AN INVESTIGATION INTO THE ECONOMIC IMPACTS OF SUBORDINATING THE SWAN FALLS HYDROELECTRIC WATER RIGHT TO UPSTREAM IRRIGATION

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FOR

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IDAHO WATER AND ENERGY RESOURCES RESEARCH INSTITUTE

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EXECUTIVE SUMMARY

This study was requested by the Swan Falls Interim Study Committee and funded by a grant from the Idaho Legislative Council to the Idaho Water and Energy Resources Research Institute. The purpose of the study was to use existing information, reports, and studies to examine the economic impacts of subordinating the water right at Swan Falls to upstream irrigation.

Chapter I outlines the background, objectives, methodology, and organization of this report.

Chapter II provides needed background information by summarizing what we know about historic and present flows at Swan Falls, and factors that could influence these flows irrespective of the subordination decision. This information is necessary to identify how much water is available for use by new irrigation if the Swan Falls right is subordinated.

Historically, late summer flows at Swan Falls were enhanced by irrigation diversions in the upper Snake, recharge of the acquifer system and resulting increased flows at Thousand Springs. Deep well pumping from the aquifer beginning in the 1940's and high lift pumping which began in the 1960's have led to systematic river flow declines since the early 1950's. When the IDWR streamflow / aquifer model is adjusted to account for the 1980 level of irrigation depletions, and is used to simulate the 51 years of actual, historical streamflows, it projects an expected average July flow at Murphy of 6,300 cfs. Using data from the worst year of record, 1961, the model projects a July flow of only 5,249 cfs. Some daily flows in dry years would have been as low as 4,500 cfs. Subordination would allow additional depletions of 3,061 average cfs of July flows in an average year, and 1,949 average cfs of July flows in even the driest years. Greater depletions in other months would be possible. However depletions might need to be held to lower levels to meet daily minimum flow requirements--as low as 1200 cfs during some extreme days in a very dry year

The chapter outlines a number of reasons why future river flow is uncertain. These include uncertainties surrounding the effect of the S.B. 1180 contract, continued expansion of water use within existing permits, changes in cropping practices, changes in methods of irrigation, uncertainties about the effect of water bank operation, and growth in municipal and industrial use. The result is both uncertainty as to exactly how much water will be available for new irrigation, and uncertainty as to the ability of Idaho's current water institutions to effectively control water use at any desired level.

Chapter III looks at probable levels of irrigation development if the Swan Falls water right is subordinated, and at the consequences of this new irrigation for Swan Falls flows.

In a memo during the 1983 legislative session, IDWR estimated that it would take 450,000 new acres distributed between hig lift development on the Bruneau, surface water development on the Snake Plain Aquifer, and groundwater development to reduce July flows to the 3,300 minimum flow mandated in the State Water Plan. The IPUC in a memo to the Interim Study Committee implied that 384,000 acres could be developed by high lift pumping from the river, or that 1,557,000 acres could be developed by various developm nt methods before encountering the flow constraints. We accept these estimates as valid measures of the maximum possible new irrigation under alternative scenarios. However it is not likely that this maximum level of development will occur.

With input from the Swan Falls Technical Committee, we have arrived at an estimate that about 195,000 acres of new irrigation would probably develop by the year 2000, if subordination allowed it. This would probably consist of 65,000 new acres on the Bruneau Plateau, 125,000 acres above the Snake Plain Aquifer, and 5,000 new acres on the Salmon Falls Project. These estimates should not be taken completely literally as predictions that particular projects would develop, but rather as indications of the type and extent of probable development. The Technical Committee estimates that the Bruneau development might consist of 17,000 acres served by gravity from Milner, 38,000 acres served by large river pumps operating ten months and using off-stream storage, and 10,000 acres served by small river pumps but no off-stream storage. For the Salmon Falls Project, development is expected to involve 5,000 new acres, along with supplemental water for existing project lands with inadequate water. This water would be diverted at Milner, with no storage. The largest portion of the acreage which the Technical Committee expects to develop by 2000 consists of 125,000 acres over the Snake Plain Aquifer, which would be served predominantly by wells but with some surface diversions. Much of this new acreage would consist of small individual developments rather than large projects.

When the IDWR streamflow/aquifer model is run, using the assumptions of 195,000 acres of new development, flow impacts, by month can be estimated. The average flow reductions at Swan Falls range from a high of 653 cfs in May to a low of 171 cfs in July. The total annual flow reduction is 321,000 acre-feet. The July flow reduction is small because of the assumption that little land requiring direct lift pumping from the river will develop. The assumption that new development will emphasize groundwater use and off season diversion above Milner means that the effects are buffered through the Snake Plain Aquifer. Under this scenario, the new irrigation likely to develop by 2000 has minimal effect on summer flows at Swan Falls.

The chapter discusses the reasoning that underlies the 195,000-acre development estimate. Recent study of water permit applications on file at IDWR indicates a lessening of interest in new irrigation on the Bruneau Plateau. Data on quality of available land suggest that only limited acreages coula be feasibly developed, especially given the depressed state of the farm economy. Uncertainty about future Federal land policies, and the unlikelihood of new on-stream storage projects further clouds the issue.

While the 195,000-acre development scenario is used in the rest of the study as the basis for deriving electric system and economic impacts, it is important to emphasize that the figure is very uncertain. While 195,000 acres now looks like a probable development figure, future changes in the economy or policies could boost the actual development figure closer to the IDWR or PUC figures, or could drop actual development even below the 195,000 acre level. If this happens, then both the electric system and economic impacts would be shifted accordingly.

Chapter IV uses the 195,000 acre new development scenario to estimate the impacts of subordination on electric loads, generation, and costs.

Under subordination new irrigation electric loads and lost hydroelectric generation due to depleted river flows are estimated to be 417.894 million KWH and 224.1 million KWH respectively. These figures differ and are significantly less than those obtained by IDWR and IPUC staff for two reasons. Better data on possible irrigation projects led us to reduce estimates for irrigation acreages likely to develop and the estimates of KWH/acre required for irrigation. Our estimates are 195,000 acres and 2272 KWH/acre (average across possible projects) respectively.

Estimates of costs for lost generation and new irrigation loads are based on figures for the cost of electricity that, in the first instance, involve only the marginal cost of generation (6.4 cents per kwh) but, in the second, the marginal cost of generation adjusted for transmission/distribution losses and reserve margin plus the marginal cost of transmission and distribution capacity (8.5 cents per kwh).

Depending on the method used to apportion these costs as new electric rates are set in the future, the rate increases can be computed. One procedure used in the IPUC memo loads more of the costs on irrigators, resulting in a 52% increase in irrigation electric costs, and a 4.7% increase in rates for all othet users. Another allocation possibility that allocates these costs more evenly between all user classes results in 14.7% and 12.6% rate increases respectively for irrigators and other electricity consumers.

Finally this chapter looks at some of the impacts which these rate increases would have on existing and prospective future users of electricity in the state. The large part of Idaho irrigation which uses little electricity because it relys on gravity delivery and application would not be affected. The irrigation users who are large power users would face income declines if rates increase, as would Idaho industries which use large amounts of electricity. Presently Idaho has among the lowest electric rates of any state, which contributes to its comparitive advantage as an industrial location. Significant rate increases would erode that advantage.

Chapter V examines the economic impact which the new irrigation associated with subordination would have on the economy of the state.

It is clear that new irrigation development would result in new income and employment in the southern Idaho region. We have estimated that per acre value of production might run as high as $631 annually, given that high valued crops are essential for development to be feasible. However, value of output is a poor measure of the benefit of this new production to the region. Profits accruing to the new farm operators might be a better benefit measure, but we have not attempted to estimate profits since this would ignore the impacts of development on all of the other sectors of the regional economy. We argue that value added (the amount left over after paying for other variable production inputs to compensate for the labor, land and capital investment used in production) is a good measure of the impact of new irrigation. Our first estimate of value added per acre is $238. We also argue that the new acreage devoted to crops such as potatoes, sugar beets, and dry beans may displace some existing acreage of these crops. Markets for these crops may be unable to accommodate large increases in production in the next 15 years, and the resulting price drop would drive some existing land from production. Because of the importance of this displacement effect, we estimate that the net direct value added is closer to $130 for each acre of new irrigation, and half that for supplemental irrigation.

Any new irrigation development made possible by subordination would have important effects on the other sectors of the Idaho economy. We estimate that each dollar of new crop production is linked to $1.50 of additional output from other sectors, and to $.60 of new value added. Using the development forecast from the Technical Committee, this implies $77 million of new crop production, an additional $116 output from other sectors, and $46 million new value added. A Columbia Basin study is cited which suggests that this new value added will be heavily concentrated in the farming and food processing sectors, while households will face costs due to higher electricity prices, and energy intensive industries may face narrowing profit margins for the same reason.

Many components of these value added estimates are very uncertain. Things such as the actual nature of future development, future economic conditions, export markets, and federal farm policies are very hard to predict, but they are very important determinants of future crop prices and hence of the value added by new irrigation.

Chapter VI looks at the implications of the Swan Falls situation as it affects the availability of water for municipal and industrial purposes. We recognize that the present situation where new municipal and industrial uses must secure a water right represents a new cost that must be paid by firms loacting or expanding in Idaho. However similar costs would be faced by fims locating in other western states, and these water costs are generally a small part of the cost of setting up a new business. We argue that non-subordination is not causing water availability problems that will significantly disadvantage Idaho as an industrial location.

The chapter also takes a broader look at the possibility of relying more on markets to allocate water within and between uses. We conclude that water markets might improve the efficiency of water use, and make most people better off -- if ways can be devised to either protect or compensate damaged third parties. However the political sensitivity of water rights issues suggests that the issue needs more study than was possible in the short time frame of this study.

Chapter 7 notes that environmental concerns do limit the options available at Swan Falls. The State Water Plan minimum flows are such a constraint, and the Northwest Power Council's fish plan could potentially be another constraint.

The actual economic effect of the environmental consequences of subordination is very difficult to estimate with confidence. We have chosen not to present estimates of such costs. We suspect that while the consequences of subordination may be important for the environment of southern Idaho, the direct economic consequences of these environmental changes are probably not large, so long as the 195,000-acre new irrigation development forcast is not exceeded.

CHAPTER I

INTRODUCTION

1.1 Study Background

In response to issues and questions emanating from the Idaho Supreme Court decision (No. 13794) dealing with water rights at Swan Falls dam for power generation, an interim Legislative Study Committee was appointed (Senate Concurrent Resolution No. 110). In May of 1983 the Interim Study Committee on Swan Falls contacted the University of Idaho to request help in assessing the effects of water right subordination or non-subordination on the economic growth and well being of the state. This report details the results of that research project, begun in August of 1983, and conducted by the University's Idaho Water and Energy Resources Research Institute.

1.2 Study Objectives

The purpose of this project was to examine, with available data, and in the limited amount of time available for the study, the possible economic effects of subordinating or not subordinating the hydropower generation water rights at Swan Falls Dam to irrigation diversion. Specific objectives are:

1. to assemble existing information and the results of relevant research.

2. to evaluate and analyze this information and research.

3. to determine what conclusions about Swan Falls subordination can be drawn from the available data and analyses performed.

1.3 Study Methodology

The research has been aimed at identifying the facts, circumstances, and conditions critical to evaluating the regional economic effects of the legislature's options regarding the Swan Falls water right. Arguments for the adoption of any one policy are not presented, nor are political implications discussed. To the extent possible within limited time constraints, the study has evaluated the impacts of various alternatives.

This study has drawn on existing data and information from a range of state, federal and private agencies. Specifically, the study was aided materially by the cooperation of the Idaho Department of Water Resources, the Idaho Public Utilities Commission, the Idaho Power Company, and the U.S. Bureau of Reclamation. In addition, the study benefitted from close cooperation with the Swan Falls Technical Committee appointed by the Interim Study Committee.

1.4 Organization of Report

The report's results and conclusions are summarized in an executive summary.

Chapter 2 examines Swan Falls historic flows, and estimates of future flows if the water right is not subordinated. Some attention is given to institutional, economic, and technical factors which may influence future flows without subordination. These estimated future flows define the amount of water which subordination would make available for new irrigation development.

Chapter 3 looks at several estimates of the acreage of new irrigation possible with subordination. An estimate of probable new irrigation by 2000 is derived from information provided by the Technical Committee, and the consequences for Swan Falls flow are derived. Factors which influence the probable rate of new irrigation development are examined.

Chapter 4 presents estimates of the electric system impacts of this new irrigation, accounting for both lost hydropower generation and new irrigation pumping loads. The consequences for electric rates are estimated, and the implications of these rate increases for the Idaho economy are discussed.

Chapter 5 addresses the impacts of the new irrigation development for the state and regional economies. The new output and value added generated by the new irrigation is estimated. Results from some related research are cited to suggest the impact of such new irrigation on the other economic sectors of the Idaho economy.

Chapter 6 looks first at whether non-subordination poses a serious barrier to location of new industry in Idaho. The chapter then turns to a wider discussion of whether market oriented institutions could be used to help allocate water in Idaho.

Chapter 7 takes a short look at some of the other potential consequences of subordination such as environmental, recreational, and fishery impacts.

CHAPTER II

EXPECTED RIVER FLOWS AT SWAN FALLS WITHOUT SUBORDINATION

This section presents data on projected flows at Swan Falls under the assumption of no subordination. These data can then be used to estimate the maximum amount of irrigation that could be allowed were subordination to occur. While it is likely that economic factors will be the limiting force in irrigation development, the data developed here provide a basis for estimating how much development would be possible under subordination. The authors would like to emphasize at the outset that river flows may not always be as predicted or determined by established water rights. For example, rental of storage rights to a downstream user such as Idaho Power could result in an increased flow at Swan Falls purely as a result of a water bank transaction. Therefore because of this and other similar examples, care must be taken in interpreting flow data.

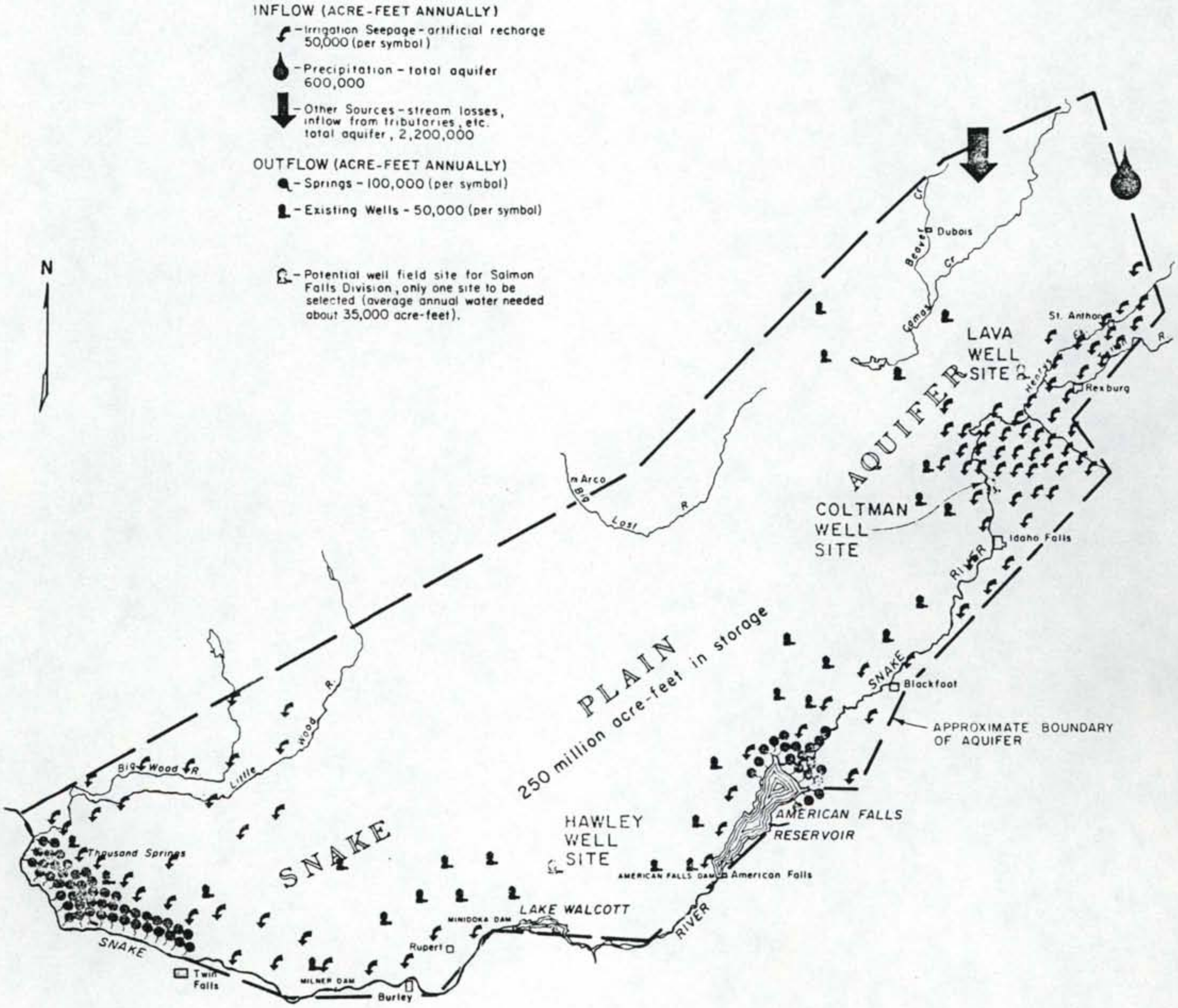
Because historic data and the results of simulation analysis with available river/acquifer models do not account for all factors that may play an important role in future river flows, this section first discusses such data and results and then presents qualifications. Specifically, part 1 presents historic flows and trends, part 2 provides results from simulation of flows with the IDWR acquifer/river flow model with conditions judged reasonable by the Technical Advisory Committee and the authors, part 3 analyzes factors influencing flows that will operate outside model projections and part 4 provides a summary of conclusions.

2.1 Historic Flows and Trends

Flows at Swan Falls are highly seasonal. They peak in April and tail off to a minimum in mid July. These flows come from two major sources; flows past the diversion dam at Milner, and inflows to the river downstream from Milner consisting largely of the flows from springs. This springflow is the outlet from the lower end of the Snake plain Aquifer that underlies much of the upper Snake basin. The aquifer and river are intimately interconnected with water moving from one to the other in different river reaches (Figure 2-1). Figure 2-2 shows the historic pattern of summer flows at Milner and at Murphy gage near Swan Falls.

