. The program targets flow-related projects that reconnect tributaries and increase flow in the mainstem Lemhi and Pashimeroi rivers to improve fish passage conditions and increase the quantity and quality of fish habitat.

Implementation Strategies:

- Continue implementation of programs to improve instream flows in the Salmon and Clearwater River basins.
- Pursue opportunities for partnerships with local water users and other stakeholders to implement programs that improve instream flows and support local economies.

Milestones:

- Number and scope of instream flow improvement projects implemented.
- Number of participants in instream flow improvement projects.
- Degree of habitat improvement resulting from instream flow programs.

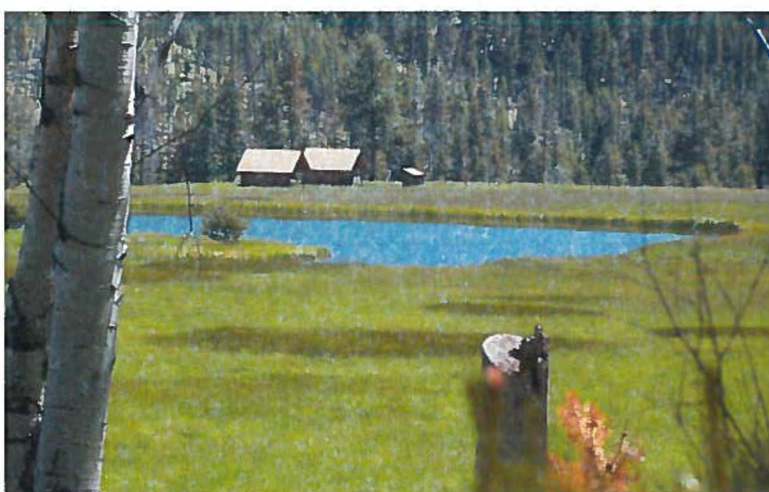


Photo: Scenic Central Idaho near Salmon *(Photo Courtesy of Shari Ferree)*

7. PANHANDLE RIVER BASINS

7A - INTERSTATE AQUIFERS IN THE PANHANDLE RIVER BASINS

Completion of comprehensive aquifer management plans and the Northern Idaho Adjudication and implementation of interstate agreements are central to the optimum use of the Panhandle Basin's water resources.

Discussion:

The Panhandle's rivers and lakes are key to continued economic development and provide for multiple uses of water including irrigation, domestic supplies, mining, and commercial uses. These lakes and rivers also provide significant recreation, fish and wildlife, and aesthetic resources important for the region's economy. In average water years, Idaho's Panhandle region has a stable water supply. A growing population and the urbanization of agricultural lands, however, have resulted in increased ground water use which has resulted in conflicts over water quantity and quality within the region and across state boundaries.

- **Spokane Valley-Rathdrum Prairie Aquifer**

The Rathdrum Prairie Aquifer ("RPA") extends south from Bonner County through Kootenai County toward the cities of Coeur d'Alene and Post Falls and west to the Idaho-Washington state line. The aquifer extends into Washington and becomes part of the larger Spokane Valley-Rathdrum Prairie ("SVRP") Aquifer. The area includes the rapidly growing cities of Spokane, Washington and Coeur d'Alene and Post Falls, Idaho. The SVRP Aquifer was designated a "Sole Source Aquifer" by the U.S. Environmental Protection Agency in 1978 and a sensitive source aquifer by the state of Idaho.

In 2002, the Director of the Department, pursuant to Idaho Code § 42-233b, designated the Rathdrum Prairie Ground Water Management Area and created the Rathdrum Prairie Ground Water Management Area Advisory Committee, composed of members representing the interests of citizen groups, municipalities, counties, and other irrigation, commercial, and industrial water users within the designated area. On September 15, 2005, the Director issued a final order adopting the Ground Water Management Plan for the Rathdrum Prairie Ground Water Management Area. The plan, based in large part on the recommendations of the advisory committee, sets forth goals, strategies, and actions for managing the ground water resources of the SVRP Aquifer. Goals include obtaining adequate technical data and quantification of water availability and water use, managing the ground water resource efficiently and fairly for all users, and encouraging planning and water conservation efforts.

Although the states of Idaho and Washington have primary responsibility for water allocation and water quality, local governments are increasingly being called upon to consider water supply and water quality implications in land use planning. To address these challenges, a study of the SVRP Aquifer was conducted jointly by the Department, the Washington State Department of Ecology, and the United States Geological Service. Begun in 2003 with broad community support, the purpose of the project is to provide a scientific foundation to assist the states in water administration. The SVRP Aquifer study established a collaborative modeling committee of experts from both states. Significant new information from the study refined earlier estimates of hydrologic information. The data, computer model, water budget, and other information are available to the public and provide a detailed, up-to-date basis for assessing all aspects of ground water use, including water development, establishing well head protection zones, and local and regional land use planning. A 2007 agreement between the Department and the Washington State Department of Ecology establishes a collaborative framework to maintain and enhance the model to inform state management decisions.

