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DISTRICT COURT-SRBA
TWIN FALLS CO, IDAHO
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REPORT REGARDING ANNUAL VOLUME OF CONSUMPTIVE USE

In Re SRBA

Twin Falls County Civil Case No. 39576

Sub-Case Nos.: See Attachment A

Report to the SRBA District Court

Prepared by the Idaho Department of Water Resources

Karl J. Dreher, Director

David R. Tuthill Jr., Acting Adjudication Bureau Chief

September 18, 1996

REPORT REGARDING ANNUAL VOLUME OF CONSUMPTIVE USE

The Director of the Idaho Department of Water Resources (IDWR) submits this report regarding annual volume of consumptive use in response to the request of Special Master Haemmerle, pursuant to Idaho Code §42-1412(4) and the court's I.R.E. 706 Order.

This report was prepared by and under the supervision of David R. Tuthill Jr., the Acting Adjudication Bureau Chief for IDWR. The Affidavit of David R. Tuthill Jr., previously filed with this court July 1, 1996, describes Mr. Tuthill's education and work experience, and is incorporated by reference herein. Jeff Peppersack and Marci S. Sterling, Adjudication Engineers, also participated in the preparation of this report. The Affidavit of Jeff Peppersack and the Affidavit of Marci S. Sterling, previously filed with this court July 1, 1996, describe their education and work experience, and are incorporated by reference herein. Consumptive use was the subject of two previous reports, IDWR's Report Regarding Evaluation of Irrigation Diversion Rates and IDWR's Report Regarding Consumptive Use for Irrigation in the Hagerman Area, previously filed with this court July 1, 1996, and incorporated by reference herein.

The claimants in the 24 subcases listed in Attachment A filed motions for summary judgment that asserted an annual volume of consumptive use for irrigation of 4.5 AFY per acre. The Affidavit of Charles E. Brockway, submitted by the claimants in support of the motions for summary judgment, states "that 3.75 acre feet per acre per annum is the amount of consumptive use that is reasonable [in the Hagerman area] based upon a yield of ten tons [of alfalfa] per acre." IDWR conducted further analysis of the annual volume of consumptive use, which is described in IDWR's Report Regarding Consumptive Use for Irrigation in the Hagerman Area dated July 1, 1996, and recommended an annual volume of consumptive use of 3.5 AFY per acre for irrigation in these subcases. The Special Master's Order on Summary Judgment denied summary judgment as to the element of annual volume of consumptive use, and found that the only significant difference between the quantity asserted by the claimants and the quantity recommended by IDWR is whether or not average precipitation is deducted.¹ The Special Master subsequently ordered a

¹ In the Order On Summary Judgment, the Special Master also ruled that, absent an order granting a motion for leave to amend the claim, the claimant may not assert a quantity greater than stated on the notice of claim. Of the 24 subcases listed in Attachment A, only the following involve a claim that asserted a total consumptive use for irrigation greater than recommended by IDWR: 36-00003E, 36-00035J, 36-00061, 36-00062, 36-00063, 36-00064B, 36-00092, 36-00106, 36-00108B, and 36-10283B. As to each of these, however, the per acre consumptive use claimed did not exceed the per acre consumptive use recommended by IDWR; the total consumptive use claimed was greater than recommended because the total number of irrigated acres was greater than recommended. For example, in subcase 36-00003E, the claimant claimed 3 AFY per acre for the irrigation of 10 acres for a total of 30 AFY; IDWR recommended 3 AFY per acre for 5 acres for a total of 15 AFY, and subsequently increased this recommendation to 3.5 AFY

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mandatory settlement conference and requested this report addressing the matters listed below. As a result of these orders, IDWR has conducted further investigation as to methodologies for the quantification of annual volume of consumptive use, but has concluded not to change its recommendation of 3.5 AFY per acre for irrigation in these subcases. The Affidavit of Jeff Peppersack Regarding Annual Volume of Consumptive Use for Irrigation and the Affidavit of Marci Sterling Regarding Annual Volume of Consumptive Use for Irrigation describe communications with water resource agencies from other states as to their methodologies, and are incorporated by reference herein.

I. EXPLAIN IN DETAIL THE FACTUAL AND LEGAL BASIS UPON WHICH IDWR SUBTRACTS AVERAGE PRECIPITATION FROM A DETERMINATION OF ANNUAL VOLUME OF CONSUMPTIVE USE.

A. Annual volume of consumptive use, as an element of a water right, is the consumptive use from the water system pursuant to the water right, which does not include precipitation.

The total amount of water consumed by a crop is provided in two ways -- by water diverted from the water system pursuant to the water right, and by natural precipitation. The purpose in quantifying annual volume of consumptive use as an element of a water right is to quantify the consumptive use provided by water diverted from the water system pursuant to the water right. The water consumed by the crop from precipitation never reaches the water system and is not diverted by the appropriator from the water system, and is therefore not part of the water right.

This conclusion is clearly supported by the definitions found in the adjudication statute. Consumptive use is defined as "the amount of water that does not remain in *the water system* after use or is not returned to *the water system* through return flows or seepage" Water system is defined to include "all rivers, streams, lakes, springs, groundwaters, or *other sources* within this state" The elements of a water right are defined to include the "*source of water.*" IDAHO CODE §§42-1401A(2), 42-1401A(13), 42-1411(2) (Emphasis added). Thus, the adjudication statute does not define consumptive use as the total amount of water consumed by the crop; rather it defines consumptive use as the consumptive use provided pursuant to the water right from that portion of the water system identified as the source of the water right.

This conclusion is further supported by the definition of what constitutes an appropriable source of water. The Idaho Constitution affirms the right to divert and

per acre for a total of 17.5 AFY. In subcase nos. 39-00039N, 36-00079, 36-00085A, the claim included irrigation but not did not state a consumptive use for irrigation.

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appropriate the unappropriated waters of any "natural stream." IDAHO CONST. Art XV, §3. The public waters of the state subject to appropriation are defined by statute to include "all the waters of the state, when flowing in their natural channels, including the waters of all natural springs and lakes within the boundaries of the state" as well as the "ground water resources of the state." IDAHO CODE §§42-201, 42-226. Public waters subject to appropriation do not include "diffused surface water," defined as "the mere collection of flood water from rains and melting snow and does not actually comprise or enter any natural stream or body of water." *Washington County Irrigation District v. Talboy*, 55 Idaho 382, 43 P.2d 943 (1935). Although the line between diffused surface water and an appropriable body of water is not always clear, it is sufficient to clearly distinguish an appropriable body of water (which may result from rains and melting snow) from an attempt to directly appropriate rainfall. In excluding rainfall from the definition of an appropriable source of water, the law follows the dictates of common sense. The many dry-land farmers in the state who rely on natural precipitation for the growing of crops do not acquire a water right for the rain, because not only do they not meet the legal elements of an appropriation, but rainfall is not a source that can be distributed by a watermaster in accordance with priority.

