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Summary Report of
Water Resources Seminar
First Semester 1975-76

INSTREAM FLOW NEEDS

AND

COMPETING USES FOR WATER

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FOREWORD

The Idaho Water Resources Research Institute has provided the coordination and supervision for this graduate seminar on the campus of the University of Idaho. It is the Institute's policy to make available the results of significant water-related research conducted at Idaho's universities and colleges. This effort has focused on the problems associated with instream flow needs and competing uses for water. The Institute neither endorses nor rejects the findings of the authors and participants. It does recommend careful consideration of the viewpoints put forth in the series of seminars that generated this proceedings.

ABSTRACT

This report is a proceedings of discussions and presentations that took place in an interdisciplinary graduate seminar conducted on the campus of the University of Idaho during the fall semester of 1975-76. The topic considered was instream flow needs and competing uses for water. Ten presentations were made by guest speakers and questions were entertained from participants that included faculty and graduate students from various academic departments. Students were required to investigate research needs in Idaho's consideration of instream flow needs and competing uses for water. They also tried to assess the objectives or goals that should be approached and recommend ways of solving the problems. Oral presentations were made by each student.

A summary of the students' ideas and brief bibliographies on the specific subjects have been presented in the report. Observations and conclusions have been made by the editors to give a basis for future studies that need to be addressed.

ACKNOWLEDGEMENTS

The editors acknowledge the cooperation of various departments that encouraged student participation and helped the graduate students in their search for ideas, literature and significant problems concerned with instream flow needs. Our sincere appreciation is extended to each of the guest speakers and their companies, agencies or institutions for taking the time and providing the necessary supporting funds to make possible their excellent presentations. Acknowledgement is also made for the attendance and participation of state representatives Norma Dobler and Robert Hosack, and Mrs. Kathleen Warnick of the Idaho League of Women Voters. Their participation added immeasurably to the quality of the seminar. Finally, a sincere thanks is extended to each of the graduate students and participants for their interest and questioning that enriched and made possible an atmosphere of inquiry that should always be fostered both within the university and in public forums and planning efforts.

.8 to 1.3 million acres that can be developed for agricultural production in southern Idaho, principally Snake River Plains. A statement was further made that it would be simple to tap the water in the Snake River, pump it to newly developed lands for irrigation, and turn a semi-desert condition into a flourishing agricultural area. The rebuttal came from a representative of a hydroelectric power company who responded "yes, that's true". "We perhaps could develop an additional million acres of land for agricultural production in Idaho, but you need power to run the pumps that lift that water to the bench country in order to make the crops flourish." The point became even more graphic when one realizes that in order to develop approximately one million acres, it would reduce the flows in the Snake River to approximately 50 cfs. A reduction of flow to that low level would not permit the necessary hydroelectric power generation. Another point was made that large untapped water reserves exist in the Idaho aquifer. I think it was Higginson who put proper light on this subject by saying "yes, we do have a tremendous reserve there, but if we tap that reserve we have to have some means to 'recharge' it". So, if one takes, he must put back -- a healthy concept applicable to many situations.

I think enough has been said on preliminaries. Direct your attention now to the handouts.

1. Navigation: We have in the Snake River of Idaho and other larger rivers, navigable reaches. Navigation is important when considering the tradeoffs concerning instream use.

2. Assimilation of Waste Materials: I'm not going to belabor this point because Dr. Mike Falter will be talking on this subject later. For years, before EPA and stringent government controls, rivers were a convenient means for flushing refuse out of the system. Being open ended and having an abundance of microbial life, a fair load of organics can be dissipated. With the creation of dams on the Columbia and Snake River systems, we have changed what has been free-flowing river into a pool condition; therefore, the "flushing" mechanism has been greatly reduced.

3. Recreation: This point covers an extremely diverse area including everything from boating to fishing. I've traveled the state for ten years, and I've witnessed the growth of recreational use on these rivers. I was never more impressed by the very intensive use of the Middle Fork Clearwater River during this past summer. Tremendous numbers of people are enjoying an environmental experience in and around these beautiful waters. Most of the experiences cannot be evaluated on a dollars and cents basis.

4. Fish and Wildlife Habitat: To this point, I guess, I most closely identify with regard to ongoing research. I'll have more to say on this subject during my slide presentation.

5. Hydroelectric Power Generation:

6. Log Storage: Currently not a big use in Idaho waters.

7. Transporting Water Downstream for Irrigation and Other Diversionary Uses:

8. Placer Mining, Gravel Mining and Gold Mining:

Some of the current difficulties in determining water needs and values are:

1) the difficulty of achieving comparability of needs when some water needs are expressed in economic terms and others are expressed in uneconomic terms. It's relatively easy when you you have an industry that is using X number of gallons from a river directly as opposed to a well system which may cost much more money to obtain water. By contrast you have an environmentalist who enjoys the peaceful view of Myrtle Beach on the Clearwater River, and says "that view is worth 20 bucks to me at this point in time". The variability in personal values makes this type of environmental appreciation difficult to evaluate economically.

2) the problem of preexisting water rights, related to instream flow needs. I haven't personally been involved with this concern, but if you have been reading your newspapers, you're aware of the fact that by virtue of old, outstanding treaties, particularly with Indians, litigation is underway to resolve the problem. We're getting a little smarter, we're trying to anticipate these problems in advance and deal with them in appropriate fashion, rather than from hindsight which always seems to get us into trouble.

3) the short time frame allowed for flow regulations and implementation by some state laws. In other words, as we start interacting politically between the local, state, and federal government, we find legislation places us under some very

TABLE OF CONTENTS

INTRODUCTION

Prior to the beginning of fall semester of 1975 Dr. Gladwell, in consultation with faculty members of various departments, discussed alternative subjects that might be timely topics for a seminar. It was a concensus that discussion of instream flow needs and competing uses for water in Idaho would be a particularly important topic. The Idaho Legislature had in progress then a special Interim Committee study chaired by Representative Vard Chatburn, several agencies had recently participated in a special workshop at Utah State University and the American Society of Civil Engineers and the American Society of Fisheries had agreed to have a specialty conference in Boise during the spring of 1976.

The Seminar follows a long established pattern of inviting guest speakers to the campus to present particular viewpoints and at the same time encouraging faculty members and graduate students to bring forth questions and ideas that will need to be addressed. The seminar is offered regularly as an interdisciplinary course listed as Agricultural Engineering Ag E 589, Civil Engineering CE 589, Forestry FWR 589, Geology Geol 589, and Inter 589.

The guest speakers for the fall seminar and their affiliations are listed below:

Guest Speaker	Affiliation
Dr. Merlyn Brusven	Department of Entomology University of Idaho Moscow, Idaho

Guest Speaker	Affiliation
Dr. C. Michael Falter	Fishery Management University of Idaho Moscow, Idaho
Dr. James H. Milligan	Department of Civil Engineering University of Idaho Moscow, Idaho
Dr. John F. Orsborn	Albrook Hydraulic Laboratory Washington State University Pullman, Washington
Mr. Tim Cochnauer	Idaho Department of Fish and Game Boise, Idaho
Mr. John Rosholt	Twin Falls Attorney President, National Water Resources Association Twin Falls, Idaho
Mr. James Runsvold	Environmental Division Idaho Department of Health and Welfare Boise, Idaho
Rep. Vard Chatburn	Chairman, Legislative Interim Committee on Instream Water Use Albion, Idaho
Mr. R. Keith Higginson	Director, Idaho Department of Water Resources Boise, Idaho
Mr. Al Isaacson	Hydrologist, Panhandle National Forest, U.S. Forest Service Coeur d'Alene, Idaho.

The graduate student participants and their departmental affiliations are listed below:

Graduate Student	Professional Department
Richard G. Allen	Agricultural Engineering
Thomas V. Dechert	Plant and Soil Science
Wayne R. Dorband	Fishery Management
John Michael Harker	Agricultural Economics
Ned Horner	Fishery Management
James Osiensky	Geology

Graduate Student	Professional Department
Joseph P. Pessutti	Geography
Cary R. Schaye	Entomology
Robert J. Schott	Entomology
James E. Stanton	Entomology

Presentation by

MERLYN BRUSVEN

Professor of Entomology, University of Idaho

Thank you, Cal. I understand there are two of us that are classified as biologists speaking on different aspects of this broad subject. I'm an aquatic entomologist-ecologist; however, when one deals with a subject as instream flows, one almost immediately finds himself transcending many disciplines to get at the answers.

If there's a central message, I'd like to relate with regard to instream flow needs, it is that when one interacts with people, one finds that almost every individual who is discipline oriented attempts to protect his discipline even at the expense of others that may be equally important. This was never more clear to me than during the Water Conference in Boise last spring. Many of the interest groups presented their cases along with appropriate rebuttal. It is only through exchanges of ideas and through open dialogue that a central point amenable to the majority can be arrived at. I think communication, and an element of humbleness on the part of the many interest groups, is the thing we're going to have to strive for in order to arrive at acceptable management plan for one of our most important resources in Idaho, i.e. streams. So, while I will largely deal with the biological implications, and more specifically entomological concerns, I will also allude to fish management, primary production, engineering, hydrology, and others.

A statement that I classify as contemporary and revealing was a statement made by Governor Andrus as featured speaker at the spring Water Conference. He said, "Ladies and gentlemen, no longer should Idaho consider itself a state that has an 'abundance' of water -- rather, it has an 'adequate supply' of water". I further predict that within 10 years, and I am pointing primarily to the major river systems, we are going to have rather critical shortages of water in certain sectors of the state. So, we must tighten our belts and look reflectively and to the future as we plan new strategies. Let me expand this point with some of the dialogue that prevailed during the spring Water Conference. I'm going to direct my initial illustration largely to the agricultural community, because agriculture is centered in the economy of the state. Anyway, one of our great world concerns is food. How do we get more food produced on X numbers of acres? One of the participants in the discussion indicated we have approximately

stringent controls almost immediately. In order for scientists to properly weight the conditions, biological in my case, we simply don't have enough lead time to develop base line information necessary to fully assess the implications and tradeoffs that have to be made in wise management practices.

4) the identification of critical stream reaches, critical streams, if you will, where flows are absolutely required for certain uses. We have perhaps assembled on this campus and in Boise, some of the best minds in the country for assessing the state and regional water uses and needs.

5) the problem of determining habitat water flow relationships from a multidisciplinary frame of reference.

6) the problem of establishing a methodology for large streams. A concluding comment at the recent AIBS meeting in Corvallis just two weeks ago stressed the need for developing methodologies for studying big river systems.

7) obtain the kind of data that's going to be meaningful for interpretation and making wise decisions.

8) the problem of waste dillution and assimilation.

9) establishing use priorities. Here's where one experiences infighting during the establishment of use priorities. It is often axiomatic that the "louder" one talks the more that use prevails. I think its time for both talk and quiet, humble listening, to arrive at an acceptable compromise. In developing strategies for the future we need to not only see those things that are clear to us now, but try to perceive the options in the future. That's a tough one.

10) the problem of conveying to the developers an understanding that instream flow is a limiting factor - that's simply an educational process. Once we have the data base, representing several disciplines, we can then proceed with the educational process.

11) the problem of excessive duplication of effort. I think that with our effective coordination of water resource projects in Idaho, for all intents and

purposes, we have reduced this situation to a minimum. When you expand your activities to other states and regions, then there is greater chance for some duplication. That is not to say that all duplication is bad, since similar methodologies can often be applied to different conditions.

12) the problem of gaining acceptance of established flow levels. This is essentially an educational problem.

13) the problem of developing methods to evaluate impacts and tradeoffs for incremental flow levels. At this point, incremental flow is very close to my research effort in aquatic entomology and will be expanded upon later.

Q. As far as the Indian water rights are concerned, what is the problem there, because they don't really use the water any more than anybody else, or do they?

A. Well, the problem as I see it, is we have to anticipate potential problems of this type in advance. So many times we've walked into this condition in a presumptuous manner, assuming we have control over water rights when we really don't. Consequently we need to check old Indian treaties carefully. Before one creates large changes that have to be mitigated later, it is better to anticipate them in advance. At this point I turn the question over to Dr. Gladwell who is much more familiar with Indian affairs than I am.

C. (Gladwell) The big problem in not only Indian water rights, but all the reservation rights is that the state doesn't know what the rights are. There are a lot of uses being made of water now which we may very well have a clouded title and could change whether or not we can in fact divert more water for irrigation. For example: the tribe on the Fort Hall Reservation is now essentially saying that they're entitled to all water on and pertinent to the Fort Hall Reservation, which is the Snake River. Well, now if they can divert all of the Snake River for their uses at the Fort Hall Reservation, there may be large consequences downstream, now as well as in the future. I think the big problem is that we just don't know what their rights are. But the man that's really going to be able to explain that to us will be on the program, and that is Keith Higginson. It's not just Indians, it is any federal reservation. A reservation carries with

it the right to use the water and as you know, Idaho is roughly two-thirds federal land, most of which is reserved lands. And most of that is where the water is generated in the state of Idaho. So, it can mean very important things to the state. We can go ahead and make our state water plan and find out we don't own or control any of the water later on. We may have had an interesting exercise of futility. But, Higginson will be here and will be the man that can really talk to us on that subject.

A. A point on that order is on the legal aspect of the water right and there is some question as to what a water right is, whether it is property right or some kind of use right, the Indian question and the reservation doctrine question are opening up a sort of "Pandora's box". States have overappropriated in some instances, and supposedly guaranteed water rights to non-Indians and non-federal people. The economic impacts of coming back and saying that you no longer have this water right are pretty far reaching, particularly for agricultural states in the West.

Well, we'll continue then with some of my specific involvements in instream use, dealing specifically with biological entomological-ecological concerns. Insects are only part of a very complex system properly described as an ecosystem. To properly frame insects (and I'm not going to make small their role), insects essentially occupy the rather unique position in the food chain between plants and fish. And I suspect, Mrs. Dobler, when you interact with your colleagues in the legislature on environmental problem, a large part of the discussion centers around fish. You've got to deal with fish, it's a very big industry and very important. In due respect to my fishery colleagues, I think it is where our dollars and cents values many times are measured, because fish are a more measurable commodity than insects. But in a sense, from an ecological point of view, it's "putting the cart in front of the horse". Because, in order for the fish to be in a river, we have to have the proper life support systems. The life support system for many fish is insects, other invertebrates, and the plant life. Consequently, you have to deal with the totality of all those organisms that are tied one to each other in the food chain; insects represent a very important component in the system. Let me move then to some of our current research and concerns dealing with instream use, establishment of minimum flow criteria, and the role of water fluctuations resulting from hydroelectric power operations upon the stability of insect life and aquatic biota in general. Over the last four years we've conducted studies in the Clearwater River and the study which Mr. Warnick alluded

to on the Snake River in 1973. I brought a few slides along to illustrate some of the processes involved in arriving at inter- and multi-disciplinary approaches to the problem and some of the results that were obtained from the study. I'll present some of the results with "tongue in cheek" because short-term studies cannot always generate definitive results applicable on a long-term basis.

I'm going to relate much of the subsequent discussion to the Clearwater and Snake Rivers, rivers which are close to home and very important politically and economically in the future of Idaho. I'll tell you a little bit about what we're doing there. So, let's at this point go on to the slides.

At the outset, one does not just wade into a river and initiate a study. A study of the magnitude of the Snake River controlled flow study in 1973 required several months of interchange and dialogue with many people. We even had to get a permit from the Federal Power Commission to waive the one-foot per hour vertical fluctuation, because we were really going to impact this river. In fact, we reduced the river to a trickle (77,000 - 5000 cfs over a 5-day period). The coordination effort was done, to a very large degree, by Mr. K. Bayhau, who now is in Washington in the Bureau of Sport Fisheries and Wildlife.

The area of concern is the Hell's Canyon reach of the Snake River between Idaho and Oregon. It was politically an issue because of the National Recreational Area that was currently being considered in Congress. There was great pressure brought to bear on the principal investigators to get the results written up and compiled so the document could be used in the decision making process.

(Slide) Here's where it all started - Hell's Canyon Dam seen some 60-65 miles above the Grande Ronde River. Flows were regulated at this point in a logarithmic scale from 27,000 cfs to 18,000, 12,000, 7,700, 5,000 cfs over a five-day period. I might also add that these flow changes were dramatic. They were not generated over a period of 3-4 hours, but were almost instantaneous, to such a degree that 30 miles below the Hells Canyon Dam, we perceptibly could see the waters dropping on the gentle sloping shoreline we studied. One of the things we wanted to determine was: what impact did this dewatering phenomena have on the insect life? were insects stranded? was mortality a result? did they survive? - if so, by what means?

Logistics becomes a major problem, you have no towns within 40 miles. It became a highly technical coordinated activity. We had a helicopter crew from Fort Lewis, Washington that provided aerial support. The Forest Service

contributed tents, army cooking facilities were used, and everybody played their role.

(Slide) Here's the famous river. When I first came into Idaho ten years ago, I couldn't help but be enthralled by the imposing canyon, some 5,000 feet deep. Before we started the study, Dr. MacPhee and I took a jet ride up the river to select sample sites. It was quite an experience to challenge the riffles and to cruise on up this river and to see it in all its majestic beauty. I might say that when you set up a study of this type, I don't care what discipline you represent, it is very important to have an advance look at what you are dealing with. For example, one of the things that became very obvious to us -- you simply don't pick at random any point on this river for study. I would say 95% of the shoreline is so formidable as to preclude effective sampling.

(Slide) Here's what happens when the water is reduced. This represents a rather small increment here, I expect about 12,000 - 15,000 cfs on a vertical bank. All you're really looking at is about 3-4 vertical feet. But what happens when you take that same shoreline and project it over a more gentle horizontal profile type stream, now, rather than 3-4 vertical feet exposed, you have 100 feet.

(Slide) Here is the beach where the work by the entomologists, the fishery biologists and the algologists was performed. It's directly across from Pittsburg Landing on the Wilson Ranch, which if you have been reading your newspaper over the years, has been quite a problem. The Forest Service has attempted to buy it, but has been relegated to go through condemnation proceedings. The ecological zones are distinct. This white zone was largely coated with filamentous algae. The upper zone appears rather brownish, but actually has a darker narrow zone just above the white zone. You can perhaps see it. This zone had single cell algae which apparently developed very quickly when the waters were raised. We found very few insects in this zone. Below the white zone was a dense mat of cladophora, a filamentous algae which had a wealth of insect life. This zone appears almost like a plush green carpet that one might have in his living room. In these filaments prevailed one of the richest insect communities in terms of biomass I've seen in Idaho.

(Slide) Now, here's another photo of the Snake River where flows are down to the lowest level, 5,000 cfs.

(Slide) Here's one of the products of dewatering - a small sculpin. It was stranded during the flow changes.

(Slide) Here's a mass of insects, a natural aggregation of insects in a small depression of a rock. There are perhaps a couple hundred insects stranded on that rock.

(Slide) Here's some of the methodology we used. Drift nets were used in the deeper parts of the water. Using another method, one of my assistants is taking bottom samples to determine stranding crop.

(Slide) This belt transect was used to quantitatively count insects that were stranded. We could also determine rate of dewatering. So, here we are, eight people, amassed to do different tasks, e.g. take belt transects, run enclosure devices, run drift nets, etc.

(Slide) This is a flow graph of drift, that reflects the rate of insect drift at different times during the day. Insects generally are night drifters. I anticipated that we would probably break that rhythm with the reduction in flow. I believe the drift pattern will play importantly in my recommendations to the Corps of Engineers.

(Slide) That's enough for the Hell's Canyon area - this is the Clearwater River. This photo was taken the morning of February 10th or 11th. This is the time that Lower Granite Dam closed its locks and the water began to build to form Lower Granite Pool.

(Slide) In late afternoon, this is what the situation looked like. We have changed the condition rather appreciably, changing a free-flowing river into a slackwater condition.

(Slide) Port Lewiston - we're going to see a lot of things happening down there in the next year.

(Slide) This is one of my most appealing pictures - a shot I took about seven years ago on the grade overlooking Ahsahka. In 1965 the North Fork Clearwater was a free flowing river, now it is a dammed river. The upper reach there represents the Middle Fork of the Clearwater. Dworshak Dam is a very efficient hydroelectric power generating unit -- one of the most efficient in the whole Columbia system.

One of the parameters we've investigated with regard to insect life is change in temperatures as a result of Dworshak Dam. I might explain just a thing or two about it. The flows from Dworshak are regulated and released through a multiple level penstock system. In other words, they can take water off at different heights, therefore come closer to the natural temperatures of the Middle Fork of the Clearwater than if they were taking it from one level. During the months of

August and September natural temperatures cannot be matched. Temperatures are about 3-5° colder than normal. What does this mean biologically? To the fisheries people - in talking with the people in Boise they tell me that the spiney ray fishery, namely the small mouth bass fishery is marginal in the Clearwater River. Why? The temperatures are too cold. I'm especially concerned about the insects, because insects go through a series of molts during development. The only way they increase in size is to shed their old skin and grow a new one. What happens if you decrease the average temperature by 3-5° C? You tend to retard development. And it's impossible, although we haven't witnessed this yet, to eliminate a species by retarding development.

Let's just look at the lower graph there, we see temperatures at Ahsahka - this is monitoring water temperatures on the North Fork at the fish hatchery. In 1968-69 temperatures were ranging up fairly high, from 72-75° F from 1973 on. When Dworshak came into operation, temperatures were quite a bit colder.

The other chemical parameter we dealt with was dissolved oxygen. We had cooperation from the Corps of Engineers on this. They monitored it for us. All I can say at this point even though the North Fork waters ran slightly less than the mainstem, Clearwater waters in terms of parts per million mg. per liter, the prevailing conditions were not serious.

Insect drift on the Clearwater River this past summer performed in a very predictable fashion. Highest drift occurred at midnight, lowest drift during the daylight hours. The plot here is on the logarithmic scale causing the afternoon plot of data to appear excessive.

We were fortunate in obtaining a lease on an abandoned spawning channel which was used to simulate dewatering phenomena.

Here's the channel. We've conditioned the streambed with selected sediment types. We're monitoring insect movement into and out of the reach under different flows. We are also looking at distribution of insects within the substrate bed to a depth of 12".

So much for the slides. Perhaps we can use the remaining time for discussion.

Discussion Questions and Answers

Q. When they backed the water up at Lewiston, how long did it take for the insects to adjust or to change?

A. We really haven't as yet analyzed our data. We set up a program to obtain samples immediately before and immediately after the fill. Filling the reservoir took a little over three days. We were unable to recover our one-month postimpoundment basket samples because of muddy water. We have basket samples in now, and I think it's safe to say we're going to have changes toward a midge community.

Q. What about the effect of the very extensive and quick, something like putting in Lower Granite where you're changing your water volume very quickly and where sediments are going to be washed down very quickly? I was out on the Snake last week and some people from PFI who were taking bottom (grab samples) said that the difference between early February before they closed up to now is that there is absolutely no sediment on the bottom and that any of the mayflies larvae which they were finding in past summers are just completely absent and that all there is now are tube worms.

A. Yes, this is what you'd predict. We did pick up a few mayflies near the Potlatch Mill, however, which is a transition area. I've not done anything in the Snake River itself below the confluence myself.

Q. On the water you dropped to 5,000 cfs, what percentage of the insects did you kill off like mayflies?

A. I've got some tables on that. Results are based upon time exposure and ambient temperature of the day. We found, much to our surprise, a 70% survival of the midge larvae after 48 hours. Mayflies and coddisflies were less resilient.

Q. Did you mess with desiccation, water law, evaporation, at the time - so that you could determine what desiccation was going to be?

A. This can best be handled in the laboratory. It's really tough to do in the field.

Q. I know you don't think you have enough data and probably never will to make the final equation, but when it comes time to set these minimum flows, everybody's going to be

working without enough data. What kind of guidelines would you recommend at the moment for people that are going to be faced with this business of setting minimum flows? How would they take into account the factors of insects and other things?

A. There are several points I would recommend: as a biologist I'm very emphatic on this point, that when we make flow recommendations they ought to be "instantaneous minimum flows" rather than average flows for a day, week, month, etc. Our biotic communities have become, through evolution, attuned to the natural hydrologic phenomena of a river. So, instantaneous flows are very important. I further recommend that establishing a single minimum flow for a river should be modified to follow seasonal minimum flows. I think you people in fisheries would agree that different seasonal flows might be appropriate for summer and fall-run chinook. Thirdly, from the standpoint of insects, I would recommend a nighttime fluctuation rather than a daytime fluctuation because of their activity patterns. If it's dark, they are going to be more active and experience less chance of becoming stranded. There's another reason for nighttime fluctuation in that temperatures are more favorable for survival at night if an insect should become stranded.

Q. On a related point, Merlyn, the one foot now are licensed. What's your opinion of that now?

A. My recommendation to the Corps with regard to this criterion was: "the one foot per hour vertical fluctuation is a subjective criterion", and cannot be equally applied to all rivers and all reaches of a river. Now as far as its relationship to the Clearwater River, my opinion is that "for reaches of the river, particularly where you have a high vertical or near vertical banks, it is acceptable". In the lower reaches of the Clearwater, such as prevail around Hog Island and lower where slack waters occur and very low profile conditions prevail, this regulation parameter is unacceptable because one vertical foot fluctuation/hour can expose 70 or more feet on the horizontal. And that's where Woody Trihey's model is going to come in.

Q. What about it on the Snake?

A. Well, the Hell's Canyon reach has banks that are pretty vertical. I think one foot per hour, not to exceed two vertical feet per day is acceptable as far as insects are concerned. A more serious problem may be in the Snake River in the 15 miles above Lewiston.

Q. Do you think on setting the one foot per hour limitation it was rather an arbitrary thing in the Federal Power Commission license?

A. Yes, I think it's pretty subjective.

Q. Now, along that line, what if you had a limit of 3.0 foot per hour but, as you then commented about, what if you do the fluctuation in that 8:00 p.m. or later hour, recognizing that from the power output advantage it may be more desirable to fluctuate it during the period 6-7:00 at night?

A. Well, I think it comes a little earlier than that. I think their desired time for fluctuation is during the daylight hours. On the Clearwater the impact would be on the critical reaches in my opinion and may put those critical reaches in dark hours. So, they've got to do a lot of finagling and calculating here with hydrologists to determine the facts. We, as biologists, can demonstrate key areas, you guys can execute your fancy models to calculate time of travel. So, you really have to be very specific as to the river you're dealing with, and the critical reaches. You cannot make a blanket statement that applies universally to all river systems producing hydroelectric power. Each river has to be analyzed on its own merits and own conditions.

Q. Let me skip over to one other location but related topic. I was interested in your comment about the great growth in recreational use that you observed on the Clearwater. I'm interested in that growth compared to flat water use relatively, that is comparative to the increased recreational use down on the Clearwater confluence. Maybe that use up there that you observed is great, but maybe the use on the flatwater section is 3 or 4 times that relatively increased.

A. Well, I wouldn't say so, but again, it is conjectural on my part. But, you've got to remember, we've got a different kind of use. We've got rafters heavily using the faster waters above Orofino. When you get to the slackwater the hazards are riffles which have been eliminated, thus providing better conditions for conventional boating. I predict sail boating is going to become a very big thing. So, I think we're going to see in the next two years a revolutionary change in the kind of recreation in the lower Clearwater.

I think my time is up. I appreciate the opportunity to present a few of my thoughts.

Presentation by

C. MICHAEL FALTER
Associate Professor of Fishery Resources
University of Idaho

I understand that my directive for today was to present the "stream" side of instream flow needs; basic aquatic ecology leading into the ecological impacts of decreased flows on the stream system.

I want to simply go through the dominant factors of the stream system which are concerned with minimum flow and impacted by minimum flow; water quality considerations such as temperature, oxygen, flow velocity, space, the basic physical/chemical characteristics, periphyton (attached algae) growth patterns in a large or small stream, and free floating algae. I'll skip over the insects, because that was probably covered by the last speaker and, finally, I will get into the minimum flow needs of the fishery. It certainly won't be comprehensive, but hopefully I'll touch some spots that might stimulate some questions.

Reduced stream flows result in a disproportionately increased surface area. Let's look at a cross section of a stream. The Snake River below Lewiston is typically a wide U-shaped channel. Let's say the river is flowing at 50,000 cfs and it's got a certain surface area. Reduce that flow to one third, down to about 17,000 cfs, but the surface area has been reduced only in half. So reduced flows then disproportionately give us an effective increase in surface area on the stream so the result is more penetration of heat per unit volume of water. All other things being equal, we're going to have a hotter stream coupled with the fact that reduced flows give us a much reduced velocity.

Look at this river channel again back up at 50,000 cfs (50,000 cfs is the mean annual flow of the Snake at this point below Lewiston) and let's say our mid-channel velocity is somewhere around 6 cubic feet per second. When we reduce that flow down to 17,000 cfs (typical late summer flow) our velocity is going to drop to much less than a third. It will be reduced to something like maybe a fifth of the original velocity at this flow. So, we have a disproportionate decrease in velocity with the decreased flow. The velocity drop is not proportional to the decrease in discharge. So, if somebody wants to drop flow from 50,000 to 25,000 the velocity will not be halved, it will be much lower than that. That's a major consideration when you're considering the impact of flow changes. That sets the stage for a lot of other considerations.

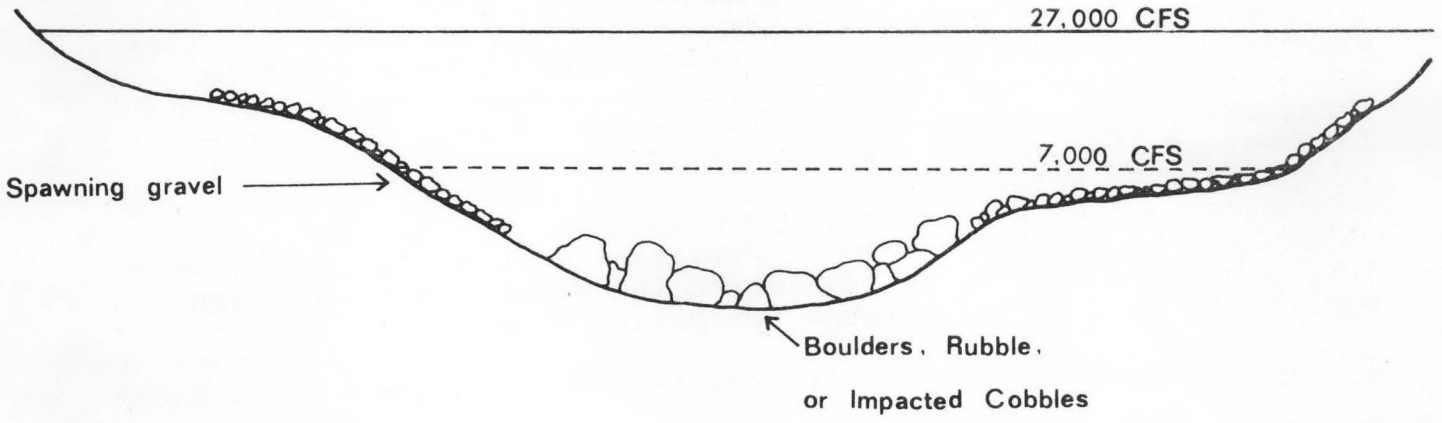
With a reduced flow the ability of water to carry sediment will be disproportionately reduced. It's going to drop its load

of suspended materials. The result will be an impacting of river gravels. We'll look at the impacts of that later when we get into the fishery considerations. In summary, we have these disproportionate changes in velocity and surface area with decreased flow.