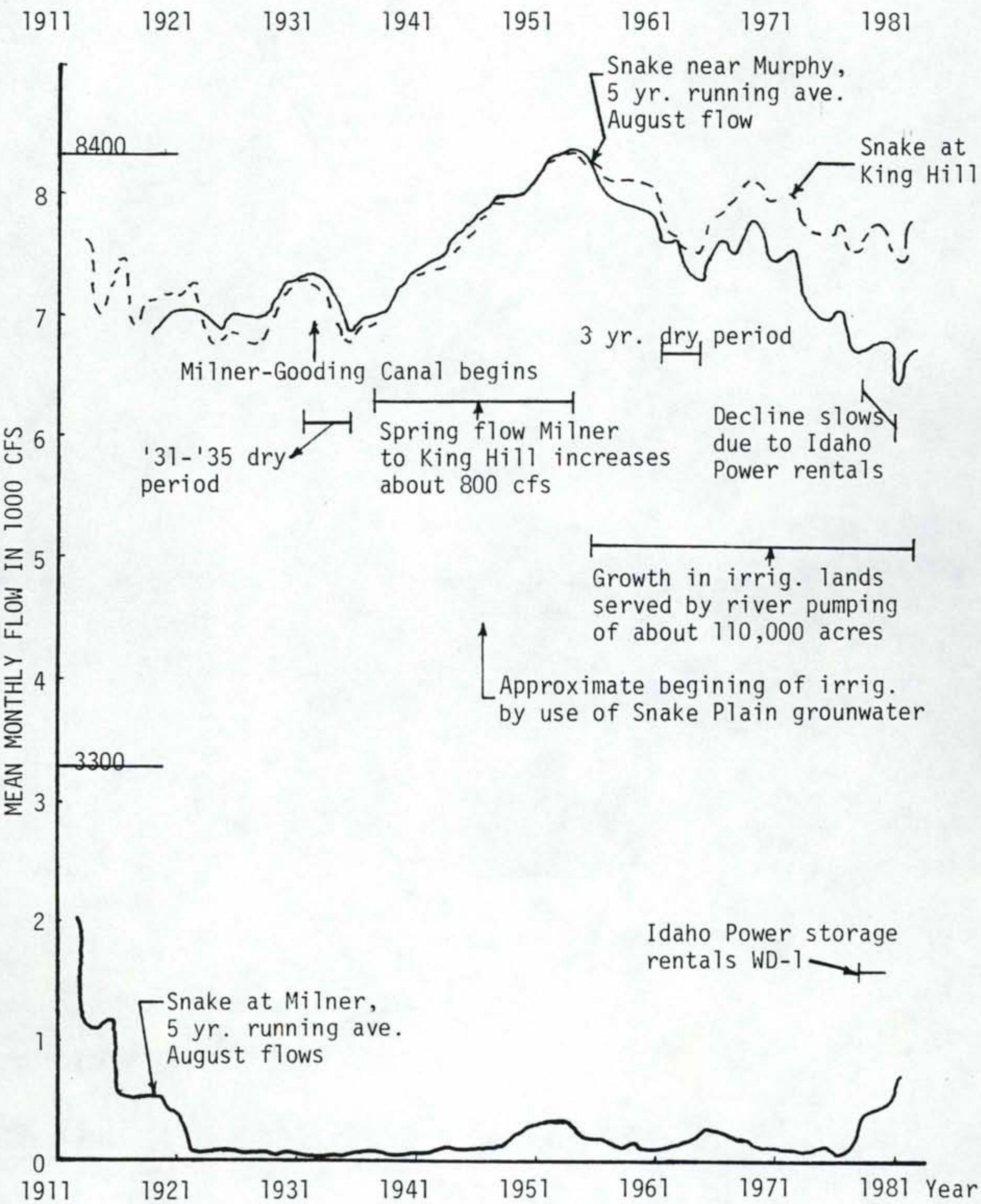
Summer flows at Milner dropped quickly to nearly zero following the extensive development of new irrigated land in southern Idaho in the first decades of the 20'th century. In these summer months, flow at Swan Falls is now almost totally dependent on springflows. Even in the years prior to extensive irrigation development, Swan Falls summer flows were substantially below the 8,400 cfs water right at Swan Falls. Excess diversions for expanding irrigated acreage over the Snake Plain Aquifer served to recharge the aquifer and increased flows at springs in the Milner

Figure 2-1: Snake Plain Aquifer Inflow, Outflow, and Storage.



Source: Salmon Falls Report (1983).

Figure 2-2: Snake River Near Murphy--Summary Hydrograph 1970-81 Ave. and Min.



Source: Idaho Department of Water Resources.

to King Hill reach (Figure 3). These increased springflows pushed Swan Falls summer flows to a peak of over 8,600 cfs in the early 1950's. By that time wells were beginning to draw irrigation water from the Snake Plain Aquifer, and high lift pumping began in the reach between Milner and Swan Falls. This development has continued to decrease Swan Falls summer flows to their current level of between 6,000 and 7,000 cfs. Recent flows have been bolstered somewhat as Idaho Power Company has been able to purchase water bank storage water to supplement its summer hydropower generation needs.

2.2 Simulation of River Flows With Aquifer/Streamflow Models

The IDWR maintains a computer model of the aquifer and streamflow characteristics of the Snake River system. The Swan Falls Technical Committee accepts the projections of this model as the best available, so estimates based on this model will be used in this report.

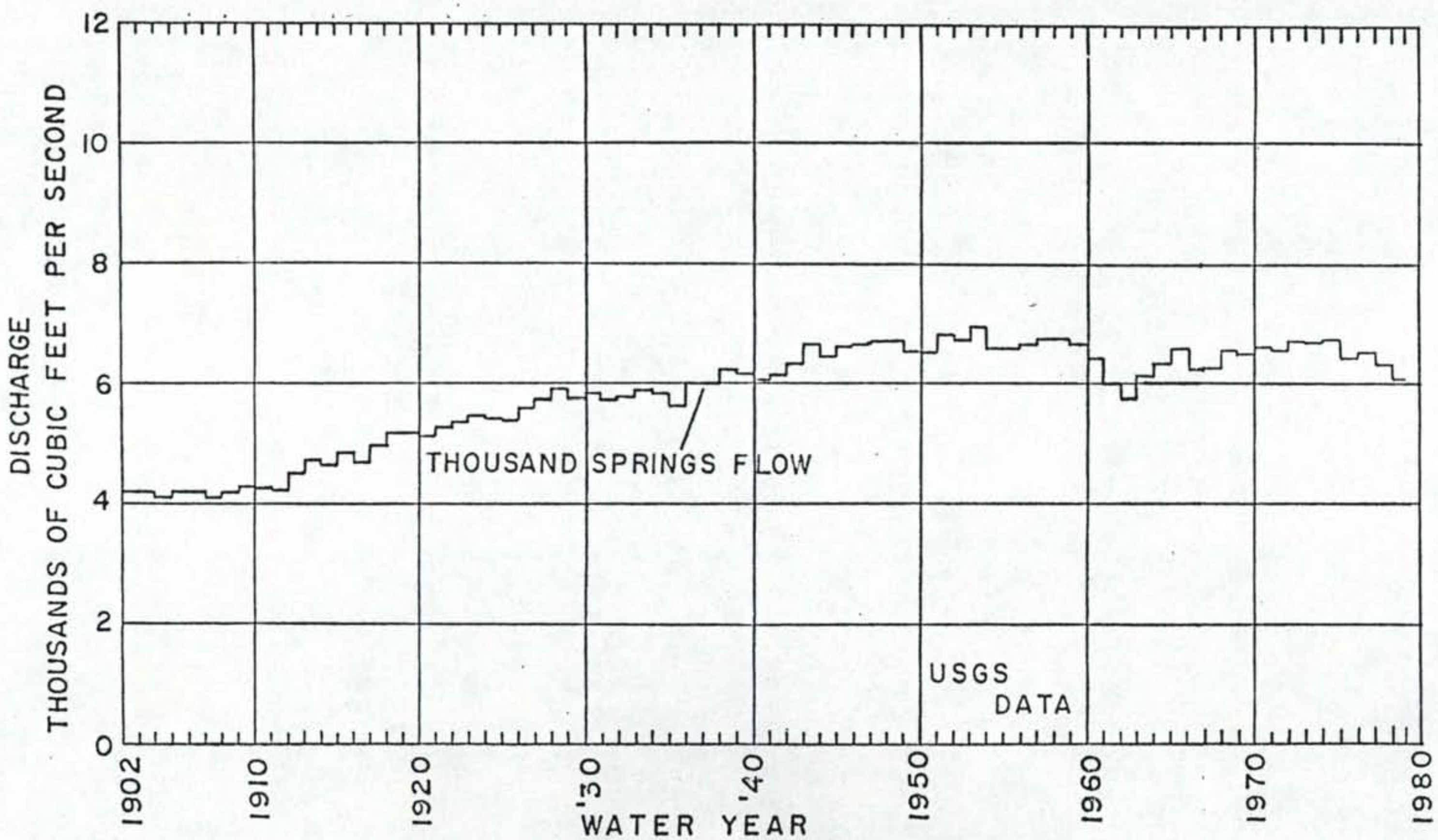
The model allows an evaluation of the impact of alternative levels of depletions on river flows at various points. IDWR has used the model to estimate what flows would have occured in historic years at various points on the river if the 1980 level of irrigation development had been in place. Estimated flows at the Murphy gage just below Swan Falls are shown in Table 2-1 and Figure 2-4. These estimates give an idea of the current flow situation on the Snake River, and consequently they provide an estimate of how much additional depletion is possible before flows are reduced to the minimum flow of 3,300 cfs at Murphy gage protected by the State Water Plan.

Note that the flow estimates in Table 2-1 show long run average July flows of 6,361 cfs, which is 3,061 cfs above the minimum flow. The lowest estimated average July flow produced by the model was 5,249 cfs, corresponding to 1961 hydrologic conditions and 1980 development. Figure 2-4 shows that the average daily flow rates would change quite markedly durring the month of July, dropping from 9,500 cfs in early July to 6,000 cfs in mid month. The lowest estimated daily flow shown in Figure 2-4 is 4,500 cfs in late June. These data suggest that subordination would allow additional depletions of 3,061 average cfs of July flows in an average year, and 1,949 average cfs of July flows in even the driest years. Substantially greater depletions of flows in other months would be possible. Actual depletions would have to be held well below these levels to assure that daily flows meet the required minimum. The limit on new depletions could be as low as 1200 cfs during some extreme days in a very dry year.

2.3 Critical Factors Influencing Flows

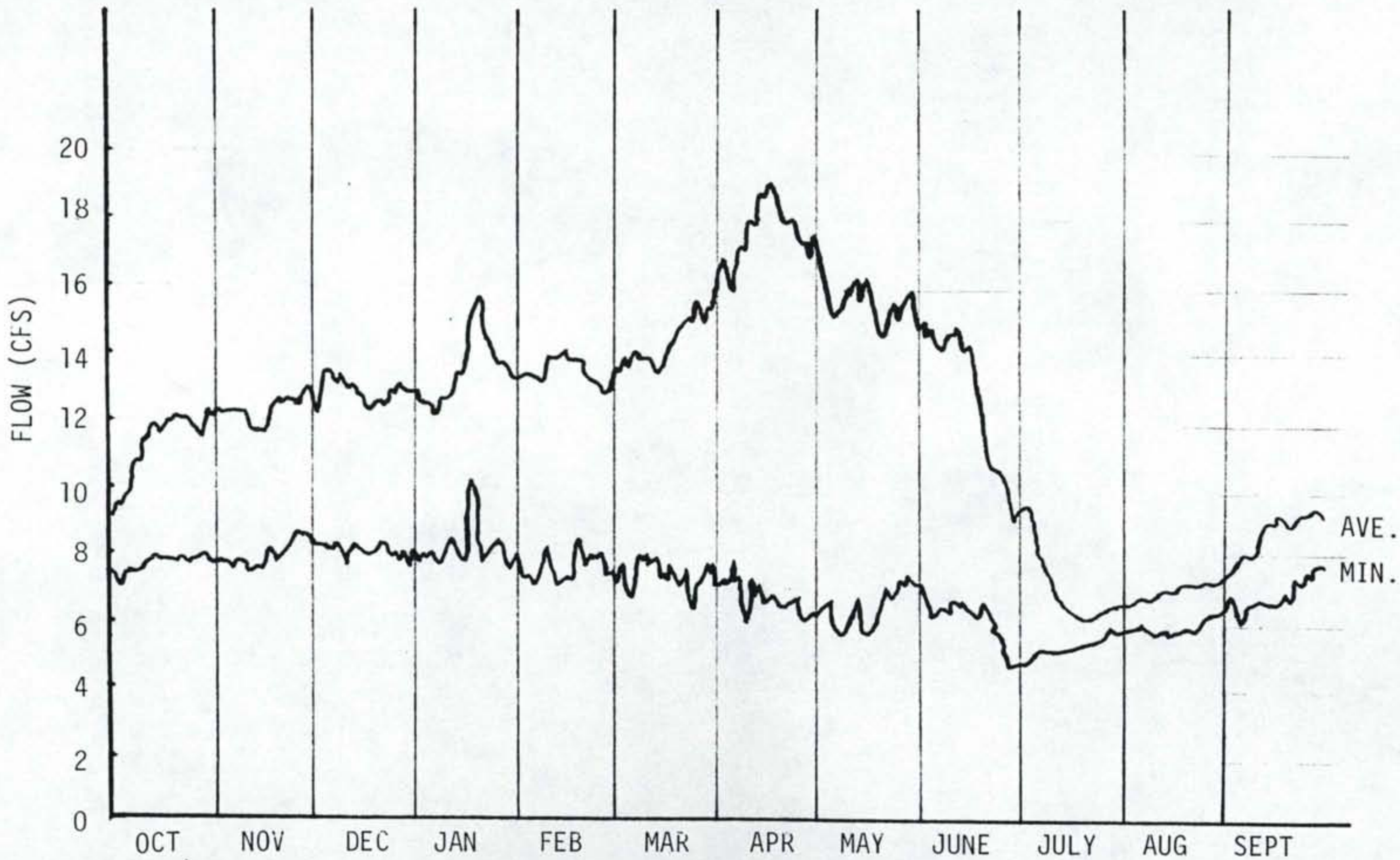
There are various factors influencing the future flows at Swan Falls that are not easily measurable with current data, and are not built into the IDWR model or require significant new research. Some of these factors will involve

Figure 2-3: Historic Spring Flow Between Milner and Swan Falls.



Source: U.S. Geological Survey.

Figure 2-4: Trends in Summertime Flows and Indicators of Causes - Snake River Near Murphy (Swan Falls).



Source: Idaho Department of Water Resources.

TABLE 2-1: ESTIMATED MONTHLY RIVER FLOW AVAILABLE FOR DEPLETION ABOVE SWAN FALLS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP
AVERAGE MONTHLY FLOWS FOR 51 YEARS OF DATA												
1980 LEVEL OF DEV.	9157	11232	11954	11776	12846	12773	13138	10200	8788	6361	6645	7979
REQUIRED MIN. FLOW	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300
DIFFERENCE	5857	7932	8654	8476	9546	9473	9838	6900	5488	3061	3345	4679
LOWEST MONTHLY FLOWS FOR 51 YEARS OF DATA												
1980 LEVEL OF DEV.	7936	8328	7940	7792	7996	7574	6843	6124	5941	5249	5735	7049
REQUIRED MIN. FLOW	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300	3300
DIFFERENCE	4636	5028	4640	4492	4696	4274	3543	2824	2641	1949	2435	3749

SOURCE: IDAHO DEPARTMENT OF WATER RESOURCES AQUIFER/STREAMFLOW MODEL problems with the current definition of water rights and the current flexibility and capability of institutions to address problems with allocation, leasing and exchange of water among irrigation interests, power generation and other users or applications. They are outlined as follows:

2.31 The S.B. 1180 Contract

When the Idaho Supreme Court decision on Swan Falls was released, the Idaho Power Company initiated a lawsuit against some 7,500 farmers alleged to have begun diverting irrigation water since 1976. The Company's position was that these farmers, in diverting water, were encroaching on Idaho Power's water right at Swan Falls. A contract between the State of Idaho and Idaho Power to dismiss a significant number of the farmers or irrigators from the suit has been debated by various parties but is as of yet unsigned. The thrust of the contract would be to drop some 5000 farmers who had begun irrigation activities or had made a "substantial" investment in in these activities on or before 1979. Suits would not be dismissed against those who began to divert water after 1979, when Idaho Power had again begun to assert its rights -- as evidenced by the moratorium on new electric irrigation pump hookups in its service region.

The Supreme Court remanded the Swan Falls case back to the District Court to decide whether the power company had forfeited or abandoned some portion of its water right. This case also has not been decided.

If either the contract remains unsigned, or the lower court decides that Idaho Power should retain all of its water right at Swan Falls, then land targeted for irrigtion or currently under irrigation could not be irrigated. At this time there are no estimates available as to the acreage presently at risk, or of the flow consequences if some land were to exit from irrigated production. While it is impossible to know the future on this matter, it is assume for purposes of this study that either a contract will be signed between the State and Idaho Power and/or the lower court will decide that Idaho Power has abandoned enough of its water right at Swan Falls so that little if any presently irrigated land will be affected.

2.32 Possible Expansion in Current Water Use

Without subordination, it is very possible that increased depletion may occur with no expansion in valid water permits. One possibility and a serious problem is undocumented expansion in water use through decisions by individuals to spread water over larger acreages without proper permission from IDWR. It has been argued that currently there are substantial acreages (that have been irrigated in recent years) where irrigation system improvement on one parcel has released water that subsequently was used to irrigate adjacent parcels without authorization by permit. Regardless of the benefits that irrigation system improvements may bring an irrigator or his neighbors, the evapo-transpiration needs of additional crops produce an additional depletion from water that would otherwise recharge the acquifer or produce return flows to the river system with the net result of reducing flows at Swan Falls.

Any existing undocumented expansions in water use are included in the streamflow data and computer-simulations of the acquifer and river system for the current level of development. The issue of how to deal with the water rights involved with these problems is beyond the scope of this study and should be an important target for future research. The important point here is that institutions have not been effective in controlling (or even detecting) such past use expansions -- and, without some attention, modification or development, are likely to be unable to control such expansions of use in the future. While the magnitude of these flow reductions is open to speculation, the position in this report is that some new depletions will occur with or without subordination. Our estimates of future irrigation development will include some such undocumented acreage expansion.

2.33 Changes in Cropping Practices

Some expansions of depletions are apparently completely legal under current water institutions. Specifically, changes in cropping practices may result in changes in the amount of water used by plants, even if diversions remain unchanged. For example, there is some interest in double cropping practices for both erosion control and economic reasons. One possibility might be to harvest a grain silage crop before planting beans or corn. Other more exotic crop combinations are being discussed. The point is that if such practices become widespread, the inevitable result will be increased crop water requirements, and increased Snake River depletions. While potentially important within a few years, it is too early to even try to estimate the impact on Swan Falls flows, especially the critical summer month flows.

Some figures will be presented, not as predictions, but rather as an example to illustrate the potential importance of double cropping on water use. In recent years the total Idaho irrigated acreage devoted to dry bean and corn production has been about 300,000 acres. If only 10% of this land, located upstream from Swan Falls were to adopt double cropping practices that would involve 30,000 acres. A normal spring grain crop has about a 20-inch net irrigation requirement. Double cropped grain, removed early for silage might have only a 12-inch net irrigation requirement -- but spread over 30,000 acres this would be a non-trivial new depletion of 30,000 acre feet.

Less spectacular, but perhaps more important, is the possible impact if the crop mix grown on irrigated land should shift. Even a small percentage shift of land from low consumptive use crops such as grains and beans to high consumptive use crops such as potatoes, sugar beets, or alfalfa would result in substantially more depletion and lower river flows. It is difficult to do much more than speculate about the likelihood of such shifts in future cropping patterns. However as water constraints restrict the development of new irrigation in southern Idaho, it is at least plausible that cropping intensity will increase on existing irrigated land.