B. Annual volume of consumptive use is included in a decree solely for purposes of transfers, and a transfer of a water right cannot include precipitation.

The adjudication statute provides that consumptive use is included in a decree "only for the purpose of transfers pursuant to section 42-222, Idaho Code." IDAHO CODE §42-1401A(2). Section 42-222 requires any person who wants to make a change in use² of their right to make application to IDWR for approval of the change in use. The fact that a transfer of a water right cannot include precipitation is illustrated most simply using a change in place of use as an example. Again, the law follows common sense. Although one can move a water right to another place of use by altering the diversion system, one cannot move the rainfall.

C. Annual volume of consumptive use is included in a decree solely as a rebuttable presumption.

Annual volume of consumptive use is included in a decree solely as a rebuttable presumption, for two reasons, as further explained below.

1. Any method to determine annual volume of consumptive use is at best an estimate, and methods for estimating annual volume of consumptive use continue to improve.

² Changes in use of a water right are frequently referred to as "transfers."

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IDWR's methodology for estimating annual volume of consumptive use is based on the best information and the best techniques to evaluate the information that are currently available. The available information and the available techniques to evaluate that information, however, continue to improve. For example, the first methodology used on a widespread basis for determining consumptive use is known as the Blaney-Criddle method, developed by Blaney and Criddle in 1945, and modified by Blaney and Criddle in 1950 and again in 1962.³ For many years, IDWR's standards for determining consumptive use in Idaho were based on the Sutter and Corey study published in 1970, which used the Blaney-Criddle method as further modified by the Soil Conservation Service in 1965 and 1967, and the available climatic data that had been collected from Idaho weather stations at that time. IDWR's current standards for determining consumptive use are based on the Allen and Brockway study made available in 1983. This study used a further modification of the Blaney-Criddle method, known as the FAO Blaney-Criddle method, and the additional climatic data that had been collected since the time of the Sutter and Corey study.

The original Blaney-Criddle method was primarily temperature-based; the various modifications to the Blaney-Criddle method sought to account for additional climatic variables, such as solar radiation (daylight), wind, and humidity, as well as for crop variables, such as type of crop and length of growing season. Later studies as to consumptive use in Idaho sought to make use of additional climatic data, which included data from additional stations as well as longer periods of record at those stations. Partly as a result of objections to consumptive use recommendations in the SRBA, IDWR in early 1996 contracted with the University of Idaho for a revision and update of the 1983 Allen and Brockway study. Dr. Charles E. Brockway is leading this effort, which will utilize the vastly increased amount of weather data that have been generated since 1983. IDWR anticipates that this revision will result in changes from the present consumptive use estimates.

2. A final determination of annual volume of consumptive use can be made only at the time of a transfer proceeding.

Annual volume of consumptive use is not used for the distribution of water pursuant to Title 42, chapter 6, Idaho Code. Because IDWR is charged with the "distribution of water from all of the streams to the canals and ditches *diverting* therefrom," the relevant measurement for purposes of distribution is the *diversion rate* and/or *diversion volume* stated in the quantity element of the water right. Annual

³ Blaney & Criddle, *Determining Water Requirements for Settling Water Disputes*, 4 NAT. RESOURCES J. 29 (1964); Gould, *New Challenges to Western Water Law: Transfer of Water Rights*, 29 NAT. RESOURCES J. 457, 466 (1989); DuMars & Minnis, *New Mexico Water Law: Determining Public Welfare Values in Water Rights Allocation*, 31 ARIZ. L. REV. 818, 821 (1989).

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volume of consumptive use is included in a decree solely for purposes of transfers pursuant to Idaho Code §42-222, as stated in the adjudication statute.

As noted above, §42-222 requires any person who wants to make a change in use of their water right to make application to IDWR for approval of the change in use. Before IDWR may grant the application, the applicant must show, among other things, that the change in use will not result in injury to other water rights. To meet this requirement, the applicant must show, among other things, that the change in use will not result in an increase in annual volume of consumptive use beyond the actual historical consumptive use.⁴ This requires a comparison of the consumptive use volume before and after the transfer. Such a comparison can necessarily only be made at the time of the transfer proceeding.

D. For purposes of quantifying annual volume of consumptive use as an element of a water right, the most appropriate measure of precipitation is average precipitation.

1. The most accurate measure of historical consumptive use is average consumptive use.

As noted above, an applicant for a change in use of a water right must show that the change will not result in injury to other water rights, which includes showing that the change will not result in an increase in annual volume of consumptive use beyond the actual historical consumptive use. Because it is the historical consumptive use that is to be determined, the historical consumptive use will include both unusually dry years and unusually wet years. A quantification based solely on dry years will overestimate the consumptive use historically provided by the water right; a quantification based solely on wet years will underestimate the consumptive use provided by the water right. An accurate quantification therefore requires use of the average precipitation.

2. Both IDWR's methodology and the claimants' methodology are methods for the determination of *average* consumptive use.

The Affidavit of Charles E. Brockway, PH.D., which was filed by the claimants in support of their motion for summary judgment, describes the yield-based methodology developed by James L. Wright for estimating consumptive use. Both the yield-based methodology described by Dr. Brockway and the Blaney-Criddle

⁴ Utilization of annual volume of consumptive use for purposes of a change in nature of use from irrigation to industrial use is illustrated in IDWR Administrator's Memorandum, Transfer Memo #7, dated September 24, 1982, which is attached hereto and incorporated herein by reference.

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methodology (including its various modifications) used by IDWR are methodologies to determine the *average* amount of water consumed by the crop, and both methodologies yielded consistent results. As noted above, the total amount of water consumed by the crop is provided in two ways - by water diverted from the water system pursuant to the water right, and by natural precipitation. To determine the portion of the total consumptive amount that is provided by the water right alone, effective precipitation⁵ is deducted. To be consistent with the methodologies used by both the claimants and IDWR, which use an *average* total consumption, *average* effective precipitation is deducted to determine the *average* consumptive use provided pursuant to the water right.