Pursuant to Idaho Code § 42-1779, which established the Statewide Comprehensive Aquifer Planning and Management Program, a comprehensive aquifer management plan was adopted on July 29, 2011 for the Rathdrum Prairie Aquifer by the Idaho Water Resource Board. The Board will be responsible for implementing the plan to obtain sustainable water supplies and optimum use of the region's water resources.

- **Palouse Basin Aquifers**

The development of a CAMP for the Palouse Basin is also a priority. The Grande Ronde and Wanapum aquifers underlie the Palouse Basin. The Pullman-Moscow area of eastern Washington and northern Idaho relies almost entirely on ground water for its supply of municipal, institutional, and domestic water. The Palouse Basin Aquifer Committee consists of representatives from the cities of Moscow, Pullman, Colfax, Latah, and Whitman counties, the University of Idaho and Washington State University and was formed to address concerns about declining ground water levels and coordinate studies to further inform water management decisions. In 1992, with the assistance of the states and pursuant to several intergovernmental agreements, a Pullman-Moscow Ground Water Management Plan was completed. The plan provides technical information about the general response of the Wanapum and Grande Ronde aquifers to pumping withdrawals and recommendations for future use that limit ground water depletion and protect water quality through conservation practices and other measures. Additional studies are needed to better understand the hydrology of the aquifers.

Managing cross-boundary conflicts requires an accounting of the state's water resources. Adjudication of water rights in the Panhandle region should therefore be completed to fully define and quantify existing water rights. The determination of all existing water rights from the river basins in northern Idaho will provide the basis for administration of water rights and for interstate cooperation. Pursuant to Idaho Code § 42-1406B, the Director of the Department filed a petition in the district court to commence an adjudication for northern Idaho. On November 12, 2008, the district court ordered the commencement of adjudication in the Coeur d'Alene Spokane River water system. The estimated date for completion of the adjudication is Fiscal Year 2018.

Idaho Code § 42-1734(3) authorizes the Idaho Water Resource Board to appear on behalf of the state in negotiations with the federal government. Consistent with state law, the Idaho Water Resource Board should serve as the lead agency for coordinating state participation in the Northern Idaho Adjudication.

Implementation Strategies:

- Implement the CAMP for the Rathdrum Prairie.
- Evaluate timing for developing a CAMP for the Palouse River Basin that establishes goals, objectives, and strategies to address the increasing demand on water supplies, reduce cross-boundary conflicts, and provide for effective conjunctive management of hydraulically connected water resources.
- Complete the Northern Idaho Adjudication.
- Implement and maintain the cooperative agreement between Idaho and Washington for maintenance of the SVRP Aquifer ground water model.
- Advise and provide technical support to Palouse Basin Aquifer Committee and other stakeholders to promote the wise use of the region's water supply.
- Provide technical support for the completion of aquifer studies that will assist in water management.

Milestones:

- Cooperative agreements approved and implemented by Idaho and Washington.
- Implementation of Rathdrum Prairie CAMP action items.
- Development and implementation of Palouse CAMP.
- Aquifer studies completed.
- Northern Idaho Adjudication completed.

7B - MINIMUM STREAM FLOWS IN THE PANHANDLE RIVER BASINS

The Idaho Water Resource Board will establish and protect minimum stream flow and lake level water rights to preserve the scenic and recreational water bodies in the Panhandle river basins.

Discussion:

The Panhandle contains some of the most significant scenic and recreational water bodies in the state. The Idaho Water Resource Board holds 19 minimum stream flow water rights on reaches of the Pend Oreille, St. Maries, Pack, Moyie, St. Joe, Coeur d'Alene, and Spokane rivers that protect approximately 17,600 cfs total flow. In 1927, the state established minimum lake levels for Priest, Pend Oreille and Coeur d'Alene lakes. These water rights protect and support many beneficial uses of water such as fish and wildlife habitat, aquatic life, recreation and aesthetic values, and navigation in the Panhandle basins and make a significant contribution to the economy of the region and the state.

Population growth and new water demands may increase the need to obtain additional minimum stream flows in the Panhandle region. The establishment and use of local water supply banks and rental pools should be considered as a strategy for addressing the need for meeting minimum stream flow water rights or new water rights in the Panhandle region, including minimum lake levels for the protection of navigation and transportation, fish and aquatic resources, and aesthetic and recreational values.