Again in the spirit of an example, not a prediction, note that if irrigated alfalfa production above Swan Falls were to increase by 10 percent (or 48,000 acres) at the expense of spring grain acreage, each acre affected would consume about 9 inches more water. This hypothetical shift from grain to alfalfa would increase depletions by about 36,000 acre-feet.

While future shifts in cropping practices and acreage mix are very likely, we have no basis for predicting their extent or their effect on depletions. While we will ignore these factors in the analysis which follows, they are potentially important and deserve further study.

2.34 Changes in Irrigation Technology

We have noted that improved irrigation technology has often enabled farmers to irrigate new land -- often under an IDWR permit, but sometimes undocumented. It is important to look a bit closer at the impacts of such improved technology in some regions. In areas above the Snake Plain Aquifer non-sprinkler irrigation recharges the aquifer and enhances flows at the various springs discharging from the aquifer to the river. If sprinklers were to be installed in such areas, less water would be diverted from the river and aquifer recharge would be reduced. In a dry year this water left in the river would be used to firm up junior downstream rights, while spring - dependent flows at Swan Falls would be reduced. However in years or situations where the saved water is not diverted downstream, the change would enhance critical summer flows.

Much of the interest in sprinklers and other high-application efficiency irrigation systems, results from the somewhat higher yields they often make possible. Sprinklers often allow better timing of water application, more even water distribution and hence can increase crop consumptive water use along with yields. Sprinklers may also increase other consumptive water uses such as evaporation losses. The result can be greater depletions above and lower flows at Swan Falls.

In summary, changes in irrigation technology can affect the route through river or aquifer which flowing water takes and the timing of these flows. However, irrigation efficiency improvements in southern Idaho, as they would currently be handled, would not tend to "save" much if any water that is then available for use elsewhere within the river basin. Clearly research needs to be undertaken to determine what changes in irrigation technology are most likely and the magnitude of their impact on future flows at

Swan Falls.

2.35 Idaho Water Bank Ooperation

While the Idaho Water Bank expedites the transfer of water to users who benefit from it and potentially provides an important institution for directing water to its highest valued applications across farming, electric generation, industrial and other possible uses, its operation may influence future Swan Falls flows. Theoretically, if an irrigator were to become more efficient and were to transfer excess water through the bank to another farmer who irrigates new land, then this expansion of use might lead to stream flow reductions. On the other hand, third parties are supposedly protected against adverse impacts of Water Bank transactions. Yet consider the example of a farmer who installs sprinklers so that he no longer needs to divert part or all of his storge water right. If the Water Bank serves as a mechanism for him to lease that storage to another farmer to apply to new land, the increased depletions will reduce flows from the river / aquifer system at Swan Falls. It is not clear which if any of the many diffusely affected third parties would perceive the damage and act to block that transfer. It is not even clear that the transfer should be blocked--as the question stands: Who owns the water right and are there ways to alter the definition of the water right so that damage to third parties is either prevented or compensated? Certainly to the extent that transfers exert a cumulative but diffuse effect, the Water Bank needs to become a sufficiently flexible institution to handle them.

Water Bank transactions presently involve a large volume of unallocated and infrequently used storage rights at several the Federal dams on the upper Snake. Table 2-2 summarizes the water bank activity for the years 1976 - 1981. The fact that some farmers hold both a flow right that is almost always sufficient and a substantial storage right for insurance, results in some storage that is infrequently used. If storage remains unused, the result may be increased spill in spring months, most of which could otherwise be used for electricity generation. If this stored water is diverted for expansion of irrigation through the water bank, then some spring power generation is lost. Admittedly, if such new irrigation had less than perfect irrigation efficiency, the surface runoff and aquifer recharge might possibly enhance critical summer flows. If this were in fact the result, the loss of substantial spring flows in trade for some enhancement of late summer flows might possibly be worthwhile. Clearly, the value of the Water Bank is in its potential for allowing water in dry and wet years to go to its highest valued use--where any water user might be able to bid. It is therefore important that alternative uses be studied and prices appropriate to compensate third parties as well as those owning storage rights be set with some market mechanism playing a role.

In recent years, the Idaho Power Company has been a major purchaser from the Water Bank. This, of course, provides for

Table 2-2: Waterbank (Rental Pool) Transactions for 1976-81.

Year	Placed In	Marketed	Prices Paid: Spaceholder	Prices Paid: District 01 Administration	Prices Paid: Total	Percent Runoff to Normal
	acre-feet	*acre-feet*	*dollars*	*dollars*	*dollars*	
1976	8,300	8,300	0.50	--	0.50	123
1977	84,500	84,500	0.50	--	0.50	51
1978	18,300	7,100	0.50	0.25	0.75	120
1979	88,200	74,000	0.62	0.57	1.19	90
1980	71,600	14,600	0.64	0.56	1.20	95
1981	168,700	134,000	1.80	0.50	2.30	80

Source: Salmon Falls Study (1983).

company demands for electric generation--forestalling alternative development of thermal generation plant and the significant rate increases that would be required of electricity users in order to pay for such plant. It is important to understand that one result of Idaho Power purchases of storage water is increased flows at down-river locations--including Swan Falls. Recorded flows at Swan Falls may therefore not accurately reflect the actual flow associated with Idaho Power's water right there. Recorded flows will exceed whatever actual flows associated with a water right by the amount attributable to water released in response to storage right purchases and hence usage. Figure 4 suggests that summer low flows at Swan Falls in recent years may have contained at least several hundred cfs of purchased water bank flows.

2.36 Growth of Municipal and Industrial Use

Idaho population growth has been rapid over the last decade and may continue with a similar trend. Currently, municipal use is small relative to irrigation use. Nevertheless, IDWR estimates that the annual, maximum irrigation usage for maintaining grass on only one large, residential city lot--by itself--would be 1.5 acre- feet annually. IDWR is also allowing new, small residential, commercial or industrial diversions of less than 1.5 acre-feet per year. The future depletions in flow at Swan Falls may not be large but will probably be important to some degree.

Industrial users above 1.5 acre-feet annual use per user are presently being required, by IDWR, to secure a water right. The importance of looking at water rights in terms the consumptive use of the water available is something to again emphasize here. If the industrial water right is obtained by transfer from irrigation use, and if the new user is held to the same level of depletion (consumptive use) under that right as was true of the former irrigation use, then annual river flow will be unaffected, although its timing may change. However if the issue of consumptive use is neglected and the particular industrial uses replaceing other uses are more consumptive, then development of these uses could significantly reduce river flow.

2.4 Summary

Historically, late summer flows at Swan Falls were enhanced by irrigation diversions in the upper Snake, a recharge of the acquifer system and hence increased flows at Thousand Springs. Deep well pumping from the aquifer beginning in the 1940's and high lift pumping which began in the 1960's have led to systematic river flow declines since the early 1950's

When the IDWR streamflow / aquifer model is adjusted to account for the 1980 level of irrigation depletions, and is used to simulate the 51 years of actual, historical streamflows, it projects an expected average July flow at Murphy of 6,300 cfs. Using data from the worst year of record, 1961, the model projects a July flow of only 5,249 cfs (1980 level of irrigation still assumed). Of course, it should be understood that some daily flows in dry years would have been as low as 4,500 cfs.

In the next section, we will use the difference between the 5,249 cfs critical year July flow and the 3,300 cfs minimum flow mandated by the State Water Plan in estimating the maximum additional irrigation that would be possible if subordination were about what the future flows might be without subordination. One of the important issues is clearly a development of Idaho's water institutions into a secure mechanism for controlling consumptive water use and, very importantly, for promoting a market for water where water tends to be allocated to its highest valued uses.

If subordination occurs, and at the same time the problems discussed in this section are not addressed, the conclusion here is that the maximum acreage of possible irrigation development may fall considerably below the upper bound estimated in the next section. Viewed from a different angle, the points we have raised here raise serious questions about the possibility that, given subordination, depletions could be stopped at a level that would assure the 3,300 cfs mandated minimum flow. The problem of either shutting off some water users or arguing for an abandonment of the minimum flow requirement would be difficult to deal with.

CHAPTER III

ACREAGE OF NEW IRRIGATION POSSIBLE WITH SUBORDINATION

New irrigated acreages possible as a result of subordination depend on the difference between the 3300 cfs minimum flow set by the State Water Plan and the flow at Swan Falls that would exist without subordination. Chapter II above established estimates of flows without subordination and it is the purpose of this chapter to project the implications of the "available" flow (flow above 3300 cfs) for irrigation development. Specific objectives are: (1) presentation of the new irrigation acreage estimates believed here to be best, (2) comparison of these estimates with those developed by others, and (3) examination of factors influencing or raising questions of uncertainty about these estimates.

The methodology here is similar to that followed by others interested in projecting possible irrigated acreage expansion following subordination. Specifically we define the water potentially available for new irrigation as the difference between current flows with a 1980 level of development but under a dry water year assumption and the 3,300 cfs minimum mandated by the State Water Plan.

3.1 Expected Locations and Acreages for New Development

One key question when trying to estimate the amount of new acreage that might be irrigated with subordination, is where that new acreage might be located. Location is important because of the effect of the aquifer - streamflow interaction. If new development occurs as new high lift pumping from the Snake between Hagerman and Swan Falls, then large amounts of water will be pumped in the late summer critical low flow months. This would sharply reduce July - August flows but influence other summer flows less, and winter flows hardly at all. In contrast, if the new development uses groundwater from the Snake Plain Aquifer, the effect of the wells on Swan Falls flow will be buffered by the aquifer. While both types of development may have similar effects on annual flows past Swan Falls, the high lift development would primarily impact summer flows, while the groundwater development would depress flows year - round. If the effective constraint on new irrigation is the 3,300 cfs minimum flow, then much more groundwater development is possible than if high lift pumping is the method of development.

In the remainder of this section we discuss the alternative projections that have been made for acreage development. We identify what we consider to be the best estimates of new acreage and discuss how these are different from the other available estimates. We also draw inferences as to what these developments will mean for Idaho agriculture.

3.11 Alternative Projections

There have been several attempts to estimate the upper bound of how much new irrigation would be "possible" if the water right at Swan Falls were subordinated to upstream irrigation. One estimate was made by IDWR durring the 1983 legislative session. They estimated, using their aquifer - streamflow model, that it would take 450,000 new acres distributed between high lift development on the Bruneau, surface water development on the upper Snake, and groundwater development on the Snake Plain Aquifer to reduce July flows to 3,300 cfs in a dry year such as occured in 1932 (1932 flows represent the kind of dry year that might occur in one year out of eight).

More recently the PUC estimated the maximum possible development under two extreme scenarios. They computed that it would take 384,000 acres (806,600 acre-feet divided by 2.1 acre-feet per acre) of direct pumping from the Hagerman to Swan Falls reach to reduce July flows to 3,300 cfs under the one year in eight dry year conditions. Alternatively, they estimated that it would take 1,557,000 acres of development of various types including extensive water storage to reduce Snake River flows at Swan Falls to 3,300 cfs in all months.

We have no reason to question either the methods used or the figures obtained by IDWR or the PUC. However, we feel that these figures or estimates have not always been interpreted correctly. What they represent are essentially estimates of the MAXIMUM new irrigation possible under a range of alternative development scenarios. It is our opinion that the maximum is very unlikely to be achieved in the near future. Several reasons for this view are discussed later in this section. Furthermore there are sufficient uncertainties in estimating new irrigation development that a range of possibilities exist which may include the estimates of IDWR and the IPUC staff.

The best estimate that we were able to identify for acreages likely to develop with irrigation under subordination was provided to us by the Swan Falls Technical Advisory Committee with our input. Their estimate of new irrigation likely to be developed by the year 2000 appears as Table 3-1.

The committee estimates that a total of 195,000 new acres will be developed. This new acreage will consist of 65,000 new acres on the Bruneau Plateau, 125,000 acres above the Snake Plain Aquifer, and 5,000 new acres on the Salmon Falls Project. These estimates should not be taken completely literally as predictions that particular projects would develop, but rather as indications of the type and extent of probable development. The committee estimates that the Bruneau development might consist of 17,000 acres served by gravity from Milner, 38,000 acres served by large river pumps operating ten months and using off-stream storage, and 10,000 acres served by small river pumps but no off-stream storage. For the Salmon Falls Project, development is expected to

TABLE 3-1

POTENTIAL IRRIGATION PROJECTS DEVELOPING UNDER SUBORDINATION

AREA**	IRRIGATION SOURCE	PROJECTS	ACRES
1. Bruneau I	Snake River: large pumps with off-stream storage & ten month pumping	-Twin Buttes, Little Pilgrim & Enterprise Acres: 20000ac -Dove Springs: 12000ac -Narrows: 6000ac	38,000
2. Bruneau II	Milner: gravity with no storage	-Canyon View - Tuana	17,000
3. Bruneau III	Snake River: small pumps with no storage	-small pump projects	10,000
4. Salmon Falls	Snake River at Milner: no storage	-5000 new acres -Salmon Falls Project (supplemental water supply)	5,000 plus supp. for S.F. project
5. Eastern Snake Pl. (90% IPC serv.area)	Groundwater and surface water: in-season pumping, no storage	-Minidoka project: groundwater-3000ac -Expanded irrigation on small farms	125,000 mostly add'n to existing system
		TOTAL	195,000 ac

COMPARISON: a. Salmon Falls Study[ ] (class 1 & 2 land with pumping lift less than 500 ft & groundwater only) 140,000 ac

b. IPUC staff[ ] (imputed from net annual water depletion figure of 806,600 af and assumed consumptive requirement of 2.1 af/ac 384,095 ac

c. IDWR report[ ], "Estimate of Possible Primary Impacts Resulting from The Swan Falls Dec." 450,000 ac

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** Bruneau I, II and III designations are arbitrary for purposes of distinguishing projects.

SOURCE: Snake River Technical Advisory Committee
October 19 and November 7, 1983 memoranda

involve 5,000 new acres, along with supplemental water for existing project lands with inadequate water. This water would be diverted at Milner, with no storage. The largest portion of the acreage which the Technical Committee expects to develop by 2000 consists of 125,000 acres over the Snake Plain Aquifer, which would be served predominantly by wells but with some surface diversions. Much of this new acreage would consist of small individual developments rather than large projects.

3.12 Implications of the Expected Development

IDWR agreed to run the acreage predictions of the Technical Committee through their streamflow/aquifer model. The results are shown in Table 3-2.The average July flow at Murphy would decrease to 6,190 cfs (a drop of 171 cfs), and the lowest July flow would decrease to 5,090 (a drop of 158 cfs).

These estimated July flow reductions are smaller than might be anticipated for the 195,000 new acres because of the assumed distribution of the development. The development projected in the table 3-1 includes only 48,000 acres served by high-lift river pumping between Milner and Swan Falls, substantially less than the corresponding acreages used in the IDWR and PUC reports. Thus three-quarters of the new acreage would be served by either diversions above Milner or wells. The reasons why such a configuration is probable are outlined below. The small amount of direct river pumping, which is additionally buffered by the assumption of some off-stream storage, reduces the size of the summer flow impact. The impact of new wells and diversions above Milner is spread across all months. It is important to keep in mind that while this development configuration would minimize summer flow impacts, it would result in 321,000 acre-feet of new annual depletion at Murphy.

3.2 Factors Influencing The Type, Extent, and Location of New Irrigation Development.

As we have indicated, there is considerable uncertainty about how much irrigation development is likely to occur in the future. Obviously, water availability is not the only prerequisite for development. The actual level of development would depend on economic conditions and a wide array of governmental policy decisions, all of which influence farmers' willingness to proceed with irrigation development.

3.21 Evidence from Water Filings

Much of the proposed future irrigation development in southern Idaho has been backed up by applications to IDWR for water permits. Hence the permit applications should give some idea of the possible levels of development and the locations where development is likely to occur. Most of the applications to divert from the Hagerman to Swan Falls reach are linked to proposed Carey Act or Desert Land Entry projects. There are many

TABLE 3-2: ESTIMATED IMPACT OF 195,000 ACRES OF NEW IRRIGATION ON SNAKE RIVER FLOW AT MURPHY

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP
AVERAGE MONTHLY FLOWS FOR 51 YEARS OF DATA												
1980 LEVEL OF DEV.	9157	11232	11954	11776	12846	12773	13138	10200	8788	6361	6645	7979
195,000 MORE ACRES	8827	10538	11509	11480	12209	12168	12571	9547	8316	6190	6421	7730
DIFFERENCE	330	694	445	296	637	605	567	653	472	171	224	249
LOWEST MONTHLY FLOWS FOR 51 YEARS OF DATA												
1980 LEVEL OF DEV.	7936	8328	7940	7792	7996	7574	6843	6124	5941	5249	5735	7049
195,000 MORE ACRES	7725	7964	7902	7734	7538	7263	6529	5875	5783	5091	5484	6693
DIFFERENCE	211	364	38	58	458	311	314	249	158	158	251	356

SOURCE: IDWR STREAMFLOW/AQUIFER MODEL

parcels which were filed on several times (perhaps both Carey Act and DLE or perhaps multiple DLE filings or other combinations), so simply adding up the volume of water applications gives a misleading figure. Recent investigation by the Idaho Carey Act Association (Martin, 1983) suggests that many of these applications are either being withdrawn, are inactive, or are of very dubious economic feasibility. Many of those who originally proposed these developments are now too old to be interested in proceeding. Many of the applications that would have made economic sense a decade ago are probably infeasible at present crop prices, and power costs. Hence, at the moment, the evidence from active water filings suggests a waning of interest in new irrigation development in the Hagerman to Swan Falls reach, justifying the 65,000 new acre figure proposed by the Technical Committee. It should be borne in mind however, that if crop prices increase, and there were some assurance that electric prices would not go too high, that water would be available, and that federal land would be released, then a flood of new applications could result.

3.22 Quality of Farm Land Available

As irrigation developed in southern Idaho, the best and most accessable lands were irrigated first. Now, land quality is in some cases a restriction on development. Out of 439,000 acres in the Bruneau area studied in the BLM environmental statement there are 139,900 acres of class I and II land. Much of this is too high above, or far from the river for development to be feasible. The Salmon Falls Advisory Group developed the information in Table 3-3, which shows the potentially developable lands above the Snake Plain Aquifer. Out of 860,000 acres of potentially developable lands, only 140,000 acres of class I and II lands have a water table at a depth of less than 500 feet and yet lie outside of reservation areas such as INEL, Fort Hall Indian Reservation, and game refuges. The small amount of lands of quality high enough to justify development under present economic conditions lends credence to the new acreage forcasts of the Technical Committee.

3.23 Effects of Economic Conditions

If subordination occurs, development will still depend on the state of the farm economy. If low crop prices, and relatively high production costs and interest rates continue into the future, very little development will occur. Furthermore, the prospect of higher irrigation electric rates irrespective of decisions made about Swan Falls will also reduce irrigation expansion.

Research by Hamilton, Barranco, and Walker (1982) of the University of Idaho documents the sensitivity of new development to prices, costs, and electric rates. The interest rate problem is perhaps the most insurmountable. A few years ago high interest rates were offset by high inflation and rapidly rising land prices. Now interest rates are still high, but inflation has subsided and land prices have stabilized. Thus irrigation development can no longer be financed out of future land value

Table 3-3: Potentially Irrigable Drylands Overlying the Snake Plain Aquifer - 1977.