What about chemical water quality? We've slowed the water down or greatly increased the time of passage down the channel with decrease in discharge volume. This should allow for more dissolution of channel substrate materials into the stream water. Practically speaking, though, it's negligible. Stream channel materials are usually resistant enough that it's essentially an unmeasurable increase in ions (sulphates, chlorides, phosphates, nitrates, etc.) into the stream water. But it theoretically is there. The much greater impact of reduced flows lies in the ability of the stream to assimilate a waste discharge. Let's look at a simple graph here with oxygen on the vertical scale, and distance on the horizontal. This is just the classical waste assimilation with a waste input. That waste input may be an organic loading from municipal or industrial source, or it might even be a deep discharge from a reservoir such as Hells Canyon Dam where, in effect, we are contributing an organic load into that river water from all the algal production that has occurred in that reservoir. So, our waste organic load picture then would look something like this. Now, we'll see what happens to it. Decomposition will occur downstream (oxygen consumption through bacterial action), the organic matter will be decomposed and so it will decrease downstream to near its former level. Oxygen, meanwhile, and that's the one I basically wanted to show, will first drop, then come back up with reaeration to its former level. Now, if we reduce the flow or the discharge coming down that channel, you slow the velocity. This organic matter is still there, the same amount, but its going to be decomposed in a shorter distance. The oxygen curve is, in turn, going to be much lower, it may even go to zero. Eventually it'll come back up through reaeration to its original level. So, we've squeezed it down in space. We've squeezed this decomposition necessary for stream recovery down into a shorter interval of distance.

Now, what is the impact of this? We end up with clean streams sooner, but living conditions in this zone for algae, insects and fish are going to be much more severe than they would have been under the original condition. In other words, you will have a biota developed to handle oxygen. If we're squeezing this thing down by a distance of several miles on a daily basis then in a matter of just a few hours (and with reduced flow conditions it is going to be drastic) we'll be completely changing the oxygen regime, the dissolved ammonia regime, the hydrogen sulphide, the methane, the CO_2 conditions under which these organisms are going to have to exist. The result will be a greatly altered community. The community will shift to meet the minimal conditions present in the stream. So, we'll exclude a lot of organisms.

USABLE GRAVELS AT DIFFERENT FLOWS IN THE SNAKE RIVER



That's the major chemical impact of reduced stream flows.

Periphyton is attached algae, or algae that grows on rocks, wood, submerged wood, anything underwater. Periphyton is the dominant algae in a flowing water situation. It must be attached, otherwise it will be swept out of the system. Now, we could go back to the Middle Snake River flow study that Dr. Brusven was talking about last week and pull some information on the attached algae distribution during that study.

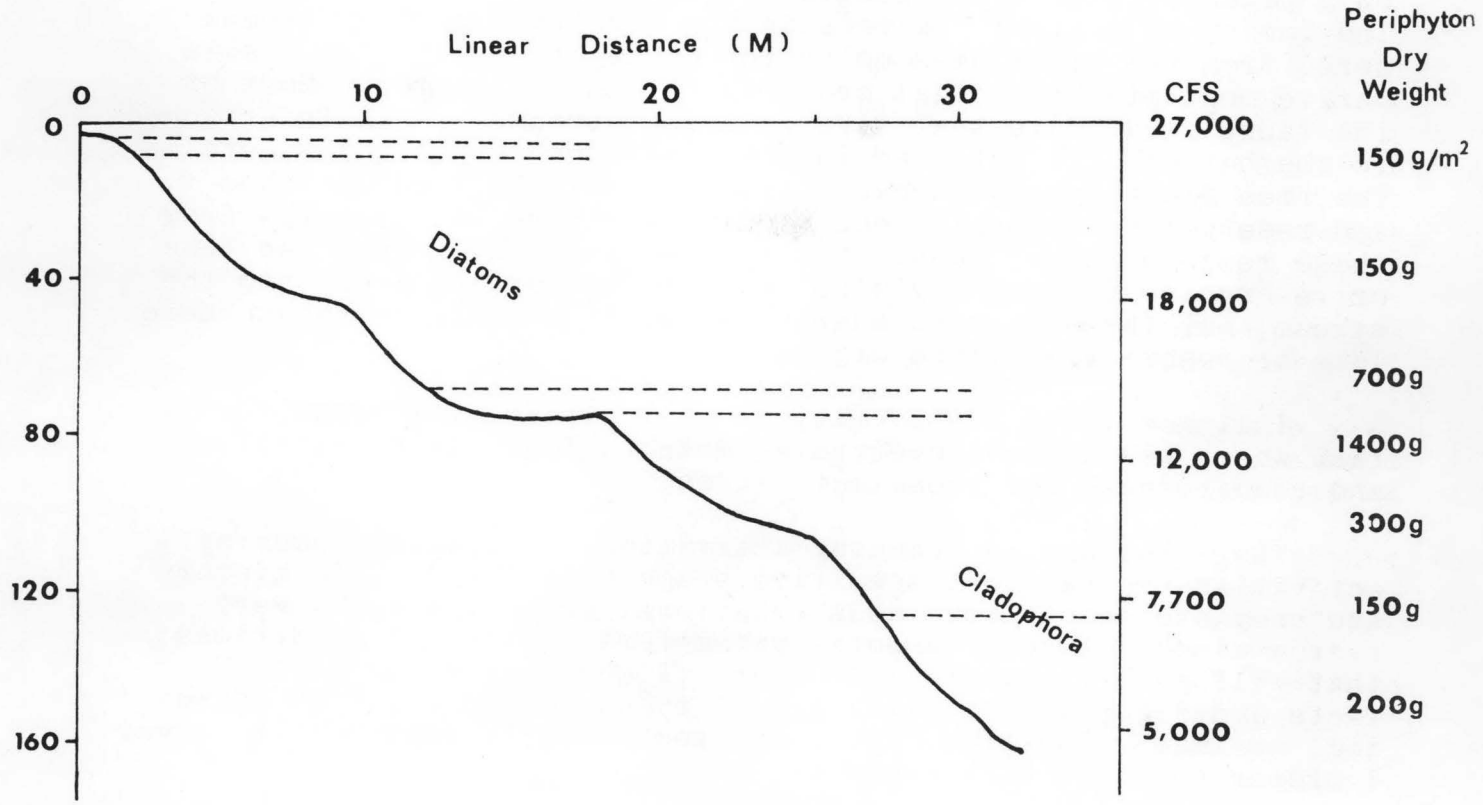
You can see from this curve the normal depth level for periphyton in March. It increases with depth to a maximal zone of periphyton abundance before decreasing below that point. The solid line simply indicates the bottom profile of the river, showing where the surface level intersects the bottom at each flow. You can plot the shoreline at each discharge volume. A 15,000 cfs drop from normal would put you right here, so that means then we're exposing that much bottom. The dashed line indicates the dominant types of algae. Diatoms are near surface, and below about 80 centimeters is a green algae, which is now thriving in that section of the Snake due to discharge from Hells Canyon Dam. From this curve it is apparent that you're going to exclude, with a drop down to 12,000, higher organisms which rely on these diatoms. The diatoms cannot maintain a viable community if they're going to be exposed in the air. Alternate drying, wetting, drying and wetting will effectively eliminate that community as far as its contribution to higher trophic levels, a food source to other organisms. That means that you would probably see a shift to organisms which could live off this filamentous green algae. A trademark of Cladophora is the development of very thick green filamentous long masses trailing in the current. These can't take exposure, wetting and drying. It's not a very diverse algal community, not as stable, therefore as this very diverse diatom assemblage is up here. From an ecologist's viewpoint, then, we've lost something when we've eliminated the stable periphyton community and gone to an unstable periphyton community.

Q. That's in centimeters. Are you talking about just a few feet?

A. Yes, there are $2\frac{1}{2}$ centimeters per inch so down here at one hundred centimeters we're talking about 3 feet (1 meter).

So not too much depth change gets us down in the Cladophora zone, a zone vastly different from the diatom zone. What's below this? For the higher levels to rely on, not a heck of a lot. The periphyton community diminishes rapidly with depth. Below the Cladophora zone you do shift back into diatoms. But the biomass continues its downward trend just like you see here, so we're below that point in deeper water, we're at much reduced periphyton growths. And you're in a sub-optimal zone anyway for organisms feeding on that periphyton because you're out in the deeper areas of the channel. I don't know if Dr. Brusven went

Periphyton Zonation in Relation to Water Depth
(Snake River Pittsburg Landing)



into this last week, but the insects do populate the shoreline areas more heavily than they do the mid-channel areas of a large river like the Snake.

I could mention one fact about biomass versus production. What kind of organic production is going on in those periphyton communities, especially as a function of flow? Periphyton or attached algae production definitely increases with flow. There's some kind of an optimal relationship here with flow - as flow increases, production increases. Then with continually increasing flows, diminishing returns eventually reduce production as water velocity gets too high. But if we reduce discharge and therefore reduce velocities, periphyton production is going to drop off. So you might have the same biomass present, but it's not going to be as active.

There's not much to say about the impact of reduced flows on a planktonic or free floating algae or planktonic crustaceans. The impact is minimal. Rivers in the size that we know around here, from the small ones up to the Snake, typically, as I said, derive most of their algal production from periphyton. Most of the fauna or animals that live in these streams are again attached to the bottom, the attached insects, attached crustaceans, etc. The free floating crustaceans, insects that you find in lakes and reservoirs, typically occur only in rivers as discharge from these reservoirs or lakes. You reduce flow, you reduce the lake or reservoir discharge, you're going to be putting less into the stream; but the stream community relies to a small extent on these lake or reservoir-derived organisms.

I'll move into considerations of instream flow needs for fish where we can boil everything down to four basic activities and requirements for those activities.

The first one is spawning activities. Typically spawning activities are the most sensitive stage of a fish's life history and they are so because these behavioral processes are a very narrow window of environmental parameters or habitat conditions that will permit spawning to occur. I could give you lots of facts and figures on minimal gravel types needed for fish spawning, maximum velocities, etc., but you wouldn't remember it anyway. I prefer to stick with concepts.

Let's look at a cross section of a river channel again and see the change in available spawning gravel. Let's go back to the Snake again. The river channel at this point is about 15-20 feet deep. The mid channel will be typically boulders, rubble, or impacted cobbles; in other words, cobbles you can just see with the tops sticking through a layer of sand with the current swiftly flowing over that. This is an undesirable habitat for periphyton, insects, or even fish. Now out towards the periphery of this zone as we get closer to the bank with shallower water

LIFE HISTORY PERIODICITY AND MINIMUM FLOW NEEDS OF SALMONIDS IN REYNOLDS CREEK, OREGON

LIFE HISTORY PHASE	MINIMUM FLOW cfs.	J	F	M	A	M	J	J	A	S	O	N	D
STEELHEAD													
Spawning	18												
Incubation	12												
Smolt	12												
Adult Migration	15												
Rearing	5												
RAINBOW													
Spawning	12												
Incubation	5												
Adult Migration	5												
Rearing	5												
CUTTHROAT													
Spawning	12												
Incubation	5												
Adult Migration	5												
Rearing	5												
DOLLY VARDEN													
Spawning	12												
Incubation	5												
Adult Migration	5												
Rearing	5												
RECOMMENDED MINIMUM FLOW		15	15	18	18	18	15	12/5	5/12	12/5	5	5	15

and lower velocity, the stream is dropping its load. It can't carry as much suspended solids and we have deposition in these fairly fine spawning gravels. A spawning gravel is all we're talking about, pea size to maybe 3 inches in diameter. In a stream you typically don't have spawning gravel throughout or across the whole thing. Some streams you will and some areas of some streams you will; but in larger streams, the ones that are more likely to be controlled by reservoirs or under consideration for minimum flow requirements, spawning gravels will be along stream margins.

So, if we drop the flow from 27,000 down to 9,000 or 7,000, we expose a lot of spawning gravel and the spawning gravel that may be underwater is going to be in areas of minimum or below minimum water velocities. Typically, most salmonids would require from .6 to .8 feet per second to about 2.5 feet per second for spawning requirements. Well, in the very shallow areas, the chances are remote that you're going to get even half a foot per second velocity. You're going to have adequate velocity out there over the submarginal spawning gravels. So even though spawning gravel may still be underwater, there are other things to consider such as velocity.

That takes us into the next critical stage which is incubation. After egg deposition in the gravel they will be buried under the gravel surface, maybe a foot or two down and develop there for probably two months. While there, eggs need an adequate flow of water percolating through the gravel to maintain a good supply of oxygen and to carry away waste materials. Even if you have fresh water down there, those eggs require a certain minimal velocity across that egg surface to effectively clean the membrane. You aren't going to get that in a periphery area on the stream margins.

As far as what's required for a minimal flow, if you've established (by stream survey) transects across the stream at different flow levels and you've established how much of a spawning gravel will receive adequate flow through it you can generally take about 2/3 of that to establish your incubation requirements.

The Oregon Fish Commission has accepted as their standard a minimal flow for spawning needs of about 80% of available spawning gravel. Two thirds of the 80% could in turn be established as a minimum need for incubation requirements. Now, put it all together to integrate these basic spawning, incubation, rearing, adult migration or passage requirements to a recommended standard or a minimum need for these organisms in that stream. Let's say it has been decided, on the basis of stream survey and available spawning gravel, that steelhead require 18 cfs in that particular stream at one particular point. When do the steelhead spawn? In March, April or May, so for three months we need 18 cfs.

Incubation - the eggs are going to be in the gravel from March through mid-July. We need 2/3 of the spawning requirements or 12 cfs during that time. If we already have 18 cfs for spawning, our only concern as far as incubation is that we have enough for June & July.

Smolt - or out migration of seaward swimming juvenile steelhead. After they've finished their rearing stint in the upland stream it's been deemed that in that particular stream they need 12 cfs to effectively get downstream to make it over the log barriers, or gravel bars, etc. They need 12 cfs in May and early June then.

Adult migration - they are coming up into that small stream in late winter or early spring. Adult passage or adult migration is a fourth major consideration of fish life history needs. Given existing ice conditions, gravel bar formations, cascades, jumps, etc., they need 15 cfs at that time of year to make it upstream.

Rearing - that's really the minimum need in our number three for fish needs. All year long the young steelhead are in that stream. The rearing needs are fairly low, only 5 cfs, because we're talking about small fish. These small fish are typically going to be in more short runs in shallower waters, so they don't need a lot of water, but it is a minimum of 5 cfs throughout the year.

Now we go through this procedure for every fish species that is there or at least every economically important fish species. For every important species you go through this procedure and end up with a table of recommended minimum flow based on all of these needs. It shows us that we need 15 cfs in late winter, 18 cfs through the spring, 15 dropping to 12 in early summer. Our minimum needs are in July and August, because the only basic activity going on in there essentially is rearing with the exception of Dolly Varden which start spawning activities in late summer. So late July or early August we have a need of only 5 cfs, late August picks up to 12 again, drops a little bit to 5 through early winter.

The question then comes in -- how extensive do we make this list? How many species do we include? Are we going to talk about all the fish present? In a mid-western or eastern stream this can become unbelievably complex since some streams have over 50 species of fish. How many are we going to include in that sort of layout?

Q. You have this just for Reynolds Creek, can you do that on section by section, or how do you normally go about that?

A. Well, that's up to the manager who is responsible for that

stream, the Fish and Game Department for instance, and the uses they want to put the stream to. If they're concerned about a fishery, then they would probably establish this sort of pattern for the lower 20 miles of the stream if the stream is 30 miles long and it supports anadromous fish for the lower 20 miles. They would probably do it at the mouth and at the headwaters 20 miles upstream and then perhaps another analysis upstream in the small 10 mile section strictly for residents, Dolly Varden and rainbow. It isn't that difficult to come up with a pattern of fish requirements for gravels, flows, spawning, etc.

Now let me back up a little bit to the rearing requirements. I'd like to show the complexity of fish distribution in a large midwestern stream, something like the Mississippi, Ohio, Missouri, Kansas, Des Moines or Illinois Rivers, considered to be large midwestern streams. We aren't talking about nearly as simple a situation as we have in the west.

In the open river channel we have maximal velocities. If you remember this channel, velocities are going to look something like this -- maximum velocity will be in the center decreasing outward and downward; minimal velocity will be on the shorelines and the bottom. Out in the open water area you will find open channel fish; shad, suckers and chubs. Moving in a bit closer to either shore, the distribution changes. Why does it change? Well, preferred velocities, body design, feeding habits, individual fish constitution and swimming endurance all work to position these fish along this gradient. As out in the open channel, food supply is scanty. The bottom will typically be hard and scoured. Even in a sluggish appearing stream, a scoured bottom will be out in the mid-channel. You can see this up on the Palouse River where it flows beneath Highway 95. It looks like a mud hole there, but you wade out to the middle and typically it is hard bottom.

Back to the large stream now, as you approach the shoreline the food supply changes from a very low to a high diversity community, numbers of species of insects increase toward the shore so diversity of fish composition increases correspondingly. That's our distribution.

Now reduce the flow. What we're doing is shoving everything toward the stream center. We're eliminating the backwaters, we're creating new backwaters in here, which probably won't be as irregular of shoreline, but we're creating smaller new ones. We're squeezing everything down. Each individual fish will have a focal point of existence in that stream, some point in three dimensional space where that individual will reside and attempt to hold within that area throughout his various life stages. He might change for feeding or spawning and move back again, but he'll work out of a focus. You can view this almost like a ring

HABITAT PREFERENCE OF FISH IN A LARGE MIDWESTERN STREAM

RIVER CHANNEL ——————————→ BACKWATER

Shad (American)
Redhorse Sucker
Sauger
Chub

Mooneye
Sand Minnow
Channel Catfish

Gar
Flathead Catfish
Redfin Shiner
Smallmouth Bass

Gizzard Shad
Carp
Carpsucker
Spotted Black Bass

Carpsucker
Spotted Sucker
Bluegill
White Crappie
Black Crappie
Largemouth Bass

HABITAT PREFERENCE OF FISH IN A SMALL STREAM

RIFFLES ——————→ POOLS

Sculpin(s)

Rainbow Trout
Cutthroat Trout
Stoneroller
Smallmouth Bass
White Fish
Squawfish
Darter(s)

Rock Bass
Green Sunfish
Longear Sunfish
Log perch
Darter(s)
Squawfish
White Fish
Common Sucker
Eel

Pike
Fathead Minnow
Black Bullhead
Orange-spotted Bluegill
Squawfish (Juv.)

of electrons around an atom. You cannot squeeze in on it without certain repercussions and that's what happens with fish forced to smaller territories. These are already very complex communities and the result is major shifts in the composition.

Now let's go to a western stream and see the pattern; a stream small enough so that if this fish occurs in the riffle zone you're going to find him from shore to shore. These fish are in a certain region of current velocity pretty much from shore to shore. We don't have the cross channel variation as in the larger stream. Everybody know what a riffle is? It is simply an area of fast water. Not too many fish are found in there, mostly sculpins. We move downstream from that riffle a little bit, the lower end of it approaching a pool, and look for these kinds of fish, the small mouth bass, darters and squawfish.

Continue to move down into the middle of the pool, to deep waters, and we'll see a shift to the juvenile squawfish, pike, flathead, suckers, bullhead, etc.

Note how squawfish would be found along shore and in the pool areas, where the juveniles find good rearing and feeding. Reduce the flow and the squawfish will be pushed further and further into the trout area and there is increased competition. Because of greater reproductive potential and growth potential, squawfish in most situations will outcompete trout with the ultimate result tending toward squawfish dominance. As for individual species requirements, squawfish can take greater temperature variation, day to day, week to week, than can trout. Squawfish can feed over a wider range of water velocities than can trout. These trout, cutthroat for instance, are adapted for feeding in stream situations. Squawfish can do very well in lakes or streams, so crowding and displacement increases innerspecific competition.

Last week Dr. Brusven described stranding of aquatic insects as a factor in reduced flows. If you change flows daily, stranding of fish is also a major concern, especially of juvenile fish. Juvenile salmonids are stationed on a territory and they are very reluctant to leave that station as the water level drops. The result is a greater tendency toward stranding in the salmonids than in some other fish. The Snake River flow study showed a great deal of stranding with reduced flows of a vertical foot per hour. So stranding is, especially with juvenile fish, a big problem.

I've been talking mostly about streams, but what about reservoirs? It is an instream or inchannel, inlake need. A very good example of what happens in a drawdown situation in a reservoir developed from an aquatic plant or aquatic macrophage study I conducted a couple of years ago throughout the Snake River Basin. We were trying to find out where various plant species were and the types of water body they were in. One observation was

that drawdown reservoirs are essentially devoid of aquatic plants. Dworshak has a capability of being taken down 150 feet in the spring. Light penetration is about 50 feet, you could expect to find aquatic rooted plants maybe in that top 50 feet right on the bottom. But you don't, because plants simply cannot take a dry over-winter period with their roots and stems exposed to the air. You simply cannot have a balanced shoreline community with drawdown; season or daily. In a lake, especially a deep lake, a very large extent of production is based on what happens in that littoral zone. Then we're restricted to planktonic food sources for support of a fish population. Therefore, by drawing a reservoir down on a daily or seasonal basis, you've precluded a lot of fish types that could have otherwise resided there.

There's some question on Dworshak as to whether small mouth bass will really develop into a good fishery, because without an effective littoral area for small mouth to rear in, we aren't really too sure whether it's going to be a successful long range fishery.

I think I'll open it up for questions. I hope I've touched on just a few of the basic considerations in looking below a stream surface; asking yourself what flow reduction is going to do. What's it going to impact?

DISCUSSION QUESTIONS AND ANSWERS

Q. Does the fish adapt more readily if the drawdown is much less rapid than a foot an hour?

A. Yes, a lower drop rate would greatly reduce the stranding possibility. But remember you're still putting those fish into a new area where the food organisms are going to be different. The periphyton composition will shift, as I showed you. Dr. Brusven showed you how the aquatic insects' composition will change in that new area. Fish in two feet of water will strive to maintain that depth. As a stream drops, fish will move and be in a new area with two feet of water. But that water used to be 4 feet deep. That means that the insects that are there, and the periphyton that was there previously adapted to four feet, are not going to do as well. That fish is not going to feed as well on those new types. With all the physical changes in the watered channel configuration, the stream further won't support as many fish, there simply is not adequate space. But a slow change is better than a fast one.

Q. I missed a point you made about a flow:surface area ratio. Would you go over that again?

A. The Snake River downstream from Lewiston prior to Lower Granite had a river water width of about 600 feet at 17,000 cfs and 800 feet at 50,000 cfs. So, at 1/3 discharge, we've still got 3/4 the surface area, i.e. a much reduced water volume still provides high surface area. You're going to absorb more heat from the sun.

Q. So you've got a significant increase in the temperature?

A. Yes, especially in a wide stream like the Snake, or the Clearwater upstream from Kooskia, where you do have a wide channel all the way up to the Selway and Lochsa. In such a stream, that additional heat input can be a very major consideration of reduced flows.

Q. You can ameliorate the temperature impacts to some extent by drawing off colder water, as they're trying to do downstream from Dworshak. How effective is that?

A. Cold, deep water withdrawal from storage reservoirs is very effective downstream. The trick is to balance the cold water from the upstream reservoir with heat input. If you had it closely tied with 24-hour weather predictions, etc. and you had a pretty good model on that, I'm sure that you could ameliorate that additional heat input effect. In the Clearwater we go to the other extreme, as you know. The cold water discharge from Dworshak has had drastic effects on the lowering of the temperature on the lower Clearwater, and it overrides the effect of ~~increased~~ solar energy to the lower river.

Q. Now they have their selective gates, they don't have to take all that cold water; they can take off warm water, can't they?

A. They can take off warmer water, but they still cannot match preimpoundment temperatures. For about two months in the summer they simply cannot get water warm enough. Then that also gets us into inreservoir considerations, as we're finding out from our three-year trends on Dworshak. We're recommending that the Corps keep all the warm water possible in the pool to augment and provide greater growth for inreservoir fishes, since temperature does seem to be a limiting factor in the pool. So it's a balance of downstream versus inreservoir needs.

Q. Then you're going to have to make a choice as to whether you are going to have the small mouth bass fishery downstream.

A. It definitely looks like we're headed for one or the other. The small mouth in the free flowing Clearwater cannot continue with the very poor spawning success they've been having the last three years because of cold Dworshak output.

Q. Do reservoir drawdowns also cause shifts in the plankton community?

A. In the reservoir itself, I don't think so. I was talking this very point over with Burgner over at the Fishery Research Institute in Seattle. Ross Reservoir on the Skagit is very similar to Dworshak in shape and water quality, and the two of us finally concluded that you really cannot manage the plankton population by reservoir level. It is too hit and miss. If you lower the reservoir, we do know that you get a tremendous increase in turbidity in the reservoir and this results in decreased plankton levels. I don't know about composition, species shift. As far as I know, nobody has actually been able to direct species composition by reservoir regulation.

Q. How far are you from being able to define how much decrease in fish production you have with a certain amount of decrease in minimum stream flow?

A. Very far. That's way out of my line, but I know of no management agency that is using such a tool yet. I just don't think they're to that point; I think they're a long way from it.

Q. So you really aren't in a position yet to be able to say how much you would trade off in a loss of fish production for whatever other gains you might have in being able to operate a reservoir?

A. As far as I know, no.

Q. Are you able to determine incremental changes in terms of flows and fish production?

A. Not as far as I know. We're to the point where we can talk about the effects of incremental changes on various life history stages, but as far as population production, I don't think so. People coming closest to that will be somebody like Vincent over at Montana State with his brown trout studies over 6-7 years where he has looked at streams operated under different management schemes. I don't know if he's working specifically on altered flows. But generally we're not yet at that point of effective flow management.

Q. On the Dworshak Reservoir, when they're pulling from the lower, deeper waters, is there any significant oxygen change in the water?

A. Yes, there's a very significant oxygen change with depth in Dworshak. Surface waters are usually right about at saturation. Right in the area of the thermocline, or

or metalimnion, usually about 50 feet down, we've typically had a drop in oxygen. In other words, if I plot a curve with depth, it will look something like temperature dropping very rapidly for about 50 feet, increasing in the upper hypolimnion and then declining gradually towards the bottom. Surface oxygen may be 8 in mid-summer and 6 in late summer with a near-bottom oxygen low of 4 mg/l at 600 feet. In the first year after formation, the curve would be something like 9, 3, 0 mg/l since a new reservoir has more algal production because of greater nutrients in it from the newly submerged soils. The resulting high production supports high decomposition at mid depths and finally shows up as greater decomposition at the bottom. So, we do have an "oxygen window" to draw from if you want to match oxygen.

Q. Do they have capabilities to do that?

A. Yes, they can go down to about 250, the exact depth I don't know but any 30 foot increment from surface to 250. So that is what you'd better select if you want high oxygen.

Q. Doesn't some material catch at the thermocline and cause a mid depth oxygen low?

A. Yes, the dead algal cells, zooplankton bodies settling down through the water column hit this zone of rapid density change and slow their rate of descent. Water temperature is still high 30-40 feet from the surface so decomposition is very high and so you'll get that little drop in oxygen there. Organic materials continue to settle down, but the water is increasingly colder and denser with depth so decomposition is much slower. It took this curve about a year to develop its deep oxygen low. The deep discharge will not reaerate the water. Up to now there have been a lot of schemes discussed for aerating deep discharges, but they are very expensive. Dworshak doesn't have any kind of a facility to do that. It looks, though, like Dworshak's oxygen regime next year is going to look something like 8 decreasing to 6 mg/l at maximum stratification. Organic production in the reservoir is declining, so expect very little oxygen water, a trend which really increases your management flexibility.

Q. Getting back to the point of stream degradation below the point of organic discharge, wouldn't the oxygen content even decrease some more to a drastic degree because of the lower flow there? The water temperature is probably going to be a little bit higher, therefore the oxygen carrying capacity of the water is also going to be lowered. So, wouldn't you get much more decrease in oxygen there, adding on to the effect?

A. The tendency will be that way, warmer water holds less oxygen.

Presentation by

JOHN ORSBORN
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Washington State University

An outline of my presentation and some handouts that we can use as a frame of reference have been prepared. If you will look at the presentation outline, let us discuss the first title, "We Used to Call it Minimum Flow". This has been selected for two reasons; 1) to tell you about the legal implications that deal with state laws which have been passed in the Pacific Northwest. These state laws do call for "minimum" flows and some use the term "base flows". Those of you who are hydrologists by training (or necessity) know that physically there is quite a difference between a minimum flow and a base flow. Immediately we face 2) the problem of terminology, and this is why I have given you the or title of "Is It a Legal, Social, or Technical Problem?" Instream flow needs have developed into a multidisciplinary, multifaceted problem. Today I want to give you an overview from the standpoint of the physical system with which we are dealing and also an overview of some of the social, legal and technological problems.

During the last five years our area at WSU has been heavily involved in a number of projects and programs and workshops dealing with most aspects of instream flow problems. Therefore, I am going to concentrate on those aspects with which I am most familiar. At the end of the seminar a lot of what has been said may appear to overlap, but it is really a parallel experience which every agency has to complete in order to come to a level of understanding, and a level of exchange. This provides an overall methodology or experience record which they can use to approach this very complicated problem.

Let us now look at this water system and use diagrams (Figures 1 and 2, respectively). These will be used as a frame of reference, and you can use it in the future to show where the instream flow problems begin to take place in the interaction of various uses. Figure 1 is a way of representing the hydrologic cycle. The two diagrams have been marked wherever they apply to instream uses and effects. Looking at Figure 2, the center line is the river. At the top of that center line you see that diversions are noted to the right and return flows to the left. The right marginal entries (B-1 for example) refer to the water cycle diagram on the left hand side.