3. Both IDWR's methodology and the claimants' methodology overestimate actual consumptive use.

The quantification of consumptive use in the adjudication already overestimates actual consumptive use to a certain extent. Pursuant to the adjudication statute, quantification of consumptive use in the adjudication is based on the most water consumptive crop that can be grown in the area (pasture in the Hagerman area), not the actual crops historically grown pursuant to the water right. In addition, the 3.5 AFY per acre recommended by IDWR for the Hagerman area is "rounded-up" from the 3.41 AFY per acre resulting from application of the methodology in the Allen and Brockway study.

Similarly, in the Affidavit of Charles E. Brockway, Ph.D., submitted by the claimants in support of the claimants' motion for summary judgment, Dr. Brockway's estimate of consumptive use is based on a yield of ten tons of alfalfa per acre. Dr. Brockway's calculations were based on information as to yield, which is described in the Affidavit of John Jones, Jr. and the Affidavit of Dan McFadden. Mr. Jones asserted a yield of 9-10 tons, Mr. McFadden stated a yield of ten tons. However, ten tons of alfalfa per acre is an optimum yield, not a typical yield, in the Hagerman area. If the yield figure is varied as little as one ton, using the 9 ton figure instead of the 10 ton figure, then the total consumptive use as estimated by Dr. Brockway is 3.3 AFY per acre, less than the 3.5 recommended by IDWR.

Because the annual volume of consumptive use in the Hagerman area proposed by the claimants is 3.75 AFY per acre, and IDWR's recommendation is 3.5 AFY per acre, it is tempting to conclude that the difference of 0.25 AFY per acre is not

⁵ "Effective" precipitation is precipitation occurring during the growing season. Deduction of total precipitation would be inappropriate, since precipitation occurring outside the growing season is not available to the crop, except to the extent it is retained as soil moisture available to the crop during the growing season.

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significant. It must be remembered, however, that this is a per acre quantification. A per acre quantification multiplied by the number of irrigated acres quickly becomes significant -- for example, 25 AFY for 100 acres, 250 AFY for 1000 acres, etc. In addition, the difference between including precipitation and not including precipitation is greater in areas where there is greater precipitation. For example, in some areas of the Snake River Basin, such as Kooskia, effective precipitation is 1 AFY per acre, 100 AFY for 100 acres, or 2000 AFY for 2000 acres.

Because the methodology used to quantify consumptive use in the adjudication already overestimates actual consumptive use, modifications to that methodology that would further overestimate consumptive use would decrease, rather than increase, the accuracy of the quantification. Because that methodology will be used to determine the consumptive use for hundreds of thousands of irrigated acres in the Snake River Basin, any significant overestimation of per acre consumptive use volumes could have a substantial impact in future water right transfers.

E. IDWR's methodology for quantifying consumptive use as an element of a water right is consistent with the methodology employed in other appropriation doctrine states.⁶

IDWR's research has revealed no other state adjudication statute which provides for the determination of consumptive use in an adjudication of water rights in an appropriation doctrine state. Two other state water resource agencies, the Utah State Engineer's Office and the New Mexico State Engineer's Office, include a determination of consumptive use in their reports, pursuant to statutes which do not expressly provide for the determination of consumptive use.⁷ The Utah State Engineer's office uses the modified Blaney-Criddle method, deducts effective precipitation, uses average values, and uses alfalfa as the reference crop.⁸ The New Mexico State Engineer's Office uses the modified Blaney-Criddle method, subtracts effective precipitation, uses

⁶ Experts in the field of water right determination and administration in the western states commonly rely on information from other western state water resource agencies in forming opinions and conclusions as to how best to address an issue in their state that is common to other western states. IDWR staff participate in the Western State Engineers Conference, the Western States Adjudication Conference, and the Western States Water Council, specifically for that purpose. In addition, IDWR staff periodically communicate with staff from other western state water resource agencies to exchange information as to particular issues as needs arise.

⁷ UTAH CODE ANN. §73-4-11; N.M. STAT. ANN. §72-4-13.

⁸ Affidavit of Jeff Peppersack Regarding Annual Volume of Consumptive Use for Irrigation.

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average values, and uses the crops historically grown to determine consumptive use.⁹ IDWR's research has revealed no other appropriation doctrine state in which the report of a water resource agency in a water rights adjudication includes a determination of consumptive use.

Three other appropriation doctrine states determine consumptive use for purposes of determining whether a proposed change in use will result in injury to other water rights. Colorado, because of its wholly judicial system for the appropriation and determination of water rights,¹⁰ has the most well-developed body of case law on the doctrine of prior appropriation. In *Green v. Chaffee Ditch Company*,¹¹ the Colorado Supreme Court affirmed the trial court's finding that "the amount of water necessarily consumed by plant life to produce a maximum crop, *in addition to natural rainfall*, is 15 inches for each acre irrigated, thus requiring 90 acre feet of water each year for the proper irrigation of said land."¹² Communications with the Colorado Department of Water Resources indicate that it generally uses the modified Blaney-Criddle method, average values and the crops historically grown.¹³

To IDWR's knowledge, the only other appropriation doctrine state whose courts of record have addressed the issue is Wyoming. In *Basin Electric Power Cooperative v. State Board of Control*,¹⁴ the Wyoming Supreme Court affirmed a district court ruling that the State Board of Control properly defined consumptive use for a surface water irrigation right as "the amount of water, *exclusive of effective precipitation*, stored soil moisture, or ground water that is consumed by the crop."¹⁵ Communications with the Wyoming State Engineer's office indicate that the agency

⁹ *Id.*

¹⁰ See COLO. REV. STAT. §§37-92-301 to -306.1.

¹¹ 150 Colo. 91, 371 P.2d 775 (1962)

¹² 150 Colo. at 101, 371 P.2d at 780 (emphasis added).

¹³ Affidavit of Jeff Peppersack Regarding Annual Volume of Consumptive Use for Irrigation.

¹⁴ 578 P.2d 557 (Wyo. 1978). See also Squillace, *Water Marketing in Wyoming*, 31 ARIZ. L. REV. 865, 885 (1989).

¹⁵ 578 P.2d at 560.