Lands	Land Class (Acres)		
	Lands 1 & 2	Land 3	Total
Potentially irrigable lands, total	490,000	370,000 1/	860,000
Less portion of above lands in Federal, State, and Indian reservations which may not be available for private irrigation development (Idaho National Engineering Laboratory, Fort Hall Indian Reservation, game refuges)			(-164,000)
Less lands where depth to ground water is more than 500 feet			(-376,000) 2/
Remaining lands where depth to water table is less than 500 feet	140,000	180,000 1/	320,000 2/

1/ Class 3 lands have severe limitations for irrigated agriculture, according to studies made for the Idaho Water Resource Board.

2/ Includes Bureau of Land Management and other Federal and State lands, some of which are not available for irrigation development

Source: Salmon Falls Study (1983).

appreciation, borrowers can no longer count on paying off loans with less valuable inflated dollars, and lenders may be more reluctant to fund much new irrigation.

Much new irrigation, especially in the upper Snake region will be new acreage being added to (but not necessarily contiguous to) existing operations. The ability to spread existing machinery, management expertise, and labor across more land may make new development feasible where it would otherwise be impossible.

It is uncertain what impact recent tax law changes may have on irrigation development. Changes in depreciation and investment tax credit rules seem to encourage development. Reductions in tax rates for high bracket income seem likely to reduce the incentive to use farming as a method to shelter other income from taxes. The Idaho property tax 50% initiative will shift more of the property tax burden onto farmland. What the net effect of these various changes will be is open to question.

The Idaho farm economy is very sensitive to federal farm policy. Federal policy seems to be moving toward greater reliance on market forces to reduce farm program cost to the treasury, and could result in lower crop price levels. Yet programs like PIK have not included large farm payment limitations, so they could favorably impact the relatively large farms that might be developed on new land.

Hence current economic conditions alone are sufficiently unfavorable to hold new development below the 50,000+ acres per year which occured in the late 60's and early 70's. However there are enough farmers with optimism about the future, with access to capital, and perhaps with existing operations that could be expanded, so that some development will surely occur if and when farmers are given permission to proceed. The new acreage forcast from the Technical Committee implies about 13,000 acres of new development per year prior to 2000, and so is consistent with the state of the economy for the forseeable future.

3.24 Sensitivity to Federal Land Policy

Much of the potentially developable land, especially in the Hagerman to Swan Falls reach is federally owned. Development plans presume that the BLM will release this land under the DLE or Carey Act programs. It has often been the low cost of this land (as compared to the free market price at which such land would sell) which has provided the margin that makes development feasible. The BLM extensively studied the possible impacts of releasing a large tract of land on the Bruneau Plateau for irrigation in a recent environmental impact statement (1979). The EIS raised a nunber of questions about the economic feasibility and energy impacts of such development. However the BLM has not closed off the possibility that it would allow such development. Current BLM evaluation procedures seem to require each parcel to stand the test of separate feasibility (rather than as a parcel added to an existing unit) and the procedures do not recognize many of the tax benefits available to the farmer - developer. Hence the procedures being used by BLM seem likely to find that development of some parcels is economically unjustified, when in fact a farmer would be willing to develop it. Moreover, there is some question whether BLM land would even be released under the DLE or Carey Act when the new BLM "Organic Act" authorizes the agency to dispose of lands through outright sale or through leasing.

3.25 The Implications of Upstream Storage Possibilities

Development of new irrigation by diversion of surface water above Milner Dam is limited by present levels of storage and natural flow. In most years little water passes Milner during the summer months. Even with subordination at Swan Falls, any new diversions above Milner would probably need to be accompanied by either new on or off-stream storage. In the past most southern Idaho storage projects have had extensive federal involvement. More recently however the federal government has shown less willingness to get involved in large new storage projects. Also, there are few really good storage sites available. The Salmon Falls Advisory Group addressed the possibility of new on-stream storage:

> "There are normally flows in the Snake River that could be stored during the months of December through April. However, in a dry year such as 1961 or repetition of the 1931 through 1942 dry cycle, no flows are available even durring these months. Providing sufficient capacity to allow carryover for the dry year planning period requires a storage-volume-to-firm-yield ratio of about 10 to 1. Thus, new surface storage is not considered an economical source of water for the Salmon Falls Division." Salmon Falls Advisory Group, 1983.

The Swan Falls Technical Committee have advised us that they also consider new onstream storage above Milner to be unlikely, although some small privately financed off-stream storage projects involving Bruneau Plateau land are possible. We have no basis for disagreeing with the Technical Committee on this point, so we concur with their forecast that forseeable southern Idaho new irrigation development will, in general, be limited to lands that can be served without new large storage projects.

3.3 Conclusions

Given the uncertainty, and lack of any well established forecasting methodology which surrounds any estimates of this type, it would be easy to criticize the irrigation forecast from the Technical Committee. It would be easy to speculate that current economic conditions, or federal land policy, will hold development below their forecast, or to speculate that economic recovery will push development beyond their forecast, and closer to the upper bound estimates of IDWR or PUC. However, we can find no really solid economic evidence which clashes with the acreage forecast of the Technical Committee. (The Northwest Agricultural Development Project (1979) was even less optimistic about the feasibility of new irrigation development in southern Idaho, but this study ignored the incentives to development posed by cheap federal land and federal tax policy. The BLM Environmental Impact Statement (1979), although now somewhat outdated, was more optimistic about the private feasibility of future development when federal land and tax factors are included.)

We have chosen to use the Technical Committee forecast of future irrigation as a reasonable baseline development scenario. We will use this forecast in the rest of this report, as a baseline case for looking at streamflow, power generation, power use and economic impact consequences. We have noted that the streamflow results of using this forecast are very sensitive to the assumption that only a small part of the new development will rely on direct river pumping durring the summer months.

We have noted that the acreage figures used by the PUC and IDWR are maximum developable acreages which would consumptively use the available water under various development scenarios. We think that economic conditions, uncertainty about the availability of federal land, and expectations of higher pumping costs will hold development of new irrigation well below the maximum possible aver at least the next 15 years. We agree that the Technical Committee's forecast of development is a reasonable baseline estimate to use in planning. The estimate produced by IDWR is useful as a realistic upper bound on development -- the maximum possible development that could occur if a drastically improved economy and other factors should come together to spur new irrigation, or to change the nature and location of new development. We have not conducted a sensitivity analysis to determine the effect of alternative development scenarios on summer flows because of the cost of using the IDWR model and the limited time available for this study.

CHAPTER IV

THE IMPLICATIONS OF SUBORDINATION FOR ELECTRIC SYSTEM LOADS, SUPPLIES AND COSTS.

New irrigation possible as a result of subordination will place larger electric loads on the Idaho Power Company and, in smaller degree, Utah Power and Light. Furthermore, this irrigation will divert water from the acquifer/river system to consumptive uses that will deplete flows both at Swan Falls and at other hydro-electric plants in the system. Estimates of these flow depletions are provided in Table 3-2 in Chapter III. The new irrigation loads and the lost hydro-electric generation will impose additional costs on all electric utilities involved--but most significantly on Idaho Power. Depending on Idaho Public Utility Commission Policy, these costs may be born by the irrigation class that is responsible or may be shared across the various customer classes.

The primary purpose of this section is to quantify and evaluate the electric system impacts of subordination of the Swan Falls water right and, most critically, those electric rate increases in the Idaho Power service area which may be necessary to cover the resource costs of supplying the power demanded and replacing the the hydropower generation lost.

In the remainder of this chapter, section 4.1 presents estimated electric loads attributed to new irrigation possible under subordination, section 4.2 provides projections for lost electric generation at those reservoirs impacted by reduced flows because water is diverted to irrigation under subordination, section 4.3 calculates costs for meeting the new irrigation loads, section 4.4 analyzes the costs of replacing lost generation capacity, and section 4.5 projects and evaluates the impact of all additional costs on electric rates. Finally, section 4.6 discusses the importance of the estimated rate increases for the Idaho Economy and section 4.7 presents summary and conclusions.

4.1 Estimated New Electric Loads from Additional Irrigation Expected Under Subordination

Table 3-1 in Chapter III provides, in our view, the best estimates of the type, location and size of irrigation projects likely to proceed under subordination. Table 4-1 presents estimates for the irrigation effort associated with each project and Table 4-3 translates these figures into electric loads according to the formulae at the bottom of the table. The methodology is identical to that employed in the IPUC memo to the Swan Falls Interim Study Committee as well as to that in the BLM [17] and Baranco [2] studies.

4.11 Monthly Distribution and Annual Growth of Irrigation Loads

The annual electric load totals in Table 4-3 are not evenly

TABLE 4-1

PROJECTED IRRIGATION FOR NEW AGRICULTURAL PROJECTS
POTENTIALLY DEVELOPING UNDER SUBORDINATION

AREA*	ACRES	DIVERSION	DEPLETION	LIFT PLUS LOSS	PRESSURE ALLOWANCE
1. Bruneau I	38,000	3.2 af/ac (121,600af)	1.7 af/ac (64,600af)	500 ft	150 ft
2. Bruneau II	17,000	3.2 af/ac (54,400af)	1.7 af/ac (28,900af)	0 ft	150 ft
3. Bruneau III	10,000	2.6 af/ac** (26,000af)	1.7 af/ac (17,000af)	500 ft	150 ft
4. Salmon Falls	5,000 new plus supp.	---------- (130,000af)	1.7 af/ac (20,000af)	160 ft	150 ft on 65,000af & 0 on the remainder
5. Eastern Snake Pl. (90% IPC serv.area)	125,000	2.7 af/ac (337,500af)	1.5 af/ac (187,500)	375 ft	150 ft
6. TOTALS	195,000	669,500 af	321,000 af		

COMPARISON:

		DIVERSION	DEPLETION	LIFT PLUS LOSS	PRESSURE ALLOWANCE
a.	Salmon Falls Study [14]				
b.	IPUC staff[15]	2.6 af/ac	2.1 af/ac	803 ft	127 ft
c.	IDWR report[11]		?		
d.	BLM[17]***	2.8 af/ac			
e.	US DOE[15]***	2.4 af/ac			
f.	ASCE[15]***	3.1 af/ac			
g.	U of I[15]***	2.8 af/ac			

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* Bruneau I, II and III designations are arbitrary for purposes of distinguishing projects.
** Irrigation efficiency assumed to be 65%.
***Average of pressure systems

SOURCE: Snake River Technical Advisory Committee
October 19 and November 7, 1983 memoranda

TABLE 4-2
ESTIMATED IMPACT OF 195,000 ACRES OF NEW IRRIGATION
ON SNAKE RIVER HYDROPOWER PRODUCTION

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP
AVERAGE GENERATION WITHOUT NEW IRRIGATION												
AMERICAN FALLS	13.20	12.10	16.70	17.00	23.30	28.10	42.70	58.10	58.50	62.60	48.50	26.00
SHOSHONE FALLS	6.40	8.50	9.10	9.20	8.00	8.00	7.30	6.90	5.50	6.10	6.60	6.20
TWIN FALLS	5.20	6.70	7.10	7.20	6.40	6.30	5.80	5.50	4.50	5.10	5.50	5.10
UPPER SALMON A	14.50	14.00	14.50	14.50	13.20	14.10	13.60	13.90	13.40	13.30	14.20	14.00
UPPER SALMON B	13.00	12.60	13.00	12.90	11.60	12.50	12.00	12.10	11.40	11.30	12.00	12.60
LOWER SALMON	23.00	27.00	30.10	28.00	27.80	30.50	28.80	24.70	21.50	18.30	19.20	21.00
BLISS	34.10	38.70	42.40	39.40	38.30	42.70	40.10	36.40	31.90	27.20	28.50	31.00
C.J. STRIKE	41.90	49.20	53.60	49.60	47.90	53.80	49.50	45.70	38.30	29.40	30.60	35.20
SWAN FALLS	7.40	7.20	7.40	7.40	6.80	7.40	7.20	7.30	7.00	6.50	6.90	7.20
BROWNLEE	188.60	220.60	264.80	273.60	252.60	291.20	302.60	278.80	275.60	178.30	142.00	167.50
OXBOW	75.60	87.90	107.70	113.70	102.40	118.50	119.00	111.10	106.20	71.50	57.60	67.80
HELLS CANYON	144.50	168.70	207.70	220.70	203.00	237.30	239.50	225.60	213.00	138.30	109.80	129.20
IDAHO POWER SYSTEM	567.40	653.20	774.10	793.20	741.30	850.40	868.10	826.10	786.80	567.90	481.40	522.80
AVERAGE GENERATION WITH 195,000 ACRES OF NEW IRRIGATION												
AMERICAN FALLS	11.50	9.90	14.20	15.40	21.60	26.30	42.20	58.50	60.80	65.10	48.30	23.40
SHOSHONE FALLS	6.00	8.00	9.00	9.10	7.90	7.70	7.20	6.60	4.90	6.00	6.10	5.90
TWIN FALLS	4.90	6.30	7.10	7.20	6.30	6.10	5.70	5.20	4.00	5.00	5.10	4.80
UPPER SALMON A	14.50	14.00	14.50	14.50	12.90	13.90	13.40	13.50	12.80	12.70	13.60	14.00
UPPER SALMON B	12.80	12.40	12.90	12.80	11.30	12.20	11.80	11.80	10.90	10.70	11.40	12.30
LOWER SALMON	21.70	24.70	28.30	26.80	26.30	29.00	27.60	22.70	19.90	17.30	18.20	20.00
BLISS	33.20	36.60	40.70	38.40	36.90	41.20	39.00	34.50	30.70	26.90	28.00	30.40
C.J. STRIKE	40.30	46.50	51.80	48.50	46.00	52.00	47.90	43.20	36.80	28.60	29.60	34.10
SWAN FALLS	7.40	7.20	7.40	7.40	6.80	7.40	7.10	7.20	6.90	6.30	6.70	7.20
BROWNLEE	183.50	211.90	258.30	268.30	242.30	284.10	294.70	269.20	269.20	176.40	139.50	162.40
OXBOW	73.70	84.70	105.60	112.20	99.10	116.10	116.40	108.10	104.50	70.80	56.70	65.90
HELLS CANYON	140.90	162.70	203.80	218.00	196.40	232.80	234.30	219.50	209.50	137.10	108.20	125.60
IDAHO POWER SYSTEM	550.40	624.90	753.60	778.60	713.80	828.80	847.30	800.00	770.90	562.90	471.40	506.00
AVERAGE GENERATION LOSS DUE TO NEW IRRIGATION												
AMERICAN FALLS	1.70	2.20	2.50	1.60	1.70	1.80	0.50	-0.40	-2.30	-2.50	0.20	2.60
SHOSHONE FALLS	0.40	0.50	0.10	0.10	0.10	0.30	0.10	0.30	0.60	0.10	0.50	0.30
TWIN FALLS	0.30	0.40	0.00	0.00	0.10	0.20	0.10	0.30	0.50	0.10	0.40	0.30
UPPER SALMON A	0.00	0.00	0.00	0.00	0.30	0.20	0.20	0.40	0.60	0.60	0.60	0.00
UPPER SALMON B	0.20	0.20	0.10	0.10	0.30	0.30	0.20	0.30	0.50	0.60	0.60	0.30
LOWER SALMON	1.30	2.30	1.80	1.20	1.50	1.50	1.20	2.00	1.60	1.00	1.00	1.00
BLISS	0.90	2.10	1.70	1.00	1.40	1.50	1.10	1.90	1.20	0.30	0.50	0.60
C.J. STRIKE	1.60	2.70	1.80	1.10	1.90	1.80	1.60	2.50	1.50	0.80	1.00	1.10
SWAN FALLS	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.20	0.20	0.00
BROWNLEE	5.10	8.70	6.50	5.30	10.30	7.10	7.90	9.60	6.40	1.90	2.50	5.10
OXBOW	1.90	3.20	2.10	1.50	3.30	2.40	2.60	3.00	1.70	0.70	0.90	1.90
HELLS CANYON	3.60	6.00	3.90	2.70	6.60	4.50	5.20	6.10	3.50	1.20	1.60	3.60
IDAHO POWER SYSTEM	17.00	28.30	20.50	14.60	27.50	21.60	20.80	26.10	15.90	5.00	10.00	16.80

SOURCE: IDWR STREAMFLOW/AQUIFER MODEL

TABLE 4-3

PROJECTED ELECTRIC LOADS FOR NEW AGRICULTURAL DEVELOPMENT POTENTIALLY OCCURRING UNDER SUBORDINATION

AREA*	KWH PER ACRE-FOOT	KWH PER ACRE	ANNUAL ELECTRIC LOAD (millions of KWH)
1. Bruneau I	923.54	2955.33	112.303
2. Bruneau II	213.13	682.00	11.594
3. Bruneau III	923.54	2401.20	24.012
4. Salmon Falls			
a. 65,000 af press. for sprinkler	440.46	---------	28.630
b. 65,000 af not press.	227.33	---------	14.777
5. Eastern Snake Plain (90% IPC service area)	745.94	2014.04	251.755
			------------
6. Subtotal			443.070
7. Adjustment: (less 10% * 251.755) East Snake Plain only 90% IPC service area			-25.176
			--------
8. Final Total			417.894
COMPARISON: a. Salmon Falls Study[14]			
b. IPUC Staff[15]	1318.00	3436--584	
c. IDWR report[11]		(2100-3478)	
d. BLM[17]	1348.00	3478.00	

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* Bruneau I, II and III designations are arbitrary for purposes of distinguishing projects.

** Assumed length of time for loads to develop--present to year 2000.

BASIS FOR TABLE COMPUTATIONS:

1. KWH PER ACRE-FOOT = (1.023/(total pump + motor efficiency))*(lift+loss+pressurization)
2. KWH PER ACRE = KWH PER ACRE-FOOT * DIVERSION IN ACRE-FEET PER ACRE
3. TOTAL MWH = KWH PER ACRE * ACRES
4. Pump + motor efficiency = 72%

distributed over the months of the year nor would they be expected to emerge immediately in one year. It is assumed here, first, that as these project loads develop, they will appear with a monthly distribution similar to that described for irrigation loads in general in [17] and represented here in Table 4-3.

Secondly, it is assumed that new irrigation projects will develop at a slower annual rate than was characteristic of projects in the mid 1970's. The Swan Falls Technical Advisory Committee feels, in fact, that the annual rate might be low enough so that complete development of the 195,000 acres of new projects might take until the year 2000. Certainly, economic conditions in Idaho and in national markets for agricultural products are consistent with these views. The opinion here is that a reasonable range for observing project completions probably has an endpoint between 1990 and 2000. Therefore, estimates for the development of new irrigation loads under subordination are determined here with 1990 as one date for completion and 2000 as an alternative later date. In each case, 1983 thru 1990 and 1983 thru 2000, the annual rate at which irrigated acreage develops is assumed arbitrarily to be constant. With this assumption, Table 4-5 presents figures for the monthly and annual incremental loads for the irrigation developments for the total adjustment and for adjustment completed by 1990 and then by the year 2000.