If you wish to see what kinds of physical processes are going on as a result of man's activities along the river, then refer to the coded portion of the left diagram. Looking at B-1

Figure 1

THE WATER SYSTEM

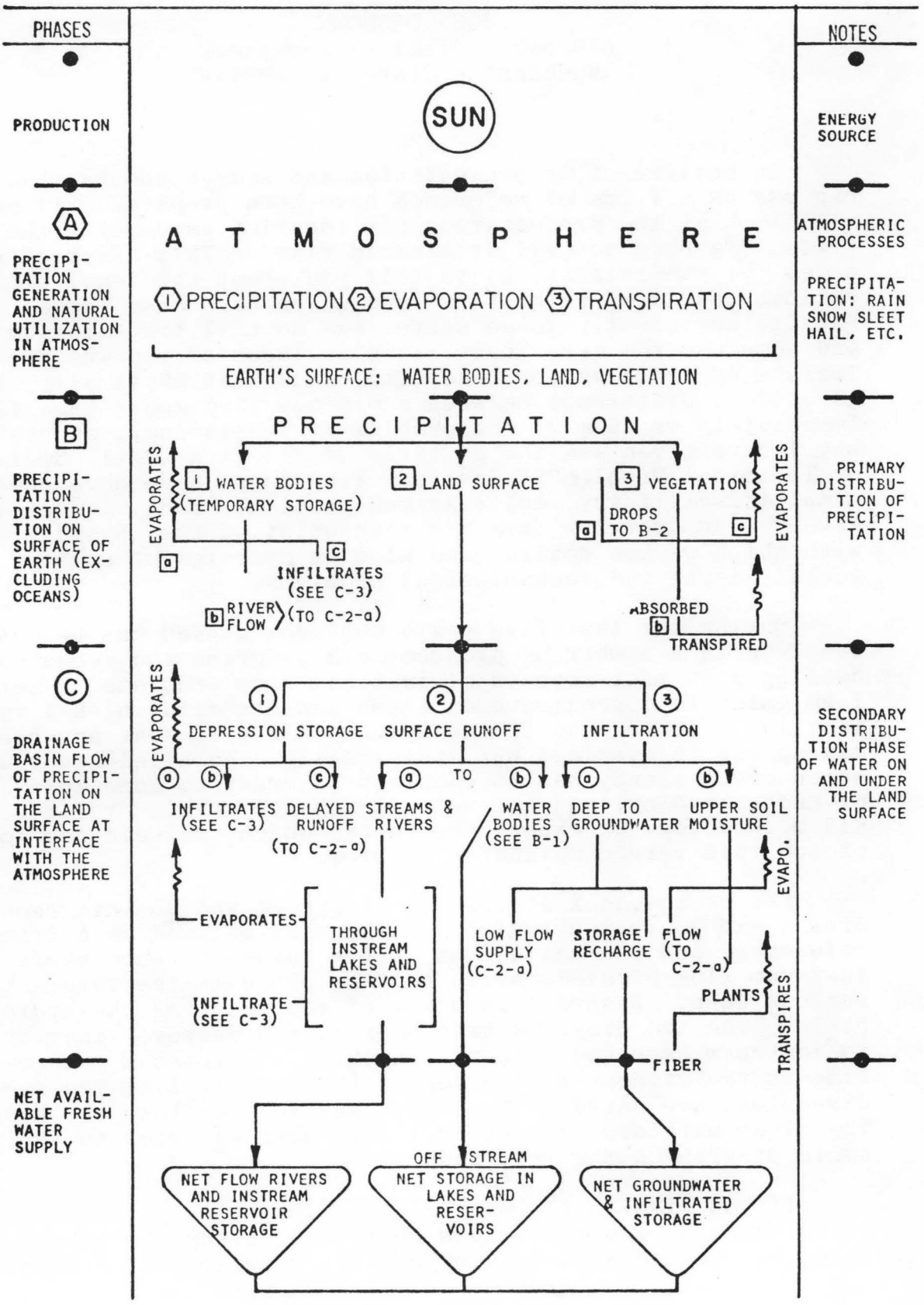
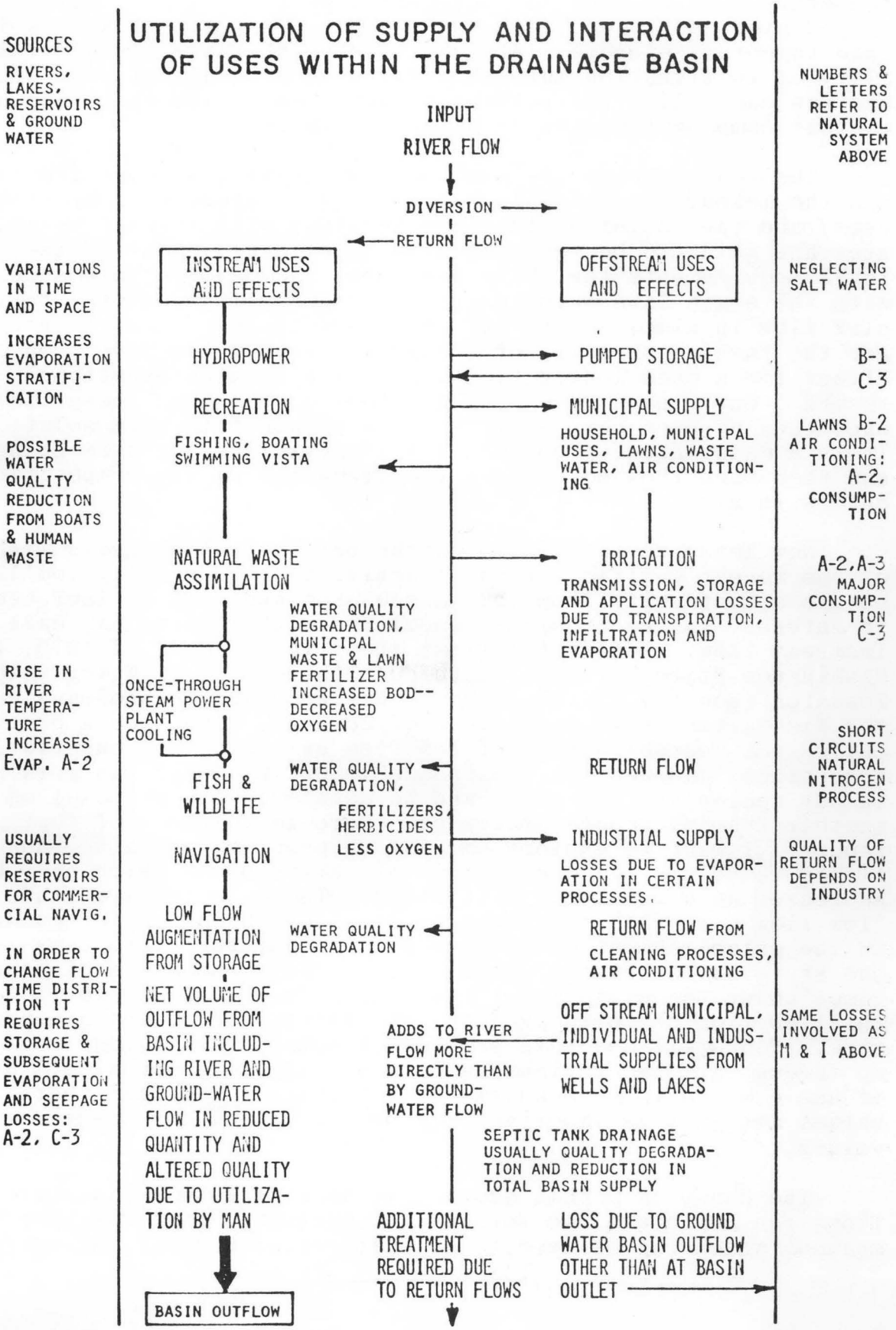


Figure 2


UTILIZATION OF SUPPLY AND INTERACTION OF USES WITHIN THE DRAINAGE BASIN
SOURCES
RIVERS, LAKES, RESERVOIRS & GROUND WATER
NUMBERS & LETTERS REFER TO NATURAL SYSTEM ABOVE
INPUT
RIVER FLOW
DIVERSION
RETURN FLOW
INSTREAM USES AND EFFECTS
OFFSTREAM USES AND EFFECTS
NEGLECTING SALT WATER
VARIATIONS IN TIME AND SPACE
INCREASES EVAPORATION STRATIFI-CATION
HYDROPOWER
PUMPED STORAGE
B-1
C-3
RECREATION
FISHING, BOATING SWIMMING VISTA
MUNICIPAL SUPPLY
HOUSEHOLD, MUNICIPAL USES, LAWNS, WASTE WATER, AIR CONDITION-ING
LAWNS B-2
AIR CONDI-TIONING: A-2, CONSUMP-TION
POSSIBLE WATER QUALITY REDUCTION FROM BOATS & HUMAN WASTE
NATURAL WASTE ASSIMILATION
IRRIGATION
TRANSMISSION, STORAGE AND APPLICATION LOSSES DUE TO TRANSPIRATION, INFILTRATION AND EVAPORATION
A-2, A-3 MAJOR CONSUMP-TION C-3
WATER QUALITY DEGRADATION, MUNICIPAL WASTE & LAWN FERTILIZER INCREASED BOD-- DECREASED OXYGEN
RISE IN RIVER TEMPERA-TURE INCREASES EVAP. A-2
ONCE-THROUGH STEAM POWER PLANT COOLING
SHORT CIRCUITS NATURAL NITROGEN PROCESS
WATER QUALITY DEGRADATION, FERTILIZERS, HERBICIDES LESS OXYGEN
RETURN FLOW
FISH & WILDLIFE
USUALLY REQUIRES RESERVOIRS FOR COMMER-CIAL NAVIG.
NAVIGATION
INDUSTRIAL SUPPLY
LOSSES DUE TO EVAPOR-ATION IN CERTAIN PROCESSES.
QUALITY OF RETURN FLOW DEPENDS ON INDUSTRY
LOW FLOW AUGMENTATION FROM STORAGE
WATER QUALITY DEGRADATION
RETURN FLOW FROM CLEANING PROCESSES, AIR CONDITIONING
IN ORDER TO CHANGE FLOW TIME DISTRI-TION IT REQUIRES STORAGE & SUBSEQUENT EVAPORATION AND SEEPAGE LOSSES: A-2, C-3
NET VOLUME OF OUTFLOW FROM BASIN INCLUD-ING RIVER AND GROUND-WATER FLOW IN REDUCED QUANTITY AND ALTERED QUALITY DUE TO UTILIZA-TION BY MAN
OFF STREAM MUNICIPAL, INDIVIDUAL AND INDUS-TRIAL SUPPLIES FROM WELLS AND LAKES
SAME LOSSES INVOLVED AS M & I ABOVE
ADDS TO RIVER FLOW MORE DIRECTLY THAN BY GROUND-WATER FLOW
SEPTIC TANK DRAINAGE USUALLY QUALITY DEGRADA-TION AND REDUCTION IN TOTAL BASIN SUPPLY
ADDITIONAL TREATMENT REQUIRED DUE TO RETURN FLOWS
LOSS DUE TO GROUND WATER BASIN OUTFLOW OTHER THAN AT BASIN OUTLET
BASIN OUTFLOW

you see that it is a water body with temporary storage; that is, temporary with respect to long-term time intervals. This is a pumped storage project, and so B-1 means that the flow is going into temporary storage. At C-3 it means that there's a possibility of infiltration into the ground as a result of that storage, and one can follow the various arrows down to see what happens to that component of the total water supply.

The real crux of the problem rests with the competing uses and the measurement of values for those alternative competing uses, and the decisions that are involved with respect to which uses are going to be recognized as beneficial. Most of these legal requirements that have presented the major problems deal with the state laws which require the establishment of a particular flow in almost every stream in the state. Some of these are the Washington laws, or the Oregon laws which have been in effect for a much longer time and have a greater experience record. But Oregon runs into problems of managing these flows once they've been set, so it's not a straight forward solution, it is a maintenance problem. The competitions for uses change and then when they do change, the frequency of the competitions enters in also.

Now let us review Item 3 on the outline, which deals with some of the recent Pacific Northwest activities. Hopefully you'll obtain a continuity from this discussion and also an increase in interest in the problems associated with what we now call instream flow. Noting the first item, in November of 1970, the Washington State University, through the Office of Water Resources Research (now the Office of Water Research and Technology) and the Washington State Department of Ecology, developed a program called the "establishment of low flow criteria for conservation, recreation, and aesthetic purposes". Dr. Gladwell was working in our center at that time, and he developed the proposal on which another team of people proceeded. Here is Volume 1 of that report. I want to explore some of the problems which we identified in Volume 1 and also some of the problems which have been addressed as a result of this study. The objectives of the "low flow criteria" study was to develop a handbook for guidance in the establishment of minimum flows under the state laws in the state of Washington. A base flow law in the state of Washington comes under the state water planning program. As we got into this low flow criteria project, the first problem was nomenclature. You still see this problem of common terminology rearing up through all the various aspects of this total problem. Now it has evolved to an emphasis on recognizing the fact that instream values are just as important (or should be) as our-of-stream values.

The handbook in this summary version gives ways in which low flows can be determined for ungaged streams. It gives very brief methods which can be used to evaluate water quality parameters,

and it gives the economic framework within which activities such as conservation, recreation, and aesthetic purposes can be evaluated. The details and the data for those activities and those methods are in Volume 2, which will probably be published next month.

Dr. Gladwell has mentioned that he will hand out the proceedings of the March 15th and 16th Pacific Northwest Instream Flow Requirements Workshop at the end of the period. This workshop was one of the first attempts to address the need for common ways of evaluating the various demands on limited stream flow, and was probably one of the first common usages of the term "instream flow". The workshop consisted mainly of persons who were either involved in or associated with the Pacific Northwest River Basins Commission committee structure. Several people were selected to present different points of view with respect to methodologies.

Out of this workshop there came an emphasis within the Pacific Northwest River Basins Commissions Committee structure on instream flow methodology, and as a result of that you see another workshop on November 14th and 15th of 1972. The program and proceedings were developed by the Washington State Department of Ecology because its people were leading a team effort to develop and evaluate the various methodologies that were then available. In this latter workshop you see a greater detail with respect to the actual methodologies than in the previous workshop. The emphasis shifts as a function of the people who are in a particular program. This is one of the problems that has been identified and needs addressing -- how do you maintain program continuity when you are addressing such a large problem, and dealing with so many different agencies?

Following the workshop in calendar time we undertook a Regional Instream Flow problem analysis project. This distributed document reports on three studies which were conducted on a regional cooperative basis between the Oregon, Washington and Idaho Water Research Centers and Institutes. The first part deals with the instream flow needs problems. More particularly I want to discuss with you the results and the objectives of some of the workshops which we held. This relatively brief cooperative study between the three centers sought to identify, on a regional basis, the problems and the research needs with respect to instream flow needs, basaltic aquifers, and wild and scenic rivers. It fell to our group at Washington State to coordinate the details of investigating instream flow needs. In addition we had a Title II grant to amplify some of the problems identified in the first study.

With respect to the workshops, we held one in Sun Valley on September 5th and 6th and two in Vancouver on September 7th and 8th and on the 8th and 9th. In the first workshop at Sun

Valley we dealt with people who predominantly "worked in the field" and were not at the decision making level in the hierarchy of administrative procedures. We did have a few people present representing the administrative group. We tried to get people directly involved as quickly as possible into the discussions. We had a lot of exchange with respect to people's backgrounds and their experiences, etc. so that they would feel free to ask questions or offer remarks with respect to some of their specific experiences as they applied to the problems under discussion. We worked with a mixed agency group at Sun Valley, and at the end of the workshop we tried to identify solutions to problems which they had identified at the beginnings. One of our biggest difficulties at the workshop was the generation of a framework to use as a basis of comparison for the various instream flow needs.

In the Vancouver workshops you will note that there was one workshop for state agencies and one for federal agencies. At these workshops we set up a hypothetical problem situation which required that various agencies cooperate in determining whether or not they should allow a permit for the withdrawal of water at a development site. In doing this, we required that the state agency people represent the federal point of view with respect to that problem, and vice versa. Beginning on page 15 of the Regional Problem Analysis report a summary of some of the specific problems that were addressed by these people at the beginning of each of the workshops and then some of the solutions which they recommended is presented.

The first problem was the difficulty in achieving comparability of needs when some water needs are expressed in economic terms and others in non-economic terms. To give you a specific example, consider the Oregon case where they have had minimum flows established on streams. Comes a drought year and an irrigator requires more flow in order to save the economic value of his crop. The board then asks the fisheries people, "How much will this cost in economic terms. How many fish are you going to lose, or what is the total value of those fish?" The problem is that the fisheries people cannot evaluate the anadromous run after it goes to the ocean and comes back, let alone what will happen to it specifically in dollar value at that particular place on the river.

Another problem is that of pre-existing water rights as related to instream needs. All of the laws which have been passed (to my knowledge) state that no pre-existing water rights will be adversely affected by the establishment of minimum flows. So this, including the new issues of Indian Water Rights, further clouds the framework for instream flow problem analysis. One of the problems which operational people face is the short time frame for flow reservations and implementation allowed by some of the laws. In other words, people who have not even had an opportunity

to set up the methods which they're going to use to measure in the field, are all of a sudden required to come up with what they are going to need in order to satisfy instream flow needs.

At the Vancouver workshop the state agency people were from Oregon and Washington, so one of the first problems identified was the impact of flow augmentation or depletion on estuaries. Estuaries are the very sensitive interface between natural fresh water streamflow and the ocean, and the state personnel are very sensitive to the problems which will develop. Not just depletion of flow, but what happens if flows are augmented during the summer time through a storage and release program? The maintenance of minimum flow and the use of surpluses for production goes back to the problem that once the minimum flows are established, this does not necessarily guarantee that those flows are going to be maintained. Another problem which the state agencies face is the regulation of competing uses during critical periods.

Toward the end of the seminar I want to present the problem situation which we gave to the federal and state agencies at the Vancouver workshop and let you begin to respond to that situation.

In addition to the workshops there was an OWRT/WSU study which has just been completed in April. If you want to obtain a copy of this report just let me know later this fall. This report addresses the problems and recommended solutions to the problems, and areas of research, in a bigger framework than does the smaller first report. In the table of contents you will see another set of problems with which we are dealing within the context of the total problem of institutional authority and involvement. Further on you see that the various degrees of agency involvement are identified by agency function. Whether or not the instream flow use that they're addressing is really a primary agency function or whether it's more of a responsive agency function to a request from another agency is of importance. On the last page of the table of contents is a survey and preliminary assessment of methodologies.

Just after that insert are two more which deal with the Pacific Northwest River Basins Commission ad hoc committee, and the Idaho Water Resource Board meeting to discuss what they call "stream resource maintenance flow studies". From June 25th to September 5th, 1974, the Pacific Northwest River Basins Commission had an ad hoc committee which was called the "instream flow study evaluation committee". It was formed at the request of the Department of Interior representative on the Commission to address and evaluate the problems associated with instream flow competition. The ad hoc committee's report to the Commission on September 5 recommended that this function be continued with the establishment of one person within the Commission to coordinate the various instream flow activities of the representative state and federal agencies. The Commission chose to refer the report to the committee on practices for its recommendation which has not been

forthcoming. But I would like to point out what some of the ad hoc committee's conclusions and recommendations were.

Conclusions

1. The need for concentrated support for the early determination of:

   a. stream resource maintenance flows.
   b. instream flows for recreation, water quality, aesthetics, etc.

2. a. development of low cost methodologies for the determination of stream resource maintenance flows where existing methodologies are not applicable (for example, warm water fisheries, large streams).
   b. instream flows for recreation and aesthetics, with specific methodologies.

3. Develop a creditable program including methodology for the evaluation of impacts and benefits for various increments of flow. (Now comes the question of trade-offs, impacts and benefits. Not necessarily in economic terms, but a credible program.)

4. The need to develop recommendations for improvements to existing legal and institutional systems for the control of inter- and intra-state waters for the above three listed purposes.

Recommendations

1. The establishment of a full time person for continuing emphasis on coordinating this program.

2. Concentrated support for the determination of the stream resource maintenance flows.

3. Develop methodologies for other instream flow needs such as recreation, water quality, aesthetics, etc.

The meeting sponsored by the Idaho Water Resource Board was on July 10, 1974 to discuss the stream resource maintenance flows associated with the Idaho programs. The purposes of the meeting were:

1. To determine agencies having an active stream resource maintenance flow study program,

2. To enumerate and discuss the stream resource maintenance flows completed on Idaho streams,

3. To study those underway in the 1974 season,

4. To look at those studies programs for future years,

5. To review the methods and techniques being utilized,

6. To look at the publication of results, and

7. (once again, this very important problem) to address the implementation of the program.

On your agenda you will see September 17-19 1975 was a workshop to rewrite a Utah State University and U.S. Fish and Wildlife project report. The report was the result of a brief but intensive study of methodologies for the determination of stream resource maintenance flow needs. A commonality of terminology is emerging and this is focusing on the real essence of any of the methodologies with which we are dealing. If we can all talk the same language, then we're going to have a lot easier time in solving these problems. This report workshop involved some seventy people, and if you were to go back over all the workshop attendance lists you would see many of the same people were in attendance.

When we invited the Environmental Protection Agency to attend the federal workshop in Vancouver in October 1974, they expressed little or no interest in attending because they felt that this was not one of their primary interests at that time. And yet, the Environmental Protection Agency was quite heavily involved in certain areas of the workshop held at Utah State University. Lee Lamb of WSU is looking at the Instream Flow Decision Making Processes in the Pacific Northwest as an extension of both of the studies which we conducted on regional problem analysis. David Dean is working on an investigation into methods for developing a physically based logic for evaluating instream flow needs. This is addressing the problem of incremental analysis and trade-offs, not from the economic standpoint, but more from the physical standpoint that relates drainage basin characteristics, stream channel characteristics, the various needs for this water, and how they are related to those channel characteristics.

You might consider this as a way to evaluate instream flow in a framework of an environmental impact assessment. This was one of the problems identified by the man who was the chairman of the Pacific Northwest River Basins Commission ad hoc committee. He said that our first problem is to identify and develop a method that we can use to obtain numerical results, then we can put the economic values on it after that.

You can begin to see that even though they are still addressing the instream flow problems we've interjected two factors which we did not have a few years ago; quality and more interest

in the legal bases. Most of the past workshops were on technical methodologies, where we had engineers or other types of technicians such as fisheries biologists dealing with the problems of more and better data. They were beginning to find, of course, that it isn't how much data you have, but the form of the data that was more important. If you're going to court, presenting tables and tables and tables of data is not necessarily as valuable as one photograph which shows an adverse situation caused by one competing use ruining a situation for another competing use. Here we begin to see the importance of not so much how much information or technical detail is available but how effective is that data with respect to the decision makers.

The Forest Service addresses a unique situation in that they are dealing with the public lands and they set up interdisciplinary teams to address a particular flow reservation. If this flow reservation is going to court, once their basic approach to the problem is addressed, they bring legal people onto the team who will carry forward their recommendations. That legal person is entrained into their whole thought process. By the time they arrive at their conclusions, the lawyer is ready to step forward with those recommendations, and rarely does he have to go back except possibly for a technical interpretation.

The last item on the agenda is a symposium and specialty conference which the Western Division of the American Fisheries Society and the Power Division of the American Society of Civil Engineers are sponsoring jointly. The fisheries people had intended to develop this conference a number of years ago. Rarely do people who are predominantly biologists and people who are predominantly construction oriented see eye to eye with respect to a problem such as leaving water in the stream. But we've scoped this conference with a steering committee made up of legal people, sociologists, political scientists, fisheries biologists, wildlife people, engineers, administrators. We have designed this meeting so that what we are going to address are large problem areas such as -- how do federal water rights interact with state water laws? We plan to do this through interdisciplinary panels which will address different points of view on a common problem and generate a lot of audience participation.

We are going to address large problems, then components of those large problems, and then we will go into specific case studies. On the second afternoon will be professional sessions, which will address even smaller components of these and in the evening we will have short courses and roundtable discussions. The short courses will attempt to develop an appreciation by certain disciplines of other disciplines. Topics such as Legal Aspects of Instream Flow Problems for Non-Lawyers will be presented. These short courses are going to be a very valuable component of this conference, because we're going to emphasize the interaction of disciplines.

Now for the identification of some problems on page 3 of your handout. As you go through the material that you've already received, you can see many problems identified. But let us look at them a little differently, and try to get at some of the basic problems, as we have seen them develop.

One of the problems is data: how good is your data gathering procedure; how well are those procedures designed; for what purposes are you going to take the data; and are we gathering data that is going to be of value to some other group?

If investment is going to be made in these field programs, they must be designed not only for our own interests, but for the interests of others. Otherwise you have a data gap. There is a legal basis also which presents unidisciplinary problems, minimum flow. These are a very real occurrence every year in every stream. The base flow in streams is a natural low flow which occurs during a period of fair weather, and yet both of these flows appear in different laws which were supposed to be applied by one agency, thus requiring the development of two programs. More technical input during formulation would make it easier for the laws to be instituted and operated.

Multidisciplinary problems divide into two major ones: output or information transfer; and how much water is there really? At each workshop which we held we provided a copy of a report called "Summary of Quality-Quantity and Economic Methodology for Establishing Minimum Flows". When we wrote the abstract, we used the key words that were available in the Water Resources Thesaurus. The descriptors we picked were low flow, water allocation, competing uses, legal aspects, preferences, (water rights), and Washington. There was one person out of 65 who had ever heard of or seen this report which had been out for almost a year at that time. The key words which we used were out of date to their needs, and their needs were defined as instream flow. Even though the title had minimum flow in it, and the abstract key words had low flow, no one found that report in any of their IR searches.

One of our recommendations was that what we need to develop is an interest group mailing list, not library or agency mailing lists. We need to have a smaller nucleus (a user-group) which reduces costs and keeps report usability high. The project reports should go to libraries and other agencies, but many times reports contain a few very valuable details of importance to a particular discipline. These should be summarized and circulated among the interest group people because they are the ones who are going to put these new findings to use.

There are some transdisciplinary problems which are not only multidisciplinary, but they cut across all of the disciplines. When you begin to discuss comprehensiveness of the problem, you can look at it as a total sphere and ask very basic questions such as -- how much water are we dealing with in this stream,

at this particular point where we are trying to evaluate alternative uses? Even with a stream gage nearby, if the land use upstream and the water use upstream have been changing over the last forty or fifty years, then the records are distorted. As a result we don't even know how much water we are dealing with, and yet we are trying to decide among competing uses.

Therefore, if you take a look at the very fundamental problem of water quantity, many of the problems being discussed become irrelevant. For example, when a person has a water right to divert for irrigation it is usually listed as a flow rate but you do not know exactly how long the flow rate was used. Also, the flow rate usually is not monitored. As a result of this lack of knowledge about flow quantities diverted for irrigation, there may be a permit system developed in the future which will require persons to measure the flow that they divert, and to report on the amount of water that they have used. An evaluation is made of that permit after perhaps a five-year period.

In closing, let us take a look at the problem situation that we developed for the Vancouver workshop. Our overall objective of setting up this evening problem session was to put the attendees in a problem analysis situation. The Corporation desired to complete a recreational/residential planned unit development (PUD). The situation was complicated by placing the property next to a National Forest, thus providing overlapping jurisdictions due to the upstream water supply intake.

One of the major problems that we had was that the participants could not perceive how they were going to start the analysis. Eventually, through common problem identification, they were off and running, and all the rest of the components fell into place. A major objective of this problem solution was not only to get the particular state agency people or federal agency people to see if they could represent the other point of view, it was also to get them to begin to communicate in a different fashion. They found it was beneficial to have an exchange (1) out of the committee structure and (2) on a very informal basis dealing with a hypothetical problem, but which paralleled many of the real problems that they had in their own states.

Instream flow problems have come to the point in methodologies where people are fairly well satisfied that they can address the technical details. The next step is going to be converting those technical details into legal and administrative frameworks where they can be successfully applied.

DISCUSSION QUESTIONS AND ANSWERS

Q. You stated that eventually we might have to report on just how much water is being diverted for irrigation. If they don't report it, would their supply be cut off?

A. That may be part of the permit system, and it may be that if someone can show they really need more water, their right might be increased. Many things happen to flow before it gets to the gage and so you have a distorted set of data that is very hard to evaluate. But, if you did know how much was diverted, then it would be much easier to decide how much you were really dealing with when you came to establishing a minimum flow or a stream resource maintenance flow. In England they call this a minimum acceptable flow (MAF) and that means that everyone has accepted it from their points of view. It is a different way of looking at the problem and I think it is quite good. It is explained in Volume 1 of Report No. 13.

Q. In this orange report on Regional Problem Analysis you list specific problems, the first one being that some water needs are expressed in economic terms and other are expressed in non-economic terms. I get the idea that this would then imply that if you could express them all in economic terms, then you would somehow have an automatic way of comparing them based on those dollar values. The question I have is -- once you develop the economic values, how can you then measure the tradeoff between public groups and the private sector? That sort of problem didn't seem to be addressed here anywhere.

A. That is true and that is why it was suggested by that ad hoc committee chairman of the PNW River Basins Commission that you not go to economic terms until after the various values had been established in different terms. I can't respond to this economic problem because I'm not familiar with those kinds of activities, and I am not an economist. But what you're addressing is a very real applied problem.

Q. It seems that that would be one of the more important questions. How do you evaluate whether fish in the stream are worth more than the crops being produced?

A. When you say more, this is the basic problem.

Q. What would you have to do in order to establish any tradeoff? You'd have to be able to measure them somehow.

A. This is why other people are trying to work out a system whereby you can evaluate things prior to going to an economic evaluation.

Q. The fundamental question that was being asked here is -- what is the social value of water in a stream? The opportunity cost is not necessarily the same thing as social value. Social value seems to have a lot of components, at least that's what the sociologists, psychologists and now the engineers are trying to tell me.

A. One way you might look at it is that for each unit of flow coming down the stream there are particular uses of the river which can either use that flow or not use it. In other words, there is a range of flows or increments. It's not necessarily aesthetically better to have more flow, because you can make it look worse. Ot it's not necessarily worse aesthetically to lower the flow, but you will come to a point where you're going to injure some other instream use. So you have to be able to approach each problem with respect to the physical characteristics of that stream. You describe those functions on a physical basis, but the problem comes in exacting a tradeoff between the value of having it there as opposed to diverting it. You can dry up sections of a stream and adversely affect the fisheries in that reach, but upstream and downstream the fish will not know what is going on.

Q. That's an important point you're making there. One of the real concerns that fisheries people have is the fact that it's so easy to manipulate the fish. If you have a flow and you want a lot of people fishing there, you bring your hatchery truck out and you dump in (x) fish and you have (y) fishermen. This is a real problem for them. If we can manipulate this system to get any composition we want, we are talking about a carrying capacity or aquatic habitat. What is the carrying capacity for aquatic habitat? I find it very interesting that the very people who manipulate the system are the ones who are concerned about the aquatic habitat. So I think that not all of the issues here are clearly on the table at this point and I might argue about methodology.

A. To carry Dr. Michalson's point further a little bit and to also point out the problem of language again, fisheries people often request an "optimum flow". The optimum flow relates to the best possible spawning and rearing conditions without an increase in flow, and it is associated with the physical characteristics of the stream. But, if you look at the optimum flow on some streams, it is impossible to achieve this flow during minimum flow periods without upstream storage. This, of course, runs contrary to fisheries interest in an anadromous fishing stream.