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uses the modified Blaney-Criddle method, average values and the crops historically grown to determine consumptive use.¹⁶

Communications with the Department of Natural Resources in Montana indicate that it also uses the modified Blaney-Criddle method, subtracts effective precipitation, and uses average values and the crops historically grown to determine consumptive use.¹⁷

Communications with other states revealed the use of differing techniques for purposes of determining whether a proposed change in use would result in injury, but IDWR's research did not reveal any western states where consumptive use is determined without subtracting effective precipitation, nor did it reveal any states where consumptive use is determined based on values other than average values.¹⁸

II. CAN A DETERMINATION OF ANNUAL VOLUME OF CONSUMPTIVE USE, STATED IN A DECREE, BE USED BY IDWR OR ANY SENIOR USER TO REDUCE OR LIMIT THE USE OF WATER BY A JUNIOR USER IN TIMES OF SCARCITY?

As discussed above, annual volume of consumptive use is included in a decree solely as a rebuttable presumption for purposes of transfers. Consumptive use is not used for the distribution of water pursuant to Title 42, chapter 6, Idaho Code.

III. IN TIMES OF SCARCITY, WILL A CONSUMPTIVE USE DETERMINATION THAT SUBTRACTS AVERAGE ANNUAL PRECIPITATION REFLECT THE ACTUAL CONSUMPTIVE USE PROVIDED BY IRRIGATION?

The question is difficult to answer clearly and accurately, because it in effect "compares apples and oranges," as further explained below.

As discussed above, both the yield-based methodology used by the claimants and the FAO Blaney-Criddle methodology used by IDWR are methods to determine *average* total consumptive use (technical consumptive use). *Average* precipitation is then deducted to determine the *average* consumptive use provided pursuant to the water right (statutory consumptive use, or the consumptive irrigation requirement). Estimated values based on averages will therefore underestimate actual values in dry

¹⁶ Affidavit of Jeff Peppersack Regarding Annual Volume of Consumptive Use for Irrigation.

¹⁷ *Id.*

¹⁸ Affidavit of Jeff Peppersack Regarding Annual Volume of Consumptive Use for Irrigation, Affidavit of Marci Sterling Regarding Annual Volume of Consumptive Use for Irrigation.

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years and overestimate values in wet years. Consumptive use, however, is not used for delivery of water in any specific year. Consumptive use is used solely to determine whether a proposed change in use will result in an increase in consumptive use beyond the historical consumptive use, which includes both wet years and dry years.

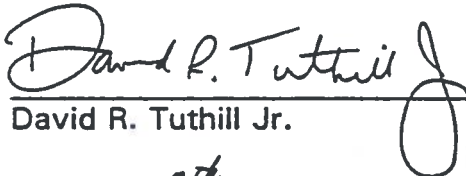
If the court's concern is that the use of average consumptive use values will underestimate actual consumptive irrigation requirement during a dry year, then the appropriate response is not to add average precipitation, because the variance between a high consumptive use year and a low consumptive use year is not equal to precipitation. This is because total consumptive use varies depending not only on precipitation, but also based on temperature, solar radiation, wind, and other climatic factors. If the court's concern is that the use of average consumptive use values will underestimate actual consumptive use, then the correct response is to use a different factor - rather than an average (50th percentile), to instead use for example, an 80th percentile. IDWR does not currently have the data available to calculate the consumptive irrigation requirement based on an 80th percentile, and does not recommend the expenditure of resources to make such a calculation, because it is the average consumptive use that has meaning for determining impacts when a change in use is proposed.

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State of Idaho)
) ss.
County of Ada)

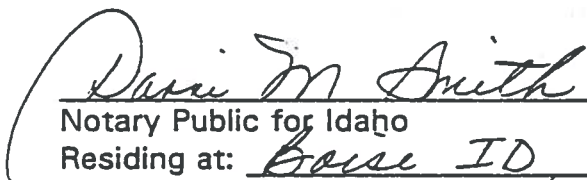
David R. Tuthill Jr., being first duly sworn, upon oath, deposes and says:

That I am the Acting Adjudication Bureau Chief for IDWR, that I have read the foregoing report, know its contents, and that the statements contained therein are true to the best of my knowledge and belief.



David R. Tuthill Jr.

Subscribed and sworn to before me this 17th day of September, 1996.



Notary Public for Idaho
Residing at: Boise ID
My commission expires: 12/5/2000

Certificate of Service

I certify that on the 17th day of September, 1996, I hand-delivered copies of the foregoing document, including all attachments to the following:

Patrick D. Brown
133 Shoshone St North
Twin Falls, ID 83303



Person delivering document(s)

#7

ADMINISTRATOR'S MEMORANDUM

TO: Regional Offices and Water Allocation Section

FROM: Norman C. Young *NCY*

DATE: September 24, 1982

RE: Sample Calculations for Change in Nature of Use.

The intent of these sample calculations is to provide general guidelines for regional and state office staffs for quantitative evaluation of requested changes in nature of use. To comply with the intent of Section 42-222, Idaho Code, Department personnel must insure that a transfer of a water right does not result in an expansion of use.

An expansion could occur if any one of the following three parameters is increased under the new use: (1) rate of flow, (2) volume or (3) consumptive use. Each of the three parameters must be computed and checked since depending on the specific situation any one of the parameters might be "controlling". The "controlling" parameter determines how much water may be transferred without injury to other rights. The sample situation below demonstrates that depending on the situation any one of the three parameters can be "controlling".

The methodology shown makes many assumptions, and is intended to be used when the portion of the water right to be changed was previously applied to 640 acres or less. For larger acreages the applicant will be required to provide an evaluation by a qualified professional. Note also that the methodology does not take into account possible injury due to change in season of use. This factor must be evaluated on a case by case basis.

Sample Situation:

A wateruser desires to change the nature of use of part of a water right from irrigation to industrial for use in an ethanol production plant. The water is currently licensed for irrigation near Mackay. The water user desires to maintain irrigation with any water not needed for industrial use. The rates of flow needed for the industrial use are 0.10 cfs for washing machinery and 0.20 cfs for the mash. The total is 0.30 cfs, since occasionally both rates of flow must be satisfied simultaneously. Assume a seven day per week operation. The volume needed for the industrial use is computed as follows:

$$\text{Volume: Washing: } .10 \text{ cfs} \times \frac{1.98 \text{ AF}}{\text{CFS DAY}} \times \frac{4 \text{ HRS.}}{\text{DAY}} \times \frac{1 \text{ DAY}}{24 \text{ HRS.}} \times \frac{365 \text{ DAYS}}{\text{YEAR}} = \frac{12.0 \text{ AF}}{\text{YEAR}}$$

$$\text{Mash: } .20 \text{ CFS} \times \frac{1.98 \text{ AF}}{\text{CFS DAY}} \times \frac{6 \text{ HRS.}}{\text{DAY}} \times \frac{1 \text{ DAY}}{24 \text{ HRS.}} \times \frac{365 \text{ DAYS}}{\text{YEAR}} = \frac{36.1 \text{ AF}}{\text{YEAR}}$$

$$\text{Total: } 12.0 + 36.1 = 48.1 \frac{\text{AF}}{\text{YEAR}}$$

The consumptive use for the industrial purposes is computed as follows:

Consumptive Use:

Washing: 1.2 AF/YEAR (assume that 10% is consumptively used)
Mash: 36.1 AF/YEAR (assume that all is consumptively used)
Total: 37.3 AF/YEAR

Case 1: Rate of Flow Controlling

Given: - Irrigation right is licensed at 0.80 cfs for 80 acres.
- Volume diverted for irrigation purposes is 3.5 AF/acre (From Water User's Handbook, IDWR p. 11. This assumes alfalfa* and 60% irrigation efficiency.)
- Number of days in the irrigation season is 215. (From Water User's Handbook, IDWR, p. 17.)
- Irrigation consumptive use is 16.3 inches = 1.4 AF/acre (From Sutter, R. J. and G. L. Corey, "Consumptive Irrigation Requirements of Crops in Idaho", University of Idaho Bulletin 516, July 1970 Table 6, page 8, copy attached. This is the average seasonal consumptive irrigation requirement for alfalfa near Mackay. Note that the attached map of Idaho shows the climatic areas.

Find: Rate of flow, volume and consumptive use for irrigation use and industrial use after change.

Analysis: - Total rate 0.80 cfs
- Total volume diverted 3.5 (80) = 280 AF/YEAR
- Total consumptive use (C. U.) 1.4 (80) = 112 AF/YEAR

Solution: a. New use check

RATE	VOLUME	C. U.
0.80 cfs	280.0 AF	112.0 AF
-0.30 cfs	-48.1 AF	-37.3 AF
0.50 cfs	231.9 AF	74.7 AF

All values are positive. Therefore, the original right is large enough to provide for the new use.

b. Number of acres calculation.

1. Rate parameter check

$$\frac{0.30}{0.80} (80) = 30 \text{ acres out}$$

2. Volume parameter check

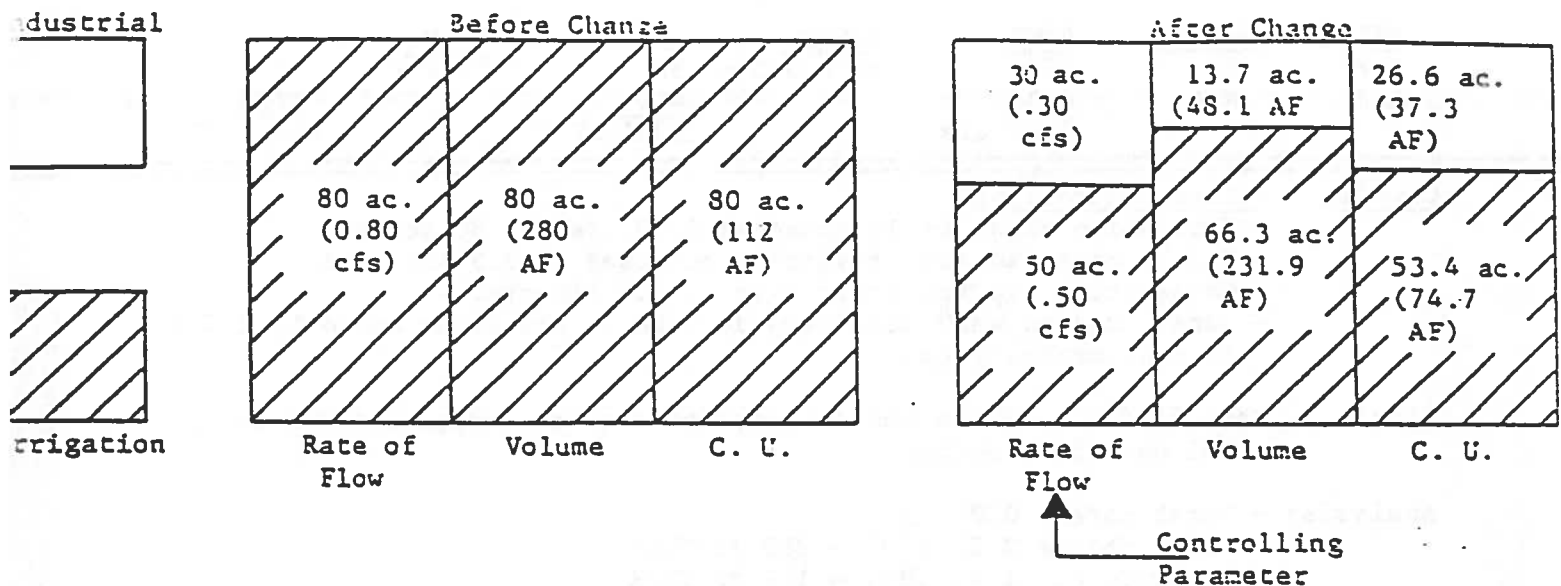
$$\frac{48.1}{3.5} = 13.7 \text{ acres out}$$

3. C. U. parameter check

$$\frac{37.3}{1.4} = 26.6 \text{ acres out}$$

*An "alfalfa standard" will be used for any consumptive use computation for irrigation. This means that regardless of the historical crop uses, the crop used in the water requirement computations is alfalfa.

c. Graphical representation of the solution:



- d. Evaluation of water right after the change. As demonstrated above, the original irrigation right is large enough to provide for the requirements of the industrial use and to provide for continued irrigation of a portion of the lands. The computation of the number of acres that can be irrigated after the change is based on maximum utilization of remaining water supplies. In this case, the rate of flow appears to limit the irrigated acreage to 50 acres, so rate of flow appears to be the "controlling" parameter.

However, when rate of flow is initially found to be "controlling" one further check should be made. If the remaining irrigation rate of flow (0.50 cfs) can provide enough water to irrigate more than the proportionate number of acres (50), then the acreage irrigated for the rate of flow parameter can be increased.

Generally, the minimum rate of flow per acre is based on the maximum irrigation demand. Since the demand is based on a number of factors including soil type, soil depth and irrigation system in addition to the factors already mentioned, this computation must be made by a qualified irrigation expert (e.g. Verl King). After the maximum number of acres is found for rate of flow when it is the controlling factor the other parameters should be checked to make sure they are not exceeded by the new maximum.