4.12 Comparison of Estimates

The estimate of 417.89 million KWH for the the final total of new irrigation loads is significantly less than either of the IDWR estimates of 1565.1 million KWH and 947.7 million KWH or the IPUC staff figure of 1319.588. The difference between the figure here and these other figures is partly explained by the smaller acreage estimate for new projects and partly explained by a lower average figure for per acre electricty requirements in irrigation. It should be understood that this research was able to make use of specific and more detailed estimates of the types of projects that are most likely to develop--information that was only available after some research by the Swan Falls Technical Advisory Committee and research for this study. In any event a comparison of the KWH/acre figures used here and in the IDWR and IPUC staff analyses may be found in Tables 4-3 and 4-9.

4.2 The Implications of Subordination for Reduced Hydro-electric Generation

While the water right in question in this study is only the one at Swan Falls, subordination would also affect flows at Snake River dams both above and below Swan Falls. The entire reduced generation that would result from subordination must be counted as a consequence of any subordination decision. Depending on what type of diversions occur, the reduction in river flows will be spread through out winter as well as summer months. Specifically, some diversions influence the acquifer with the result that the flow at thousand springs will be altered year-round. The implication is that subordination will reduce flows and hence generation in every month. Since the concern in Idaho is with the lost generation principally in the state, impacts on Idaho are separated here from impacts that will be felt down-stream on the Northwest Hydro-System lying outside Idaho.

4.21 Impact in Idaho Power's Service Area

The IDWR model of the acquifer/stream flow in Idaho Power's Service are was run with the projected irrigation depletions. The stream flow forecasts were then employed to project lost hydro-electric generation expected at the facilities operated in Idaho. The hydropower generation impacts of the 195,000-acre new irrigation development at the various Idaho Power dams are summarized in Table 4-2. Table 4-7 provides these forecasts of lost generation by month and as they would appear through time if the irrigation projects were to be completed by 1990 or alternatively by 2000. A separate column provides an estimate of the total loss in generation and it is interesting to observe that impacts are significant in winter and spring months.

4.22 The Northwest Hydro System

Subordination and reduced river flows will impact and reduce generation outside Idaho on the Northwest Hydro-electric System. Lost generation on that system will have to be replaced and the costs of doing so will be born by the current customer of that system. Some of those customers will very likely be customers in both northern and southern Idaho who buy electricity from rural electric cooperatives that obtain power from the Federal dams downstream from the Idaho Power system. Therefore, generation lost as a result of irrigation development under subordination will be important to consider not only because of possible responses by BPA and the states of Oregon and Washington, but also because that power does in fact serve parts of Idaho.

One estimate available for lost generation on the Northwest Hydro System from, say, the removal of an acre-foot (af) of water is provided by Hamilton and Whittlesey [10]. Specifically, they find that for a one acre-foot depletion in flow on the Snake below Idaho Power's facilities, KWH generation will fall at downstream facilities by a total of 618 KWH. Now, the flow depletion estimate for the Snake River -- assuming subordination -- is, from Table 4-1 or Table 4-3, 321,000 af. If one then applies the Hamilton-Whittlesey figure, lost generation outside of Idaho and on an annual basis would be:

Lost Generation on Northwest
Hydro-electric System = 618 KWH/af * 321,000 af
= 198.378 million KWH

This figure is significant and lies in the same range as the 224.1 million KWH figure for lost energy in the Idaho Power Service area.

Clearly, further research needs to be undertaken to establish the accuracy of the numbers above. For example, it seems reasonable to assume that the depletion of water will impact all the way thru downstream reservoirs as there is very little spill at those reservoirs on the system. Spills principally occur at large upstream reservoirs such as Dworshak which are managed for flood control. Research could refine these estimates of downriver hydropower losses, but it is our view that the numbers used are the best currently available.

4.3 Electric System Costs in Supplying New Irrigtion Loads

According to IPUC staff and Idaho Power Co. personnel, the peak load on the Idaho Power system is expected to continue to occur in the summer and coincide with the irrigation peak load on the system. New irrigation loads during the summer period could be supplied either by a net purchase and import of power from other sources or suppliers (B.C. Hydro has been mentioned) or by the development and operation of new capacity. While surplus electrical generation capacity currently exists in parts of the Northwest, we have assumed that such surplusses will not persist through the time horizon used in this study. Since long term purchase agreements and their associated price agreements are uncertain, it is assumed that new loads will be supplied by construction of new capacity.

Since the Idaho Power Co. exchanges electric power in meeting peak and off-peak loads, additional capacity requirements are being handled by constructing coal-fired thermal capacity rather than "peakers". Cost calculations for electricity to meet new loads therefore involves the following steps: (a) Capacity and energy costs are calculated for the most recent thermal plant and for the expected load factors for that plant; (b) A reserve margin of 14% and energy losses of 7.74% are employed to adjust generation plant and energy costs; and (c) Transmission and capacity related distribution costs for a minimum distribution system or for a system down to the irrigator's level are determined and added to the marginal cost of generation to obtain a total cost/KWH for new irrigation loads. These costs are calculated as shown in Table 4-4.

There is reason to believe that the NERA methodology used to calculate the marginal transmission cost for Idaho Power in the Purpa Filing of June 1982 has overestimated these costs. Clearly further research would be necessary to pin down an appropriate estimate with Idaho Power data. Therefore, the assumption here is that the PP & L costs of distribution to the 100 KW to 1000 KW secondary customer are roughly correct. With this assumption, the marginal cost figure appropriate for new irrigation loads is $.085

4.4 Costs of Replacing Lost Hydroelectric Generation

Table 4-4: CALCULATION OF INCREMENTAL COST OF SERVING NEW IRRIGATION ELECTRIC LOAD

(a) GENERATION COSTS: Valmy Unit #2 (expected online in 1986)

i. Investment cost: $1442/KW (1983 dollars--8% increase over 1982 cost)

ii. Fixed O & M: $13/KW per year

iii. Carrying charge rate: 16.25%

iv. Expected plant load factor: .70

v. Annual cost of capacity per KW:
(.1625 * $1442/KW) + $13/KW) = $247.33

vi. Marginal cost of capacity per KWH:
(247.33/(load factor * 8760 hr.) = $.04033

vii. Marginal cost of capacity adjusted for reserve margin of 14% and energy losses of 7.74%:
($.04033 * 1.14/(1-.0774)) = $.04983

viii. Marginal energy cost per KWH: $.0232

ix. Marginal energy cost adjusted for transmission losses:
($.0232/(1-.0774)) = $.02515

x. Total Marginal Cost of Generation:
($.04983 + $.02515) = $.07497

(b) TRANSMISSION AND DISTRIBUTION COSTS: Idaho Power, June 1982 PURPA Filing and IPUC staff data on PP&L LRIC.

Idaho Power PURPA Filing, June 1982:

i. Irrigation class load factor: .6366

ii. Transmission Investment: $123.12/KW (not annualized)

iii. Capacity related distribution for a minimum distribution system: $615.88 (not annualized)

iv. Total capacity cost:
($123.12/KW + $615.88/KW) = $739 (1982 dollars)

v. Total capacity cost in 1983 $: $798
(8% inflation in equipment prices assumed)

vi. Marginal cost of transmission capacity per year:
(carrying charge rate * $798/KW) = $129.69/KW

vii. Marginal cost of transmission capacity per KWH:
($129.69/KW/(.6366 * 8760 hours) = $.0233/KWH

PP & L Data Supplied by IPUC Staff, 1983 figures:

viii. Transmission investment $24.80/KW (annualized)

ix. Secondary distribution level capacity costs for customers with loads between 100 KW and 1000 KW:
$32.30/KW (annualized)

x. Marginal cost of transmission capacity per KWH:
(($24.80 + $32.30)/(.6366 * 8760 hr.)) = $.0102/KWH

(c) Total Marginal Costs of Supply for New Irrigation Customers:

i. Idaho Power data: $.098

ii. Idaho Power generation data & PP&L transmission data: $.085

TABLE 4-5

MONTHLY DISTRIBUTION OF ADDITIONAL ELECTRIC LOADS
POTENTIALLY DEVELOPING UNDER SUBORDINATION

MONTH	PERCENT LOAD: (ave. water yr)	NEW IRRIGATION LOADS (millions of KWH)		
		Final New Loads	Annual Incremental Loads with projects completed by:	
			1990	2000
April	4%	16.716	2.388	.983
May	10%	41.789	5.970	2.458
June	23%	96.116	13.731	5.654
July	27%	112.831	16.119	6.637
August	21%	87.758	12.537	5.162
September	12%	50.147	7.164	2.950
October	3%	12.537	1.791	.737
TOTAL	100%	417.894	59.699	24.582

COMPARISON: Study	Total New Irrigation Load
a. Legislative	417.894
a. IDWR	1565.1 to 947.7
b. IPUC Staff	1319.588

SOURCE: BLM (17)

TABLE 4-6

AVERAGE GENERATION LOSS DUE TO POTENTIAL IRRIGATION DEVELOPMENT
OCCURRING UNDER SUBORDINATION
(Millions of KWH)

Month	Total Loss	Annual Incremental Loss Assuming Projects Completed By:	
		1990	2000
October	17.00	2.43	1.00
November	28.30	4.04	1.66
December	20.50	2.93	1.21
January	14.60	2.09	.86
February	27.50	3.93	1.62
March	21.60	3.09	1.27
April	20.80	2.97	1.22
May	26.10	3.73	1.54
June	15.90	2.27	.94
July	5.00	.71	.29
August	10.00	1.43	.59
September	16.80	2.40	.99
ANNUAL TOTAL	224.10	32.01	13.18

	Study:	Total Loss:
COMPARISON:	a. Legislative Study	224.10
	b. IPUC Staff	419.432
	c. IDWR Study	430.00

TABLE 4-7

INCREMENTAL GENERATION REQUIREMENTS DUE TO NEW IRRIGATION LOADS AND LOST HYDROELECTRIC GENERATION UNDER SUBORDINATION (Millions of KWH)

Month	Annual incremental generation requirements assuming irrigation Projects Completed By:					
	1990			2000		
	Lost Gen.	Irrigation Load	Total	Lost Gen.	Irrigation Load	Total
October	2.43	1.79	4.22	1.00	0.74	1.74
November	4.04	0	4.04	1.66	0	1.66
December	2.93	0	2.93	1.21	0	1.21
January	2.09	0	2.09	.86	0	.86
February	3.93	0	3.93	1.62	0	1.62
March	3.09	0	3.09	1.27	0	1.27
April	2.97	2.39	5.36	1.22	0.98	2.20
May	3.73	5.97	9.70	1.54	2.46	4.00
June	2.27	13.73	16.00	.94	5.65	6.59
July	.71	16.12	16.83	.29	6.64	6.93
August	1.43	12.54	13.97	.59	5.16	5.75
September	2.40	7.16	9.56	.99	2.95	3.94
TOTAL	32.01	59.70	91.71	13.18	24.58	37.76

The cost of replacing lost generation capacity is assumed to involve only the replacement capacity and its costs of operation. Reserve margin allowance is not necessary as capacity lost thru depletion of river flows should already have had reserve margin attached to it--so to speak. Similarly, transmission losses and the transmission and distribution investments should also have been accounted for. The new capacity constructed to replace lost capacity might, however, require location in such a way that connection to the system would involve a certain additional transmission investment and transmission loss in operation that should not be ignored. Estimating such costs would require a research effort beyond this report.

The costs employed here are essentially those generation costs calculated above for Valmy unit #2 with reserve margin and energy losses removed.

Marginal Cost of Lost Generation = Marginal Capacity Cost + Marginal Energy Cost
= \$.04033 + \$.0232
= \$.06353

4.5 The Implications of New Costs Under Subordination for Electric Rates in Idaho

The implications of new irrigation (resulting from subordination) for rate increases are spelled out in Table 4-8. Table 4-9 provides a comparion of these projected results with the early estimates developed by IDWR and the IPUC staff.

The methods for allocating costs and estimating rate increases in both Tables 4-8 and 4-9 derive from IPUC staff recommendations and information from the most recent rate case involving Idaho Power. Specifically, what is labeled as the customer class responsibility formulae under item IV in Table 4-8 and item V in Table 4-9 is the methodology used by Dave Schunke in his report. The formulae attribute 19.7% of the cost of replacing lost generation AND ALL new irrigation load costs to the irrigation customer class. Since the rate paid by irrigators is \$.028/KWH, any electric rate increase that occurs would involve costs beyond what would be recovered by this rate. Therefore, an amount equal to \$.028/KWH times the new irrigation load is subtracted before costs are divided by the revenue responsibility (51.164 million dollars) of the irrigation class to obtain the rate increase estimate. Clearly, the remainder of the costs are then attributed to other customers who have a joint revenue responsibility (from last rate case) of 243.0813 million dollars.

The methodology used under item V in Table 4-8 and item VI in Table 4-9 is essentially to split all costs on the 19.7% -- 80.3% basis established in the last rate case.

In interpreting Table 4-9 it is important to realize that while the first year increases in rates under item IV or V and for the 1990 or year 2000 horizon do not appear large, one must

TABLE 4-8

PROJECTED ELECTRIC SYSTEM COSTS AND RATE INCREASES UNDER SUBORDINATION

ITEM	YEAR IN WHICH IRRIGATION PROJECTS COMPLETED: ONE YEAR	1990	2000
I. Lost Generation and Related Costs:			
a. generation lost (mill. of KWH)	224.100	32.010	13.180
b. replacement cost (cents/KWH)	6.353	6.353	6.353
c. total replacement cost (mill. of $)	14.237	2.034	.837
II. Additional Irrigation Load and Related Costs:			
a. new irrigation load (mill.of KWH)	417.894	59.699	24.582
b. cost of power (cents/KWH)	8.5	8.5	8.5
c. total new electric system costs (mill. of $)	35.521	5.074	2.089
III. Total Costs: (I.c + II.c)			
a. total (mill. of $)	49.758	7.108	2.926
IV. Percentage Rate Increases: customer class responsibility formulae**			
a. Irrigation Class: ((.197 * I.c) + II.c - II.a * $.028)/$51.164	52.0%	7.4%	3.1
b. All Other Users: (.803 * I.c)/$243.0813	4.7%	.7%	.3%
V. Percentage Rate Increases: 19.7% of new costs born by irrigators and 80.3% born by all other customers			
a. Irrigation Class: (.197 * (I.c + II.c - II.a * $.028))	14.7%	2.1%	.9%
b. Other Users: (.803 * (I.c + II.c - II.a * $.028))	12.6%	1.8%	.8%

** Formulae used here are those provided by IPUC Staff in the August 31, 1983 memorandum from Dave Schunke to the IPUC Commissioners and published as Appendix A to MONTHLY MATTERS, Idaho Legislative Council, Boise, Id., Sept 1983.

TABLE 4-9

COMPARISON OF RATE IMPLICATIONS AND ASSOCIATED STATISTICS
FOR ALTERNATIVE SUBORDINATION STUDIES

ITEM	ALTERNATIVE SUBORDINATION STUDIES: (all adjustments completed in one year) LEGISLATIVE	IDWR		IPUC	
		Head 625ft	Head 350ft	High Lift	Gravity/ Sprinkler
I. Irrigation Statistics					
a. acres irrigated	195,000	--450,000--		--384,095--	
b. diversion (acre-feet)	669,500	??		--998,648--	
c. net depletion (acre-feet)	321,000	??		--806,600--	
II. Lost Generation and Related Costs:					
a. generation lost (mill. of KWH)	224.100	--430.0----		--419.4----	
b. replacement cost (cents/KWH)	6.353	----6.5----		----7.5----	
c. total replacement cost (mill. of $)	14.237	---27.95---		---31.46---	
III. Additional Irrigation Load and Related Costs:					
a. KWH/acre	2,272 (ave)	3,478	2,100	3,436	584
b. new irrigation load (mill.of KWH)	417.894	1,565.1	903.0	1,319.6	224.2
c. cost of power (cents/KWH)	8.5	6.5**	6.5**	7.5	7.5
d. total new electric system costs (mill. of $)	35.521	101.73	58.70	98.97	16.82
IV. Total Costs (II.c + III.d)					
a. total (mill. of $)	49.758	129.68	86.65	130.43	48.28
V. Percentage Rate Increases: customer class responsibility formulae***					
a. Irrigation Class: ((.197 * II.c) + III.d -III.b * $.028)/$51.164	52.0%	123.9%	76.1%	133.0%	33.0%
b. All Other Users: (.803 * II.c)/$243.0813	4.7%	9.2%	9.2%	10.0%	10.0%

TABLE 4-9 (continued)

ITEM	LEGISLATIVE	IDWR		IPUC	
VI. Percentage Rate Increases: costs divided between customer classes with 19.7% to Irrigators and 80.3% all others:****					
a. Irrigation Class: (.197 * (II.c + III.d - III.b * $.028)/$51.164)	14.7%	33.1%	23.6%	36.0%	16.2%
b. All Others: (.803 * (II.c + III.d -III.b * $.028)/243.0813)	12.6%	28.4%	20.2%	30.9%	13.9%

** The costs calculated by IDWR were ambiguous and therefore the 6.5 cent figure was used since it had also been used to evaluate lost generation.

*** See footnote in Table E-1.

*****The 19.7% -- 80.3% split between the irrigation class and all others was a split, that according to IPUC staff came out of the last rate case.

recognize the cumulative effect over time. That is to say, if 1990 is the horizon, the subordination results are estimated here to increase rates so that an irrigator looking back to 1983 will see a bill that is either 52 % higher than it used to be or 14.7 % higher -- depending on which regulatory policy is employed in associating costs with consumption. Certainly there are other reasons that rates will increase over time besides the ones here. In such circumstances the rate increases projected here should be viewed as in addition to other increases--making overall rates that much higher.

Another point in interpretation is that the percentage rate increases are annual percentages and should be viewed as first year increases. Furthermore, if historical experience is a more accurate guide to the rate at which irrigation acreage comes on to the Idaho Power System, it is possible that the largest part of the total development under subordination could work itself out in only a few years with a tailing off to--say--1990 or 2000. This would mean substantial rate increases within maybe two or three years--perhaps approaching the 52% or 14.7 percent total increases for a one year adjustment. Figure 4-1 provides historical data on how much irrigation acreage has come on to the Idaho Power system in different years. The 1990 horizon makes the conservative assumption that acreage comes into irrigation at a rate of less than 30,000 acres per year--a rate lower than any observed historically (reference Figure IV.1).

Finally, it is important to realize that a zero price elasticity of demand for electricity has been implicitly assumed in this analysis. That is to say, it has been assumed that rate increases will not lead to any reductions in quantity of electricity demanded by irrigators or other electric customers. Clearly this will NOT be the case. To the extent that rate increases do lead to reduction in quantity demanded, rates will have to be pushed even higher to pull in revenues to cover the increased costs we have projected. From the Utility's point of view, this problem is commonly labeled revenue repression. THEREFORE, the rate increases projected here must be viewed as establishing a LOWER BOUND for the increases that would actually have to take place.