Presentation by

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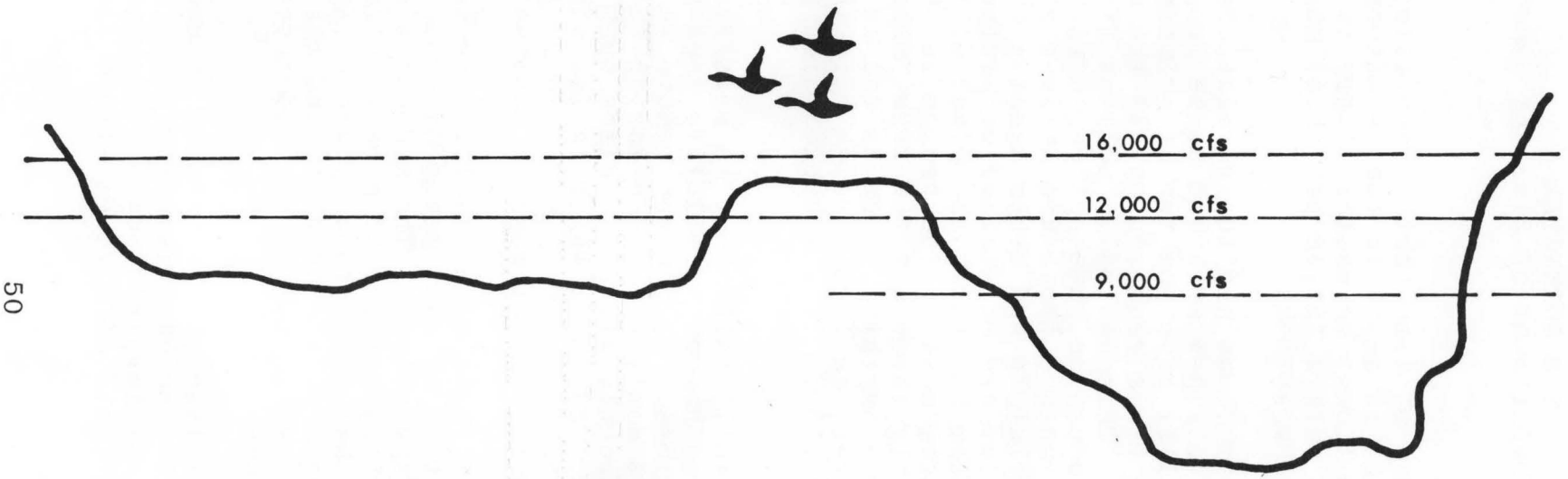
Within the amount of time that I have allotted, it would be pretty difficult to go in depth in the relationships of fish, wildlife, and stream flows, so what I'll try to do is to skim over the subject and talk a little bit about what we're doing in the Fish and Game Department.

The art of stream flows and their relationships to fish and wildlife is a relatively new area and as we progress we will develop new terms. I'll give you two of primary concern. Instream flows are defined as flows required by all the uses of water in a particular stream. This not only includes fish and wildlife, but hydroelectric production, aesthetics, agricultural uses, etc. Stream resource maintenance flows are defined as a range of flows within which fish, wildlife and other aquatic organisms and related recreational activities are maintained or protected. I think perhaps this first term has taken the place of the old concept of minimum flow. In fact, most of the people in this field agree that we should probably throw out the term "minimum flow" because it really doesn't mean anything to us as far as fish and wildlife are concerned. However, as I go through this information I will use the term minimum flow. It's a habit which I'm trying to get rid of.

The first area we'll talk about is wildlife. There are four basic effects that can happen to wildlife when you start altering the natural flow regimes: 1) you can remove the drinking water, however, some animals don't require drinking water. 2) The altered flows may directly affect wildlife such as beaver, muskrat, otter or osprey. 3) Lower water tables alter riparian vegetation, eliminating habitats of some species. 4) The change in patterns of flooding may affect wetland habitat of waterfowl.

People who are working with wildlife are trying to come up with what you might term an easy methodology to relate stream flow with wildlife populations. There doesn't seem to be any direct correlation with the size of a particular population and the streamflow. So what they probably are going to look at is the third item, the effects on the quantity and quality of riparian vegetation in relationship to an increased instream flow or a decrease in streamflows.

In regard to wildlife, or particular concern at this time in the Department of Fish and Game is waterfowl. Primarily on the project with which I am involved now on the Snake River, we are concerned with the effects of altered stream flows on the nesting


16,000 cfs
12,000 cfs
9,000 cfs

of the Canada goose and, in some areas, ducks. In southern Idaho the Canada goose nests primarily on islands in the river. There are sparse populations that utilize other areas such as the populations around the reservoirs south of Fairfield that utilize a marshland habitat.

The Snake River goose nests primarily on the islands. Figure 1 depicts the change of an island at three different water flows. If we have a flow of 9000 cfs there are no islands at all. It changes the particular habitat for these geese and they may not nest on this piece of land because it's not an island. If they do nest on that island, you run into problems of that being part of the mainland. There is an increased chance of disturbance by humans, livestock, predators and agricultural practices. It's going to reduce the nesting success of the goose. If you have an increase inflows, to 16000 cfs for example, it will completely wipe out the island. And if that flow happens to come after the nest is established, you're going to wipe out that nest and chances are that the goose will not renest that year.

For the Canada goose in southern Idaho nest establishment occurs during March and April and incubation continues through May. So essentially what we'll do is recommend flows for water fowl during March, April and May. We'll recommend flows that will retain island integrity, a maximum flow and a minimum flow that will maintain the island. But we don't want a flow that's going to flood those nests after the nest has already been established. If we're going to have a flood flow, let's have it before they start nesting and maybe they'll go someplace else or nest later.

Ducks nest approximately four to five weeks later than geese. During the period of March and April, that's generally when we get our high water in the Snake River. The ducks usually nest a little later so we're not generally concerned with high water. But if it looks like it's going to start affecting our populations, then we'll go back and take another look at it.

Any questions about water fowl?

Q. With a goose, does the same animal usually come back to the nesting spot each year, or does it vary depending on its flight?

A. A lot of geese we have in southern Idaho are resident populations, so they're going to stay around in a particular area year round. They might move from their nesting areas to another area after the younger geese have started to flock. They might move to a feeding area.

Q. Is there enough suitable habitat for good nesting to maintain a good population of geese or is it a pretty critical thing?

A. There is a good sized population of Canada geese in southern Idaho, particularly from American Falls to C.J. Strike Reservoirs. There are plenty of islands; some of the islands have been allowed to be grazed by livestock, therefore ruining the nesting habitat. We do have problems with high flows on some of the islands; some of them no problem at all. Another problem we have is an overgrowth of the islands' willows. These geese like to pick an island that's fairly open with some cover. One particular island that we looked at this spring had 21 nests on it. This island was 100 yards long by about 30 yards wide. Of the 21 nests on it, 17 were successful. So there's some reason why they like to pick one island over another. But, to answer your question, yes, there seems to be plenty of islands down there in certain areas. A lot of them, like I said, are overgrown. There has been talk of going in and burning off the willows. They also have a program of putting nesting platforms on certain islands, those that year after year are flooded.

Q. In terms of the high flow, you're talking about man-induced high flows?

A. Right. The section of river that we're working on now has 6 dams. So there are no natural flows in that particular section of the river. They are all releases from reservoirs prior to or after the spring melt.

Q. But under natural conditions if you could restore that would there have been a problem of high flows in that area? Did you have geese in there before you had the dams?

A. I don't know, I'm not 50 years old. I couldn't tell you. There aren't any records available to me right now on populations of nesting geese before the dams were built.

Q. A very critical area is up at Palisades. They've had a real problem there because after Palisades Dam went in, they changed this upper flow and they've had considerable trouble because the releases of the water were the case he was talking about, 16,000 cfs. There the geese would come in and nest before they released those higher flows, they then released the higher flows and just flooded their nests. There's been a lot of pressure on them to change the pattern of releases and I think they've done quite a lot towards negating that.

A. Right, there have been two or three studies recommending maximum and minimum stream resource maintenance flows for those nesting geese on the South Fork of the Snake River. I don't know about the agreement that the Fish and Game Department has with the Bureau of Reclamation. I know there's no legal agreement, but there might be an informal one.

Q. I know they have been trying to make an attempt to adjust that for several years.

Q. Are most of those islands at the same elevation so that, for example, that 16,000 cfs would wipe out most of them?

A. No, they are not. There are some islands there that at a particular flow are six feet above the water and there are some that are a foot above the water. So what we have to do is go in there and say; okay, we have, for example, 80% of this population nesting on these six islands, so we're going to concern ourselves with just those islands and hope that the other 20% find adequate nesting habitat elsewhere.

Now we'll jump right into fish. I think the effects of altered streamflows on fish are pretty obvious; reduction in habitat, food production, high velocities, loss of spawning habitat, etc. Before you can go in and start recommending flows for fish you have to know what their requirements are. The Oregon Wildlife Commission started back in the early 1960's looking into some of the requirements for different species of fish. What they did was survey the streams and say, there's a chinook salmon pair spawning right there on that bed, let's take velocity and depth measurements at that location. Table 1 presents an abbreviated summary of some of the Oregon Wildlife Commission's streamflow work. What they came up with was a range of velocities and a mean depth for each particular species spawning.

So this will give them some idea of the requirements of those particular species of fish for spawning only. In addition to this, there has been work on other species of fish. By no means is that all of the fish that have been looked at and there are a lot of fish that have not been touched.

We've got some pretty good guidelines on the requirements for a few of the resident fish for spawning and some anadromous fish for both spawning and passage.

Q. Would that maximum velocity for passage be over an extended distance or over a short distance?

A. No, that's an instantaneous velocity at a particular point in a stream.

Q. So if you had a hundred yard stretch at 8 feet per second they wouldn't be able to pass back?

A. I'm not sure if they arrived at this figure in the field, or if they came up with the figure in the laboratory. Essentially what you should do, if you have a migratory fish in a stream, you have to look at the potential passage blocks and measure velocities at different flows.

Table 1. Summary of redd measurements and criteria, Oregon Wildlife Commission

Species	Number Redds Measured	Number Streams Sampled	Velocity Mean (feet per second)	Depth Standard Deviation	Depth Mean (Feet)	Velocity (feet per second)
Spring chinook salmon	142	7	1.409	0.4907	1.018	0.71-2.11
Fall chinook salmon	50	7	1.629	0.6509	1.276	0.61-2.64
Kokanee	106	3	1.432	0.6618	0.748	0.47-2.39
Winter steelhead trout	115	11	2.058	0.5455	1.366	1.27-2.85
Summer steelhead trout	90 83	1	2.301	0.5956	1.331	1.42-3.18
Rainbow trout	51	1	2.287	0.4423	1.122	1.60-2.98
Brown trout	115	5	1.458	0.5413	1.396	0.67-2.24
Brook trout	122	4	0.366	0.2767	0.818	0.03-0.76

Q. Right, but if eight feet per second for 100 feet is a passage the same velocity for 200 feet might be a block.

A. The way I understand it, it's a point velocity.

Q. In other words, that's as fast as one of those fish can swim, and if the water's running faster than that, they can't get by.

A. I don't think that's as fast as they can swim. You have to take a lot into consideration when you talk about how fast one can swim. My assumption has been that it's a point velocity.

Q. A lot of velocities are measured at a point.

A. Well, say you have a hundred mile length of river and you've got one potential passage block that's so wide. You stick your current meter down in it and if it reads over that then it's a potential passage block. What you want to do is to increase your water level so that the water can come over what we term an overbank in that potential passage block, or reduce your flows.

Q. That may be the most obvious thing to do.

A. It would be hard for me to conceive a hundred foot length of a passage block.

Q. For example, culvert crossings. The length of the culvert makes quite a bit of difference in whether or not that culvert is a block even if you're talking about all the same velocities through the culvert. I would imagine that if you had a longer stretch at a certain velocity it may be a block, whereas at the same velocity a shorter stretch would not be a block.

A. I don't have the information on that.

Q. I think you're right and I don't know how this information is collected, either. But I think Tim is right in assuming that however they arrived at this they were not considering the length of the potential block.

We have information provided to us for those species on passage and spawning. What about rearing of the adults, the juveniles and incubation flows for the eggs. There's been very little research done on it. Some information that we need, we don't have. It's a top priority, one of our research needs. We do, however, have a little bit of information on general rearing flows (Table 2). These are really king of vague, but they are intended as guidelines only.

Table 2. Guidelines for recommending rearing flows

Adequate depth over riffles
Riffle-pool ratio near 50:50
Approximately 60% of riffle area covered by flow
Riffle velocities 1.0 to 1.5 fps
Pool velocities 0.3 to 0.8 fps
Most stream cover available as shelter for fish

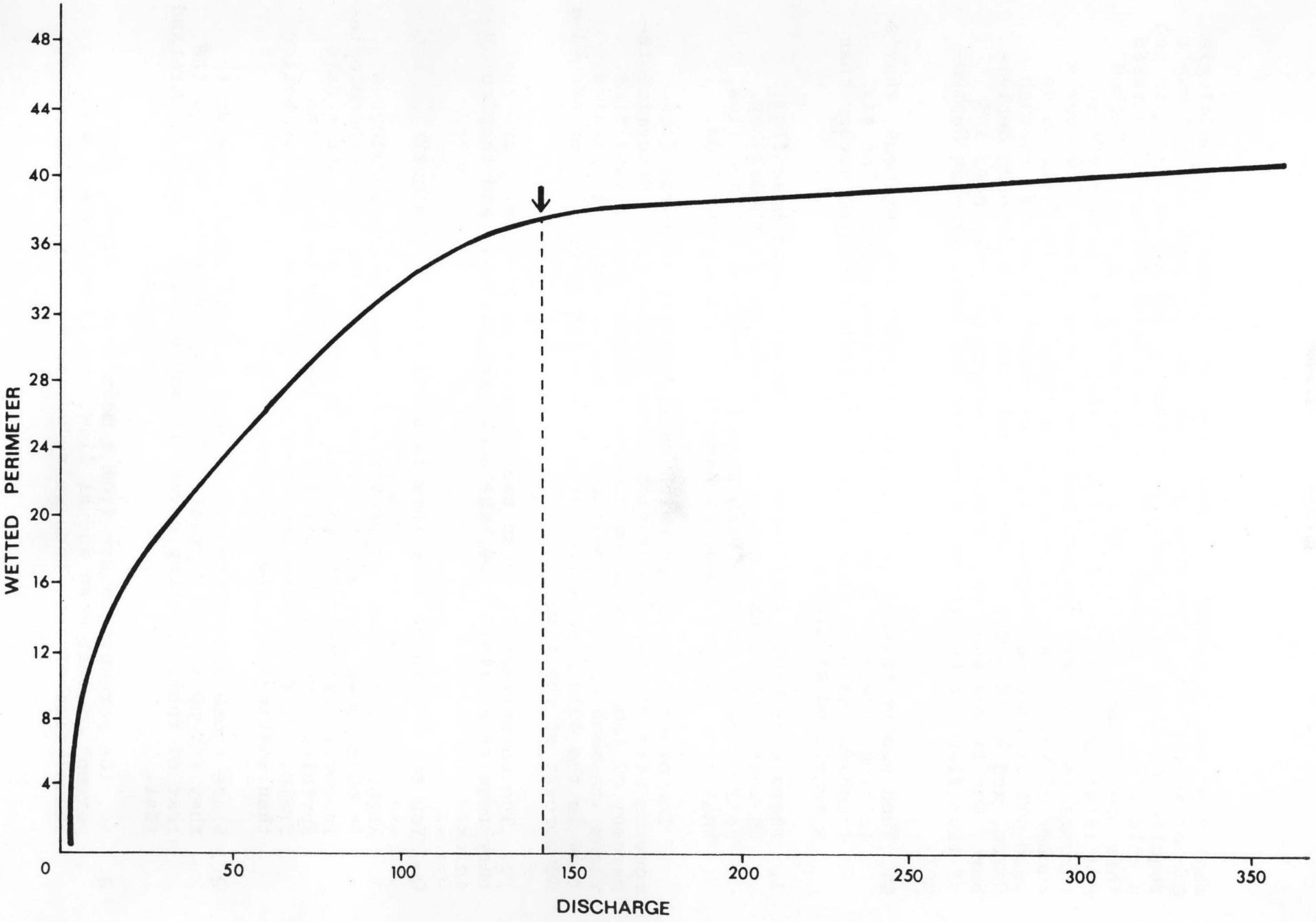
One other way we have of determining rearing flows is looking at habitat loss at different discharges. One of the ways we can do this is looking at wetted perimeter along a transect. If we plot the amount of wetted perimeter against the discharge, we get a nice curve as shown in Figure 2. Where we start losing the greatest amount of wetted perimeter with an increase in discharge we term that the minimum stream resource maintenance flow for rearing. That's kind of general because it relates for all species and all life history stages. You have to look at each individual stream and see what you're losing at various discharges. If you're talking about brown trout that need undercut banks, wetted perimeter doesn't take this into account. If that particular discharge there leaves you with no undercut banks, you're going to have to increase the flow if you want brown trout in that stream.

Q. What exactly does wetted perimeter mean?

A. In a cross section of a stream, wetted perimeter is the linear measurement along the bottom from one bank to the other. In this particular stream we might have 800 feet.

We're also talking about point measurements. When you go out to a stream you have to look at representative cross sections. If you have passage blocks you have to take a representative passage block. Spawning area, you have to take a representative spawning area. Obviously, on a stream that's a hundred miles long, it would be difficult to go in and measure all the spawning grounds. So you're talking about a representative habitat.

There are methodologies for determining stream flow. You've got information on the fish, now how do you go out and determine


48
44
40
36
32
28
24
20
16
12
8
4
0
WETTED PERIMETER
50
100
150
200
250
300
350
DISCHARGE

what's needed in a stream. There are two classes of methodologies. One of them I call a rocking chair methodology because it doesn't require anything but historic flow records and a rocking chair and a cold beer. Don Tennant, U.S. Fish and Wildlife Service devised this one (Table 3). Initially it was termed the Montana Method and this example is an extension of that. What he did was go through the historic records and find a mean annual flow over a number of years. For an outstanding fishery in that stream we need 40% of that mean annual flow for a period October through March, and we need 60% of that annual flow April through September. But if you want only a fair fishery, you only need 10% of that flow October through March and 30% April through September.

Q. When you're talking about regulated base flow regimens, that's talking like base flow is subject to regulation. The way I understand base flow, it is a natural situation rather than a regulated situation.

A. There's probably a difference in definition of base flow. We went through this a couple of weeks ago at a workshop. We'll have to come up with a good definition of base flow. What he's talking about as base flow is a minimum flow.

The other methodology which only requires historic flow records utilizes a flow duration curve (Figure 3) to determine the percent of time a flow is equaled or exceeded during that time. These are some of the guidelines you come up with. A spawning flow is the 40th percentile, or a flow which is equaled or exceeded 40 percent of the time.

The advantages of these two types of methodologies are that they require no field time, the costs are minimal, and they're quick.

Q. You say something like this is being done in Montana?

A. Right, the information provided by these two methodologies is being used just about everyplace. We used the methodologies in our report we came out with this year. If you don't have anything else, if you don't have the money to get to the field, you don't have the time, the personnel, this is better than sitting back and guessing.

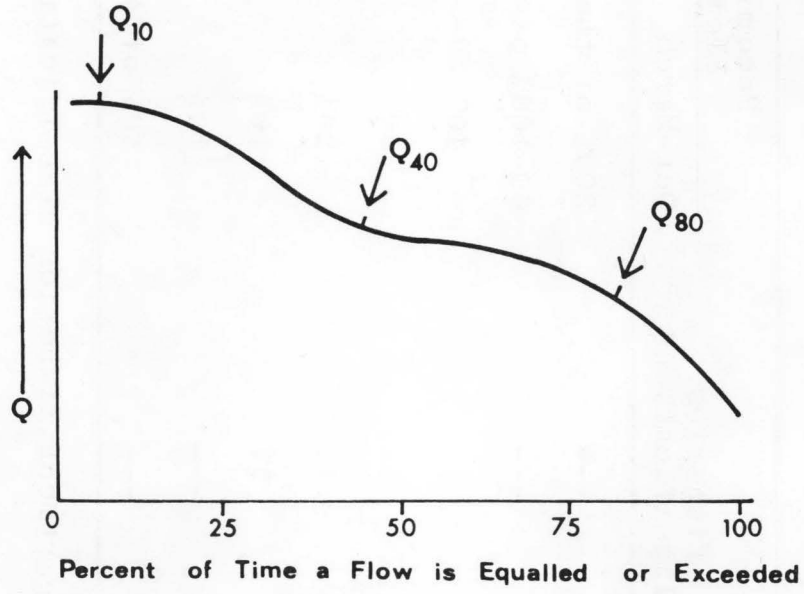
Q. Since those recommended flows were a whole year, shouldn't they add up to 100 percent? The first one does, and not the rest of them. If they cover the whole year, I don't understand that.

A. No, the percentages are from a mean annual flow. Thirty percent of that mean annual flow, say if you have a mean annual flow of 100, then we're saying we only need 30 percent

Table 3. Instream flow regimes for fish, wildlife, recreation, and related environmental resources (Tennant, 1975)

Narrative Description of Flows	Fisheries Classification*	Recommended Base Flow Regimens	
		Oct-March	Apr-Sept
Flushing Flow	---	200% of the Average Flow	
Optimum Range	---	60-100% of the Average Flow	
Outstanding	I	40%	60%
Excellent	II	30%	50%
Good	III	20%	40%
Fair	IV	10%	30%
Poor	---	10%	10%
Severe Degradation	---	10% of Average Flow to Zero	

*Montana Fish and Game Department fisheries classification system



Spawning (40 percentile)

Spawning Area Scouring (15 percentile)

Fish Food Production (80 percentile)

of that figure to maintain our fisheries in the excellent category October through March. There's no requirement that it has to be 100 percent.

Q. Probably no natural stream would be able to meet those criteria, either. It'd have to be a regulated stream.

A. No, some of the streams we looked at last year did.

Q. I have a hard time seeing where a stream could have 40% of the mean annual flow as the base flow during October through March if it's a natural stream.

A. I said some of them do, I didn't say all of them.

The Oregon Wildlife Commission, like I said, started on the field methodologies back in the 60's. Essentially what they did was go out to a stream and take measurements. They took velocity measurements, depth measurements, wetted perimeter, etc., at several different flows, at 220, 180, 140, 100, 70, 30 and 15. They came back to the office, looked at their criteria for the fish and said that, for example, a flow of 140 cfs best meets our criteria as a minimum stream resource maintenance flow.

One of the disadvantages of that methodology is you have to go into the field to measure all of those flows and you may not measure the flow that you want. You may go from 100 to 140 and the minimum stream resource maintenance flow might be at 120. That was really how the ball game got started.

Presently there are two predictive methodologies. The one which we're working with, the Water Surface Profile Program from the Bureau of Reclamation; and the Forest Service has a program which utilizes computers to predict physical characteristics of a a stream at different flows. The nice thing about this is you can go out to a stream and measure it at 140 cfs for depth, velocity, wetted perimeter and put it into a computer. The computer will predict what that stream looks like at each of the other flows. So we only have to be out in the field once. It cuts down on personnel, time and money. We have to put into the computer depths, discharge, water surface elevation and roughness coefficients. It's not required that we put velocities in there, but using a vague term such as "n" (roughness coefficient) it is best to take velocities and that way you can determine a more exact "n" at that discharge. The computer will give you back velocities, wetted perimeter, depth, and water surface elevation for each flow you ask it for. You also have a capability of dividing the stream up into nine segments. So if you have spawning gravel in segments 1, 2 and 3 and rubble in the others, you could put eight segments in spawning gravel and it'll define more clearly what's going on in the gravel segment.

Q. On that computer thing, how much data do you have to take? Do you have to take data the full length of the stream or just in specified cross-sections?

A. No, you designate representative habitats and make four cross-sections across it and you need information on bottom surface profile, water surface elevations and roughness coefficients on each cross-section.

Q. But you said the Forest Service is using this method.

A. They're not using this method, they're using a different one.

Q. I was under the impression they were doing the whole stream.'

A. They're using a method called the Sag Tape Method. It's similar to this except in this methodology we connect each transect by survey of water surface elevation. In the Forest Service method it works on one transect at a time. So here you can do forty transects on one run, on theirs you have to do one transect at a time and it works out the same basic formula, but all you need there is slope at the particular point of reference. So the Water Surface Profile Program is much more sophisticated.

Q. But they're all based on Manning's equation?

A. They're all based on Manning's equation.

Q. Then it doesn't really apply to high gradient streams.

A. It's tough.

Okay, just to give you a quick example of what we do with this information. We'll take a stream and ask the computer to give us various characteristics of each discharge. We have 100 percent of the spawning gravel at one flow. One of the criteria of spawning gravel is to have at least 80% of the usable gravel. At 220 cfs you have 85% and at 180 you have 55%. So what we'd do is go back to the computer and ask for stream characteristics at 210 and 200 which will bring us closer to 80 percent.

Q. That in the blue is too shallow?

A. Right, too shallow. Now, when we do this we will also look at velocities.

The main disacvantage of the approach is you don't get point velocity, you get mean velocities for each of these nine segments; mean velocities and mean depths. That's the best we have right now.

After we go through a stream and measure physical characteristics and the computer gives us all of the information back, one of our first steps is to devise a list of important fish and wildlife species for that particular stream. We also include a periodicity chart. We determine spawning, incubation, passage and rearing periods for each species (Table 4). Something that we don't have on this is downstream migration of anadromous fish, which we will take into consideration. Then we do the same thing for all of the wildlife (Table 5). We do this for each species that we feel might be important in that stream.

To determine stream maintenance flows for a stream section, we go through each species in that stream and determine stream resource maintenance flows for each life history phase (Table 5). Rainbow trout has a spawning flow of 900 cfs, and incubation flow of 800. We do that for each species. We could divide this up into one or two week periods, or however we want to do it. We look at the highest flow for each period and bring that down and this is our minimum stream resource maintenance flow regime for this particular river. We also have a maximum stream resource maintenance flow for waterfowl nesting.

Q. Are these numbers based on optimum performance?

A. No, these are minimal stream resource maintenance flows.

Q. You mean that's what is required just to accomplish a minimum amount of activity?

A. That is what is required to maintain that population in that stream. These aren't enhancement flows.

Q. Do you have numbers that would indicate the amount of change in population for a given amount of change in flow?

A. No.

Q. How much spawning are you assuming for the brown trout, 75 percent of the habitat available?

A. 80 percent.

Q. But your Montana method would give you somewhat of a handle on that, wouldn't it?

A. The Montana method you do in the office. So you don't really know what's going on in that stream unless you get out there and run a 30% or a 60% flow.

Q. But at least it does say on paper that there's a difference between flows, what they're good for. 40% for outstanding, 30 for good and 10 for fair.

A. Like I said, I'd like to put interim on that.

Table 7 is an example of the interim flows that we devised last year for streams in Fish and Game Region 4 in southern Idaho. We'll present minimum flows and usually the maximum flows will be for water fowl. However, in some of the streams we have maximum flows for fishing, particularly in Bear River. There we have asked for maximum flows during daylight hours on the weekends. If you look at Salmon Falls Creek that's obviously the Montana method. On Bruneau River there's quite a range of recommended flows. We had no idea what to recommend for the Bruneau River and neither did the regional manager, so we went to the flow records for the last twenty years and averaged minimum flows for each month. That's the best we could do.

Q. Was that the Montana method also?

A. Salmon Falls Creek was the Montana method.

Q. That means that a good share of the time, the natural stream would not be able to meet these flows?

A. Right. You can look at that stream and say that it can maintain itself under natural conditions. There will be hard years and there will be some good years, but overall under a natural regime, it has survived in the past.

Q. But you didn't get any measurement of what fish production was or what wildlife production was over that same twenty year period, so you really still don't know.

Q. The Bruneau River is highly inaccessible. I think there's probably 50 cfs taken out every year. There's only a few withdrawals from that stream, and that's right at the mouth. We're not particularly concerned right at the mouth anyway, because all the better fish habitat is upstream.

Table 8 shows some of the work we did last year. This is a priority list for looking at each individual stream in relationship to stream resource maintenance flow study needs. We devised this list in conjunction with the Water Resources Department. Those streams which are listed under Priority I aren't necessarily our best fishing streams or our best wildlife producing streams in the state. Those are the streams in which there is immediate concern over present or future withdrawals.

The Priority II list is kind of a catchall group. A lot of rivers in the last group are wild and scenic rivers that probably will not be touched.

Q. From what I've seen of the Clark Fork about all they can care about up there is power production.

Table 4. Periodicity chart for fish species

SPECIES	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rainbow Trout												
Spawning				**********	**********	**********						
Incubation				xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxx				
Passage												
Rearing	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++
Brown Trout												
Spawning											**********	**********
Incubation	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxx							xxxxx	xxxxxx
Passage												
Rearing	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++
Chinook Salmon												
Spawning										**********		
Incubation	xxxxxxxxxx	xxxxxxxxxx	xxxxx							xxxxx	xxxxxxxxxx	xxxxxx
Passage												
Rearing	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++	++++++++++

Table 5. Periodicity chart for waterfowl species

SPECIES	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Canada Goose												
Nest establishment			**********	**********								
Incubation			xxxxxxxxxx	xxxxxxxxxx	xxxxxx							
Mallard Duck												
Nest establishment				******								
Incubation				xxxxxx	xxxxxxxx							

Table 6. Example of stream resource maintenance flow determination for a stream section

Stretch:

Species Requirement*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rainbow Trout				S	900	900	S					
				I	800	800	I					
	R	600	600	600			600	600	600	600	600	R
Critical Minimum	600	600	600	900			900	800	800	600	600	600
Optimum Flow												
Maximum Flow												
Brown Trout											S1200	1200S
	I	1000	1000	I							I1000	1000I
	R	900	900	900	900	900	900	900	900	900	900	R
Critical Minimum	1000	1000	1000	1000	900	900	900	900	900	900	1200	1200
Optimum Flow												
Maximum Flow												
Chinook Salmon										S1400	1400S	
	I	1000	1000	I						I1000	1000	I
								P	800 P			
	R	900	900	900	900	900	900	900	900	900	900	R
Critical Minimum	1000	1000	1000	900	900	900	900	900	900	1400	1400	1000
Optimum Flow												
Maximum Flow												
Canada Goose			N(min)	6000								
			N(max)	12000								
			I(min)	6000								
			I(max)	12000								
Critical Minimum			6000	6000	6000							
Optimum Flow												
Maximum Flow			12000	12000	12000							
River Stretch												
Critical Minimum	1000	1000	6000	6000	6000	900	900	900	900	1400	1400	1200
Optimum Flow												
Maximum Flow			12000		12000							

*Information sources for species requirements should be noted

Table 7. Interim stream resource maintenance flows for streams in Idaho Fish and Game Department Region IV

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
SNAKE RIVER at Clear Lakes Bridge	Min	1000	1000	3600	3600	3600	3100	3100	3100	3100	2100	2100	2100
	Max	-	-	17000	17000	17000	-	-	-	-	-	-	-
SNAKE RIVER At Lower Salmon Falls Dam	Min	5300	5300	6400	6400	6400	6400	6400	6400	6400	5300	5300	5300
	Max	-	-	20000	20000	20000	-	-	-	-	-	-	-
SNAKE RIVER at King Hill	Min	6620	6620	7810	7810	7810	7810	7810	7810	7810	6620	6620	6620
	Max	-	-	21000	21000	21000	-	-	-	-	-	-	-
BIG WOOD RIVER at Bellevue	Min	85	85	85	170	170	170	170	170	170	85	85	85
	Max	-	-	-	-	-	-	-	-	-	-	-	-
BIG WOOD RIVER at mouth	Min	300	300	300	300	300	300	300	300	300	300	300	300
	Max	-	-	-	-	-	-	-	-	-	-	-	-
LITTLE WOOD RIVER at mouth	Min	50	50	50	100	100	100	100	100	100	50	50	50
	Max	-	-	-	800	800	-	-	-	-	-	-	-
CAMAS CREEK at mouth	Min	20	40	70	300	250	70	10	10	10	10	10	10
	Max	-	-	-	-	-	-	-	-	-	-	-	-
SILVER CREEK at Picabo	Min	140	140	170	160	110	110	130	150	150	150	150	10
	Max	-	-	-	-	-	-	-	-	-	-	-	-
BRUNEAU RIVER at mouth	Min	70	120	120	400	400	400	120	70	70	70	70	70
	Max	-	-	-	-	-	-	-	-	-	-	-	-
SALMON FALLS CREEK at mouth	Min	100	100	100	200	200	200	200	200	200	100	100	100
	Max	-	-	-	-	-	-	-	-	-	-	-	-

A. You might say that about the Snake River too.

Q. Saturday they got good flows out of the dam and on Sunday there's hardly anything.

Q. What do you do in a case of a stream where the natural flows would occasionally have a reach of the river dry?

A. Personally, it's okay with me.

Q. But after regulation those same stretches might have some water after them.

A. What kind of water are you talking about, though? Are you talking about fluctuating conditions, sustained flow or what?