Implementation Strategies:

- Coordinate with state and federal agencies and stakeholders to identify potential minimum stream flow needs.
- Submit applications for minimum stream flow water rights that are in the public interest.
- Monitor activities that could impair minimum stream flows.
- Evaluate the need for establishment of local water supply banks.

Milestones:

- Minimum stream flow water rights established.

7C - NAVIGATION, FISHERIES, AND RECREATION IN THE PANHANDLE RIVER BASINS

> **Water management decisions in the Panhandle Region should minimize, where feasible, adverse effects on navigation, fisheries, and recreation.**

Discussion:

The Panhandle's lakes and rivers provide for commercial and recreational navigation and important habitat for numerous fish and wildlife species. These resources are also affected by the operation of private and federal hydropower projects. Avista's Clark Fork projects, located in Montana and Idaho, are operated pursuant to a FERC license based upon a comprehensive settlement agreement executed by Idaho, Montana, federal agencies and Indian tribes, and other stakeholders. The Post Falls project license is also based, in part, upon a settlement agreement between Avista, the IDFG and the Idaho Department of Parks and Recreation. The Post Falls license requires a summer full-pool elevation and fall draw-down protocol for Lake Couer d'Alene that is protective of fishery needs, while providing adequate lake levels for summer recreation activities and navigation.

On the Pend Oreille River, the USACE operates Albeni Falls Dam, which controls the level of Lake Pend Oreille. Lake Pend Oreille has been designated a Special Resource Water, a special body of water recognized by the state as needing intensive protection. Since 1996, consistent with a U.S. Fish and Wildlife Service Biological Opinion on the operation of the Federal Columbia River Power System, winter lake levels have been managed for the protection of the lake's kokanee population, an important forage base for ESA-listed bull trout. Winter lake level management also directly affects the amount of erosion and sedimentation that occurs, waterfowl habitat, water quality, navigation, and shoreline infrastructure. Cooperation between the state and federal government and community stakeholders is essential for making sound management decisions regarding the operation of Albeni Falls Dam.

In 2003, the Idaho legislature created the Lake Pend Oreille, Pend Oreille River, Priest Lake and Priest River Commission ("Lakes Commission") to address water quantity and water quality issues affecting the state's and local communities' interests, while recognizing existing authorities. The Idaho Water Resource Board supports the Lakes Commission's participation in regional water management decisions and efforts to minimize adverse effects on navigation, water quality, and fish, wildlife, and recreational resources.

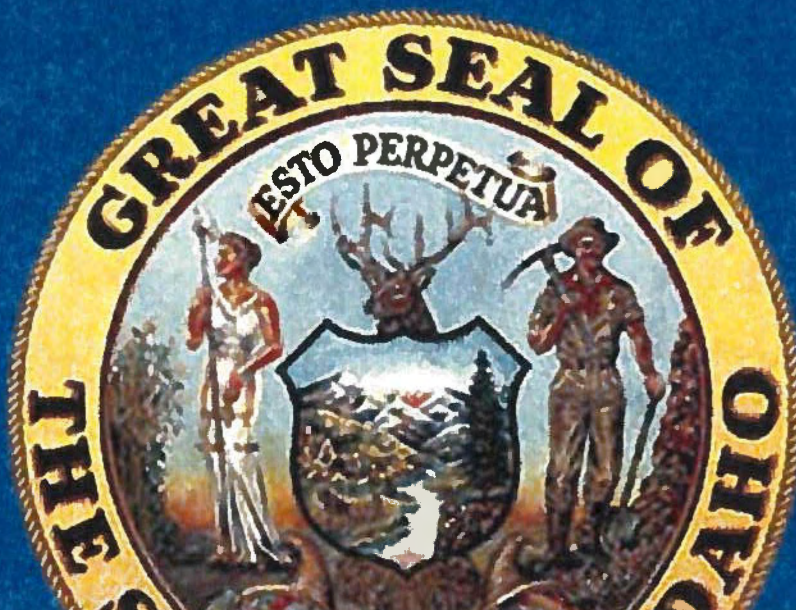
Implementation Strategies:

- Identify proposed actions that may affect navigation, water quality, and fish, wildlife, and recreation resources, in coordination with state and federal agencies and stakeholders.
- Provide technical assistance to assist the Lake Commission's participation in regional water management decisions.

Milestones:

- Collaborative water management decisions made that minimize adverse effects on navigation, water quality, and fish, wildlife, and recreational resources.

Photo: Mackay Lost River Range *(Photo Courtesy of Mike McVay)*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