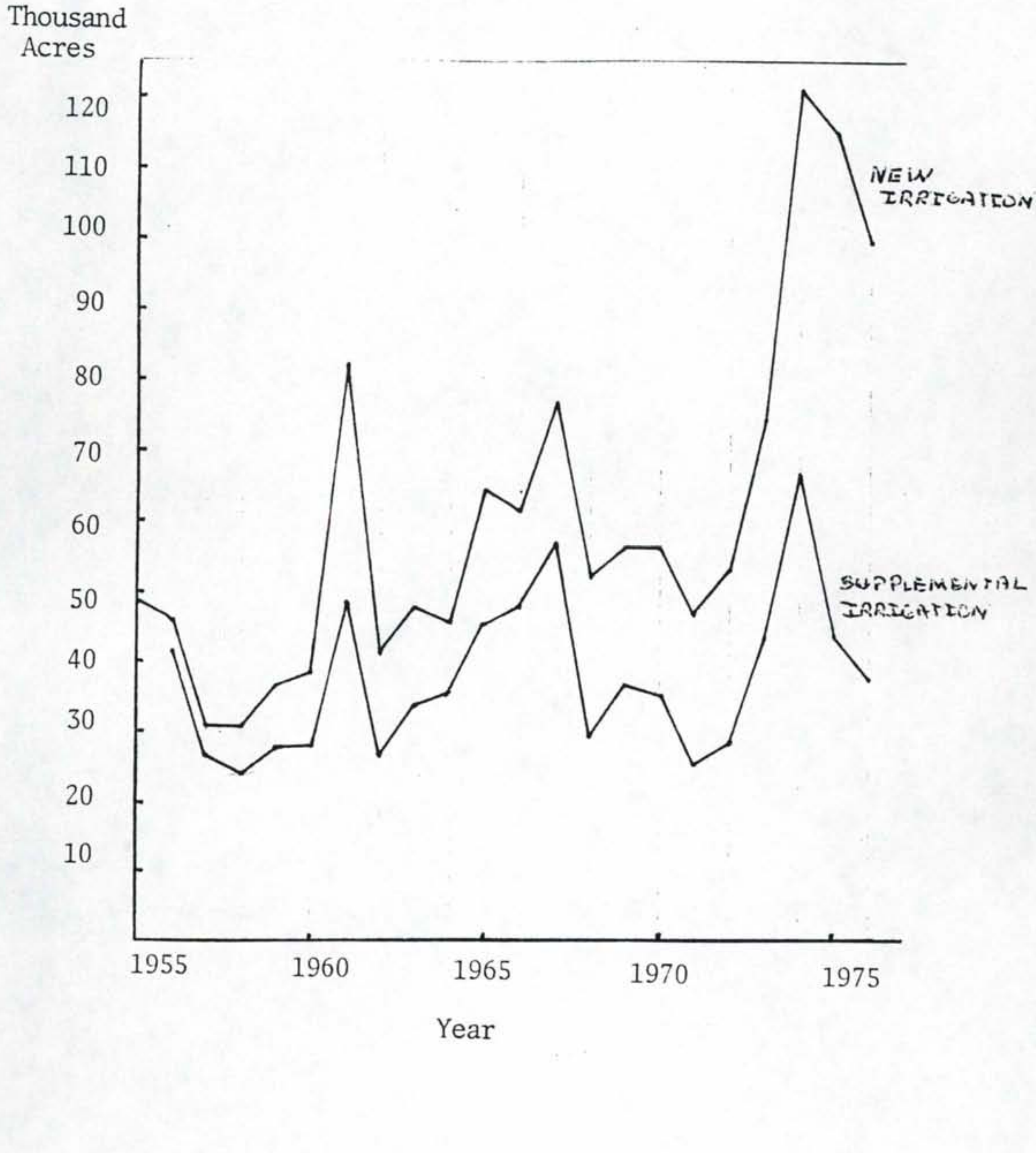
4.6 Secondary Impacts of Higher Electric Rates on the Idaho Economy

Secondary impacts of electric rate increases are defined as: (1) the response of existing irrigators and other current electric customers to higher rates, (2) the implications of higher rates for decisions by industry to locate in Idaho and (3) the effects of higher rates on decisions of individuals to move to the State.

4.61 Response of Irrigators and Other Electric Customers

A great deal of work has been done in the Economic Literature on the responses that occur when electric rates are increased. A

FIGURE 4-1
ACRES OF NEW AND SUPPLEMENTAL IRRIGATION ADDED
TO THE IDAHO POWER COMPANY SYSTEM LOAD



SOURCE: HAMILTON (1983)

recent review of this literature may be found in Anderson [1].

Electricity clearly enters into the economics of irrigated farming. Electricity for pumping is one of the major production cost components that has risen in recent years, contributing to a cost-price squeeze for pump-irrigation farmers. If a high lift irrigator uses 3000 kwh of pumping electricity per acre, his annual power bill would approach $100 per acre. Each $.001/kwh increase in rates would cost him $30 per year. If land values are considered as the residual claimant for net returns from irrigation, then each $.001 increase results in a $30 land value decline (at a 10% capitalization rate), in the long run. If residual land values fall to the level of alternative returns from dryland crops or grazing then the land would be expected to exit from irrigation. It is important to keep in mind that there is a tremendous range in the electricity used per acre by irrigated farms in Idaho. A large part of the land uses almost no electricity, since water is delivered and applied by gravity. The data is not good enough to say for sure, but probably only a few hunderd thousand of Idaho's 4,000,000 presently irrigated acres consumes enough electricity to be at all vulnerable to being driven from irrigated production by the kind of real rate increases likely to occur in Idaho. The other, less electricity intensive irrigators may suffer from rate increases, and may be stimulated to adopt energy and water conservation programs, but they will continue irrigated production.

There is very little information available to show how other classes of existing customers on the Idaho Power system will react to rate increases. It is probably safe to say, however, that for every one percent increase in electric rates that might occur, the one year or short-run response by the average customer would be on the order of a .2% reduction in electric consumption. Industries which use large amounts of electricity (for example phosphate) would certainly suffer income declines from higher rates. Whether this would affect their power use or threaten their existence is a subject for further research. Tables 1 thru 4 in attachment A to this chapter clearly show that residential electric consumption in Idaho has been very high relative to what it is elsewhere. These tables also show that electric rates have been among the lowest for any state in the Nation. It is no accident that consumption is high where rates are low and low where rates are high.

Outside of reduction in electric consumption, we do not have good information available that would predict what other kinds of retrenchment customers would go thru with higher electric rates. Certainly the cumulative impact of rate increases that would occur is the critical item to focus on. It is quite likely that the Idaho economy will suffer--but by how much is uncertain.

4.62 Growth of New Industry and Population in Idaho

Figures 4-2 and 4-3 as well as Tables 1 thru 4 in Appendix A clearly demonstrate that Idaho is a state with a significant

FIGURE 4.2: RELATIVE ELECTRIC RATES FOR LARGE LIGHT AND POWER (INDUSTRIAL)

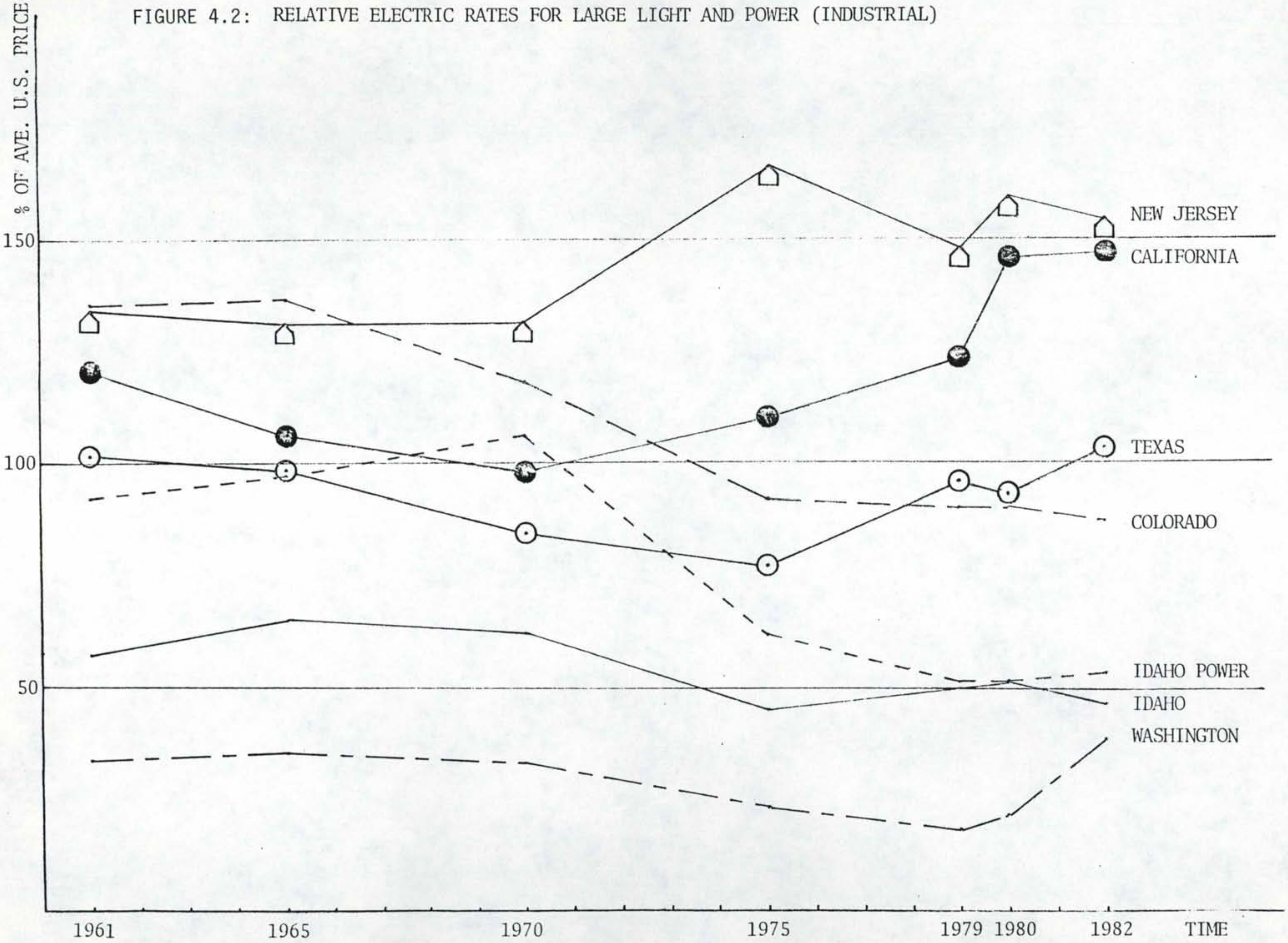
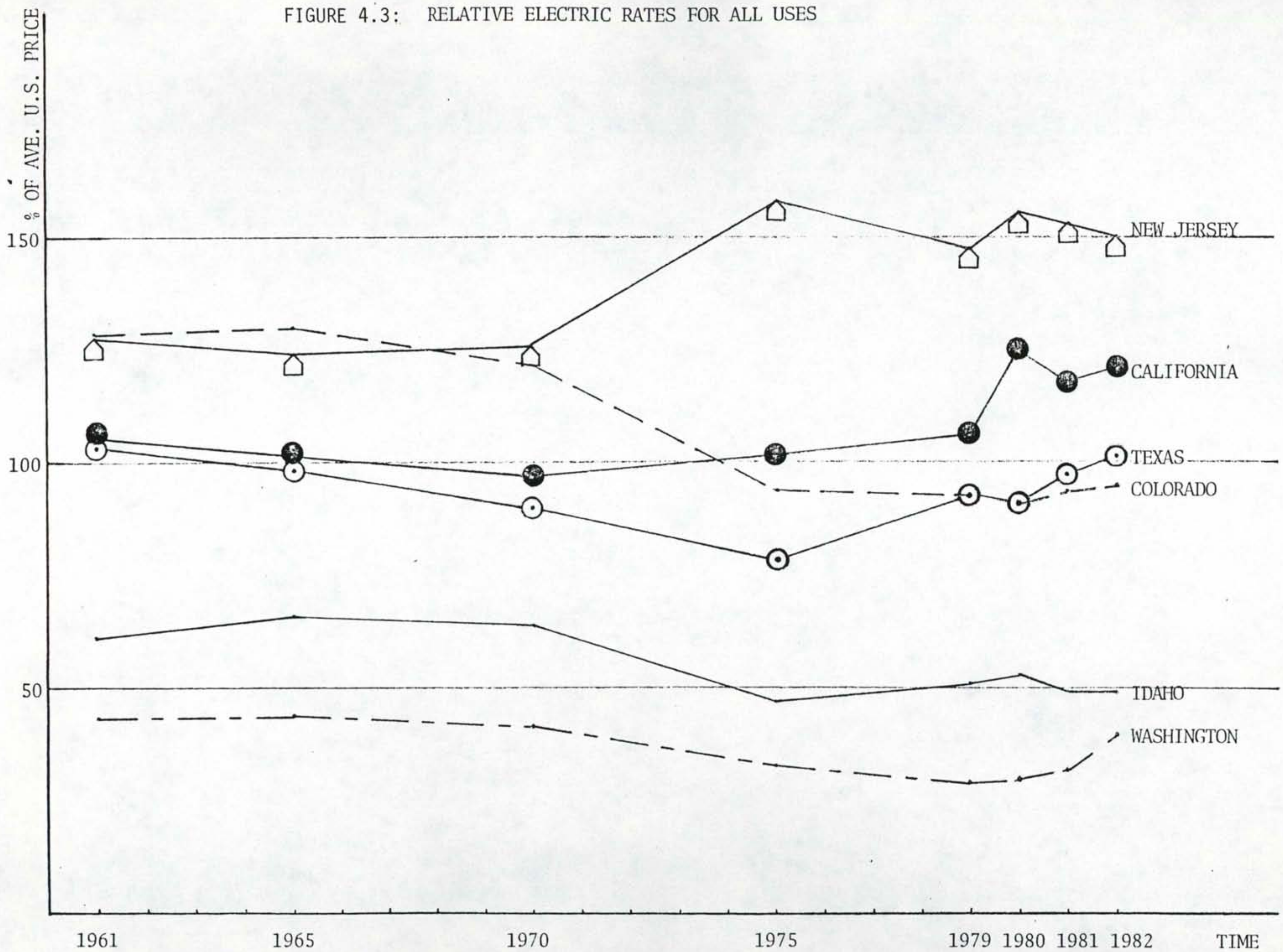


FIGURE 4.3: RELATIVE ELECTRIC RATES FOR ALL USES



comparative advantage in attracting and keeping industry--that is if electric rates are the key issue.

We have already indicated that power rates will be one factor that will affect the rate of growth of new irrigation in Idaho. The rate increases discussed in this paper are large enough to affect that rate.

However, it is our conclusion that, as long as large rate increases do not occur, low electricity costs will continue to contribute to Idaho's comparitive advantage as a region for industrial location. Large rate increases might work to discourage industry using large amounts of electricity. The same is likely to be true for continued population growth. Clearly Idaho now offers the advantage of relatively inexpensive residential electric rates.

4.7 Summary and conclusions

Under subordination new irrigation electric loads and lost hydroelectric generation due to depleted river flows are estimated to be 417.894 million KWH and 224.1 million KWH respectively. These figures differ and are significantly less than those obtained by IDWR and IPUC staff for two reasons. Better data on possible irrigation projects led us to reduce estimates for (1) irrigation acreages likely to develop and (2) the KWH/acre required for irrigation. Our estimates are 195,000 acres and 2272 KWH/acre (average across possible projects) respectively.

Estimates of costs for lost generation and new irrigation loads are based on figures for the cost of electricity that, in the first instance, involve only the marginal cost of generation but, in the second, the marginal cost of generation adjusted for transmission/distribution losses and reserve margin plus the marginal cost of transmission and distribution capacity. Table 4-9 summarizes the costs calculated.

The implications of the costs of lost genertion and new irrigation loads for electric rate increases to different customer classes depend on two things: (1) IPUC policy in associating costs in rate determination and (2) The period of time required for the irrigation projects identified to develop and hence the period of time over which the total or cumulative rate increase will occur. Two possibilities for IPUC policy are explored--the first being that used by Dave Shunke in his calculation of rate changes and the second being a simple split of costs between irrigation and other customers of 19.7% and 80.3% as dictated by the last rate case. The approach taken by Dave Shunke, which assumes that costs caused by the irrigation loads would be levied on that class of customers, projects a total increase of 52% in irrigation rates and 4.7% in rates for all other customers. The 19.7% -- 80.3% split of ALL COSTS projects 14.7% and 12.6% increases for irrigators and then all others. These percentages are less than those in the earlier IDWR and IPUC analyses for reasons already mentioned.

Clearly the increases in rates that would occur under subordination would not take place all in one year. However while alternative horizons are considered here for development of irrigation projects, our conclusion is that a larg part of the irrigation acreage and hence the following rate increases for lost generation and additional electric loads would occur within 3-5 years with a tailing off to perhaps 1990 or 2000. This would mean that, say, for an irrigator looking from 3 to 5 years in the future back to what rates were today, the observation tht he would make would be that his rates then would have increased by something near the percentages above. In fact this is a VERY conservative conclusion as the whole analysis assumes that as electric rates go up customers do not reduce their consumption. A preponderence of evidence exists to the effect that customers will significantly contract electricity usage to only high valued applications and this means that ADDITIONAL rate increases would have to be implemented to to raise rates even higher to produce revenues that cover costs. This problem is commonly referred to in the utility industry as revenue repression.

Finally it is difficult to attach any meaningful numbers to secondary impacts of electric rate increases. Secondary impacts would involve (1) the response of electric customers to higher rates in terms of their retrenchment on other economic activity that then might be transmitted on to others and (2) any rethinking that industry and households might undertake in revising decisions to locate in Idaho. We can state with some degree of certainty what the range would be for the short-run response in electric consumption to an increase in rates. However, we have no information on what is likely to happen to the State's economy as a consequence. We do have evidence that the electric rates in Idaho are among the lowest anywhere in the Nation and that residential electric consumption is among the highest. Idaho, at present, clearly enjoys an advantage in attracting industry and more population if electric rates are the basis and large rate increases are not in the offing.

ATTACHMENT A

(1) Average Electric Prices by Customer Class and by State

(2) Average Residential Electric Consumption by State

Table 1: Average Residential Electricity Prices -- 1979

Rank	State	¢/kWh
1	Washington (50)	1.53
2	Idaho (49)	2.30
3	Oregon (48)	2.47
4	Montana (46)	2.67
5	Wyoming (45)	2.89
6	Tennessee (47)	3.10
7	Louisiana (44)	3.41
8	Kentucky (43)	3.47
9	Nevada (42)	3.59
10	North Dakota (38)	3.67
11	Nebraska (41)	3.67
12	West Virginia (31)	3.69
13	South Dakota (40)	3.73
14	Oklahoma (37)	3.82
15	Alabama (39)	3.93
16	Colorado (35)	3.97
17	Mississippi (32)	3.99
18	North Carolina (29)	4.01
19	Georgia (34)	4.02
20	Minnesota (26)	4.02
21	South Carolina (28)	4.04
22	Arkansas (23)	4.11
23	Indiana (36)	4.14
24	Texas (30)	4.16
25	California (19)	4.18
26	Wisconsin (27)	4.26
27	Alaska (20)	4.31
28	Kansas (25)	4.33
29	Missouri (24)	4.36
30	Vermont (14)	4.49
31	Florida (22)	4.50
32	Utah (33)	4.54
33	Iowa (17)	4.55
34	Maine (21)	4.67
35	Ohio (16)	4.74
36	Virginia (15)	4.76
37	Michigan (12)	4.83
38	Maryland & D.C. (11)	4.87
39	Illinois (13)	4.94
40	Pennsylvania (10)	4.98
41	Arizona (9)	5.27
42	Connecticut (8)	5.40
43	New Mexico (18)	5.41
44	New Hampshire (7)	5.73
45	Delaware (6)	5.77
46	Massachusetts (4)	5.78
47	Rhode Island (3)	6.22
48	Hawaii (5)	6.31
49	New Jersey (2)	6.45
50	New York (1)	6.67

( ) Denotes 1977 Rank   U.S. Average: 4.33¢ per kWh

Source: Electricity Consumers Resource Council, "State Electricity Profiles," 1981.