Q. Well, as stable as irrigation return flow might be.

A. Occasionally, downstream of a dam, you have extreme fluctuations. Those are probably more harmful to a fish population than a lower natural flow.

Q. You can have the opposite of that, too. You can have bare, dry spots because of irrigation where you'd naturally have a base flow.

Q. I'm thinking of Big Lost River where under natural flow conditions there are stretches of that river that are dry. But after regulation, most years there is a maintained flow over that by irrigation return flows; but there are some dry years when irrigation return flow's not sufficient to maintain water in those stretches. What I'm wondering is whether minimum flow criteria would come in and say, well, you've got to maintain flow in those reaches by regulation.

A. We'd have to look at each individual stream. If we can document that a certain section of a stream had gone dry during a natural regime thirty years ago, we might take into consideration . . .

Q. You'd have to be back farther than that on that stream.

A. I'm sure I would, and there probably aren't any records about the fish population in there, either.

Q. That's a fairly productive fishing stream.

A. Yes, it is. There are large sections of that stream that are also dry now, if you get out in the desert. By the say, we did recommend a continuous flow in that stream.

Table 8. Idaho Fish and Game Department and Idaho Department of Water Resources priority list for future streamflow studies

I. Clark Fork River
Clearwater River
East Fork Salmon River
Lemhi River
Moyie River
Pahsimeroi River
Priest River
Silver Creek
Snake River--American Falls to Lesiston
South Fork Snake River
St. Charles Creek

II. Bear River
Big Lost River
Big Wood River
Blackfoot River
Boise River
Camas Creek
Coeur d'Alene River
Cub River
Henrys Fork Snake River
Kootenai River
Little Malad River
Little Wood River
Payette River
Salmon Falls Creek
Snake River above American Falls
Spokane River
South Fork Boise River
St. Maries River
Teton River
Weiser River

III. Bruneau River
Buffalo River
Falls River
Jarbridge River
Little Salmon River
Lochsa River
Middle Fork Clearwater River
Middle Fork Salmon River
Montpelier Creek
Pend Oreille River
Portneuf River
Salmon River
Selway River
South Fork Clearwater River
South Fork Payette River
South Fork Salmon River
St. Joe River
Warm River

I realize there are quite a lot of gaps in here, some information we don't have or some that I just kind of skimmed over. I didn't cover it all. Hopefully this will give you some kind of idea what we're up against in some of the work we're trying to do.

DISCUSSION QUESTIONS AND ANSWERS

Q. I might open up a question on that last list. In this case it's pretty much just a value judgment type of approach, isn't it, saying the lows are best experienced? I suppose the talk is to give priority to some of those streams that may be a little more trouble, so we ought to be looking at it. You look down to your third list and there are some that, as long as they're wild river status, why should we worry too much about them? They're probably low priority and what we do is not going to modify it too much. Were you involved in the actual selection?

A. Right, maybe I ought to back up a little bit. Two years ago, the Water Resources Department came to Fish and Game and asked for information on flow requirements for fish and game populations within certain streams. At that time they presented a list to us. Also, attached to that list, was a list of their priorities. Their priorities were streams in which they felt the present or future water withdrawals would be harmful. So, one of the jobs we had to do was devise a list of priorities for Fish and Game. Since it was their project we incorporated the lists. Some of their top priority streams are in our Priority II streams, and some of their Priority III streams are in our Priority I streams. This is not only our own list, but Water Resources' list.

Q. On that same line then, going back to what was asked a while ago and you threw out as a question planners always ask, how do you address the question that's going to be asked about the difference in priorities between you and somebody else? What information do you have available?

A. I'm not sure I understand. I'm trying to think back to what he asked.

Q. You have these minimum flow levels or whatever you call them but you also have some other situations that might arise where the flow levels aren't going to be met. What sort of changes can you expect, what sort of tradeoffs are you willing to make? Do you have the information available that's going to say that we're going to trade off this and meet some of the demand over here?

A. My own personal opinion is I don't like to make tradeoffs. But that's not for me to decide. But if you'll remember back we have our fish and wildlife species list for each river and you'll see that rainbow trout require considerably less water than the chinook salmon. This is kind of an alternative. I'm not saying I approve of it, but if somebody came to me and said, we dan't supply the 1000 cfs January through March, but we'll give you 600 cfs that's going to maintain our rainbow trout population, but chances are we'll lose our chinook salmon. The information's there if you want to talk tradeoffs.

Q. That's just it, didn't you say the information wasn't there? How do you know what the 600 flow is going to do to the chinook salmon. You said that there really wasn't information on that.

A. We don't know. We can only tell you right here on paper what is going to happen.

Q. You can only say that you won't be able to maintain the existing fish population and activity, but you don't know what it will reduce to.

A. Right, it may reduce it 50 percent, 90 percent or it may not reduce it at all. We're talking about a very complex group of relationships here and the planners say, draw us a graph with fish production versus discharge. Boy, that would be just great if we could do that but you'd probably have to draw a different graph for each stream. There's so many interrelated factors there that it's going to be tough to get a handle on it. But I think this is one area of research that we're going to be looking towards; trying to see if there are any generalities that we can draw from it, but it hasn't been done yet.

Q. There is another complexity that goes along with that. You might be able to maintain those flows but if you modify the channel in a certain manner you might still wipe out some critical habitat, or you may enhance it, so that the channel modification thing works too, besides just the flow picture. You might be able to enhance one of these barrier situations, for example, with a channel modification.

A. The alternatives are there, if you want all the fish in that stream. If you can't get the flow for chinook salmon, for example; if you're not going to be able to provide 1400 cfs in a spawning, but you can give a thousand. What's to prevent you from just taking the eggs up there and put them in hatching channels. That's a bad alternative, but . . .

Q. It's bad for natural production.

A. Right. But you might increase production in that stream tenfold.

Q. How many people does the Idaho Fish and Game Department have researching minimum low flows?

A. One permanent and two temporaries.

Q. Are they doing anything to try to increase that?

A. It all falls back down to the money. The first year was financed entirely by the Department of Water Resources. This year it was financed jointly by the Department of Water Resources and the Department of Fish and Game.

Q. It was a little shakey this year.

A. Right, I didn't even know I had a job until January. I have my own personal feeling about it. I'd like to have a million dollars a year and 10 or 15 people on the project.

Q. There's no federal money in it?

A. Not at the present time. We don't know yet about the future.

Q. I find it rather interesting that the Fish and Game people can't come up with the money, but the ones that are the engineers and economists are giving you the money to do these studies from the Water Resources Department. They have more of an interest financially than the Fish and Game people, is that what's being said?

A. You said it, I didn't.

Q. Even that's a little bit shakey. There was a note in the Lewiston Tribune not too long ago by one of the Water Resource Board members who said that the issue of minimum stream flows is a dead issue.

A. That's the Board members.

Q. That was one Board member, right. And it's the one you'd think would be most interested.

Q. I was interested in your opening part when you mentioned a need for standard terminology and yet we've already stressed the need for a better language and better interpretation. I think there's still a lot of room right there, we need more definitive language in reaching into the fisheries people; more appreciation for expressions of habitat and things like that which are communicative. How much time are you spending with your counterparts in the Department of Water Resources, Bob Sutter and some of those fellows?

A. I talk to at least two of them every week.

Q. Now, how much of the time are they getting out . . .

A. Do we have them helping me?

Q. Yes.

Q. I think that's a valid point to discuss. Communications comes from experience of being able to go out there. I take it that you've spent some pretty long hours out in the streams wrestling with problems. I'm not saying that they haven't, most of the fellows have been out at times with a current meter and things of that nature, too. But I think the pitch I would make is for you probably to go together sometimes just to improve communications.

A. I think you're probably right. Bob White and I just returned from an instream flow workshop at Utah State University. A very productive workshop. People from all disciplines involved in instream flows were there. We had fisheries people, wildlife people, water quality, recreation people, and hydrologists. Essentially what we were trying to do is to pool all of our information and come up with a set of terminologies, research needs (in particular methodologies), criteria on species, and a whole realm of needs in this particular field. Hopefully somebody back in Washington D.C. will take that input that we gave them and say, hey we better get on the bandwagon. So hopefully the movement has started, centralizing all of our information.

Q. You said when you had regulation in Palisades Reservoir that there's no legal bond, just an agreement off the books. Is anything being done to get a legal agreement between them?

A. I don't know, but I understand you're going to have a lawyer here pretty soon. It's my understanding that there's only one case in Idaho where minimum flows have been set legally, and there are at least twenty-eight informal agreements around the state.

Q. I'm sure in that case the problem, to my recollection, has been a problem for a good eight to ten years. At least it was recognized as such. I'm sure the Bureau of Reclamation has shifted their operations around the state. But remember that sometimes that's very much at variance to what they want to do. They want to keep flows up there at a certain season. Apparently it was just counter to what they want to do in that particular case. I haven'theard of any agreement being worked out but next week I'll go down and talk with Mr. Woodward. He's with them now and he should be the person to get something from the Bureau side. I'm sure they've done

modification but I know that is a very critical problem; they were just washing out a lot of the goose nests on that section of the river and really playing havoc. How much they can really modify it and still keep the storage and the flows meeting irrigation needs, I don't know.

Q. There's one stream that I'm acquainted with where the informal agreement is probably counter to the law, at least according to one legal opinion it's probably against the law; the particular informal agreement that they've worked out and operate under and have done for several years. It takes time to work out the legal agreements and sometimes I'm sure that for the sake of practicality they go ahead with an informal agreement where they may run into a lot of hassle over a long period of time in getting the legal agreement worked out.

Q. The Boise River, I know, has considerable capability of readjusting flows because of the storage that it has. But in the winter the flows are sometimes down as low as 50 second feet. I don't remember now how that would fit into the spawning and it may not be a very critical area or a very critical time of the year. Have you done much work in the Boise at all?

A. The U.S. Fish and Wildlife Service has a river basins team whose objectives are to set stream resource maintenance flows for a number of streams in their region. They've come up with stream resource maintenance flows for the Boise River. I don't know what their agreement is with the Corps of Engineers.

Q. Lucky Peak is a Corps project and there are two storage reservoirs above that which are Bureau of Reclamation. Now let's talk a little bit on that point. Was this fact that the feds were studying Boise River an impact on whether you looked at it?

A. The Boise River, Camas Creek, Henry's Fork of the Snake River, Payette River and Teton River have all had some work done by different agencies on setting stream resource maintenance flows. That's one of the reasons these streams are in the Priority III list. Now, this list isn't firm, tomorrow we may include the St. Maries River in our number 1 priority list. On the Boise River you were talking about the winter flows. They have a very excellent whitefish fishery during the winter months on that river and I'm sure that your 50 cfs that you're talking about would be detrimental to the fishery and the whitefish population.

Q. What's their spawning season?

A. November, late October. Going back to that winter flow thing, as a result of this workshop one thing that we did was set up

some research priorities and this is one of things that came out. We don't know enough about the impact of winter conditions on fish and aquatic invertebrate populations. So this should be one of the research thrusts in the next few years.

Q. Natural water conditions?

A. Natural and regulated.

Q. I'd just like to clear up a matter of philosophy on the part of Fish and Game or maybe yourself. When you're looking at a stream that has some present man-made operations, different than the natural flows; are you taking what's possible using dams and such that are there to try and optimize the conditions for fish production; or are you basing your stream resource maintenance flows on what would be natural conditions? In other words, if there's been an increased capability for irrigation that has not been taken into account and is not being used now and the stream has a higher capability for fish production; are you setting it at this in spite of the fact that it's only there because the water has not been used for other purposes?

A. Obviously it would be difficult to get another run of chinook salmon in Twin Falls. We just have to look at each section of the stream or the entire stream and go to a regional manager and ask him about tradeoffs. For instance, at Dworshak they have a regulator where they can take water out at a lower depth to cool down the water, or up higher for warmer water. There are a lot of things that are involved and like I said, I think we'd have to look at each individual stream. It wouldn't be my choice, it would be somebody else's.

Q. But the flows you recommend may be greater than what would have occurred naturally. You may actually be asking for a maintenance of a better fishery than what would be natural.

Q. That's what he said they did on the Lost River.

A. There again, we'd have to take each stream into consideration. Do we want flows to maintain those species that are there or do we want enhancement flows, where we can introduce a different species or enhance populations that were there naturally?

Q. Are you familiar with the American Falls situation? I'd like just to find out what the facts are. You're not supposed to comment on that? Does anybody else know about it? I understand that there is a fishery there now that was not possible before American Falls was in and as a result of the plans now to correct American Falls there are all sorts of things

required of the dam designers in order to maintain the fishery that was created because of the dam that they put in originally. That sounds circular.

A. When you look at the fishery that is there, it's my understanding it's in the forebay of the hydroelectric plant. That didn't used to be there. But what about that stretch of the river that's underwater now, above the dam, what was there?

Q. I'm an engineer, I don't know. What was there?

A. Is it fair to replace what might have been above that reservoir with what's there now? I can't answer that.

Q. My question is, what was there? My understanding is that there was a very poor fishery in that area prior to the dam.

A. I don't know what was up there.

Q. In economic terms, the consideration of what was there before the dam and what's there now is of some cost consideration anyway. For any present alternative that you have, that is past and gone.

A. I think the point is that there is a high quality fishery there now and it's been there for years.

Q. That is a point that some of you might want to look at, I take it that your department is a little sensitive to that.

Q. My question was not meant to be argumentative, I hoped to get some facts.

Q. But I can see that it is a sensitive point. In that particular case the reason it's sensitive now is that the amount of modification, the amount of requirements for that new construction is a matter of negotiation. If they are going to destroy something that is there now somebody is going to say they've got to pay for it. So it is a negotiable type of thing. That is the type of problem that is very much in line with our interrogation of this problem. It's an instream use that we're thinking of changing.

Q. You could probably have the same kind of situation now in the Big Lost River. The fishery that's there now is much better than what was there before because of the dry conditions under natural flows. But the Mackey Dam is a site which could potentially support a dam about twice as high as the one that's there now. You could very possibly go in and modify that structure the same way that they're thinking about doing at American Falls. The original plans for the existing dam

were for a full height. They ran into some construction problems and cut it off and that's why that particular dam is so wide across the top. But the site will support a higher dam. With modern construction techniques they could overcome the problem that was there initially and build a higher dam. There's about 10,000 acres or so that is irrigable if they had the water for it.

Q. What has been your experience so far, do the people who make the decisions listen to the Fish and Game people, or are they political when they get right down to it?

A. You're talking about the Bureau of Reclamation and set releases from the lower dams?

Q. Well, I was thinking of state agency people primarily, but I guess the other, too.

A. I don't know, I haven't been involved in that yet.

Q. I noticed you have Priest River up there. When I talked to you earlier you said your main effort was down south, but have you done any work in Priest recently?

A. No, our primary objective this year was to develop a methodology for the Snake River and recommend flow for the stretch from American Falls to C.J. Strike, primarily because they've got a large number of acres of land south of Glenns Ferry that's under the Carey Act. Under one particular plan they could take all the water out of the Snake River in that area. So that's our main thrust right now. We don't have a set methodology for looking at large rivers. We've run into equipment problems. We haven't even been on the Snake River yet. We have looked at Silver Creek because it is wadable and we do have the equipment for that. We haven't even considered the other streams yet. I suspect that we may get to three or four of them by next summer.

Q. Along that line, since you have looked at Silver Creek and it is fairly well known, would you expound on the situation there.

A. The Bureau of Reclamation, Soil Conservation Service, Water Research Institute, Water Resources and Fish and Game have all combined in a cooperative project in Silver Creek to find out what makes it tick. It's a spring fed creek that supposedly gets its water from the Big Wood River which is nearby. It's unique in that its cycle of high flows comes at the time of year that other streams are at low flows.

It's 25 miles south of Sun Valley and there are a lot of plans for development in that region. They don't know what's going to happen when 25,000 houses get out there and people run their sewage into the underground water. They don't

know what's going to happen if that many houses get out there and they all put down water wells. It's a whole complexity of things. That was one of the reasons we chose Silver Creek because there's so much work being done on it now.

Q. Very good, I think that's a very interesting one because relatively speaking Silver Creek is a very famous creek as far as fishing. There have been some rather right legal problems there.

A. I would have to be quoted as saying that Silver Creek is a famous stream only because there's about 200 yards of it that has exceptional fishing. Most of the good fishing is in the tributaries, the rest of it is fair. It has no flushing flows, you can wade out there in your waders and go up to your neck in silt without any problem at all. But the people still like to fish there.

Q. Has any sort of work been done on the effects of regulation of stream flows on vegetation and soils on the banks. I noticed you said something about the willows coming into the islands.

A. There's very little work in that area and that's one of the top priority research areas -- what happens to riparian vegetation in fluctuating flows. It's a long term effect, too, you don't do it in six months or three months.

Q. Does the Fish and Game concern itself at all with the evaluation of particular fisheries, what they are worth to society?

A. You're talking moneywise or pleasurewise.

Q. Some system by which they justify their existence in the maintaining of fisheries.

A. There's been some work done on the economic value of chinook salmon runs and steelhead runs. A particular stream, for instance the Lemhi, couldn't have a dollar value put on it, you have to take into consideration social values, what the people want.

Q. So basically there is no methodology for evaluating a particular fishery.

A. There are no set methodologies, there have been a number of approaches. It's just all in a state of confusion right now. There have been a few studies that have tried to set dollar values on fishery resources. It's easier to look at commercial fisheries like chinook salmon or something like that than to look at a resident trout population.

Q. Wouldn't you say that the current methodology is to take a public opinion poll and evaluate that?

A. That right, and there's no set type of questionnaire to use. You can sway those things so easily by the wording of your questions.

Q. It seems to me that the sort of a methodology would be critical to any of the types of things you've talked about here in that in order to justify a minimum flow, in order to justify the status quo situation of the fisheries, that you need some means of measuring their value in relation to other things. Until you do that you don't really have a reason for saying you need a minimum flow.

A. A lot of streams have had census work done on them. They come out with man-days of use per year or during a particular time of the year.

Presentation by

JOHN ROSHOLT
Attorney at Law

Mr. Chairman and ladies and gentlemen, it's a real pleasure to be here. A couple years ago Cal Warnick invited me to attend when we were in the throes of the Malad Canyon case. We had a delightful evening at that time and I've really looked forward to this ever since Jack called me. My credentials, as such, were forced upon me. I went to work for a law firm in southern Idaho in the hopes that, like every lawyer, I could become a trial lawyer and they recognized immediately I didn't have any ability. They were looking for somebody to cover for one of the senior partners and carry his briefcase around and that became my lot. From there the senior partner got older and eventually I had some responsibility. If I've made any right decisions to this time I'd like to say that you can blame my clients because I do exactly what they tell me. It's unusual, or it's a rare instance let's say, that I have an opportunity to speak in other than a vicarious situation. I've testified at a lot of public hearings and I take some public positions that I must take. Most of the time that position is a paid position, and as most of you would understand, that is how I make my living. Some people call it prosoliting. Doug (Professor Doug Grant) teaches other folks to do it and, by gosh, you're putting them out up there at a very rapid rate.

On a subject as nebulous as minimum stream flows, I'm reminded of a story that might somewhat describe the approach I take in this thing, the "shotgun approach". They tell the story about Thomas Edison when he was right in the throes of the peak of his career, and he was right on the threshold of a major discovery, he thought. He was down in the basement working every night, and each night about eleven o'clock his wife would holler down from upstairs, "Tom, it's time to go to bed." Tom would just keep working and sometimes he'd work all through the night. Every night this goes on for some six months. Finally one night she calls down as she did every night and says, "Tom, it's time to go to bed." He says, "Dear, come down here, see what I've got." She races downstairs and he's sitting there in front of this great big bulb that's all lighted up and he says, "can you hear me, can you hear me?"

That's about how much I know about minimum stream flows, what that story would depict Tom knew about electricity. It really is a shotgun approach. I prepared a written statement. It reflects to a major extent a position that I find myself advocating on behalf of irrigators and people who wish to keep southern Idaho in line with sound economic irrigation development, and to pursue that as their goal. I took that only

because I thought I knew more about that approach to the subject. But I'd like to talk a little bit about some of the things that I think we should reflect on in considering minimum stream flow legislation, as it were, or just to talk about minimum stream flows as a question that we can all question each other and have a good time with. I don't propose to read this statement to you, obviously. Many of you can glean some questions out of it and see my prejudices and whatever else. Just by way of history, I want to paraphrase this thing if I might.

I think before we can even intelligently consider this subject of minimum stream flows, we have to realize that it's something that has become a recent concern, probably as one of the many products of the recent environmental movement. There were those, obviously, who thought about it much earlier than that, but the momentum has come in most recent years.

Originally, the settlers who came to Idaho looked around at that great desert in southern Idaho and said, my gosh, what can we ever do here? Somebody figured out that water would run downhill and they took hoes and whatever equipment they could get their hands on and build canals along the surveyed grade lines and the land that was under the canal they put into irrigated farmland. Our original state constitution and the statutes that have been adopted pursuant to that constitution really encourage the development and the consumptive use of water. People were thinking, I would guess, about a way that they could give a citizen a right that was protectable, an actual property right, that he could use, that he could depend on; and by giving him a right to use the water resources of the state of Idaho (or of the West for that matter) they gave him some incentive. He was then encouraged to go out and to do the things he had to do to cut his parcel out of the world and make his living for his family and go from there.

As it resulted, we had property taxes that came down the road and income taxes that came down the road; so these people not only benefited themselves and their families, they also benefited state government to that extent. That early development gave us a strong economic base. Anybody who has spent much time in the irrigated deserts of southern Idaho realizes that the economy may be 80% dependent upon the irrigation industry. That percentage would include the related industries of cattle and processing and all of the things that maybe are in some way indirectly related to agriculture, but essentially it's that irrigated farmland that grows that crop that makes southern Idaho exist.

This has been the feeling since prior to statehood, and up until the last ten years (when things like the Water Resources Research Institute came into being) that people began giving more thought to alternatives than just putting water in the ditch and using it on the crop. They began to wonder what the

condition of the water might be when it returned to the stream. They began to wonder whether the continued consumptive development might not eliminate the flows in some of the Idaho rivers that we've known.

From that standpoint, it may well be too late in some of the river basins in Idaho and in some of the other western states to establish a minimum stream flow that's meaningful without doing one of two things. One is setting up an absolute monarch who takes water rights from people, and the other is condemning the people's property rights and paying them for it.

We've seen three actions in Idaho's history that would tend to touch the subject we're working on today. The first was in 1925 and 1927, when the legislature sat down and adopted four or five statutes to protect the major lakes of the state of Idaho. They said that we should preserve those lakes for scenic beauty, health, recreation, transportation and commercial purposes. Everybody thought that was super because not one citizen contested that legislature's action. We as Idahoans just naturally assume that these major lakes are part of our heritage. We go to Pend Oreille Lake or Payette Lake and we just assume that they are going to be there forever and that they are for our use. There was some foresight in the legislature in those days in that regard and all seemed to be pretty quiet on the Idaho front until the mid-60's when the California diversion talk came about. From a political standpoint it became the bandwagon to get on. Every politician in Idaho from that time on has campaigned on the theory that "we're going to do everything we can to keep the water that arises or flows through our state within our political boundaries". That's a pretty provincial approach, I have to think, but Idaho's political and geographical boundaries are a result of surveyers getting together with the Indians and the traders and having too much booze. They were supposed to go west and instead they went north and we ended up with this state with probably the greatest dichotomy of economies of any state in the nation.

Idahonian's are different politically. We're different geographically, resource-wise, and religion-wise. Idaho is a very unique state. This is one of the reasons that we find ourselves talking about minimum stream flows today. North Idaho is a forested land with many unique areas, scenic wonders as some would call them. People make their living to a great extent from the tourism business. They love to hunt and fish.

North Idaho needs minimum stream flows and pristine water. You talk to a potato farmer down on a southern Idaho farm and he's never griped about dirty water. In fact, over in Professor Grant's state a lawsuit has been brought against a person who had previously wasted water into a stream which an irrigator used and the user suddenly changed his method of wasting and wasted clean water. The irrigators brought a suit saying

they were being deprived of the nutrients in the water. I don't think there's been a determination on that case yet.

This thing in the 60's (the threats by southern California and the Arizona people to divert water to the arid southwest) brought about the adoption of a constitutional amendment by the people of the state of Idaho and the establishment of the Idaho Water Resource Board. The Board was given a charge at that time to prepare a state water plan and as a part of that charge, the statute directed the Board to conduct their planning in line with the following statutory language: "subject to the primary use of water for beneficial uses now or hereafter prescribed by law, minimum streamflow for aquatic life and minimization of pollution shall be fostered and encouraged, and consideration shall be given to the development of water recreation facilities". So that language is a part of our constitutional water agency's charge. To the extent that they have completed their studies and compiled them in the interim reports, they have given some cognizance to that principal. I think we're going to see an official position in their final plan, on which they hope to receive legislative approval. After the time of approval of that plan the water resources of Idaho will have to be developed in accordance with that plan.

My personal experience with minimum stream flow type problems came because of my representation of farmers and irrigators in the Malad Canyon case, which Professor Grant and I, and Professor Warnick and I have spoken of. I got in an intolerable position but at the bottom of page 2 and the top of page 3 of this paper, I state the three issues that were considered in that lawsuit.

The legislature had designated that the State Parks Department should file applications for permits to preserve certain of the free-flowing Hagerman Springs. For those of you who have never been to Hagerman, in that desert, Hagerman's a real oasis. The water that comes out of those rock outcroppings and flows through the lava down to the river is really a beautiful sight. I think not so beautiful if it weren't for the contrast that exists of looking at that black rock and seeing that beautiful pure water flow out.

From the irrigators' standpoint, the problem was not that the Haberman Springs would be preserved. Most of the irrigators that I represented, at least, lived close and enjoyed that area as a recreational area. The problem that they were concerned about was "what precedents would be set by the implementation of that legislation.

As an interesting sidelight, I think maybe one of your speakers will be Vern Ravenscroft, who was a former representative in the legislature and was the author of H.B. 69. Mr. Ravenscroft has been very strong in resource use and multiple

use concepts. Unfortunately, the Hagerman Springs happened to be in his particular district, and there was a lot of political support for the preservation of the springs, so he found himself on the fencerail (as it were) and he very carefully drafted a bill. He drafted it so that all of the water that was being used from those springs could continue to be used. He would then draw a line across the spring so that all of the water use that occurs from that spring, would be above that line, below which the water was designated for free-flowing purposes. That's just a little bit of political history on this thing.

When I got into the controversy I thought it would probably end up in such a confusing lawsuit that there would be no understandable result. I'm not sure that isn't where we ended up anyway. Hopefully not of our own doing. We tried to frame the issues for the Supreme Court in three simple statements, and we got four complex answers, none of which we really understand. We had two justices' dissent. There were three justices that voted in the majority, one of whom concurred specifically and in my reading of his opinion, I can't really determine whether he voted yes or no other than he is recorded as being with the majority. I think he should have just abstained and it would have been a tie.

The result of that case indicates that the majority of the court thought that some of our archaic procedures in water have maybe been around long enough and should be closely scrutinized. For example, the court held that a state agency can appropriate water for the purposes set out in the statute. We've never contested the right of the State Parks Department to appropriate water for their needs. (The example I give here is a restroom in a state park.) The State has made appropriations and the state water agency's always granted them. Now the question exists as to whether a state agency could, of their own initiative, walk in and make an appropriation for whatever they might determine to be a beneficial use and then at the same time, perfect that beneficial use. People who divert water and look to some of the unappropriated water as growth potential do not believe that a state agency should have that right. I would have to think that the Malad Canyon case, although the court specifically related the result to the statute involved, may eventually lead to that proposition. To the extent that I can analyze the four different opinions in tandem, I'd have to say that they unanimously agreed that beneficial use of water is something that changes with the times and conditions, and what was once a beneficial use of water for one purpose may not now be; but that it may become a beneficial purpose again in the future. You could go with any number of combinations.

I have some other questions on the decision. The court also decided, (maybe not as significant from the standpoint of water law, but maybe more significant from the standpoint of the subject of instream uses and minimum stream flows) that the

designated instream uses were, in fact, beneficial uses. The court did limit the scope, and I'll quote it: they "deem it to be the intent of the Idaho legislature to dispense with any physical diversion requirement in the case of the appropriation directed in Idaho Code 67-4307". I have to look at their opinion from my role in the case and from my involvement from the conservative side. I have to take the position on behalf of my clients, (who essentially lost the case) that the court meant just what they said, and that they didn't mean anything more than what they said. The court eliminated the diversion requirement only as directed in I.C. 67-4307.

From a practical standpoint, the irrigators feel that a general minimum stream flow bill is going to affect all of the public waters of the state of Idaho in some way or another. You're going to end up locked in a conflict. Every attempt at a minimum stream flow bill, and all legislative dictates in that regard, have always included language that totally protects anybody with an existing right whether it's perfected with a license or with a court decree, or whether there's even just a permit pending. Every draft of the bill that I've seen would totally protect such rights. The problem is that the irrigators realized that they acquired their piece of the world by being able to use a water resource, under whatever conditions the state then prescribed; and they have sons and daughters that they'd also like to see in Idaho. If suddenly diversions are threatened to be cut off or limited in certain areas of the state, they're going to oppose it. It's just a matter of political principle. Now some of them are also fishermen, some are boaters, and water skiiers. One of the finest water ski trips I've ever been on was with the guy who'll be number one in line to oppose minimum flow legislation. They're recreationists and they're environmentalists to some extent, and everything else, but it's just a philosophical thing. I don't think all the preaching and all of the studying we could do, at a university or anyplace else, is going to make any difference in that regard. I think it's just one of those things we're going to have to assume.

So how can we establish minimum flows to the extent we need to do it for Idaho on a reasoned basis, realizing that we've got this dichotomy of political positions? Well, there are some ways, and I went through and attempted to outline all the positions that the irrigators have taken in the past to oppose approaches toward instream uses which would, in fact, foreclose future development or future consumptive development.

After you analyze all of the past positions, you can only conclude that irrigators are just philosophically opposed, and it doesn't matter whether their personal domain is invaded or not. It's just one of those things. You can go down the line and every time there's been something brought about that would cast dispersions on the ability to divert and beneficially apply water in the Upper Snake River basin or the working rivers

of Idaho, the irrigators have been up front. They've screamed about it. They did participate at one time in a compact negotiation for the Snake River as a part of the Columbia system, and Idaho was, in fact, the only state to ratify that. Now they've repealed it, I believe.