As an example, assume that the maximum number of acres that can be irrigated by 0.50 cfs is computed by an expert to be 52.0 acres. Then the right after the change would be as follows:

Right after change

<u>USE</u>	<u>ACRES</u>	<u>RATE</u>	<u>VOLUME</u>	<u>C. U.</u>
Irr.	52	0.50	$52 \times 3.5 = 182$	$52 \times 1.4 = 72.8$
Ind.	N.A.	0.30	48.1	37.3
		0.80 cfs	230.1 AF	110.1 AF

Case 2: Volume Controlling

- Irrigation right is licensed at 0.80 cfs for 80 acres.
- Volume diverted for irrigation purposes is 3.5 AF/ acre.
- Consumptive use for irrigation is 1.4 AF/acre.
- Water used to wash machinery is used 24 hours/day and only 1.67% is consumptively used.

Find: Rate of flow, volume and consumptive use for irrigation and industrial use after change.

- Analysis:
- Total rate 0.80 cfs
 - Total volume $3.5 (80) = 280$ AF/YEAR
 - Total C. U. $1.4 (80) = 112$ AF/YEAR
 - Volume for industrial use recalculated as follows:

$$\text{Washing: } .10 \text{ cfs} \times 1.98 \frac{\text{AF}}{\text{cfs DAY}} \times \frac{24 \text{ HRS.}}{\text{DAY}} \times \frac{1 \text{ DAY}}{24 \text{ HRS.}} \times$$

$$\frac{365 \text{ DAYS}}{\text{YEAR}} = 72.3 \frac{\text{AF}}{\text{YR.}}$$

Mash: No change (36.1 AF/YEAR)

$$\text{Total Vol.} = 72.3 + 36.1 = 108.4 \text{ AF/YEAR}$$

- C. U. for industrial use recalculated as follows:

$$\text{Washing: } 1.67\% \text{ of } 72.3 = 1.2 \text{ AF/YEAR}$$

$$\text{Mash: } 36.1 \text{ AF/YEAR}$$

$$\text{Total C. U.: } 1.2 + 36.1 = 37.3 \text{ AF/YEAR (no change)}$$

Solution: a. New use check

<u>RATE</u>	<u>VOLUME</u>	<u>C. U.</u>
0.80	280.0	112.0
-0.30	-108.4	-37.3
0.50 cfs	171.6 AF	74.7 AF

All values are positive. Therefore, the original right is large enough to provide for the new use.

b. Number of acres calculation.

1. Rate parameter check

$$\frac{0.30}{0.30} (80) = 30 \text{ acres out}$$

2. Volume parameter check

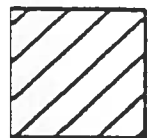
$$\frac{108.4}{3.5} = 31 \text{ acres out}$$

3. C. U. parameter check

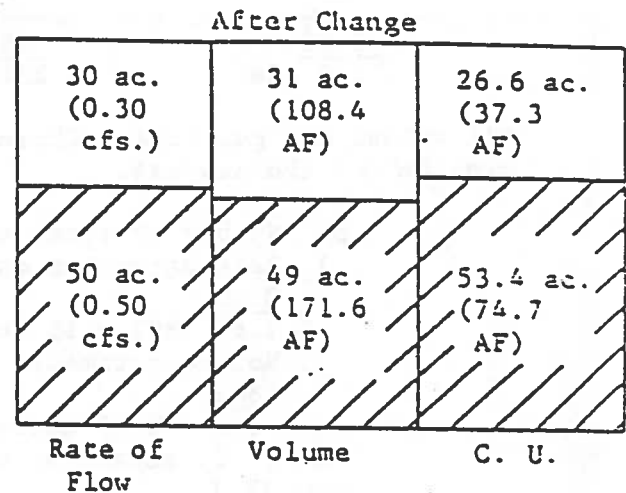
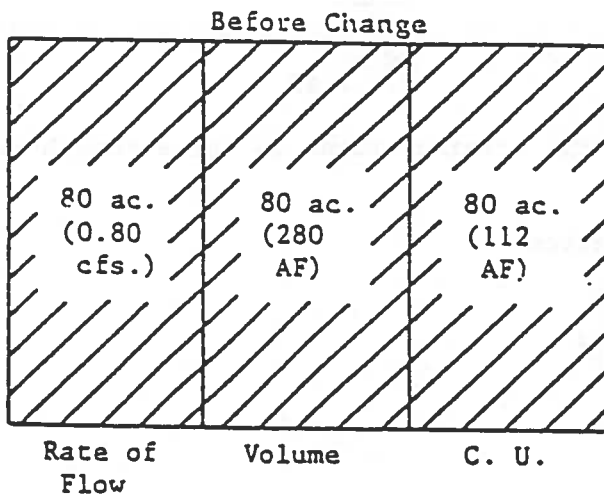
$$\frac{37.3}{1.4} = 26.6 \text{ acres out}$$

c. Graphical Solution

Industrial



Irrigation



▲
Controlling
Parameter

d. Evaluation of water right after the change. As shown in the graphical solution, volume is the "controlling" parameter, which limits irrigation after the change to 49 acres.

Right after change

USE	ACRES	RATE	VOLUME	C. U.
Irr.	49	0.50	171.6	49 (1.4) = 68.6
Ind.	N.A.	0.30	108.4	37.3
		0.80 cfs	280.0 AF	105.9

Case 3: Consumptive Use Controlling

- Given:
- Irrigation right is licensed for 1.60 cfs for 80 acres.
 - Volume diverted for irrigation purposes is 3.5 AFA/acre.
 - Consumptive use for irrigation is 1.4 AF/acre.

Find: Rate of flow, volume and consumptive use for irrigation use and industrial use after change.

Analysis:

Total rate	1.60 cfs
Total volume	3.5 (80) = 280 AF/YR.
Total C. U.	1.4 (80) = 112 AF/YR.
Volume for industrial use	= 48.1 AF/YR.
C. U. for industrial use	= 37.3 AF/YR.

Solution: a. New use check

<u>RATE</u>	<u>VOLUME</u>	<u>C. U.</u>
1.60	280.0	112.0
-0.30	48.1	-37.3
<u>1.3 cfs</u>	<u>231.9 AF</u>	<u>74.7 AF</u>

All values are positive. Therefore, the original right is large enough to provide for the new use.

b. Number of acres calculation.