Table 2: Average Commercial Electricity Prices -- 1979

Rank	State	¢/kWh
1	Washington (50)	1.69
2	Idaho (45)	2.15
3	Oregon (49)	2.16
4	Wyoming (46)	2.31
5	Kentucky (47)	2.51
6	Montana (48)	2.52
7	Nebraska (43)	3.37
8	North Dakota (38)	3.42
9	Oklahoma (40)	3.44
10	Louisiana (42)	3.48
11	West Virginia (30)	3.57
12	North Carolina (37)	3.57
13	Colorado (39)	3.65
14	South Carolina (35)	3.66
15	Nevada (32)	3.83
16	Utah (41)	3.86
17	Arkansas (26)	3.89
18	Tennessee (44)	3.90
19	South Dakota (28)	3.90
20	Texas (34)	3.94
21	Minnesota (25)	3.99
22	Indiana (33)	4.01
23	Kansas (29)	4.01
24	Vermont (24)	4.04
25	Missouri (31)	4.05
26	Alaska (23)	4.18
27	Wisconsin (21)	4.29
28	Mississippi (27)	4.32
29	Georgia (22)	4.37
30	New Mexico (36)	4.41
31	Alabama (20)	4.44
32	California (11)	4.48
33	Virginia (15)	4.55
34	Iowa (17)	4.61
35	Ohio (18)	4.65
36	Pennsylvania (12)	4.67
37	Florida (14)	4.72
38	Illinois (16)	4.73
39	Maine (19)	4.76
40	Arizona (13)	4.96
41	Michigan (9)	4.98
42	Connecticut (10)	5.11
43	Maryland & D.C. (8)	5.16
44	Rhode Island (7)	5.56
45	Massachusetts (6)	5.65
46	Delaware (5)	5.69
47	New Jersey (3)	5.85
48	New Hampshire (4)	6.08
49	New York (1)	6.86
50	Hawaii (2)	7.03

( ) Denotes 1977 Rank U.S. Average: 4.40¢ per kWh

Source: Electricity Consumers Resource Council, "State Electricity Profiles," 1981.

Table 3: Average Industrial Electricity Prices -- 1979

Rank	State	¢/kWh
1	Washington (50)	0.50
2	Montana (49)	0.80
3	Oregon (48)	1.20
4	Idaho (47)	1.42
5	Wyoming (46)	1.56
6	Louisiana (45)	2.16
7	Nebraska (42)	2.27
8	Kentucky (44)	2.42
9	Oklahoma (39)	2.42
10	West Virginia (33)	2.43
11	Arkansas (29)	2.51
12	South Carolina (36)	2.55
13	Colorado (41)	2.57
14	North Caroline (30)	2.63
15	Ohio (40)	2.63
16	South Dakota (32)	2.65
17	Texas (37)	2.73
18	Tennessee (43)	2.77
19	Utah (35)	2.78
20	Alabama (34)	2.84
21	Wisconsin (28)	2.85
22	Nevada (31)	2.86
23	Vermont (19)	2.87
24	Maine (38)	2.90
25	Kansas (24)	2.90
26	Iowa (22)	3.00
27	North Dakota (12)	3.01
28	Georgia (23)	3.02
29	Minnesota (14)	3.05
30	Missouri (25)	3.09
31	Illinois (26)	3.10
32	Indiana (27)	3.11
33	Mississippi (20)	3.16
34	Maryland & D. C. (16)	3.19
35	Arizona (15)	3.22
36	Virginia (17)	3.22
37	Florida (18)	3.24
38	Alaska (6)	3.26
39	New York (13)	3.34
40	Pennsylvania (11)	3.34
41	California (9)	3.51
42	Michigan (10)	3.54
43	Delaware (7)	3.72
44	New Mexico (21)	3.93
45	New Hampshire (8)	4.02
46	Connecticut (5)	4.12
47	New Jersey (3)	4.21
48	Massachusetts (1)	4.51
49	Hawaii (4)	4.55
50	Rhode Island (2)	4.68

( ) Denotes 1977 Rank U.S. Average: 2.85¢ per kWh

Source: Electricity Consumers Resource Council, "State Electricity Profiles," 1981.

Table 4: Residential Annual kWh/Customer 1979

Rank	State	kWh
1	New York (50)	5367
2	Rhode Island (49)	5614
3	New Mexico (48)	5954
4	Massachusetts (45)	6150
5	Colorado (47)	6382
6	New Jersey (44)	6384
7	California (46)	6444
8	Michigan (42)	6678
9	Maine (43)	6706
10	New Hampshire (40)	7151
11	Hawaii (35)	7438
12	Connecticut (37)	7443
13	Illinois (39)	7453
14	Utah (38)	7594
15	Pennsylvania (36)	7653
16	Wyoming (41)	7834
17	Wisconsin (34)	7854
18	Delaware (33)	7936
19	Vermont (31)	8099
20	Minnesota (32)	8158
21	Maryland & D.C. (28)	8290
22	Kansas (29)	8403
23	Missouri (30)	8515
24	Ohio (27)	8521
25	Iowa (25)	8893
26	West Virginia (26)	8937
27	Arkansas (22)	9319
28	Nebraska (23)	9461
29	Montana (24)	9577
30	South Dakota (21)	9690
31	Indiana (19)	9729
32	Oklahoma (20)	9801
33	Kentucky (17)	10320
34	Georgia (14)	10390
35	Arizona (16)	10509
36	North Dakota (18)	10517
37	Alaska (15)	10548
38	Virginia (12)	10772
39	Mississippi (13)	10911
40	Florida (11)	11160
41	North Carolina (10)	11174
42	Texas (7)	11282
43	Alabama (6)	11407
44	South Carolina (8)	11487
45	Louisiana (9)	11714
46	Nevada (5)	12374
47	Oregon (4)	14182
48	Idaho (3)	15035
49	Tennessee (1)	15212
50	Washington (2)	17175

( ) Denotes 1977 Rank U.S. Average; 8833

Source: Electricity Consumers Resource Council, "State Electricity Profiles," 1981.

CHAPTER V

THE ECONOMIC VALUE OF THE ADDITIONAL CROP PRODUCTION RESULTING FROM SUBORDINATION

Clearly one of the most important benefits of subordination would be the income earned by the farmers who could irrigate new land. The report prepared by IDWR durring the 1983 legislative session estimated that 450,000 acres of new land could be developed if the Swan Falls water right were subordinated to upstream irrigation. They estimated, using average production and value data for existing irrigated land, that an average acre of new land would produce crops valued at $212.30 per year, for a total output value of $95.5 million. For reasons developed below, we argue that the methods used by IDWR give a conservative estimate of the per acre crop value that can be expected from new development. For this reason our analysis below will use a higher per acre value of crop production.

However, value of new crop production is not the best measure of the benefits of new irrigation to either the farmers involved, or to the region. For those directly involved in the new projects, the benefits will be their net returns to their land, labor, management, and capital investment -- a term which economists call "value added". The community and region will benefit from new irrigation by being able to sell inputs such as the fertilizer, services, irrigation equipment, and electricity needed by the new irrigated land. The community and region also benefit by being able to buy, transport, process, and market the crops produced on the newly irrigated land. This section will first estimate the value added that could be generated by new land likely to be irrigated if the Swan Falls water right is subordinated, and then explore the impacts of irrigation development on the wider community and region.

5.1 Crops Grown, Prices, Costs, and Value Added

In order to estimate the value added by new irrigation it is necessary to estimate the acreage and value of crops that will be grown on the new land, and the costs of production. The actual crop mix on any new land is likely to emphasize high value crops to a greater degree than the crop mix assumed by IDWR. The figures shown in Table 5-1 are those used in the IDWR memo and represent average 1980 crops on existing irrigated land.

However, much of the new land coming into production will involve expensive high lift pumping systems and high pumping electricity costs. For this reason only the best of the land that is available will receive water, and only above average managers will have the nerve and the access to capital necessary for development. In 1979 the BLM Environmental Impact Statement concerning the Bruneau Plateau area used the crop mix shown in Table 5-2 as provided to them by IDWR.

TABLE 5-1: Crop Mix Assumed in IDWR Meno TO Committee

Crop	% of Area	Cash receipts per Acre
Wheat	33.6	211.64
Barley	19.1	120.37
Corn	3.1	51.12
Hay	29.9	64.74
Oats	1.0	56.63
Potatoes	6.5	833.50
Dry Beans	3.9	419.44
Sugar Beets	3.0	884.24

TABLE 5-2: Crop Mix Assumed in BLM Impact Statement

Crop	% of Area	Assumed Yield
Potatoes	22	315 cwt
Dry Beans	21	18.75 cwt
Winter Wheat	17	75 bu
Barley	17	75 bu
Sugar Beets	17	20 tons
Alfalfa	6	5.5 tons

TABLE 5-3: Crop Mix Assumed in Barranco Study

	First 5 Years		Subsequent Years	
Crop	% of Area	Assumed Yield	% of Area	Assumed Yield
Wheat	50	90 bu	33.3	85 bu
Potatoes	50	350 bu	33.3	335 bu
Dry Beans	0	-	33.3	24 cwt

TABLE 5-4: Crop Mix Assumed in This Report

Crop	% of Area	Assumed Yield
Potatoes	25	310 cwt
Dry Beans	20	22 cwt
Wheat	20	110 bu
Barley	15	90 bu
Sugar Beets	10	23 tons
Alfalfa	10	5.5 tons

A research study at the University of Idaho by Barranco (1977) assumed an even more intensive crop mix for the same area studied by BLM, as shown in Table 5-3. The High intensity crop assunptions used by Barranco were are probably appropriate for the new land on the Bruneau Plateau under the assumption of development by high lift pumping. However in this study we are assuming that development will be spread across a wide region of the Snake Basin above Swan Falls, so the overall crop mix will probably be less specialized and less intense than assumed by Baranco.

In this study we will assume the average crop mix shown in Table 5-4 on all newly developed irrigation lands. This assumed mix represents a compromise between the average mix used on presently irrigated lands in the region and the high intensity crop mixes which might be grown on the high lift and deep well portions of the new land. The assumed yields shown are taken from crop budgets for southern Idaho prepared by the UI Extension Service.

Table 5-5 presents estimates of the per acre costs, returns, and value added for the 195,000 acres of new development forcasted by the Technical Committee. This table is based on information from the UI crop budgets. Given the assumed yields, prices, and crop mix, the average gross returns per acre would be $631 per year. The UI budgets reflect the current depressed state of the Idaho farm economy. The estimated return to risk and management for four of the six crops is negative. This of course does not mean that the farmer would be operating at a cash loss -- the budgets do allow him an estimated market rate of return on operator labor, on land, and on other fixed investment.

Table 5-5 shows value added averaging $238 per acre. This is composed of returns on labor, operating capital and other fixed factors. We have assumed that new development will use substantial amounts of borrowed money, and have deducted from value added a term to account for this flow of payments out of the region. Using this figure for value added per acre, and the 195,000 acre forcast for new development, results in a total of $46.4 million of value added associated with the new irrigated acreage.

The value added estimate is, of course, very sensitive to the costs and prices that are assumed in the analysis. Those used above reflect the current depressed farm economy. We see no evidence that the years between now and 2000 will see a major turnaround in this situation. The depressed state of agricultural exports and growing concern with the cost of Federal farm programs are just two negative factors.

There will also be value added associated with the supplemental water that the Technical Committee is assuming will be provided to the Salmon Falls tract. The Technical Committee has not specified in detail just how this supplemental development

TABLE 5-5: COSTS, RETURNS, AND VALUE ADDED FOR NEW IRRIGATED LAND IN SOUTHERN IDA

	POTATOES	DRY BEANS	WHEAT	BARLEY	SUGAR BEETS	ALFALFA HAY
GROSS RECEIPTS						
YIELD	310.00	22.00	110.00	2.20	23.00	5.50
X PRICE	4.50	13.00	3.70	90.00	34.00	65.00
= TOTAL	1395.00	286.00	407.00	198.00	782.00	357.50
VARIABLE COSTS						
INTEREST ON OP. CAPITAL	30.14	4.36	7.65	5.84	30.17	5.04
LABOR	73.49	34.80	21.18	26.14	68.03	29.45
OTHER	710.61	101.86	163.65	144.75	394.23	116.34
TOTAL VARIABLE COST	814.24	141.02	192.48	176.73	492.43	150.83
FIXED COSTS						
MACHINERY	204.87	121.96	46.45	104.43	316.08	91.12
LAND	285.00	90.00	110.00	50.00	260.00	120.00
OVERHEAD	27.53	6.13	6.49	7.05	19.51	5.89
TOTAL FIXED COST	517.40	218.09	162.94	161.48	595.59	217.01
NET RETURN TO RISK & MGT.	63.36	-73.11	51.58	-140.21	-306.02	-10.34
VALUE ADDED						
LABOR	73.49	34.80	21.18	26.14	68.03	29.45
INTEREST ON OP. CAPITAL	30.14	4.36	7.65	5.84	30.17	5.04
RETURNS ON FIXED FACTORS	517.40	218.09	162.94	161.48	595.59	217.01
NET RETURNS RISK & MGT.	63.36	-73.11	51.58	-140.21	-306.02	-10.34
LESS: NON-IDAHO PAYMENT	146.96	63.59	46.94	46.33	172.82	63.34
= TOTAL VALUE ADDED	537.43	120.55	196.42	6.92	214.95	177.82
PERCENT OF AREA	25.00	20.00	20.00	15.00	10.00	10.00

AVERAGE PER-ACRE GROSS RETURNS= 631.00
AVERAGE PER-ACRE VALUE ADDED= 238.07

SOURCE: UI EXTENSION (16)

would occur. The Salmon Falls Division has 57,200 total acres, with cropping in any year limited to 30,000 to 40,000 acres by water shortage. The Technical Committee has assumed that 5,000 more acres would be cultivated in normal years, and that acreage increase is included in the value added figures above. The supplemental water (amounting to 20,000 acre feet of depletions) would be used to firm up supplies to the 30 to 40,000 acres now getting inadequate water. This would both increase yields and allow more valuable crops such as potatoes to be grown on this land. Lacking the more detailed information necessary to arrive at a firmer estimate, we will assume that the value added per acre generated by use of supplemental water on the Salmon Falls Division is equal to 1/2 the value added per acre from new irrigation. Using the $238 average value added per acre figure from table 5-5, implies that 40,000 acres of supplemental irrigation would generate a total of $4.8 million of new direct value added.

5.11 The Impact of Unreliable Junior Water Rights on New Irrigation

The IDWR report based its estimate of the maximum possible irrigation development on flows in a "one year out of eight" dry year. This means that they assumed that someone (presumably the new irrigators) would have at least some part of their water supply cut off in one year out of eight in order to protect the 3,300 cfs minimum flow at Murphy gage.

If development actually approaches the IDWR figure of 450,000 acres, or if development is more concentrated in the Hagerman to Swan Falls reach than expected, then problems will result. Any of the new acreage that pumps from the Hagerman to Swan Falls segment of the river would be especially vulnerable to being shut off in a dry year. Shutting the river pumper off rather than some even more junior well pumper would be the only administrative action that would assure the required minimun flow. Since a large portion of the costs for high lift irrigators continue irrespective of water shortage, these interuptions would result in a significant loss of revenue.

However, if development levels do not reach the 450,000-acre maximum level, then the junior water supplies will be much more firm. It would require additional detailed simulation work using the streamflow/aquifer model to show the reliability of the diversions above Milner assumed by the Technical Committee. While we have used the 195,000-acre development forcast from the Technical Committee, our analysis assumes that there will be little or no cost associated with unreliable water supplies. New development beyond the 195,000 acres, occuring after 2000, might need to contend with less firm water supplies.

5.12 The Effect of Decreased Water Supply Reliability on Existing Irrigation

We have noted that development excessively concentrated in the Hagerman to Swan Falls river reach could result in the new farmers holding unreliable junior water rights. The other extreme would result if excessively large acreages of new development are allowed to rely on groundwater withdrawl from the Snake Plain aquifer. Suggestions that the aquifer be declared "non-tributary" to the Snake River could potentially produce this result. What could happen is that enough groundwater development could reduce springflow to where flows at Swan Falls might approach 3,300 cfs after depletions in the Hagerman to Swan Falls river reach. Shutting off the new wells on the aquifer would not be effective in maintaining minimum streamflows without unacceptable time lags. The only effective management action available would be to shut off existing high lift pumpers. This too would result in a large loss of value added.

While this phenomenon could be significant if development approaches the maximum possible level of development, at the lower development levels which we expect by 2000, this should not be a significant problem. After 2000, if groundwater development were allowed to continue, existing irrigation in the Hagerman to Swan Falls reach could be hurt unless creative changes in water institutions are devised to deal with the problem.

At levels of development which are likely by 2000, it is much more likely that groundwater decline could be a problem. Changes to more efficient application systems in the upper Snake region, and drilling of new wells could mean declines significant enough to result in higher power costs for pumping from well, and costs for deepening wells. While this is a potentially significant result of subordination, we have no reliable estimate of how far wells might decline, or what costs might result.

5.13 Market Impacts of Increased Crop Production

This section has so far assumed that expanded irrigation has no impact on crop prices. For some crops this is probably true. The amount of grain that would be grown on new land would be so small a percentage of total U.S. production that it would have little discernable impact on grain prices (although one might ask why we need more grain when federal farm programs are aimed at reducing grain production). For other crops such as potatoes it seems much more likely that new production will have some price depressing effect. Above, we assumed that the new land allowed by subordination would grow 25% potatoes. Many econometric studies have shown that potatoes have an "inelastic" demand -- each 1% increase in supply results in more than a 1% decrease in price. This behavior is evident in recent production - price data. Good production years have usually coincided with low prices. In recent years Idaho has grown about 25% of all U.S. potato production. The assumption of a crop mix devoted 25% to potatoes means 48,750 new potato acres. This would be about a 20 percent increase in Idaho's potato acreage (and a 5% increrase in U.S. potato production) unless offset by acreage declines by existing producers. Such a production increase would result in a decline of U.S. potato prices by at least 5%, hurting existing potato producers in Idaho and other production areas.

Actually most agricultural commodities have inelastic demands, so more production will depress prices a small amount and hurt existing producers. What is unique about potatoes (perhaps along with sugar beets, some varieties of beans and hay because of its local market) is that Idaho producers supply such a large portion of the total market for the crop.

We estimate that total Idaho potato prodiction is unlikely to increase by very much irrespective of subordination. The production on new lands will be mostly offset in a few years by acreage reductions on existing lands as the result of lower prices. The existing land released from potato production will instead grow lower valued crops such as hay and grain. In fact it has been federal policy when evaluating the benefits and costs of new irrigation projects, to assume that such projects do not result in net increases in specialty crops such as potatoes -- but rather there are net production increases in lower valued crops such as hay and grains. In a study for the Washington Legislature, the WSU Agricultural Economics Department found evidence of this kind of market behavior for new irrigation in the Columbia Basin.