But during the Hells Canyon conflict days when the public-private power fight was going on, the irrigators didn't really give much of a rip about who got to build a dam. What they cared about was whether they were going to have the right to develop upstream. So when the Idaho Power Company was granted the right to build in Hells Canyon, they looked very carefully at their licenses and one of the most artfully drafted articles in that F.P.C. license contains the right to deplete the whole river upstream from Hells Canyon. So the irrigators win again.

Senator Packwood came along a couple years ago with a proposal for a national river, which is a new concept out here. I understand there are a couple rivers in America designated as national rivers and Professor Grant can probably tell you a little more about the legal concept of a national river. I understand it would be similar to a federal reservation that they just clamp on, and say "this is a natural river in its free flowing state and it will continue to be as it is now". It is like putting a primitive area designation on a portion of the river, from a legal standpoint. But southern Idaho rose up in absolute furor at Packwood. His bill would have meant that the current flows, or the average annual flows through Hells Canyon would have to be forever maintained. That would mean that we couldn't take any more water out of that stream.

The state of Washington, just two years ago, proposed some minimum stream flows for that reach of the Snake River right across the Idaho border west of Clarkston. There was a delegation of some 25 Idaho people who went to the Department of Ecology hearing in Walla Walla and opposed that position, knowing full well that any minimum stream flow attempt by the state of Washington would involve, eventually, some kind of an agreement to supply the water from Idaho.

I think I'm a realist. There are those who are super states' rights people and contend that eventually the states have to obtain the ultimate jurisdiction over the management of all water resources. I don't think the federal government is ever going to present a bill that in any way will erode their jurisdiction over water resources in America. So as a result, you'll find water administrators and state attorney generals and other people who are in a position representing states, have to walk on eggs in some instances.

For example, in the Sawtooth NRA the Forest Service just went ahead and drilled several wells for domestic purposes; our state water rights administrators were very upset that they hadn't obtained permits under the mandatory permit system. The

attorney general was contemplating a suit. I sent him a copy of a Nevada case that was identical in all the facts and just blew out the state water rights administrator. Idaho is now looking carefully at the Forest Service action.

Eventually one of the areas that is going to bring about some type of minimum stream flow result is the supremacy of the federals over water within state boundaries. We see it happening more or less in reverse by application of the reservation doctrine. To my knowledge the courts have uniformly held that a federal reservation has the right to the water that they need for whatever purpose they might need it which is consistent with the purpose of the reservation. The priority date is as of the date of the establishment of the reservation. What will happen in the future? I don't know whether we can go much further afield than pupfish, but for an Indian reservation generally the courts have applied the agricultural standard. In other words, three and a half acre feet in Utah is that standard they're using to quantify water entitlements for Indian reservations.

An Indian reservation that was set up in 1880 has a water right to develop all of their irrigable acres from the free flowing streams near the reservation to the extent of three and a half acre feet per irrigable acre, whether or not they've developed any acres. Assuming all of Utah's state-established water rights post date that reservation date and the Indians did develop, everybody who supposedly has a vested water under state law would have nothing. I think we've been trying to avoid that ultimate confrontation with the federals. I just don't think there's a federal district judge in the world that's going to determine that state water rights are superior or that federals must comply with state water rights.

There are some ways, from a practical standpoint, to obtain some minimum stream flows, even in the working rivers where, like I indicated before, it's really too late to do much with the unappropriated flows. The Snake River gets stopped three times during the irrigation season east of Twin Falls, the last of which is the major diversion which supplies the Magic Valley at Milner Dam where I live. But no water goes by that dam in an average water year, probably beginning with the last day of any flood that might have come off until about September 1. Then the water surveys would be able to predict that we are going to have a good water year the following year, and we can then release some water that's in reservoirs to adhere to flood parameters.

There are also some funny things happening on the Snake River Plain. People have determined, because of labor problems, that they might do better by pumping groundwater and going to the circle sprinklers or solid sets or whatever. So a lot of people are getting permits from the state to tap the Snake Plain Aquifer and are perfecting rights and they've got a duplicating

surface water right. Some blocks of that water are for sale. We watched the Fish and Game sit by and argue with private landowners about access to state streams for many years. Finally, they started buying access and they started buying critical ranches that were in unique areas. They got out in the market and they competed with the farmer, and they won a lot of those confrontations and they bought some beautiful property.

I would think, just as the farmer has bought and paid for his water, to the extent that you can say he's paid for it. He's still really using a state resource at no charge, but he has to spend a substantial amount of money to build diversion works, to improve his farm, to use the water. I would think to the extent that water's available, people who are interested, whether it be the State Parks Department or the Fish and Game, should go to the legislature and say, "look, we need to appropriate some money to acquire this right". Acquire the right in the reservoir, release it when they want to.

The irrigator isn't all bad, there are several stretches of the working rivers of Idaho that, in the summertime, would be closer to dry than they are now, except for the augmented flows from reservoirs. I think the Snake is a good example of that. The minimum stream flow in late July going into American Falls would probably be 5000, and if there were no dam there, down at Milner there'd still be 5000, because there's very little augmentation between there and Milner. However, with releases from American Falls Reservoir, there's some 12-13000 cfs in that stretch, so essentially there's a 70-mile stretch where the release of water during the summertime by irrigators benefits instream uses.

The other fact, I think, that has to be contended with is that most of these reservoirs that have been constructed on working rivers are in fact federal reservoirs. They're in federal ownership. The naked legal title to the water rights is in the federal government. The water user signs a contract to pay back a given amount of water so that he has a right to store water if it's available in a certain amount of space in a reservoir. All of those people are on 40 or 50 year contracts. When it comes right down to it, if we assume there were no minimum stream flows, or there was a minimum stream flow bill enacted, and there was no stream flow of any sort, let's say, in July of one year, it's a practical fact that the water from those reservoirs is not going to be obtained to keep some fish happier than he might have otherwise been. Irrigators have contracts with the United States of America to use that water. If you get the state mixed up in between where they've adopted a minimum stream flow bill, which in any way would conflict with those contract rights, then you just take one step closer to this federal-state confrontation and eventual federal supremacy, as I view it.

So purchase for working rivers may be the only thing that is viable in places where streams are over-appropriated.

Q. Do you think the state can do that, legally?

A. Can buy water? Why not?

Q. Well, in terms of planning for the future?

A. I think they've got to adopt a plan. But I think the whole problem might have been solved by the drafters of the constitution had they determined that beneficial use inferred some economic beneficial use, maybe.

Just let me make a couple closing remarks, then I'd like to get into some questions.

Idaho is a beautiful place and we all love it dearly, but from a practical standpoint, there is some of our land that really doesn't do much but foster sagebrush. When we're looking at 36% of our land in state ownership, and I think another 2% of the state is in tax exempt bodies, such as churches and others. Our tax base isn't really desirable from the standpoint of maintaining a reasonable economic growth. Once you give up on growth, you give up on economics.

I lived in northern Idaho for 26 years. My parents lived in the Sandpoint area and the St. Maries area. I grew up in Lewiston and worked in the Clearwater Forest. A minimum stream flow law probably makes about as much sense as a maximum stream flow law. The good Lord is going to put down that river what he wants to put down it anyway, and whatever is there is there. If the river doesn't have a reservoir on it, there's no way you can really control it. Maybe we should have had a law that says "Thou shalt not flood Lewiston every year".(before the port district).

But if the people of Idaho can resolve their differences by approaching these things on a basin basis or a river basis, I don't think anybody in southern Idaho would have any objection to the Moyie and the Kootenai and the Clark Fork and Clearwater all being designated for minimum stream flows forever. What these people are concerned about is their way of life and that river that runs past their place is their livelihood and they don't want to foreclose that option or that alternative for their children. So I think there are some ways to accomplish what minimum stream flows or a general piece of legislation in that regard may attempt to accomplish.

I might say one other thing, I communicate and talk to and like very much Scott Reed, who has been an advocate of minimum stream flows and similar ideas; always, unfortunately, on opposite sides of the fence. We communicated and agreed that

probably HB 137 was, from a legal standpoint, about as fine a bill as could be drafted. There are some things that people might put in it to make it more viable and more flexible. But when it comes right down to it, it isn't going to matter if that bill is perfect, when you go to see the consumptive water users in southern Idaho. They don't like it and that's going to be the problem.

It may turn out that the Environmental Protection Agency comes around and, through the back door, does a lot to promote a minimum stream flow in working river basins with this NPDES discharge program that's going on. The criteria that's established may be so difficult to comply with that people are going to divert less water. As an end result there would be a minimum stream flow in some rivers during some times of the low flow. Essentially it's a political problem, a philosophical problem, and reason is going to have a tough time overcoming it.

I'd be real happy to try and answer any questions in regard to this subject that I might, or anything water related because I don't get up here but about once every four years and I enjoy seeing people that are interested in this field. I think it has a tremendous future. I happened into it by mistake as a briefcase carrier, but I really think the potential of water resources in the west is great. You meet a lot of fine people, like these two gentlemen here, and I even got to Professor Grant on a golf course one day to find out how much he studies in his spare time. I really think it's unlimited and the problems are not going to get easier, they're going to get tougher.

We may all be pulling the oar the same direction some day, rather than going our own diverse ways based on which side of an abstract state political boundary we live on, rather than pulling our oars as one common people in the United States. I've been to Arizona and I've been to Colorado and New Mexico and southern California and those people really aren't bad folk. They're Americans and if they run out of water and it's to drink and it's a question of them living or us putting too much water on our beet crop, maybe we ought to consider that. Right now that's heresy in southern Idaho.

Are there any questions that I could answer?

DISCUSSION QUESTIONS AND ANSWERS

Q. Whatever happened to that bill that Governor Andrus vetoed about two years ago that dealt with stream alterations?

A. I think what he vetoed was the bill that would have stripped the stream alteration bill of its teeth. He was on the right side of that veto. We have a good stream alteration

law as I see it and it requires permits, and the permits are tough to come by. He vetoed the bill that was designed by Representative Ellsworth and some of his cohorts to gut the law, really; to take the teeth out of it. I think he was well advised on that veto.

Q. Was there any more opposition after he vetoed it?

A. I'm not saying that, I don't know. Behind every tree there lurks . . . There is an interesting situation in the Sun Valley area where, under that stream alteration law and the high water mark legislation that's developed. I don't know how many of you have ever been to Sun Valley, but north of Sun Valley some beautiful homes have been built down on the Wood River. Some of the homes even have patios that go out into the stream and the river goes under. These people have never thought about flood plains or anything like that. They paid for it the first year. It's been determined now in a pending stream alteration suit that's been brought up there, that the stream channel was changed as a result of a manmade alteration. Consequently many nice, large homes ($100-200,000 places for easterners) are built on state land. The title company is a little embarassed up there because they've written title policies giving title to all this land which is probably in state ownership. It's going to be real interesting if the state decides to assert their right to the streambed and comes through and puts the channel back where it was and runs the river through a guy's front room.

There are all kinds of things that can develop from these little, seemingly inoccuous laws, that are considered by the legislature. I think the stream alteration law has stood in good stead and the state has been taking some legal action in regard to some violations. In fact, I think it has been very embarassing for the Governor. There is one democrat in Madison County and he happened to be the guy that violated the stream protection laws.

Any other questions?

Q. I am under the impression that it's hard legally for a state or governmental agency to buy rights to land or water for some future use.

A. I don't think it would be a future use. It's a "right-now" use. If you designate minimum stream flow and instream uses for public purposes, (which essentially you could construe the Malad Canyon case to say), then I think the expenditure would be valid right now. I think your point is well taken, you don't go around condemning the right of way for a road through a guy's farm that you're not going to use for 75 years because he beats you on a question of necessity.

Q. In the same light, there are the waters for present consumptive use and those waters that aren't conscripted at the present time. If we're talking about who is going to have control over those waters that aren't conscripted at the present time, can the state in fact buy those, is that the way they're going to have to take control of them or not?

A. No, I'm talking about the water rights that are now used for irrigation purposes. The farmer has an actual perfected water right, or a group of farmers. I know of one instance right now where there is about 100 cfs available for sale. It's a beautiful right, it's an 1895 right, it's ahead of anything in the Magic Valley. It's available from a group of people that have converted to wells. They want what seems to be a God awful price for it. But when you look at it from the standpoint of 'what's water worth now and what's it going to be worth in the future' the price is very reasonable.

I represent some trout propagators and in that trade it's considered that the right to the use of a cubic foot of water for trout propagation is worth $15,000. That's one foot of water worth for the purposes of, assuming a beneficial use application of 5/8 of an inch will irrigate 80 acres, what's 80 acres worth with a water right and without? Right now the eighty acres in our valley's going for 2 grand an acre irrigated, an acre not irrigated is going for $400. So you put that in terms of dollars of investment and that water is worth talking about, it's worth protecting.

On that eighty acres that farmer may be raising 30 bags of beans at 50 dollars or he may be raising 300 bags of potatoes at, unfortunately, 3 and a half, or some pretty good yield sugar. If you're talking about the quid pro quo of why people take positions, it's because everybody is concerned about their own personal well-being. There are some people that are really truly benevolent, objective people who go around and their general intention is to really do good for others. But there aren't a lot of those folks. The longer I'm out of law school, excuse me Professor Grant, there's a quid pro quo for everything. There's a dollar sign on everything.

Q. I remember the first time I saw those homes along the river outside Sun Valley, I thought, that's ridiculous that someone can block off a river from the public. What legal right does the public have? I imagine you can't cross their property to reach the river.

A. That's right, you can use a public right of way. The Silver Creek case is probably the closest thing on that point. I'm not an expert on the Silver Creek case. I'll let a professor and lawyer here explain it, but as I understand the

result, they held that in Silver Creek the land underneath the stream was deeded and the defendants tried to use the bootstrap doctrine and say by reason of the deeds, (it was listed on some deeds) that they owned the bed of the stream and as a result also owned the water. I think the court said that the state by reason of this being a water course, owned to the high water mark within that stream. How they get to the stream is the tough part. But the state obviously has the legal authority to condemn through any private owner for that purpose.

Q. Is that also true in terms of lakes?

A. I would say that for all lakes that exceed five acres in size, yes. If you've got private water -- the code does say that springs that arise on your property and don't run off in a defined channel and lakes of under five acres in size are private waters -- I don't think probably somebody could condemn to your private water. But for anything other than that, it would be within the designation of public waters, and yes you could condemn.

One interesting question which relates to minimum stream flow is the priority among constitutionally designated uses. Of course, domestic is our most important need, that was first; agricultural, second in agricultural areas; mining second in mining areas. There are only five such designated beneficial uses. I think that power was mentioned in the constitution, too. Domestic, agriculture, mining, manufacturing and power if I've got them right.

The court in Malad Canyon has said what everybody has known all the time is that there are other beneficial uses for water. But once you establish this public use as it were, that's not a type of public use in the context of the existing constitution. In other words, any use of water by a private citizen if it's done in accordance with the state law becomes a public use. It says so in the code and the constitution. Actually, what is a private use, (you privately using the water for the purpose that the state permits) is designated a public use.

Now let's go to a different classification of public uses; the public uses that the public really uses, rather than the private citizen; that all of us can go enjoy. Those are the instream uses, (the obvious public uses) and there may be others. Where would that fall in the priority among uses? In other words, is domestic first and then ahead of agriculture comes that priority of public uses? I would think logically that's where it has to fall. All of the citizens enjoy that use and if it is so designated, that would give the state the right to condemn an inferior public use; which would be in fact the private citizen using consumptively for the so-called public purpose, not the general public using it for the public purpose.

This creates a Pandora's box of questions from the standpoint of property rights as I see it. If the state were to have the right to say, O.K., we want your water for minimum stream flow purposes and we are going to condemn that water and pay you for it, that's a new concept. All the minimum stream flow discussions to date have assumed, and the code charges, the Water Board at least, with assuming that the vested right would be protected.

Q. You said that some of the farmers were going to well irrigation. Well, I was just wondering how does their water right to the groundwater compare to the surface water?

A. Well, they obviously give up a priority date. In other words, the right to the surface water is 1895 or 1890 because they have diverted it since that date. The well permits they get out of the Snake Plain Aquifer are 1975 if they did it this year, so they give away that priority. What they're gaining, though is the right to go down 60 feet; they're tapping clear water; they're pumping it out and it's not plugging their sprinkler systems. They're going to sprinkler systems and it's just easier to run a sprinkler system if you don't have to build ponds and this kind of thing.

Q. This is probably a long way in the future, but when the groundwater starts affecting the surface water rights, will the surface water right have the priority?

A. That's a good question. There are lots of states that have this problem right now, I think Nebraska is one of them, where they're now trying to adopt a water code that takes into account the interrelationships of ground and surface water. There are some situations where, as I understand it, the surface water appropriation is really a groundwater appropriation or vice versa. That'll happen in the Snake Plain Aquifer the day that the people drilling the wells begin to affect the surface flow rights to an extent that it's noticeable and provable, and it'll be stopped. All I'm looking for is the proof, and I hope some of you guys come out of here good enough scientists to help prove it.

Q. This sort of ties in with what you were just talking about. You said that you considered economics without growth as being bad. How can you apply something like that to minimum flow which has got a protected finite resource? How can you keep growing when you're dealing with finite resources like land and water? How do you reconcile the philosophy?

A. Well, it's just like the guy told me about the Congressional Record. Nobody ever said what goes in the Congressional Record has to be true. Nobody ever said the irrigators'

position has to be logical. That just happens to be their position.

Q. What you just said right now was you hope that someone would stop that.

A. Well, what's going to happen is, here I am and I've got my farm and my water right. Now I'm all for the development of another farm and water right with unappropriated water as long as it doesn't bother me. But if it bothers me, look out, because I like to litigate.

Q. You see the whole idea of something has to keep growing, conflicts with the finite resource idea.

A. As to the philosophy of finite resources, that's right. That's why I would think in the Upper Snake Basin at least, there would probably be a possibility right now to acquire 150,000 acre feet of water in several reservoirs by purchasing it from people who have a contract right to it. 150,000 acre feet would run 1000 cubic feet for 75 days. That would take you through the low flow period. Granted, it's reservoir water and it may not be as pure and pristine and beautiful as when God put it there, but it will do the job. It would protect the instream uses and the fish would be happy and the fishermen would be happy and the boaters would be happy and it would make for a better operation of the river for all purposes. The acquisition of 300,000 acre feet of water is not an impossible shot. That could be accomplished in, I could put it together in six months if I had the money to pay the bill after I got it negotiated. There are other river basins where, obviously, there is no problem. The general stream flow or minimum stream flow law or designation of the water for instream flow purposes is just going to go lickety-split, because nobody's going to care.

Q. Any other other questions? I'm appreciative of John's different presentation than we've had before. I'd like to ask him a few questions or get into a question. I liked his reference back in his text where he said something to the effect that this particular court case was decided on the case of that particular bill as such. Other people may be applying for a water right to acquire it for public good in other streams and may not be acknowledged. I wondered, and you kind of alluded to this . . . you see, up in north Idaho, yes, we can do that.

A. Unfortunately they don't permit legislation that says "north" or "south" of the Salmon River, as it is special legislation. Whatever you adopt such legislation, unless it be to a particular stream, you have to make it generally applicable. If I get your question, what you're saying is within the parameters of what this case determined, can an additional appropriation be made by a state agency without legislative authority.

Q. Yes, I'm curious.

A. Well, I think probably it would be of help, in my candid opinion. Probably it would be opposed, but it probably would be upheld. The question that most concerns at least the lawyers for irrigators, is the question of taking the appropriation doctrine and eroding it in some way by giving the right to appropriate for riparian or instream purposes or free flowing purposes to the private land owner. Then you've got the real dichotomy, I don't know what your water right system is then. If I can buy a cabin and, at the time I buy the cabin there are 50 cubic feet in that stream as it goes by my place in the low flow period and I file an application for scenic, aesthetic, and recreational purposes, and I perfect a right to have that 50 feet go by my place and the court says that's a beneficial use, I think that's the logical extention of the Malad Canyon case. You go from a situation where the state agency's appropriating for these so-called public purposes, which are really for the public to the private landowners appropriating what he calls a public use, really for his own private use.

Q. Along that line, I once asked Mr. Steve Allred about that same deal. He said, what if I went out here to the Potlatch River and appropriated water for instream use? Do you think I'd be upheld?

A. I think I come out differently, because in Malad the court discussed the need for diversion and said there is no constitutional requirement for diversion. But there is a general statute. When you apply for a permit you've got to describe your diversion and the only reason they didn't need a diversion in the Malad Canyon case was there was a special statute exempting the thing from the general statute. So I would say, not unless that general statute is changed could you go out and make an instream appropriation.

Q. That was his (Allred's) interpretation, and I take it from you that what you're aiming at is that there's a private use that you make of it instead of really a public use.

A. That's what I'm saying. I mean, I have three children and I was born in Idaho and will probably die in Idaho. I enjoy the water resources of our state, but I don't think that I ought to have the right to do something to exclude the rest of the public from the use of the water resource. This is the dichotomy the gentleman at left pointed out. Here is an irrigator who makes his total living from a molecule of water that the state owns. But he makes it in a way that complies with the rules that the state sets up, and the state has said in its constitution and statutes that this is good. When they get around to saying these other things are good, and they set up the rules for them, fine. But it's an

evolutionary process and, from the standpoint of the consumptive irrigation users of south Idaho, they may get it but they don't like it. I think that's my message today.

Q. Along that line, a very interesting thing is this idea of the state being able to apply for a water right. The interesting thing that I questioned yesterday, as I was in the Idaho Department of Water Resources office, was, what's happened to this water right that the Caribou Land Company sold to Utah Power and Light? Are you aware of this situation, John?

A. Caribou Land sold to Utah, was this on . . .?

Q. On the Bear River. The Caribou Land Company had a water right to, I think it's a storage water right, and they had a right to so many, let's say, just off hand, 50,000 acre/feet of water. This is a little different than the instream problem. They have now sold it to the Utah Power and Light. So Utah Power and Light anticipates that they may want to use that water for a different purpose than the Caribou Land Company acquired it for. Caribou Land Company was planning some kind of water development. They've now decided that it wasn't too good an idea. It's interesting that apparently the Idaho Department of Water Resources has taken that right over from the Utah Power and Light Company. I don't know whether you're aware of this or not, Professor Grant, but I'm kind of skeptical. The instream use might be for power production in the future, that is, they might run it through some turbines but probably what Utah Power and Light is looking at is a consumptive use. They're probably looking at using that water for cooling purposes in a new steam power plant. But they're not in a position to use it now and they may lose the right because I think what happened recently is that date of perfecting that right is fast coming to a close so they went to the Department of Water Resources and asked them to preserve the right. My understanding is that the state is taking this up. I want to follow this up because it's a very touchy point.

A. They (IDWR) are very specific on the time in which you have to apply water to beneficial use and if you haven't done that, presumably it's forfeited and it goes back subject to appropriation to the next senior appropriator. There's a beautiful article written by one of your (Grant's) contemporaries over in Colorado, Sandy White, on changing beneficial uses within Colorado. There is one suit presently pending that I know of where the Environmental Defense Council is contesting the right of the Bureau of Reclamation to make water available from their reservoirs for municipal and industrial and other purposes. We're in a period of changing beneficial uses all the time. I think this is an area we're really going to have to look at and

you're going to have to, in my business, be very careful about when you give a guy an opinion letter that says, yes, he's got a right and he can transfer it to X and X is going to be able to use it, because you may be converting a non-consumptive to a consumptive use. Or you're talking about an irrigation right that's for six months and the guy wants a twelve month use. All these things are factors.

Q. In this case, my understanding was that it was a storage right. It could have been storage water that would have been stored in Bear Lake.

A. But they never built a reservoir.

Q. But I think they were intending to develop other storage on Bear River and use it for irrigation. That kind of intrigued me, have you ever heard of it at all?

A. I've never heard of that case.

Q. I mean that particular instance, I don't think it's a case yet. I can see what John Rosholt has referred to today is this interest of the farmer saying he doesn't want to give up anything. In this particular case, if I was a farmer down there and had any interest in that water and wanted to develop that, I'd say, hey, you are reserving something that's mine, that I can have the right to acquire.

All of our talking today has centered around something a little different than some of the earlier discussions where you can't deny the instream has so much to do with the diversions that are going to be made. You're just always in conflict.

A. I'm sorry I've been what I like to call practical, maybe it's blunt, but that's the approach that my people take. When the client comes in to see you, you've got to be able to at least tell him what you think; so I do. Your ability to make it stick determines whether he comes back again.

Q. What's the status of the right that Idaho Power Company has to insure that they have water for the dams on the Snake River? Do the irrigators have prior right down there?

A. The interesting thing is that obviously a minimum stream flow law benefits a hydroelectric power company. To my knowledge, power, (to the extent of the use in Hells Canyon for certain, and probably in connection with most of the other power rights they (IPC) hold) is subordinate to the use for agriculture.

Q. If there isn't enough water to go through so they can generate power, then where do the irrigators get the power to pump?

A. That's the real crisis. You go to Wyoming and you build steam plants.

Q. But you raise the cost of pumping by double, so many irrigators are unable to make a go of it?

A. That's the dichotomy the power company finds themself in. They have always promoted irrigation development, and have now promoted it to such an extent that they can't get a pump hooked up unless you're on a three-year waiting list. There just isn't any power to supply it. At the same time, if they get the pump hooked up, the guy takes more water out of the stream and they generate less electricity. It's really a complex question.

Presentation by

J. VARD CHATBURN
Idaho State Representative
26th District

Since about 45 years ago when I popped the question to my wife and she said yes, I've been a better listener than I have a talker. I think of that now when I face this group. I think of an old, old story, and it is an old one, of the young boy who was sitting beside a stream when a traveler came by on horseback and that shows you how old it was. He asked the boy if he could cross the stream and the boy said "yes, you can go across here". The traveler rode off into the stream and the horse went under and so did the man. They came up floundering and finally got to the other side. He hollered back to the boy and he said "I thought you said I could get across here", and the boy said "yes, I did, I can't understand it. It only comes up to here on grandpa's ducks".

The guy didn't know what he was getting into and I'm in that same situation. I'd perhaps have had second thoughts but I'm glad I have the opportunity to be here and it's good to see Mrs. Dobler again. I had the pleasure of working with her on the Resources and Conservation committee. She's a very able representative of this area, or any area as far as that's concerned, on that committee.

The legislature over the years has been concerned with minimum stream flows. They have been concerned becuase of public concern and the fact that there have been several different attempts to establish minimum stream flows in the state of Idaho through legislation. So the legislature decided it was time that it made a study of minimum stream flow necessities within the state of Idaho. The committee which is provided for reports back to the legislature its findings. On that committee are: Senator Marsden Williams from District 29 in Idaho Falls; Senator Wilson Stein from District 22 in Glenns Ferry; Senator John Peavy from District 21, he headquarters at Muldoon and lives in Rupert part of the time; Senator Art Manley from District 2 who lives in Coeur d' Alene; Senator Kermit Kiebert who lives at Hope, Idaho is from District 1.

The representatives who sit on the committee are Representative Cliff Scoresby from Iona, just a short distance east of Idaho Falls from District 31; from District 32 is Russell Westerberg from Soda Springs; from District 19 is Gene Winchester from Kuna. Kuna is out of Boise a short distance. We have Rep. Dan Emery from District 14, who lives in Boise, and I have the privilege of chairing the committee and, as Professor Warnick stated, I live

at Albion in southern Idaho, 30 miles from the Utah border and represent District 26.

I take the time to run through the committee membership so that you'll get a visual picture of the areas from which they come and how widely they are dispersed throughout the state. That is a good thing because we have instances sometimes when the right hand doesn't know what the left hand is doing. We could say that north Idaho doesn't know what south Idaho's doing and vice versa. Many times the people who are from the south have no knowledge whatsoever of the north until they're elected to the legislature. Then the North Idaho Chamber of Commerce hosts them, brings them here and sells them north Idaho. We have people from north Idaho who, of course, come down to south Idaho sessions, when we take our turn at the same procedure, and we work just as diligently as our friends from the north.

The committee, at the first meeting, decided to comply with the directions of the legislature that we would have to hold meetings inthe various parts of the state as we were directed, so we set up an agenda for the meetings and picked out the places we were going to have those meetings. We decided to hold the first one in Lewiston.

The committee thought, also, that it would be a good idea if they saw firsthand the Hells Canyon of the Snake River that we'd had so many complaints about. So they did on their own, go up the Snake some 80 miles to above Pittsburgh Landing and observe firsthand the river on that particular day and then came back and had their meeting in Lewiston.

The next day we went to Coeur d'Alene and we held a meeting. Following the Coeur d'Alene meeting, we met in Burley, then in Ketchum, Payette and Boise. Following the Boise meeting we met in Preston, Idaho Falls and Salmon.

We held our meetings in the north, through the central, the extreme southeastern and eastern parts of the state. I think we covered the area extremely well. We had good representation and much interest was exhibited at all the meetings.

As you might expect, Lewiston somewhat favored minimum stream flow. As we went across the state, occupations of those testifying usually indicated the nature of the testimony. If they were people who had time to recreate, they were the people who by and large espoused the recreation philosophy and were absolutely for minimum stream flow.

When we got down in the agricultural areas we found out that those folks, while they wern't adverse to minimum stream flows, were looking at the bread and butter side of it and by and large they opposed legislation requiring minimum stream flows

in the rivers of the state of Idaho. We were in the area where irrigation is the life blood of the country and we received that kind of testimony.

I quote the governor here, he says:

> We in Idaho are fortunate to have agriculture as our number one industry. Agriculture is an industry that preserves and protects our land and air for future generations. It is an industry that makes us use our winter snows to make semi-arid land highly productive. It is an industry that, through good stewardship, uses the same basic resource year after year, without consuming that resource,

that resource, of course, being the land.

However, agriculture does consume one resource. Each year it is replaced providing mother nature is willing, and we get the replacement of that very valuable resource for southern Idaho. In southern Idaho we have some four million acres that are irrigated. We have another 8 million acres that can be developed at such time as economic conditions will warrant. Putting land under irrigation in southern Idaho began in about 1866. The ranch on which I live and was raised has a water right with a March 4, 1876 date. However, development was slow until about 1902 when the Carey Act and the Reclamation Act were passed. By 1920, about 2,150,000 acres were irrigated from natural flow, there being only two storage dams of any consequence; Arrowrock, that stored some 286,680 acre-feet of water and Jackson that stored some 847,000 acre-feet of water.

Need for more storage soon became apparent with the development of the land and the dry years of 1915-1919, 1920 and 1924, when due to water shortage, crops were lost and very vividly do I remember that situation. We didn't think it would ever happen.

Then in 1927 the American Falls Dam, which is our largest storage dam in the state, was completed. That dam stores 1,170,000 acre-feet of water. The Deadwood Dam near Loman stores 161,900 acre-feet of water and that came on board in 1930. In 1938 Island Park Dam was built which impounds 127,265 acre-feet of water. In 1945 Anderson Ranch Dam impounded 464,200 acre-feet and in 1947 Cascade came in with 700,000 acre-feet. Lucky Peak in the 1950's, and I don't know just exactly when, was 280,000 acre-feet. In 1956 Palisades came in with 1,201,000 and then Brownley came on the line in 1958 at 1,000,000 acre-feet. Since that we've had two other dams on Hells Canyon. Their storage, of course, is entirely for electricity.