1. Rate parameter check

$$\frac{0.30}{1.60} (80) = 15 \text{ acres out}$$

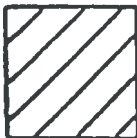
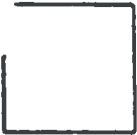
2. Volume parameter check

$$\frac{48.1}{3.5} = 13.7 \text{ acres out}$$

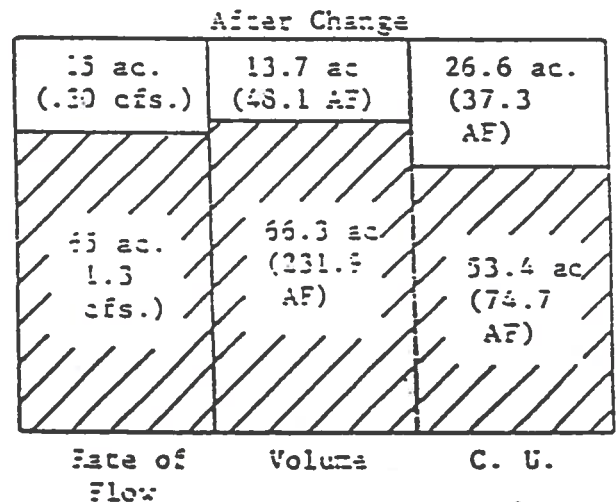
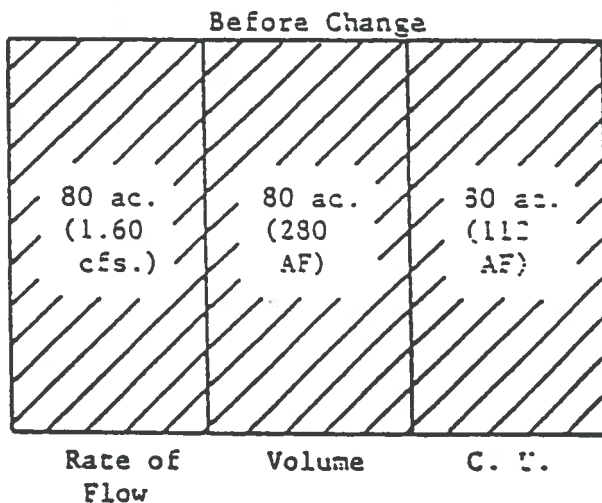
3. C. U. parameter check

$$\frac{37.3}{1.4} = 26.6 \text{ acres out}$$

Industrial



Irrigation



Controlling
Parameter



d. Evaluation of water right after the change. As shown in the graphical solution, consumptive use is the "controlling" parameter, which limits irrigation after the change to 53.4 acres.

Right after change

<u>USE</u>	<u>ACRES</u>	<u>RATE</u>	<u>VOLUME</u>	<u>C. U.</u>
Irr.	53.4	1.3	53.4 (3.5) = 186.9	74.7
Ind.	N.A.	.3	48.1	37.3
		1.6	235.0 AF	112.0 AF

When the supplemental information sheet for change in nature of use is received by the regional office, the computations of the three parameters should be completed and placed in the file. These computations will be reviewed by state office personnel during the review process.

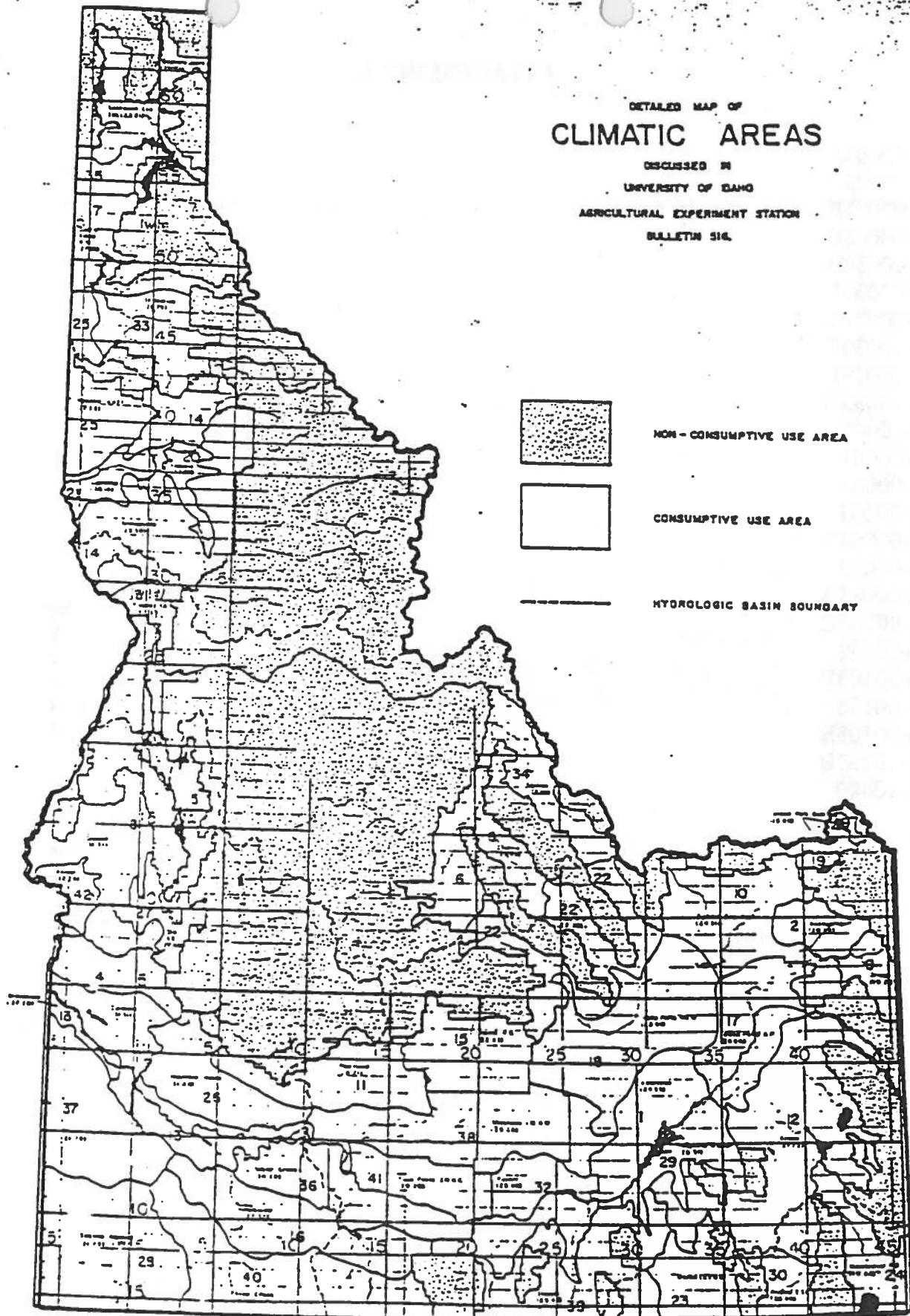
Table 6. Average annual consumptive irrigation requirement by crop for Idaho (inches)