It is useful to note the effects on average value added per acre if one assumes that new potato acreage exactly displaces existing potato acreage, resulting in no net change. If we assume that the existing potato land shifts to wheat and barley, the results might be as follows:

TABLE 5-6: Value Added if Existing Potatoes Displaced by New

	PERCENT OF AREA	VALUE ADDED
POTATOES	0.00	537.43
DRY BEANS	20.00	120.55
WHEAT	35.00	196.42
BARLEY	25.00	6.92
SUGAR BEETS	10.00	214.95
ALFALFA HAY	10.00	177.82
AVERAGE VALUE ADDED=		133.86

Because potatoes were the prime contributor to value added from new land, dropping their net contribution to acreage to zero reduces crop value per acre from $631 to $363 and per acre value added from $238 to only $134 per acre.

We feel strongly that this kind of displacement effect operates to some degree for potatoes, and probably also for sugar beets, some varieties of dry beans, and perhaps even for hay in the local market. However the extensive econometric studies necessary to precisely quantify this effect have never been conducted. It is our judgement that, after these displacements are accounted for, that a net crop value increase of about $350 per acre is reasonable, and that net value added of about $130 per acre of new development is a reasonable figure for the direct effects of irrigation development.

5.2 Secondary Economic Impacts of New Irrigation

We have noted that the farmers themselves are not the only ones who would benefit from new development. New irrigation has both forward and backward linkages to the rest of the regional and national economy. That is, the output from the new land must be transported, processed, and marketed, and the inputs of fertilizer, equipment, energy, labor, and financing needed to farm the new land must be provided. All the way along the line people will be employed in new jobs, and various businesses will make money from the irrigation expansion. This is often known as the "multiplier" effect. Most studies have found multipliers between 1.5 and 3.5 -- meaning that each dollar of new output from one economic sector is associated with between .5 and 2.5 dollars new output in all other sectors of the regional economy.

Input - output analysis is a technique used by economists to examine and quantify these links among the various sectors of the economy. Unfortunately the state does not have in place an Idaho input - output model with sufficient detail and accuracy for use in assessing all of the impacts of new irrigation on the Idaho economy. Some tentative work has been done at the University of Idaho by Pongtanakorn (1981), and further work is ongoing.

Perhaps the best answer about the impact of new irrigation on the rest of a regional economy comes from a study of Columbia Basin irrigation development by Findeis (1982). Many of the results of that study apply equally well to southern Idaho. The methodology used and conclusions reached by Findeis can be summarized:

a) The Findeis study looked at the economic effects of developing 585,000 new acres in the Bureau of Reclamation East High Project plus 286,000 acres of private development in the Horse Heaven Hills area. The study estimated the effect of this new irrigation, including the effects on those firms which supply inputs and those sectors such as food processing and livestock production which use the production from new irrigated land. The study also estimated the effect which rising electric rates would have on the residual income (similar to what we have been calling value added) of all sectors of the Washington economy.

b) The gross value of crop production was estimated at $349 per acre. Results indicated that gross output from all economic sectors would increase by $1,122 for each acre of development, 5 jobs would be created somewhere in the economy for each 100 acres of development creating new labor income of $273 per acre, and residual income to all sectors would increase by $259 for each acre of new irrigation. The ratio of total impact ($1,122) to value of crop production ($349) implies a multiplier of 3.21.

c) Findeis emphasized that these large income and employment benefits from new irrigation obscured a whole range of distributional issues -- some sectors gain and other sectors lose from development. The study noted that irrigation itself would be quite unprofitable without the subsidization of construction capital by the Bureau of Reclamation, and the electricity cost subsidy implied by BOR contract electric rates and average cost procedures for setting utility electric rates.

d) The study estimated that residential electricity users would pay an average of $11.36 (1972 prices) more per person annually for electricity as a result of the new irrigation, to maintain current electricity consumption levels. However the benefits of development would be unevenly distributed among households, going mostly to those associated directly with the new development.

e) The principal gaining sectors would be the agricultural production and processing sectors ($182 of residual returns per new acre) and transportation services, trade, and other services ($87 in residual returns per acre). The losers would be diverse and spread throughout the Washington economy. Since the electricity cost increase is the main negative impact, the main losers would be the energy - intensive industries such as aluminum; mining; wood products; pulp and paper; glass, cement, stone and clay; iron and steel; other nonferrous metals; and aerospace.

f) The study estimated the changes in return to stockholder equity for several important Washington economic sectors in an effort to see how the viability of these industries might be affected by the new irrigation. Of course the losing sectors all experienced declines in the rate of return to stockholder equity, ranging up to a 4.8 percent reduction for aluminum. Changes of this type could damage the state's efforts to retain some industries and to recruit others. The most surprising result of the study is an estimated 16 percent drop in the rate of return on stockholder equity in the food processing sector. This sector had large increases in employment and residual income resulting from irrigation development. However, the large sales increase was offset by a decline in product price which, together with higher electricity costs, caused return on equity to fall.

The Columbia Basin irrigation development examined by Findeis would be similar to what is anticipated in southern Idaho. Somewhat higher multipliers would be expected for Columbia Basin development than for development in Idaho because Idaho farmers will tend to buy more of their inputs from outside the state, and more of their production will be shipped outside the state before being processed. If, as expected, the net new production consists of only small amounts of potatoes and sugar beets because of the displacement effect, there will be little new food processing, and the multipliers will be smaller. Reasonable estimates for Idaho might be that each dollar of new crop value generates 1.5 additional dollars of new output elsewhere in the state economy, and in the process generates 60 cents of new value added in all sectors of the Idaho economy.

Using the $360 estimate of the per acre value of new crop production due to new irrigation means that the 195,000 acres of new irrigation would generate about $70 million of new crop production. An additional $7 million of crops would result from the new supplemental water development. This $77 million of new crops could result in about $116 million of new output in all other sectors of the Idaho economy, and at most $46 million of new value added in all sectors of the state's economy.

5.3 Conclusions

It is clear that new irrigation development would result in new income and employment in the southern Idaho region. We have estimated that per acre value of production might run as high as $631 annually, given that high valued crops are essential for development to be feasible. However, value of output is a poor measure of the benefit of this new production to the region. Profits accruing to the new farm operators might be a better benefit measure, but we have not attempted to estimate profits since this would ignore the impacts of development on all of the other sectors of the regional economy. We argue that value added (returns to land, labor and other fixed factors) is a good measure of the impact of new irrigation. Our first estimate of value added per acre is $238.

We also argue that the new acreage devoted to crops such as potatoes, sugar beets, and dry beans may displace some existing acreage of these crops. Markets for these crops may be unable to accommodate large increases in production in the next 15 years, and the resulting price drop would drive some existing land from production. Because of the importance of this displacement effect, we estimate that the net direct value added is closer to $130 for each acre of new irrigation, and half that for supplemental irrigation.

Any new irrigation development made possible by subordination would have important effects on the other sectors of the Idaho economy. We estimate that each dollar of new crop production is linked to $1.50 of additional output from other sectors, and to $.60 of new value added. Using the development forecast from the Technical Committee, this implies $77 million of new crop production, an additional $116 output from other sectors, and $46 million new value added.

The Columbia Basin study suggests that this new value added will be heavily concentrated in the farming and food processing sectors, while households will face costs due to higher electricity prices, and energy intensive industries may face narrowing profit margins for the same reason.

All of the value added estimates cited in this chapter are quite uncertain. Some of these estimates could be improved with further research. For example it should be possible to better define the kinds of development that would take place, the crops likely to be grown on new land, and the impacts of new production on markets. Other components of the value added estimates would be harder to refine. Things such as future economic conditions, export markets, and federal farm policies are very hard to predict, but they are very important determinants of future crop prices and hence of the value added by new irrigation.

CHAPTER VI

WATER ALLOCATION ISSUES IN IDAHO

This study has raised a number of questions about how water should be allocated in Idaho. A large body of water law and institutions has grown up in Idaho to answer these kinds of questions. However the problems associated with Swan Falls demonstrate that Idaho's current water institutions and laws do not necessarily operate in a way that would be universally recognized as fair, equitable, or efficient.

This chapter will first address a topic which the Swan Falls Interum Legislative Committee identified as a concern: the effect of any Swan Falls action on water availability for industry. The chapter will then turn to the broader topic of whether new institutions, such as water markets could improve water allocation in Idaho.

6.1 Water Availability for Industry

Water for municipal and Industrial use has rarely been a growth constraint in most of southern Idaho. These uses are generally small, relative to water demands for irrigation and power generation, so that their needs have been easily accommodated. Many municipal and industrial uses are non-consumptive, for cooling or waste disposal, so that the limits are more constraints on water quality than quantity. The Swan Falls constraint has caused some recent concern. The Director of the Idaho Department of Water Resources is now requiring new commercial and industrial firms using more than 1.5 acre-feet per year (the maximum domestic household use) to obtain a water permit even if the water is to be taken from a municipal water supply system. Since the Snake is now fully appropriated above Swan Falls, no new water rights can be issued, and commercial and industrial firms seeking water will need to purchase rights from existing uses such as irrigation. This situation is so new that the institutions for water right transfer between irrigation and other uses are quite untested, and the cost of water obtained in this manner is uncertain.

This is a new hassle and a new cost that firms wanting to expand or locate in Idaho must now face, so this must be recognized as a cost which non-subordination is imposing on Idaho industrial growth. However, firms would face the same problem (and probably higher water right costs) in many other western states. In the Fort Collins area of Colorado, a share of Colorado-Big Thompson water, yielding .7 acre-feet per share, cost over $2000 in 1980 (Young and Gardner, 1983). Even though these prices have declined some since 1980, the implied industrial water cost is still much higher in Colorado than what it would cost to obtain industrial water in Idaho by purchasing irrigated land and diverting the water to industry.

A recent experience in Twin Falls where water was cited as one reason why a food processing firm decided to locate in Utah rather than Idaho has focused interest on these issues. In the Twin Falls case it appears that water availability was not the determining factor (a package of water rights had been tentatively secured). The location decision was apparently more influenced by a number of other incentives to locate in Utah, than it was by water.

We argue that the cost of obtaining a commercial or industrial water right in Idaho should be very small relative to other business start-up costs, so for most industries will not be that important a factor in the location decision. In fact, the generous availability of water is one basis for comparitive advantage of Idaho over other states as an industrial site. While it is true that requiring new industry to obtain water from agriculture will involve a slight retrenchment for agriculture, most of the likely new industrial water uses are very small relative to Idaho agriculture's use of water. Improvements in the way water is used within irrigated farming can be far more important to the economy of the sector and the state than the small impact of transferring water from willing sellers in farming to willing buyers in industry. The important water constraint is the one linking irrigation and hydropower, since it may constrain the growth of other sectors which depend on the growth of irrigation, or else may subject all sectors to higher electricity prices.

6.2 A More Thorough Look at Water Markets

The above discussion of water availability for industry suggests that water will probably not constrain Idaho industrial growth, largely because a water market exists to allow water to be transferred to municipal, industrial, and commercial uses if these are the more valuable water uses. An obvious question is whether water markets are more generally applicable to solving the range of water problems raised by the Swan Falls issue. We will conclude in this section that the answer is a qualified yes.

Idaho's water law and institutions seem to have grown out of the desire to promote the state's economic development by assuring the security and stability of water rights. The present system emphasizes the security of existing users, and the protection of third parties against damages. However the system has become inherently rigid and economically inefficient, rather than allowing water to move to its most valuable use as competition for water has increased.

If they were allocated by a free market, resources such as water would go to those willing to pay the highest price for them. Those who could pay the highest price would be those for whom water is the most valuable productive input, and by implication those who could use the water best to benefit the Idaho economy by creating income and jobs. This would result in "allocative efficiency" -- the most efficient possible use of the water resource -- so long as third parties are not hurt by the transactions. A free market could result in water transfer between farmers, from less valuable to more valuable irrigation uses. This might allow water use to shift from poorer to better soils, or from low value to high value crops. Markets already exist to transfer water from irrigation to municipal and industrial uses. It is possible that markets could be devised to allocate water between irrigation and power generation, with transfer in either direction depending on which use was more valuable. It is important to note that such free market transfers would be between willing buyers and willing sellers at prices set by the market, so if a transfer occurs, both parties must consider themselves better off.

Most of the objections raised to free market allocation of water center on the potential for damages to third parties. Much of the discussion in earlier chapters of this report dealt with ways in which actions of upstream irrigators might affect the water rights of downstream irrigators and flows at Swan Falls. One technique that has been used to address these third party effects in Colorado, which is discussed in a paper by Gardner (1983), is to define water rights in terms of consumptive use rather than diversions. This technique, along with institutions designed to make the parties to a water transaction compensate damaged third parties, could possibly make expanded water markets a viable water allocation mechanism. Because of the intense political sensitivity of any proposals to alter water law or water institutions, suggestions that we rely more on markets for water allocation need much more study, prior to making actual proposals

6.3 Conclusions

This chapter has looked at the implications of the Swan Falls situation as it affects the availability of water for municipal and industrial purposes. We recognize that the present situation where new municipal and industrial uses must secure a water right represents a new cost that must be paid by firms loacting or expanding in Idaho. However similar costs would be faced by fims locating in other western states, and these water costs are generally a small part of the cost of setting up a new business. We argue that non-subordination is not causing water availability problems that will significantly disadvantage Idaho as an industrial location.

The chapter has also taken a broader look at the possibility of relying more on markets to allocate water within and between uses. We conclude that water markets might improve the efficiency of water use, and make most people better off -- if ways can be devised to either protect or compensate damaged third parties. However the political sensitivity of water rights issues suggests that the issue needs more study than was possible in the short time frame of this study.

CHAPTER VII

OTHER ENVIRONMENTAL, RECREATIONAL, AND FISHERY IMPACTS OF SUBORDINATION

The purpose of this chapter is mainly to note that there may be other environmental, recreational, and fishery impacts of subordinating the Swan Falls water right to new irrigation, and these may translate into impacts on the region's economy. Given the time constraints of this study, we have done little work in this area, so our conclusions are very tentative.

The environmental, recreational, and fishery factors enter into the Swan Falls issue in two possible ways; as constraints, and as costs. These factors may constrain the decisions that the State can make regarding the Swan Falls right, and the decisions that farmers can make about development. The decision that are made by the state and by farmers may involve economic costs and benefits depending on how they impact fish, recreation, and other environmental variables.

7.1 Environmental Factors as Constraints

The most obvious environmental constraint on the Swan Falls decision process is the 3,300 cfs minimum flow established at Murphy by the State Water Plan. This minimum flow was established, in part, to help protect the fishery, recreation, and other environmental amenities of the Snake River. The Memo which IDWR prepared durring the 1983 legislative session suggests that this minimum flow constraint is not adequate to prevent some substantial fish damage. They note that the flow reductions, associated with their 450,000 acre development scenario, would eliminate Sturgeon from this river reach.

One other fishery factor which could possibly constrain action at Swan Falls results from the Fishery Plan of the Northwest Power Council. This plan anticipates that water to aid in "flushing" anadromous fish through the Snake and Columbia will be available in late spring from sources in Idaho. If that should happen to take the form of some of the unallocated water storage in Federal dams on the upper Snake River, that could limit the options for irrigation development in southern Idaho. It is yet too soon to do more than speculate as to whether this is a real problem.

7.2 Environmental Factors as Costs

This is the much more difficult issue for economic analysis. Subordination may result in a very wide array of environmental consequences. A given consequence may even be evaluated as positive by one person and negative by another. Some people find open sagebrush aesthetically pleasing, while others prefer the view of green fields. Conversion to irrigation may damage antelope habitat, but improve pheasant habitat. These kinds of changes are potentially important to the state's economically important tourist industry, but they are very difficult to define in dollars.

Even the sturgeon example is difficult to value in money terms. It is not clear whether the lesser summer flow impacts associated with the 195,000-acre development forcast used in this study would have a discernable impact on the sturgeon.

7.3 Conclusions

It is clear that environmental concerns do limit the options available at Swan Falls. The State Water Plan minimum flows are such a constraint, and the Northwest Power Council's fish plan could potentially be another constraint.

The actual economic effect of the environmental consequences of subordination is very difficult to estimate with confidence. We have chosen not to present estimates of such costs. We suspect that while the consequences of subordination may be important for the environment of southern Idaho, the direct economic consequences of these environmental changes are probably not large, so long as the 195,000-acre new irrigation development forcast is not exceeded.

SELECTED REFERENCES

[1] Anderson, K.P., "A Review of Studies of the Demand for Electricity," NERA, November 20, 1981.

[2] Barranco, G. "The Feasibility of Irrigation Development in High-Lift Pumping Areas of Southwest Idaho," MS Thesis, University of Idaho, Moscow, Id., 1978.

[3] Bonneville Power Administration, TIME-DIFFERENTIATED LONG RUN INCREMENTAL COST ANALYSIS, U.S. Department of Energy, March 1983.

[4] Brockway, C.E. and Johnson, G.S., "Bibliography of Literature Related to Water Resources of The Snake River Plain above Swan Falls," IWERRI, University of Idaho, Moscow, Id., September 1983.

[5] Findeis J. and Whittlesey, N., "Competition Between Irrigation and Hydropower Use in Washington State," Washington State University, June 1982.

[6] Gardner, B.D., "The Untried Market Approach to Water Allocation," Department of Agricultural Economics, Univ. of California, Davis, Calif.

[7] Gardner, R. and Miller, T., "Price Behavior in the Water Market of Northeastern Colorado," WATER RESOURCES BULLETIN, August 1983.

[8] Hamilton, J., "Economics of Electric Load Growth in the Pacific Northwest," Department of Agricultural Economics, University of Idaho, Moscow, Id., November 8, 1977.

[9] Hamilton, J., "Water, Electricity and Irrigation in Idaho," Department of Agricultural Economics, Univ. of Idaho, Moscow, Id., June 1983.

[10] Hamilton, J., and Whittlesey, N., "Social Costs and Energy Impacts of Irrigation Expansion in the Pacific Northwest," paper presented to the Pacific Northwest Conference on Non-federal Financing of Water Resource Development, Portland, 1978.

[11] Idaho Department of Water Resources (IDWR), "Estimate of Possible Primary Impacts Resulting from the Swan Falls Decision," September 1983.

[12] Lyman, R.A., "Optimal Pricing and Regulation of Electrical Energy in a System Depending on Hydroelectric Capacity," IWERRI, Moscow, Idaho, May 1979.

[13] Pongtanakorn, C., "Economic Impact of Irrigation Development in Southwestern Idaho," MS Thesis, University of Idaho, 1981.

[14] Salmon Falls Study Committee, SALMON FALLS STUDY, 1983.

[15] Schunke, Dave, "Response to Senator Laird Noh's Letter of July 6, 1983," Memorandum to Commissioners Ward, Swisher and High, Appendix A, MONTHLY MATTERS, Idaho Legislative Council, Boise, Id., Sept. 1983, pp. 44-65.

[16] U.I. Extention Service, "Crop Enterprie Budgets," 1983.

[17] U.S. Bureau of Land Management, "Boise District Agricultural Development Environmental Statement for Southwest Idaho," Boise, ID., 1979.