There have been many other small dams built, and they bring the capacity of the storage in the state of Idaho to some 9,680,793 acre feet.

The U.S. Geological Survey branch of the Department of Interior and the Idaho Power studies have determined that long term depletion of stream flow is about 2 acre-feet per acre of irrigated land. On the average, the net depletion and consumption use equals about 43.7 percent of the long term yield of the runoff of the Snake River. That figures out at about 1.7 acre-feet per acre of irrigated land.

There's a difference, of course, between depletion and consumption and the amount of water that's used for irrigation diversion. The amount of water that's taken out of the streams for irrigation is a larger quantity than is actually consumed or depleted. Some of it returns to the stream. In some areas, the amount of water that is diverted is 1.5 acre feet per acre and in other areas it runs as high as 10 or 12 acre feet per acre. If any of you are from the Idaho Falls area up in that neck of the woods you have witnessed such diversions of water, and you know that to be the case.

During the 13 year period between 1930 and 1942, there was virtually no spill of water past the Milner Diversion Dam. That dam takes the water out for the North Side Canal to the Jerome, Gooding, Wendell area; and the South Side to the Twin Falls, Buhl, Filer area; and there are flumes that take water out to the Milner area.

This was astounding to the members of the committee who were from north Idaho. They saw the Snake River in all its force at Burley. Just seven miles west of Burley we took them down to the Milner Diversion and we went across the bridge below the Milner Diversion and it was essentially dry. One of the fellows from the canal company from Jerome said, when he presented his testimony in Burley, "we'd have every drop out of the river at Milner if we could make our dams tight enough to hold it." They did have 20 second feet of water going through that day. Now a second foot is about 50 miners inches, if you're acquainted with inches instead of second feet. So 20 times 50 would be only a thousand inches of water. It depends on what size ditch you have it in whether that's a lot of water or whether it isn't very much.

From 1971-74, at least 100,000 acres of new land below Milner have been irrigated by means of pumps. The water comes largely from springs in the Hagerman Valley. That was another thing that was very interesting to the members of the committee was the recharge of the river and the volume that they observed farther down the river. The Idaho Power people say the development of another 390,000 acres of land will virtually dry the river up at Murphy. This chart represents the river stream flows of the state of Idaho. The shaded areas on the river channels indicate the amount of water that the river discharges. You can see very easily the mighty Snake here, as she winds through all of southern Idaho

and comes on up and joins the Columbia just down from Lewiston.

If we developed another 390,000 acres, and the land is there to develop, we have 8 million acres of it that could be developed, Idaho Power says we will essentially dry the river up at Murphy.

That brings up the problem then, you have the acres we need to develop if possible, from my point of view and from a great many people in the state of Idaho, and those figures I'll quote to you in a few minutes. We need to create upstream storage. The Snake River has a good deal of storage now on it, but we have 46 or 47 sites yet that could be developed for upstream storage. Whether and when those sites will be developed will be a matter of conjecture, but they will be developed someday. When those sites are developed and we're able to hold the water back on the Snake River, then we can develop those other 8 million acres or parts of them, provided that we change our method of application of the water to the irrigated lands.

That is catching on rapidly down in southern Idaho and, of course, in other areas of Idaho. I've been up on the Rathdrum Prairie and seen the sprinkler systems that have been installed up there in recent years. But that isn't a drop in the bucket compared to what's being done in southern Idaho in the way of changing the irrigation procedures.

Through a change of irrigation procedure they can irrigate at least twice as many acres with the same amount of water. In my personal experience and in my particular area, I can irrigate three times as many acres through sprinklers as I can through the open stream.

The Water Resource Board commissioned a study of public opinions. That study was completed and I'd like to quote a few of those figures in relation to what I've said here previously and some of the comments that have been made. The report states, "more that 58% of the residents of Idaho maintain a preserve sense with regard to the state's rivers and streams. This represents a substantial increase over a year ago when only 48½% were of that opinion." Interestingly, even smaller numbers are advocating a natural position and 17.7%, compared with 25.1% a year ago and 21% in 1972. Regionally, the Clearwater and Salmon well exceed the statewide average favoring preserve with Clearwater spiraling to 64%. The Upper Snake, on the other hand, indicated the strongest support, yet still substantially weak, for development.

A direct relationship between preserve and new residents of the state was noted. There were more of the new residents that wanted preservation than of those who have lived here for a long time. I guess there are many reasons for that, we won't go into that aspect of it today. A strong tendency toward a status quo defined

as balanced growth as it naturally occurs was the result of some of the questions and fully half of the sampled favored growth for Idaho. The presumed populat no-growth concept drew a slight support, 6.6%

Two essential questions dealt with the desirability of the level of agricultural development considered desirable and the priority to be allocated to agricultural development compared with protection in fishing waters. The results indicate that Idahoans would prefer agricultural development be restrained to a slower growth rate than has been permitted in past years. Yet, agricultural development should be given the nod over fish priority. Agriculture was given a higher priority than the protection of fishing waters, or fishing values. More than 45% sided with agriculture, while nearly 24% gave priority to fishing and 30% were undecided. Interestingly, even preservationists failed to support fishing to the degree one might expect. In fact, the strong preservationists are equally divided on whether or not to give agriculture first priority or fishing first priority.

Further support for agricultural priorities comes in the responses to irrigation needs and the total of all responses for the right to water resources if they become limited. The major flows received strong endorsement with 34.3% believing that most major streams and rivers should be covered with flows to produce a maximum number of fish and 35.1% endorsed most major streams and rivers should be covered with flows for fishing to prevent fish kill. So you see there was just a slight difference of 1%. Only 5.9% saw no need for minimum flow. Strong preservationists endorsed minimum flows by 76.2% while those favoring development registered only 43.1%. Even 20% of the strong developers favored most major streans and rivers be covered with flows to produce the maximum number of fish. 70% said they believed it would be sound public policy to provide differing protections to certain streams and lakes than to others.

Now I'll take the stance of a fellow from southern Idaho who has depended upon agriculture for his livelihood and turn to some of the agricultural statistics from the 1975 source book, the latest ones that we have. I will just briefly run down the list of the priorities that Idaho finds itself as far as agriculture is concerned. The first in the 48 states in the production of potatoes. We are fourth in the production of barley. We're third in the production of dry edible beans. We're second in the production of dry edible peas. We're fourth in sugar beets, third in hops, second in alfalfa seed, ninth in red clover seed, third in Miriam Kentucky Bluegrass, thirteenth in apples, fourth in plums and prunes, sixth in sweet cherries, second in mint, sixth in onions, sixth in sweet corn for processing, seventh in green peas for processing, twenty-third in cattle, twenty-second in milk cows, twenty-first in milk production, eighth in sheep and lambs, eighth in mink pelts, and eleventh in honey.

The value of those agricultural products in 1973 was $1,116,400,000. That was just from the marketing of those agricultural products. Then there were other monies; government payments of 31.9 million, non-income monies to agriculture of 58.9 million, and other farm income 13.2 million, a total gross farm income of $1,220,400,000. This is a total net income 479.9 million dollars from agricultural products.

Let's take another look at this chart and see where the water in the Snake originates and where we might put upstream dams for storage. If those upstreams dams were built by those who propose minimum flows and if their money was the thing that went into the dams, irrigators would wholeheartedly support minimum flows.

The north Idaho people, who have an abundance of water, pump water off the land instead of onto it. There's no reason why in specific places, in my opinion, on specifically designated streams and specifically designated places, we should not be able to conscientiously establish a minimum flow for the resource maintenance of that stream. It would seem to me entirely logical and possible under those situations.

DISCUSSION QUESTIONS AND ANSWERS

Q. You seem to have some good information on those potential storage sites on the Upper Snake. If and when those are developed, what will they do to the flow into the reservoirs on the Lower Snake that are already set up? That's going to decrease their water supply, right?

A. No, they wouldn't. We have times when we have to let water go on down the river. Those upper storage sites would retain the water at the upper levels. In most years we can fill every reservoir we have, and we could fill those up there, too, according to the Bureau of Reclamation statistics.

Q. You were saying that 40,000 acres at Murphy would dry up the Snake, so it seems logical that they could use all the outflow from the upper basin they could get for irrigation down there. So you'd have some 30 more sites upstream that would cut down the flow of the river.

A. I indicated that efficiency in irrigation would have to be one of those things that would make it possible for us to irrigate those extra acres. I further stated, or I intended to make it clear, that those who want minimum stream flows should have storage in those upper reservoirs. In that event, that water would come down, if they had the storage,

and we have a precedent for that now, because the Fish and Game Department does have storage in some of the reservoirs and they maintain that storage at a certain level. That's what I would propose they do in that area providing for any sort of minimum stream flows.

Q. I might interrupt on that point. In your hearings, you said you went down and witnessed Milner. Was there any expression of people saying, well, we're willing to pay if we need 150 or 200 or 300 second feet flowing there below Milner instead of 20 as you said it gets down to? Was there an expression of interest in that, did people really say they'd like to see that?

A. Throughout the state people said they would like to see, especially in the north, the minimum stream flow. But when asked if they would be willing to give money for the purchase of storage, they said, we have a problem. Why should the fishermen put the money in to buy storage when perhaps the person who drives along the stream enjoys that stream as much as the fisherman does.

Q. How many of you are familiar with that stretch of the river between Milner Dam and Twin Falls? It really isn't very accessible, not a lot of people get there. The only thing I maintain is; 1) there is this one stretch where you can go and witness the Shoshone Falls, and I've always said to my students in the past, why don't we have Shoshone Falls Days, and have a certain flow go over it, maybe ten days every year or 20 days every year and really build a program around that. I'm convinced that we could find the finances for this, it's worth that much in an aesthetic sense and in a tourism approach. If you knew there were 10 days or 20 days a year that you could have flow over Shoshone Falls, that would be worth something. I think that's getting into some of that instream use that might be possible. But as you point out, very wisely, in order to do that, maybe you need some more storage and you need this change in irrigation efficiency and change in irrigation pattern use upstream to accomplish this. Would you say there is a means now to finance it?

A. I don't believe there is a means right at the present time to finance any flow of water over the Shoshone Falls because that water would have to be purchased from someone who already owns it. The day after we were there, the Bureau turned 500 second feet loose at Milner because it was water that Idaho Power owned and they turned it loose up at Palisades. It would have been released from Milner the next day after we were there, it would take it just that long to come from wherever it was released and released it then to Idaho Power for power production. If there was an organization of some entity that wanted to show Shoshone Falls off more than just in the spring and the winter, they'd have to buy some storage from

somebody, or else they'd have to build some storage in order to put the water over the falls. And it is a spectacular sort of a thing. Higher than Niagara and the rainbows are something terrific off the mist of the falls.

Q. You said that the Fish and Game Department had bought water for minimum flow reasons. Now if you had a short water year, would their water right hold up against farmers that bought a later water right than they did?

A. Yes, it would. Because they would have bought the water in those dams the same time the farmer bought them. Their water right would be just as good as the farmer's for that date. If the prior right or the earlier rights needed the water, they would get it.

Q. If the Fish and Game have priority to just run the water down the river for minimum flow, there's no override of priority in a short water year?

A. Not in the case where they own the water. Our constitution provides that the first priority for water is domestic use, our second priority is agriculture or, if it's a mining district mining has second priority. But where they buy and own the water, and it's storage water, that's their water and they have it. They put it in there, you take the fifty cents out of this pocket and put it over in this pocket and there it is. When you get ready to use it you take it out of that pocket and use it. It's just that simple.

Q. You mention that they purchased some of those, but my recollection in studying the Boise River and the Boise River storage has some Fish and Game storage right, I don't remember the exact amount of that, but I don't think they purchased it. I think they negotiated it with the Bureau when it was being built. Of course, there is the problem I'm sure the Fish and Game has in some cases.

A. I stand corrected. That was the wrong word to have used; they negotiated it. No dollars changed hands.

Q. But there are some cases, I think when there'll be enough finances in the Fish and Game Department that they might do that. But it's so difficult in the public picture to say, well, we'll collect another dollar from every fisherman to pay for this. It's very questionable whether it's going to ever be. Even if we could assess that as a value to the public there would be no change of dollars, but we've identified that as a value. It would be very valuable to our state resources fi we had those identified.

A. Up in Lewiston and Coeur d'Alene they were extremely concerned about the fluctuation of the river as to the fishery and to migratory water fowl. But I'm inclined to think that if they protect the fishery we're going to have to do it by a minimum stream flow of some sort. Otherwise the fish are going to have to take their chances as they've been doing and there would be some loss, there's no doubt about that. But down in southern Idaho and maybe in northern Idaho too, they have "trained" the geese to build their nests up on tall platforms. Make a platform, set it up on a post five or six feet above the water or more and the goose makes his nest up on that platform. That's done partly because of the fluctuation of the water but mostly because of predators. I'm not saying we're going to train fish to take that into consideration. At the Hayspur Hatchery down in southern Idaho they have selected the German Browns and Rainbow Trout so that they have changed their spawning season through selective breeding, just like we do with cattle or pigs or anything else. And there's no reason why they can't. But don't think you're going to teach them to spawn on a dry bank. In connection with that, I've got to read you one gal's testimony from Coeur d'Alene. She says:

> I'm not really a person, I really am a fish.
> To speak with legislators is now my dearest wish.
> A fish that's out of water can neither swim nor sink.
> A fish long out of water will soon begin to stink.
> Deodorants for fishes, no brand can I recall.
> Please consider what will happen
> When there is no stream at all.

Q. Do you have any numbers on the average water year on the Snake River? How much water is going past your storage, how much are you wasting, not using?

A. Somewhere around 110,000 acre feet. It varies, of course, but that's about the average. If we take 1½ acre feet, just what's wasted now . . .

Q. I was just going to say that, when we talk about whether it's more important to grow potatoes or to catch fish we tend to think about how much more important it is to have the food than to have the fun of going out fishing. But tourism is Idaho's second largest industry and there's also a large fishing industry downstream toward the coast that's dependent on the fish in our streams. These are two factors that I think we forget to put into the picture.

A. Perhaps if those fish that got up the Snake past the dams and finally got up to Lewiston, if we could train those rascals to go up the Clearwater instead of the Snake . . .

Q. They can't get very far up the Clearwater.

A. No, I guess they can get farther up the Snake than they can the Clearwater, really.

Q. When you talk about a total of 8 million acres that could be developed in 43 dams, are there any studies or any ideas about what that's going to do to the quality of water in the Snake River in terms of salinity or in terms of water temperature or any of this sort of thing?

A. I'm sure that before they were developed that we'd have to have an impact study and that would have to be taken into consideration. However, there are areas in southern Idaho where the quality of the water that runs off after the irrigation is better than what we put on. We've made some very intensive studies in relationship to that. I cite the Twin Falls Tract, for instance. They have a better quality of water coming off, through percolation perhaps, than they had going on.

Q. Using what parameters do you determine that quality?

A. Well, I'm not an EPA man.

Q. Do you use temperature or nutrients, or what?

A. Nutrients. More nutrients coming on, and of course those nutrients coming out of the land farther up where mother nature put it on to start with, but there are more nutrients coming on the land in that area where the studies were made than there are coming off.

Q. But you need cold water for trout. If it's coming off too warm for the trout all you're going to end up with is a river full of suckers and squawfish.

A. Right. I have a son who went to Oklahoma, he married an Oklahoma girl and is teaching school there. He got addicted to bass fishing and he says there isn't any fish that'll even hold a candle to a good bass. And, of course, there's the solution for warm water. Maybe some of these streams, instead of trying to maintain them for trout, we'll let them go to bass.

Q. In defense of his last two questions on improvement of quality, the whole fishing industry, the commercial trout industry, is really based on cold water that is increased by irrigation. The water that comes out of Thousand Springs is now three to four thousand cfs more than it would have been naturally. The water in the Snake River in the natural condition flowing along Hagerman wouldn't be very good quality water for trout. But what comes out of Thousand Springs is good. So there is another case of an improvement in quality of water through

irrigation. The main thing is the nutrients; I think phosphorus and nitrogen both decrease in the Twin Falls Tract. I don't say that's true in all cases. That's just a unique situation in the Snake River that's true in that particular stretch. It is a valid statement.

Q. That isn't an improvement over the natural condition of the water. That's improvement over the water that had been contaminated from upstream agriculture.

Q. I disagree. If you had no upstream irrigation in the Snake River I think the temperature of the water in the stretch along through the Twim Falls area may not be too favorable. I think the temperature now is a better temperature because it is a more sustained temperature. That which comes out of the springs is almost constant, about 52-55°. The water that would have naturally flowed there fluctuated widely in a natural year. Sometimes it approached 60-70 some degrees in the summer in a natural channel. But the temperature quality now is an improvement.

A. That's the greatest example that could be pointed out. In the Burley area water again enters the river through percolation and when my dad was a boy he used to ride across that river in the wintertime, horseback, or we'd drive across with a buggy or wagon and now, on occasion the river does freeze over, but just for a very short period of time, just for a day or two. That is due to the cold water that is running back into the river. It's coming back into the river in the 50 degree range and of course that same water is helping cool that river in the summertime, as well as keeping it from freezing in the wintertime.

Q. I'd like to ask you a question about water rights aspects. I'm going to show my ignorance; every time I think of water rights I get confused. In a case of a stream where we are not considering additional storage, where there's going to be no purchase of storage and it's a matter of there being some water unobligated or not tied down by a water right; what if the state were to come in and claim that for fisheries or recreation or what else. As I look at this, it seems the critical period is the time when water's short. The state, if it simply took a normal water right in a short water time, would be the first one to lost it's right under the normal system, with those with the oldest water rights being the last to suffer during a drought period. If that's correct, then it seems to me that the state's going to have to go in and buy some of the older water rights out or take them over, or however states do these things. This seems then to be a problem because those that thought they had the best protection to the water are the ones that are going to have to be taken over by the state if it's going to do that sort of

thing. Did that subject come up in your committee?

A. You hit the problem right squarely on the head of the nail. The legislation that has been proposed would declare that minimum stream flow is a beneficial use. If it passed so that it would be a beneifcial use, then, of course, it would have equal rights with the uses that are considered now to be beneficial. That's what, by and large, the ranchers and farmers are afraid of with minimum stream flow legislation. It has been mentioned. We do have instances now in the state of Idaho where we have declared that a stream flow be put to a beneficial use other than diversion and when we think of diversion we think of agriculture. Those cases have been specific, the legislature's taken action on a specific case, like maintaining the level of some of the lakes, Priest Lake, for example, or the last one we got into a hassle about, and we went to the Supreme Court on that. The legislature did dedicate some waters for non-consumptive beneficial use down in the Hagerman Valley and that went to the Supreme Court and the court ruled that in this specific case the water could be considered as a beneficial use and wouldn't have to be diverted to be beneficial. But it's only been in specific cases and I think that any legislation that was enacted would have to be on that same basis.

Q. Let's just take that case. Out speaker before last talked about it a little bit, I guess I didn't ask the question then. What is the priority of that water right that was declared a beneficial use? Does it now supercede all the other uses there? It seems to me that an instream use is of no value if that right goes out first when you have a drought condition. If you're going to protect fish, that's the most prior right, or should be.

A. My understanding of that is it does have a prior right from that particular spot. Nobody could go in up above him and put in a pump and divert water. It has to flow down there for the benefit of the fisheries in particular.

Q. So then my question really is, they have in effect lowered everybody else's priority by this action.

A. No, because it isn't a consumptive sort of a thing. They have declared it to be a beneficial use without diversion and, up until this time, only in specific areas could you declare anything to be a beneficial use without a diversion. So you see, the water is not diverted, there's no depletion of it, but his right maintains that amount of water, if it's there and nobody can go in above him and start diverting, drop a pipe down over the canyon and pump the water up on the flat.

Q. But if somebody had a prior right to this right above him,

then they could divert the water.

A. Absolutely.

Q. Along that line, can I interrupt again. Professor Brockway was here on Wednesday and pointed out that there in Box Canyon, one of the streams that is involved, the Fish and Game people were there trying to measure some flows and they had some difficulty. But that is the case in that particular stream. There were some prior rights that had been filed ahead of the Box Canyon Bill and I don't know the status of some of those. To my recollection there wasn't previous diversion. There was a fish development that diverted water and I imagine that their right was prior to this bill, but I'm not sure of the dates of that. But my understanding was there were about three different filings that were ahead of this bill. Now some of those have not been proven up. That's the interesting thing that turns it into a problem is they've got to go in and make the use and prove up on them. This particular fish one has; they diverted down near the mouth of the river, so it disrupted just a small distance of it. Since it's a very short little stream it does have some effect. But I take it that any future appropriations would not be allowed. You couldn't go in there now and file for a right to divert any new filings. You couldn't do any more of that.

A. That's my understanding, too.

Q. If I could put in some numbers, because I'm still not clear. Let's take a river that has, in the time period we're worried about, 100 cfs flow. We've got 3 people that have 25 cfs that have already appropriated this river, which is 75 cfs. The state comes in, Fish and Game, and says, alright, it's a beneficial use, we're going to claim the other 25 so nobody else will divert it and dry it up. They'll maintain that 25 cfs instream. But now we come to a year when there's only 75 cfs. What happens? If the last right loses, Fish and Game has lost and the river goes dry. But if the Fish and Game has got a prior right somehow, through what I can only assume is fanagling in this process, then somebody else with a junior right doesn't get the water.

A. In Oregon, they were maintaining a minimum flow for fish. They got short on water for agriculture and after discussion they gave the water to agriculture and I guess they'll restock the stream again when the water's there. They've got all kinds of trout farms all around the country to do it with, so the supply is there.

Q. I still don't understand the difference. You declare fish and wildlife, recreation, aesthetics as a beneficial use. Does it necessarily mean that it would have prior or be more beneficial in a sense than the others. Agriculture is a

beneficial use. All it seems to me you've added is another beneficial use so that someone can come in and claim a water right.

A. Yes, that's what you do. Then you go back to the old rule of first in time, first in right. That holds on anything.

Q. In that case, in the 100 cfs river; if the river went down to 75 cfs, the three irrigators would pump their 75 and there'd be nothing left for the state, is that right? That's the way I would see it. But in that case, then, it seems to me that that right really isn't worth very much because the first time you get a critical situation, that beneficial use is gone. The first time you start to get a squeeze on water, the fish and that sort of thing lose out, the ones that can really least afford to lose out.

A. That's absolutely true. We have the same situation all over the state under that rule first in time, first in use. When the streams drop down, the guy who has the latest water right is cut off, whether he's made a crop or whether he hasn't. His whole year's work is gone.

Q. First in time, first in use; does that also apply with your ladder of priorities? In other words, if your first in time usage was something that was lower than agriculture and the guy that had second in time usage had an agriculture usage, would he get the water in that case, or would it still be the guy that had the first priority on the water?

A. Everybody in the first priority would be satisfied.

Q. So the real question is, where would you put the Fish and Game if something like this would occur, where would you put that on the ladder? If you did have to do some kind of fanagling it seems that they would try to get themselves on the ladder so that they were above some of the prior uses timewise, but they wouldn't have to be above some of the lower uses. In other words, if somebody had a really old right, but it was a lower priority they wouldn't have to worry.

Q. I understood that the decision by the attorney general was that those rights were not ranked rights but simply declared beneficial uses. Is that not what the attorney general said?

Q. I think he says that there's a priority of importance, but I don't think that you can just arbitrarily come out and say that it's going to be decided on that. I think that priority of importance is when there's a decision that will say which one do you allow. I think at the present time the priority of time rule will apply always. But if there's a case where there's two rights that are the same time, then the priority of importance will go with the one that has domestic need ahead

of the other one.

A. That's a constituional provision. Our constitution provides those priorities for water.

Q. But I think today if you were to rule that, I think if you had a right out here to drawing the water for agricultural use and one had it for domestic use and the domestic use was the junior in time, I think he'd still be cut off.

A. I hate to differ with Professor Warnick, but domestic use would receive priority any time. It's enough water for his household and the garden and a horse or cow.

Q. But even in priority of time?

A. Yes, a human being comes first in that respect.

Q. But does it go that way down the ladder, too. Say we're talking about agriculture now and something directly below agriculture, and his right was senior in time over the agricultural use. Would the agriculture again get the usage if it came down to that point?

A. Well, I'll cite you an example. Over in the Raft River Valley we have a water table that's being depleted and nobody can drill a well for irrigation in that area. Our constitution says that the right to divert waters will never be denied, but the commissioner or the director of the Department of Water Resources has declared that this is a closed area and nobody's doing any well digging without his permission. And he's not giving permission. But people are moving in and they're drilling wells for culinary purposes and some of them are doing it without getting a permit and there's nothing he can do about it, they just stick down a well.

Q. That's true in a groundwater situation that now the domestic water supplies don't have to apply for a domestic water supply from groundwater so that they feel safe to go in and do that.

Q. Coming back to Jack's point, it seems there's still an advantage to Fish and Game or the state applying for a water right even though there is a possibility that they will have junior rights and they will not get water in a year when there's only 75 second feet. The advantage is that they've stopped somebody else from filing on the water and diverting it every year. It's really a protective strategy, whereas they're trying to protect what's left of the unappropriated water.

Q. I was just going to say what he said to Dr. Gladwell and I was also trying to think if I had been reading something that would clear up his question about a priority, not only

a priority in time, but a priority in importance. The way the constitution words the priorities of uses, of beneficial uses, if first domestic, then agriculture, mining is more important in a mining district. That is used especially when the water commissioners or water marshalls are giving out the permits to divert water. Then if there are several permits being processed at the same time and there's only so much water, in some areas they will give it to miners and they will not give it to an agriculturalist. In other agriculturalists will get it. So when you come down to the permits that have already been given, the appropriations that are already on the records, then it usually does go according to first in time, first in right, rather than miner versus agriculturalist. The Fish and Game Department in Malad Canyon would be the last to get the right. But there's also a matter of someone being able to condemn someone else's rights and that would, of course, go through the courts and there would be a great big battle as to whether the Fish and Game Department use for preserving fish or preserving scenic beauty was going to be more important in a particular case than an agricultural right. If the court found that it was more important then they could actually condemn a prior appropriation that some rancher had and actually take away that rancher's water and give it to the Fish and Game Department or whoever for this newer use. I don't know whether Idaho has had actual cases of condemnation like that, but it is a possibility.

A. You put it very mildly when you said there'd be a great big fight.

Q. The fellow who was here two weeks ago said something about the solution being for the state to buy up some of these water rights. I hadn't realized this was possible. You mentioned that you have a water right that dates back to 1876. Is it attached to your land, or is it yours and could you sell it? Of course, I realize you wouldn't because you want to use it on the land, but would it be a possibility?

A. Some of the water rights, some of the decrees are applied to certain sections of land. In that event you couldn't sell it without the approval of theDirector of Water Administration. Other decrees are just to the person, and mine is to the person. In that event it could be sold. They sell water all the time in the reservoir districts and canal districts and under the Carey Act those fellows own their water. They built the dams, they stored the water, they own it. But in my particular case some of the water is decreed to the land and some to the individuals. And all on the same stream.

Q. So if you sold your property you could take your water right with you?

A. I could. We have, in that particular drainage, been through the courts two different times in adjudications.

Q. If the state did buy some older water rights that have priority would those hold up according to the way they rate them? Like would you win out over anybody that bought a right later than that date? Even though your use might have been agriculture before and you bought it for minimum stream flow, it would win out over all later dates, right?

A. That would be a decision for the court. Not being a lawyer or judge I'd be inclined to hesitate. Until minimum resource flows are recognized as a beneficial use, I think you'd be out of luck.

Q. So you don't think the state would actually, by buying the right now, win in court if he ever had to . . .

Q. Along that line, I think I may have alluded to this last time or the time before, it was in reference to the Bear River. The power company, Utah Power and Light, bought the Caribou Land Company's right to some storage rights. It was a storage right for a future dam that would be built on Bear River. They bought that right, expecting to use it some time in the future, possibly for cooling water for power plants, and they've gone to the state now and asked them to take over that right. It's just in the process now, I don't know whether you've heard of it or not.

A. No, I wasn't aware of it.

Q. Dr. Cackley was involved in the Caribou Land Company's water. I don't remember how much it was, it seems to me it was 50,000 acre feet or something in that line. Utah Power and Lightis trying to get just what you're talking about, the state would own the water right in this case and keep that water right so that it eventually could be used. But I think there is a very moot question in this case and you say rightfully that the judge has got to decide. Can you preserve that right, when the constitution says the right to appropriate water shall never be denied. Now I'm maintaining the sense that th the state may be preventing it from some other use and that use is not being made now. If they've got a use and they're going to protect that use, there's a certain limit, I think it's five years, you have to do it. They can renew them, but it's a very questionable point there. I think this purchasing of water rights has been a very good one to bring up today because it's very changeable. As you pointed out, sometimes it's to the lands, sometimes it's to an individual, sometimes it's a storage right. You can't always say that you can purchase the water.

A. In some instances, up in the Upper Snake River country they've sold the water off of the land and the land is just as barren as it can be. They needed it down below because they're in that area where they take ten or twelve acre feet to raise a crop. They've just taken the water out of two farms and put it on one. We did go out on a limb when the people of the state of Idaho gave us authority to set up a water resource agency. We did that for the general benefit of the public of the state of Idaho. We did give them authority to apply for water and get these applications of water and that was one of the big fights in the legislature that any state agency, like the water resource agency, could apply for this water and set it back, and of course they have to apply it to the director of the Department of Water Resources just like anybody else, like any other individual, but they can get that water set aside for some future development and, of course, they have had an eye on that. Perhaps they'll do it sometime.

Q. I'd like to ask just one more question. I haven't heard it brought up in any of our discussions. The concept of the reservation doctrine, especially in Idaho, as much federal land as there is, with every court case that comes up, the federal government seems to get more and more control of dictating the use of the water. Has anybody talked about this in these hearings that you've had? In particular I begin to think that it's almost a logical conclusion that even off the reservation now that people will not be allowed to, as an example, dry up a river because fish will not then be able to get onto a federal reservation that was set up so that people could fish and thus the rules will be extended far beyond these reservations.

A. That's been mentioned. It hasn't been specifically brought out too much at any of these hearings, but it's been in the air for a long time. There have been examples when the federal government has taken the water of individuals and used it for their own purposes. The Forest Service recognizes that this water raises on their land, but we as the state have assumed, and our constitution says, that the water belongs to the state of Idaho, so we're assuming that. We've gone right ahead with control of water on federal reservations just like the old law gave us the right and we're going to stick with it until proven otherwise. It'll be a right good fight.

Q. It's being proven otherwise, though, case by case. Every time it seems to be in favor of the feds.

A. In some instances.

Q. I think there was a case, was it up on Hayden Creek.

Q. They did not lose out, they won out. In fact, Keith is so upset that part of the ruling in favor was that the waters should be there available for children to skip rocks on and wade their feet in, so you can't divert. That's a beneficial use in a forest.

Q. I thought there was one where the Forest Service dug a well and they weren't supposed to and they made them close it down. Where was that?