Sta	Station	Sugar beets	Dry beans	Corn silage	Field corn	Spring grain	Pota- toes	Small veg.	Winter grain	Al- falfa	Pas- ture	Or- chards
1.	Aberdeen	18.1	14.0	14.4	15.5	13.5	17.7	9.5	18.4	19.6	15.7	----
2.	Ashton IS	12.1	----	9.6	----	10.0	12.3	----	13.7	13.5	10.1	----
3.	Bonnars Ferry ISW	----	----	11.8	----	13.0	15.1	----	15.1	16.7	12.0	----
4.	Caldwell	24.4	16.9	18.8	19.8	13.7	23.4	10.7	19.9	26.1	20.3	21.4
5.	Cascade 1NW	----	----	9.9	----	10.3	11.4	----	13.8	13.7	10.3	----
6.	Challis	----	----	13.6	----	15.2	15.3	----	16.3	19.3	14.7	----
7.	Coeur d'Alene RS	----	----	13.5	----	13.9	17.2	----	16.1	19.1	13.5	----
8.	Council	20.4	----	16.2	----	13.4	20.3	----	17.1	22.5	16.5	----
9.	Driggs	----	----	9.4	----	9.2	11.5	----	13.5	12.7	9.5	----
10.	Dubois Exp. Sta.	16.5	----	12.4	----	12.6	16.1	----	16.0	17.5	13.5	----
11.	Fairfield	----	----	11.9	----	12.3	14.4	----	15.6	15.6	12.1	----
12.	Grace	12.8	----	10.2	----	10.5	12.4	----	14.2	14.4	10.6	----
13.	Grandview	18.7	18.8	22.6	22.9	16.2	26.9	13.0	21.1	31.6	24.2	26.1
14.	Grangeville	----	----	9.5	----	6.4	12.7	----	11.5	14.1	8.5	----
15.	Hailey RS	----	----	12.7	----	13.1	14.9	----	16.3	17.5	13.7	----
16.	Hollister	18.5	13.3	14.0	15.2	11.8	18.3	8.1	17.1	20.4	15.2	----
17.	Idaho Falls AP	18.6	----	13.9	----	12.9	17.9	----	17.1	19.4	15.5	----
18.	Idaho Falls 46W	15.6	----	12.9	----	13.5	16.6	----	16.2	17.3	13.5	----
19.	Island Park Dam	----	----	5.6	----	4.6	7.0	----	9.3	3.2	5.7	----
20.	Kooskia	----	----	13.4	----	11.0	17.4	----	14.6	19.2	12.0	----
21.	Lewiston	----	----	18.2	----	14.8	21.4	5.1	14.4	25.8	18.2	20.7
22.	Mackay RS	----	----	11.5	----	13.3	13.2	----	15.7	16.2	12.8	----
23.	Malad	19.1	----	14.3	----	15.0	18.4	----	16.6	20.3	15.5	----
24.	Montpelier RS	----	----	10.8	----	11.1	13.3	----	15.1	14.5	11.2	----
25.	Moscow U of I	----	----	12.8	----	11.0	16.2	7.7	15.0	18.2	12.6	----
26.	Mountain Home	25.1	17.0	19.1	20.7	16.6	24.1	11.9	21.5	26.7	21.1	22.1
27.	Ola 4S	18.9	----	15.1	----	10.0	19.4	7.6	17.6	21.2	15.7	17.1
28.	Owyhee, Nevada	----	----	12.6	----	13.0	15.5	----	16.5	17.3	13.1	----
29.	Pocatello WB AP	21.3	14.3	16.2	----	12.8	20.2	9.6	17.3	22.6	17.5	----
30.	Preston 2SE	18.3	----	14.3	----	14.3	18.0	----	16.8	20.1	14.3	----
31.	Riggins RS	----	----	13.5	----	14.6	22.2	----	14.6	26.5	17.2	----
32.	Rupert	23.3	16.2	18.1	19.2	12.7	21.9	10.2	19.1	24.9	19.5	20.5
33.	St. Maries	----	----	12.8	----	13.1	16.0	8.4	15.9	17.9	12.8	----
34.	Salmon	----	----	12.2	----	13.0	16.5	----	16.4	17.0	13.3	----
35.	Sandpoint Exp. Sta.	----	----	10.2	----	11.6	13.4	----	14.4	14.6	10.2	----
36.	Saylor Creek	26.9	17.5	20.5	21.9	17.8	25.3	12.1	19.3	28.7	22.2	23.7
37.	Sheaville, Oregon	----	----	13.9	----	13.7	17.0	----	17.5	18.0	14.3	----
38.	Shoshone 1WNW	21.9	16.1	17.2	17.8	12.8	21.6	10.2	20.6	22.6	13.8	----
39.	Strevell	16.2	----	13.0	----	13.5	16.6	----	16.5	18.0	13.6	----
40.	Three Creek	----	----	7.5	----	7.5	11.5	----	12.1	11.3	8.7	----
41.	Twin Falls 2NNE	21.9	15.6	16.8	17.4	13.2	21.3	9.7	19.2	23.2	18.3	18.9
42.	Weiser	25.6	17.9	19.3	21.2	14.5	23.7	7.3	21.4	26.8	21.2	22.0
State Average		20.0	16.1	13.9	19.2	12.6	17.3	9.4	16.3	19.3	14.5	21.4

16.3 inches = 1.2 AF/

DETAILED MAP OF CLIMATIC AREAS

DISCUSSED IN
UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION
BULLETIN 516



NOTE: Figure in Parenthesis is 80
Percentile Seasonal Alfalfa
Consumptive Use From U of I
Bulletin 516

ATTACHMENT A

36-00003A
36-00003C
36-00003E
36-00003F
36-00034B
36-00035J
36-00039C
36-00039E
36-00039J
36-00039N
36-00047
36-00061
36-00062
36-00063
36-00064B
36-00079
36-00085A
36-00086C
36-00092
36-00103F
36-00106
36-00108B
36-10283B
36-10409