A. Well, I don't say they've been unanimously favorable.

Q. I'll have to go look that one up.

Presentation by

R. KEITH HIGGINSON

Idaho Department of Water Resources

I approach this task with some misgiving, as I indicated to both Dr. Gladwell and Professor Warnick. Having reviewed the list of speakers that you've had up to date and not really knowing for certain what they have covered, I feel like I'm flying a little blind. I have had an opportunity to briefly scan the presentations of Mr. Rosholt and Representative Chatburn who appeared before your group because I felt that they would cover some of the topic areas that I have a direct interest in.

This idea of being an authority on some subject reminds me of my favorite story about the expert. You all know what an expert is, but I think the story of being an expert is exemplified by the traveling salesman who visited the proverbial farmhouse and asked if he might spend the night. He was told by the farmer that he could spend the night but would have to sleep out in the barn with the hired man. He went out in the barn and found that where they were going to sleep was down in the stall where the cows were stanchioned. So they bedded down in the hay as best as they could; everything was fine and the salesman went off to sleep. Pretty soon he felt some hay sticking down the back of his collar and up his pant leg and things got a little scratchy and hard, so he nudged the hired man and said "I'm sorry to bother you, but I wonder if you could tell me what time it is?" Without hesitation the hired man stuck out his hand and there was a milk cow standing in the stall right next to him and he just happened to grab the udder and he hefted it and he said "it's two o'clock". The hired man turned back over and the salesman thought "that's amazing, this man's been milking cows for so many years that he's become an expert in just telling what time of day it is just by what he's able to detect there". So he went back to sleep, but it didn't last long and he woke up again with the hay down the back of his collar and again he nudged the hired man and he said "I'm sorry to bother you again, but I wonder if you'd mind telling me what time it is". Again the hired man stuck out his hand and lifted and said "it's four-thirty". This was just too much for the salesman and he said "you know, that's wonderful. I've been thinking about that. How in the world do you do that? You must have been milking cows for a lot of years in order to have that expertise." The hired man said "Oh, that's not too hard. You see, if I lift this high enough I can see the clock on the wall over there."

That's about the way I feel sometimes about being an authority or an expert in any subject. It's all in the point of view and there are things about the subject that perhaps the audience

really doesn't know that make it appear you're somewhat of an expert.

I'm pleased to be here to talk to you about the subject of instream flows. I have gone around the state with the interim committee, Representative Chatburn's committee, and have discussed this subject with members of your legislature and with the public in general. I know that there's a good deal of misunderstanding concerning the concept. I hope that perhaps we can clarify some things.

There's been a historic concern in Idaho over the subject of maintaining our streams and lakes for public purposes. Mr. Rosholt just briefly mentioned to you the initial legislative action in this regard when, back in 1925, the legislature directed the Governor of the state to appropriate the waters of Big Payette Lake to preserve it for scenic beauty and recreation, for public uses. Pursuant to that directive from the legislature the Governor did apply and obtained a permit and a subsequent license from the state reclamation engineer. It is recorded as a valid subsisting water right in the name of the Governor of Idaho of the water between high and low natural levels of Payette Lake as a public resource to be enjoyed by all of us. This was done to preserve it against appropriations that would be made for private purposes that might deprive that lake of those scenic and recreational values.

Two years later a similar directive of the legislature authorized the Governor to do the same thing with regard to Priest, Pend Oreille and Coeur d'Alene Lakes. Subsequently licenses were issued by the department and between high and low levels of those lakes there is a water right.

In the minds of many people there has always been a question as to the validity of those filings, as to whether they were constitutional, whether they would hold up in court, whether they met all the tests of the law with regard to a water right in order to become recognized and protected. However, there has never been any court determination of that issue.

I would point out that they differ from the general subject area of minimum stream flow and lake level in that in those four lakes there is, in every case, an outlet control dam. There is a structure that controls the water level in those four lakes by which you can regulate the high and the low level of the lake within some limits. You cannot entirely regulate it because of the inability to pass flood flows all instantaneously and therefore there's a buildup in the lake, but you can control the lake within certain levels. In fact, the legislature a number of years ago directed by department, my predecessor department, to construct the outlet dam at Priest Lake. This dam which controls the level is owned by

the state and is leased for operational purposes to the Washington Water Power Company. But it is a state constructed facility, built for the purpose of maintaining the lake level at a high enough elevation to provide for recreation, navigation in the shallow areas. Then in the fall of the year the boards are pulled out of the outlet dam and the water is released during the fall and winter period. Then, after the high flows have passed in the spring, they're put back in and the lake is controlled at an elevation specified in a statute. There has been a historic concern in the state for that kind of thing. But I would point out that there is that major difference; that in these four lakes there are these physical outlet control dams whereby you can regulate a lake level.

In connection with those filings, as I indicated, there's always been a legal or constitutional question as to their validity. Mr. Rosholt reviewed that and I won't go into a great deal of detail. There are a few things with regard to that that I would like to comment on.

One of the questions is, can you appropriate water without physically diverting it under our appropriation process? I think he gave a very good presentation concerning the growth of the water law in Idaho. We operate under a set of water laws that were written by the irrigators. There's no question about it. They were the ones that had an interest. They were the ones whose well-being and financial economy was affected by whatever laws would be on the books. Those interests in the state of Idaho have historically written our water laws. When any modification is proposed in the legislature to existing water laws; any extention of privileges or denial of certain rights, it is the irrigation interests in the state that generally rally around that issue and have the loudest voice in the legislature and really the most votes. So historically our water laws have contemplated that in order to appropriate water you have to divert it and apply it in some "beneficial" use. There was always the question as to who could appropriate water. Whether it's something to be left to the general public or whether the state or state entities in their sovereign or proprietory capacity had the authority to appropriate water.

Despite this question of the ability to appropriate water without physically diverting it and establishing a water right, we do have numerous locations in the state where there are already established either lake regulations for recreation and similar purposes or minimum stream flows. This map, which many of you may not be able to see, is a sketch that I put together from the information we have been able to gather throughout the state of locations in Idaho where there are already established by one means or another either a minimum or maximum lake level control or a required release of water from existing reservoirs for maintenance of stream resources, whether they be recreation or fishing. You can see they're scattered pretty

generally throughout the state and we could discuss any or all of those as you see fit.

We have all of these locations in our state where there are some resource maintenance flows at the current time. Just pointing to a couple, Hells Canyon Dam in the license issued to the Idaho Power Company for construction of Hells Canyon Dam, the Federal Power Commission required that as a condition of construction of those dams that there be a minimum release from Hells Canyon of 5000 cfs or the inflow to Brownlee Reservoir upstream, whichever is the smaller of those two. So that's a typical example of where there is already established a minimum flow requirement by some act. With regard to Teton Dam, and that's a controversial issue throughout the state, there is an agreed upon minimum release from the Teton Dam during the filling period. So that instead of the Bureau of Reclamation just shutting the gate tight in the fall of the year and keeping it that way until spring when they get ready to make releases for irrigation purposes, there is an agreed upon release of water from Teton Dam to maintain the flow down the Teton River during the non-irrigation season. During the irrigation season there are, of course, irrigation releases which maintain a flow in the stream.

There are other projects that are under similar conditions.--Cascade Reservoir, Island Park and so on where these are established on existing projects and they do maintain flows because of that purpose.

What is missing in the minimum flow or stream resource maintenance flow is the authority and the ability of an entity, whether it be a state entity or a private person, to simply go out on a stream that is flowing in its natural condition and designate or determine the amount of water necessary to retain the value that that stream has and preserve it for some beneficial use in its natural condition without diversion. Now that's the thing that's missing in our state water law. There is no authority whereby the Idaho Water Resource Board, the Fish and Game Department, Parks and Recreation, sportsmen's groups, whoever it might be, where any entity can simply say: here is a stream that has value in its natural condition; there are resources in that stream such as fish, aquatic life, etc., that should be preserved in order to prohibit the diversion of that stream for other beneficial uses, which would deprive the stream of the instream values. There needs to be some mechanism to do that legally. And I think Mr. Rosholt, again gave a good explanation of the history of the water law as it relates to this issue. It was built upon the concept of diverting the water onto the land to grow the agricultural crop. The cry ten years ago in Idaho with regard to the creating of the Water Resource Board was, we've got to have some entity who'll get the water on the land because we either use it or lose it. The whole thinking back in those days was that the

only thing we can do to preserve and protect our resources is to get them out of the stream onto the land under some kind of a water right.

As we went along through the appropriation process, starting five or six years ago, my office began receiving a large number of applications to appropriate the waters of the springs arising in Hagerman Valley, the Thousand Springs area. These were large filings for 500 or 600 or 700 cfs on some of the springs. And for those of you that have never seen those springs, they're a sight to behold, just bubbling up out of the ground, sometimes in an area not much larger than this room, 400 or 500 cfs just bubbling up and flowing off down the channel. They're beautiful and there is some public interest and value in those resources. So, locally there was some concern that because of the filings we were receiving for fish hatchery purposes, commercial pisciculture, that the eventual result of that activity would be that all of the springs in Hagerman Valley would be appropriated and diverted from their natural course. The waterfalls and the effects that you see as you drive along the highway and up in some of the little valleys there would be lost to the public and the water would all be used for commercial fish hatchery purposes.

So, in the legislature Representative Ravenscroft authored a bill and he was joined by Representative Greenawalt and the bill directed the State Parks and Recreation Board to appropriate waters of five of those springs. Five of the main springs had not yet been touched by this commercial development, to preserve them for public purposes. The five springs were in the Malad Canyon, and that's the key one that we want to mention just a bit; the Malad Canyon is the same river as the Big and Little Wood River, but as it gets down in the area where the two rivers join together, it suddenly becomes the Malad River for some strange reason. Someday we'll have to find out who names streams and how come that happens. But the Malad Canyon gorge, you see it as you drive down the interstate east of Bliss. As you're going across the fairly flat open county and suddenly there's this canyon below you. That very narrow, very deep canyon is the Malad Canyon gorge. If you stop there in the summer months you'll see at the bridge where they're building the new interstate bridges and if you look down in the canyon, you'll see nothing, there's no water. But all you need to do is go about half a mile to the west and look down and there's about 1200 second feet of water bubbling up and flowing out. That's the springs that we're talking about.

The other springs are Blue Heart or Big Spring, which is located right at the mouth of Box Canyon. That particular spring is an unusual one in that there is a sand condition and the spring comes up in the bottom of the Snake River in a kind of a little cove. This sand plugs off the outlet until such time as it builds up enough hydrostatic pressure that it

blows the sand loose and it boils up, sometimes a foot to a foot and a half in height. The river raises and boils and then it settles down as the sand settles down and in effect plugs the outlet and builds up enough hydrostatic pressure that it comes loose again. So that's kind of an interesting one and we want to preserve that. There is Box Canyon and the other was Niagara and the fifth one is the Thousand Springs which are currently being used by Idaho Power Company for power purposes. The legislation is written in such a manner that in the event that Idaho Power should ever abandon its power facilities, the Parks board has filed to appropriate that water for public purposes, they then would remove the intake structures, the power plant would be dismantled and it would be turned into some kind of a park facility. The water would be allowed to fall back down over the Tallus slopes and restore it to its original appearance as much as possible.

So, anyway, those filings were made and we knew immediately we had a conflict on our hands. Indeed, there were those in the legislature who said, as that bill was being discussed in committee, that if they could be assured that passage of this bill would result in a Supreme Court case which would answer the questions concerning instream flows and beneficial uses, that they would vote for this bill, although they personally did not feel that way. There were those who expressed that and did vote for the bill in order to get the authorizing and directing legislation passed. And we did set up and go through the Supreme Court with a test case and Mr. Rosholt explained to you the results of that case which, in effect, answered the three constitutional questions concerning the authority of a state agency to appropriate water, the beneficial uses and whether you need to divert in order to appropriate.

I think there were a couple of other things that were in that case that I don't believe he mentioned that I would just like to point out. One is a "bonus" decision of the Supreme Court in which they construed that the 1971 enactment establishing a "mandatory" permit system was constitutional. Just in passing they mentioned that. It wasn't the issue that was before the court, but they said in 1971 the legislature made the permit system mandatory. Well, that's enough to give me a good feeling because we worked for four legislative sessions just to get that issue out on the floor for discussion before it finally passed the legislature. And to have the Supreme Court say that was constitutional was wonderful because that was the argument used against it in the four years that we tried without success to get it out of the Agricultural Affairs Committee. But we finally got it through and we do have a mandatory permit.

The other thing is that the court, in addition to discussing these three questions that were squarely before it, talked about the question of "proprietary" versus "sovereign"

responsibility of the state. In other words, the state, in its capacity as the operator of state parks, is a proprietor. Therefore, in that proprietory sense, the state must appropriate water for its uses with regard to the University of Idaho, an entity of the state of Idaho. It must have water for facilities and so forth. With regard to highway rest stops, with regard to Fish and Game facilities for rearing of fish and so on, it must have water and therefore as a proprietor, it must appropriate.

Now, in the other capacity, it talked about it in its sovereign capacity. As the sovereign, the state of Idaho has certain responsibilities with regard to those water resources. Most of the language covering that doesn't come in the majority, it comes in the dissenting opinion of Justice McFadden, in which he says that the state in its sovereign capacity has a duty to protect the streams and the public interest and benefit in those streams. There's one part of his specific language of his dissenting opinion that I'd just like to read to you. Again, I don't believe Mr. Rosholt read this:

"I note, however, that the effect of a proposed appropriation upon scenic beauty and recreation can and should be considered in determining whether the use contemplated is beneficial within the meaning of the constitution. In other words, where the benefits of a proposed use are outweighed by the attendant detriment to scenic beauty and recreation, the use is not a beneficial use and the application for a permit to appropriate public waters for that use should be denied."

Were it not for the fact that this is a dissenting opinion of one of the five justices, concurred in by one of the other dissenting justices, that would be very significant, as far as the operation of my office. This would say to me that if someone proposes the diversion of water from a stream in Idaho for, let's say, irrigation purposes (for years we've recognized irrigation without question as a beneficial use of water, and the courts have upheld that determination and water rights have been established), that if the effect of that proposed diversion would be to deprive the stream from which it would be diverted of the water necessary to preserve in the stream the scenic beauty and the recreation values of that stream, then the irrigation is not a beneficial use, and the application should be denied. As I say, that's a very significant thing in this decision, and had it been in the majority decision rather than minority, I think we would have an entirely different operation in our office. It gives me the feeling that as subsequent cases now come before the Idaho Supreme Court that we can anticipate that this thread of thinking will come through those cases. We may get a case before too long where that will no longer be a minority opinion but will become the majority opinion, and will therefore be binding in Idaho as the water law as interpreted by our Supreme Court.

So we have that in this case and I am being urged by a number of interests in the state that in order to get that squarely before the court that I should make a determination on a water right permit on that basis and throw it back to the court. But I am reluctant to do that under the current expression of the legislature and the Supreme Court of the state.

So, as I say, we have those two bonuses out of this case besides answering the three direct points that they were asked to decide. They told us we had a mandatory permit and that was constitutional; and second, we have the thinking of the court concerning the public interest in our streams. I think it's something we should keep in mind.

Well, the question then comes -- what, as an agency, are we doing with regard to minimum stream flow and why are we involved? I was going to refer to the mission of the Water Resource Board. I'll just point out that it was just ten years ago that the legislature created the Water Resource Board as a result of a constitutional amendment which said that there shall be an agency with responsibility under the constitution to plan and implement a state water policy and program and that they should develop an integrated, coordinated multiple use water resource policy.

There is specific direction in there and Mr. Rosholt read it to you, but I think it's worth reading one more time. In the development of a state water plan, the legislature told the board they had to give consideration to various things, one of the things that must be considered they said, "subject to the primary use of water for the beneficial uses now, or hereafter, prescribed by law" (that phrase is significant when you think back to 1965 and what was going on in this state, and what the thinking here was. The water law that we were talking about was what the people of Idaho thought of in 1965 and it was primarily developmental law. We're talking about agricultural water law, the irrigation law of the state because that's the source of all our water law). And so they said, "subject to the primary use of water for the beneficial uses now or hereafter prescribed by law, minimum stream flow for aquatic life and the minimization of pollution shall be fostered and encouraged, and consideration shall be given to the development and protection of water recreation facilities". That minimum direction to the Water Resource Board to me implies that the thinking was these other uses of water, irrigation and industrial and municipal and so forth, are the primary uses of water, but if you can accomodate a little minimum stream flow on the side, try to work it into the water plan. I think that's the way that thing was couched. I think very frankly, since it did have the support of water user groups and farmers groups and so on, that's the way they intended it to be couched, subject to the primary uses recognized in our state; see if you can give a little water over here for minimum stream flows and for recreation facilities.

We have approached it as a department and as an agency and Dr. Gladwell pointed out that I've been director since a year ago in July, but I've been a member of the Board since 1966 and a non-voting ex-officio member of the Board and I've been involved in connection with the development of the state water planning program for all that time. We approach it from the standpoint that we should first determine how much water is needed for these instream flow uses. Those of you in Agricultural Engineering and other courses recognize the Blanery-Criddle and the Lowry-Johnson and the various other empirical methods of trying to estimate the amount of water used for agriculture and needed for agriculture. The same thing is true with regard to industry and municipalities and so on, but with regard to instream flow how much water do you need? How much water does it take to float a duck? How much water do you need for fish, what do you need for fish spawning? How much do you need for migration of fish? What to you need for water fowl? How much do you need in the bottom of a stream channel in order to protect the gegetation on the side that forms a "green belt", which is valued for aesthetic purposes. This is not known so we began a number of years ago trying to make studies and there are a number of studies if any of you want to pursue the issue which has been made over the years on this subject area. The first one put out in 1969 was "Aquatic Life Water Needs in Idaho Streams", and it was prepared under contract by the Idaho Fish and Game Department in which they gave some very preliminary figures of recommended flows necessary to protect fish resources. That was the first cut of the thing; since then there have been a number of others, a couple of reports in 1973 on "A Survey of Instream Flow Protection in the United States". The most recent one is one done here at the University at the Cooperative Fishery Unit. Work primarily done by Robert White, that is entitled "Stream Resource Maintenance Flow Studies" and again it adds to the information we have as to how we might arrive at this. And I won't go into that because I think Fish and Game people have been here and Fish and Wildlife Service are going to be here next week to talk probably about technology or how you try to establish these things.

Our concern has been that we have this information because as we've gone about the state in preparation of water planning input, we find that the public is very interested in this. The Board has authorized and had conducted three public opinion surveys. We also had an extensive program which I am sure many of you saw, related to getting input from the public as to what they wanted. We had three newspaper supplements and each one of these is different because it related to a different part of the state. And in Moscow, in Idaho Falls or wherever it might be the same people are going to show up, meeting after meeting on the same subject and they are going to tell you essentially the same thing that they told you last time, as to their particular point of view. But the general public, "Joe Citizen", the mechanic down in the garage, the guy who works at a job somewhere and goes fishing on the weekend, this kind of public

generally doesn't come to public meetings. And as a result we don't get their views. So we've gone very extensively to public opinion surveys and to these newspaper supplements to every home and asked that they be mailed back to us with their comments, to try to find out what the public really wants. We think we know, and they're telling us very loud and clear they want wild and scenic river systems, they want minimum stream-flows established, they want our streams, our quality streams in Idaho protected, but they also want a continued growth of the economy.

Q. Would you make a comment in passing as to what the difference is in your statistics you get from your surveys like that and the ones you get in the hearings, is there a significant difference?

A. There's very little difference, there is some slight difference, but you're talking only about 4 or 5 percentage points, and we don't consider that to be significant difference. You're dealing with a public opinion of 70% in favor or 80% in favor of establishing your stream resource maintenance flow as legally protected. You know it may vary 4 or 5% but you're still up in that range, so we don't see any significant difference on this question. On other questions it's closer, the question of rather it's a majority or not a majority on some other question, but this one has good widespread support for it.

Ultimately we are going to have conflicts because there just isn't enough water to satisfy all of the desires and wishes of the people as they are telling us. And I put one display up here behind me as an illustration of the kind of conflict that we see happening now and will happen to a greater extent in the future. This is a flow diagram, a hydrograph of the flow of the Snake River at the Hells Canyon Dam for the period of record starting in 1928 running through 1972. Each one of these is an annual cycle, plotted with the mean monthly discharge of that stream for each month of the year and then we've drawn a line through it. This comes out of our computer program where we can simulate the flow of the stream and simulate stream conditions and therefore with some degree of confidence predict what will happen in the future if certain actions take place. We took the natural record of the flow of the stream, and you have to recognize that from 1928 to 1972 there have been a lot of changes in Idaho. We built Palisades Dam, we built Anderson Ranch, we built Lucky Peak, we built various other dams up and down the stream. We have irrigated another maybe two million acres of ground in the state. We have adjusted that and have worked our way back so that this represents the present condition had the present condition been in existence in 1928. This is what the flow of the river would have been in 1928. So it's corrected for present situation. The top line, the blue line represents the current condition flow.

Carey Act is an 1894 law of the federal government which authorized the states of the west to select, manage and dispose of desert lands for reclamation settlement in units of 160 acres each. Our state law, enabling law, was amended to authorize a husband and wife to join together for the purpose of selection of land under the Carey Act and a lottery disposal of the land. And the legislation made a couple of other changes with regard to the fees and so forth so that there was generated in the state a considerable interest in this development. The result is that in the year and a half since that amendment was made I have received 82 formal applications for segregation or withdrawal of land under the Carey Act encompassing about 360,000 acres of new land development. I said to the staff, take a look at those filings along with other applications currently pending in the office and tell me what is the potential effect upon the flow of the Snake River if all of those are granted and if all of the development were to take place? And so the red line you see on the chart is the simulated flow of the Snake River taking into consideration what will or would happen if these are all granted, taking into consideration the diversion requirement for the location of the land with respect to the river, the return flow, when it would get back into the stream, the delay pattern. They've worked the whole thing out; you end up with these flows. Keep in mind that the Corps of Engineers license I referred to for Hells Canyon Dam requires 5000 cfs as the inflow to Brownlee. There have been petitions filed by recreation interests that the license be amended to require that Idaho Power release no less than 10,000 second feet at any one time in order to provide navigation and recreational flows below Hells Canyon. So there's that interest. So you can see that under current conditions there are many years when the blue line dips below 10,000. There are many more years in the future, if all this development takes place, where it will dip below 10,000 and in many years it will dip below the 5,000 as the mean monthly discharge.

Coupled with that, what was expressed to you by Mr. Rosholt is the interest of the state of Washington where they attempted to establish at Clarkston a minimum flow requirement of 22,000 cfs. The low month flow at Clarkston now is about 12,000. In the future in the low day, the low month, our projections are that will go as low as 6 or 7 or 8,000 cfs. And they want us to guarantee them 22,000. Obviously, there are conflicts.

Another major conflict that we see is that it's the flow of water in the river that generates electricity in Idaho. The effect of this in our power studies shows that there is an average annual loss between the red and the blue of 8% of the total power produced by Idaho Power in the Hells Canyon system from Bliss down to Hells Canyon Dam. In the worst year it's 40% of the current power produced by Idaho Power in those complexes of hydropower, if this development takes place. Obviously you've got some conflicts.

The irrigators are the people who lift water up out of the river, and that's where most of it is going to be in the future. All of the easy land along the river has been developed, and in order to get water onto new land in the future they're going to lift it, they're going to convey it. They're lifting water now in the state. The highest lift that I know of is 820 feet. A fellow over in eastern Idaho is lifting water 820 feet out of the Snake River and raising agricultural crops with it and doing it, he says, economically. I still question whether he's being subsidized by his other ranch. But nevertheless, we're doing that. We're doing it in the state consistently. We need more power in order to produce, we need more energy in order to get water on to this land. But the result of putting the water on the land is production of less energy. So then you convert to some other form of energy, you go to coal-fired steam electric generating and the energy cost is going to be three to four times the cost of the hydropower. Then the farmer can't afford to buy the energy. So you get into this vicious cycle of loss of water, loss of energy, need for more energy, producing of more energy at higher costs, farmer cannot afford it, therefore he goes out of business and so on. So there are some direct conflicts, of course.

I'm going to stop here in a minute and give you a chance for questions. Starting almost five years ago, certainly four years ago, we could see coming down the pipe at us the problem of protecting stream resources and a mechanism for providing such flows. We were concerned at the time that there would be some proposal put forward that would do violence to existing uses of water in our state. If you will, existing water rights. We were concerned that there might be a proposal that would come in that would gain enough support that it would go through and it would completely disrupt the economy of the state, recognizing that we are an agriculture-based state.

So, in anticipation of such a thing happening, I drafted and put in my hip pocket a bill which would provide a mechanism for appropriation of water instream in its natural condition for stream resource maintenance flows. I kept that in my hip pocket until one senator found out that I had it. He took it and introduced it and the action has gone from session to session until in this last session there was introduced House Bill 137 which was a bill that would have provided a mechanism by which there could be appropriated, of the unappropriated natural stream flow of the streams in the state, a stream resource maintenance flow to give that use of water a priority of right that would protect it against subsequent appropriations for diversion from the stream that would deny the stream those values. That was the genesis for the hearings by the legislative committee of Representative Chatburn and hopefully they will come back to the legislature with a report in January which will enable the legislature to give serious consideration to the question. I could spend some time reviewing what that bill would provide for, but I think in the interest of time I'll skip that.

Let me just say in closing my comments that the Department of Water Resources is very much interested in all aspects of the use of water in the state of Idaho. The water resource plan is in draft form and is scheduled to go to the printers about mid- or late-November. Hopefully then we will have a draft plan to give to the Board because they are the entity to adopt or to take action or demand, or do whatever they want with it; but it will be available for general public distribution about mid-January. The Board is then required by law before they can take any action on that draft or recommended plan to hold formal public hearings throughout the state; the legislation says "in every area affected". I don't know if that means every county, every town and hamlet and village, but it does say in every area affected. The Board will have to determine for itself how many such hearings and where it will hold them, but it must hold hearings throughout the state and thereafter it may amend, adopt, rescind, change, whatever it wants to that draft plan. The schedule is that they will have taken action by this fall. We will then, again, have to go back to the printer and print the final plan officially adopted by the Board and that plan, once adopted, will then govern future allocations and uses of water in Idaho. The Board has that kind of prerogative, that kind of responsibility. It was created as a result of a constitutional amendment, so they would have constitutional authority behind the plan that they adopt. That will be the guideline for future uses of water in the state. That plan recommendation will include recommended stream resource maintenance flows. Whether the Board agrees with the staff recommendation, or whether there's any change in that will depend upon, I think, what the people tell them as they hold the formal hearings. It will also depend upon actions of the legislature because, in my opinion, it will take an act of the legislature in order to enable the Board to protect those flows legally. They might otherwise just designate a flow but it will have no legal protection unless there is a mechanism for that legal protection. We're hopeful that the legislature will see it that way and grant that authority and will provide for it.

I'd be pleased to try to answer any questions in the time we have left.

Discussion Questions and Answers

Q. Just to start things going here, as I recall, Representative Chatburn was indicating that he thought his committee would not submit a report until they had a chance to see the state water plan. Will you have a standoff here?

A. I don't know that that's a standoff. I do know that the staff of the legislative council that have worked with the committee are working toward some kind of a draft of their report, because they've called me in this last week about

what they're trying to put together. But whether they'll completely hold off until such time as they get the draft plan in their hands, I can't tell you, that's a good possibility. We should have the plan in their hands about the time the legislature meets, or a week or two after.

Q. Do you see the role of the Board as one of really setting policy or more one of carrying out policy as you're speaking about the state Supreme Court and you're apparently going to try to force the issue. Some people thought that you should and some people thought that you shouldn't.

A. I see the role of the Board as both. They are directed to prepare and implement a state water plan. They have an implementation responsibility. If implementation means, as it has in some other states, construction of water projects, state construction, then they would be the entity to construct. If, on the other hand, it does not mean to construct anything, but to establish and implement policy, then they would be the entity to establish that policy and to provide means of implementation. I think, even though the legislature said that to the Board, the legislature retains the real authority insofar as adopting any new laws. But the Board would have the authority and responsibility to recommend to the legislature those changes that they would see as necessary. There are, of course, thousands of diversions and uses of water in our state for agriculture. We see as the water supply becomes more and more reduced and as there is a need to maintain water for instream uses there is less water available for appropriation to uses, that new uses will come in, say, in the form of expanded municipal requirements or industrial or similar uses. The best source to get water for that, is to buy up existing rights, and in the market place that's usually the practice. An industry will approach some rancher or farmer and they can afford to pay the man a lot more than the water's worth to him and buy his ranch with the water rights and then just take the water and use it for some industrial use. The problem we have is in our statute there is no mechanism for changing the nature of use of water rights. In other words, if it's an irrigation right that's been established, there is no mechanism for changing it to an industrial right. We tried in 1967 to get the legislature to change that provision of the law, saying that this future problem will create a demand for water now being used for other purposes. But, again, it went into the Agricultural Affairs Committee of the House and they said that Idaho doesn't want any mechanism whereby California can come to Idaho and buy our water away from our farms and take it down there and use it for industrial and municipal uses. Therefore we don't want that mechanism even in our law. And it was struck out of the bill and it never has become part of our procedure. We've already seen examples where entities have purchased the right and come in

to make the change in use and we had to deny it. Maybe the court will tell us that they can make that change. It is a property right and maybe the court will tell us they can make that change even though the statutory provision is not there. But as yet there's been no test case on that and that's really a flaw in our current law. So policy may say we should allow more free conversion of uses from one use to another, but it'll take the legislature to act in order to bring that about.

Q. You indicated the minority opinion on the Supreme Court case that you mentioned was that diversions should not be allowed if they would impair recreational use or scenic beauty and so on. Would you see any extension of that idea to the effect that enhancement of scenic beauty of recreational uses would be considered to be a beneficial use? For example, would you see the possibility of storing water in a reservoir or lake such as Priest River and making releases downstream in order to enhance the recreational uses of the stream?

A. Thanks, I'm glad you mentioned that. I want to make this clear and it's a problem, I think, that the interim committee is struggling with. Some of them just don't completely comprehend that there is no prohibition currently in the law to prevent the appropriation of water by diversion for instream uses such as you're talking about. In other words, you can construct a reservoir which has as its sole purpose the subsequent release of the water for instream uses below as a beneficial use. But in that, you see, you physically divert it from its natural stream channel or location by constructing a dam and through that act appropriate it under the traditional theory of appropriation which is to take physical possession of. There's nothing we see in the law that prohibits that, in fact, a lot of this is done in that way; 50,000 acre feet of the storage in Lucky Peak Reservoir under the Bureau of Reclamation's permit is owned by the Fish and Game Department for the purpose of maintaining stream flows in the Boise in the winter period. That's a valid use and appropriation of water as we see it. There's nothing to prohibit that. Where the problem lies is in maintaining a natural condition. There is no mechanism whereby you can simply say, there's a free-flowing stream, we want to leave it free flowing in order to prohibit someone from appropriating it under a right which is guaranteed by the constitution. We need a mechanism whereby publicly you appropriate enough water to maintain a minimum flow. But the problem of release from Priest Lake to maintain a river below--that can be done within the mechanism of the current water laws.

Q. In other words, there is provision for enhancing the flows but not to maintain them?

A. Not to maintain in a natural condition. Therein lies the problem. That's the main thing that we can hammer on; there is no mechanism to protect a stream in its natural condition and leave some water in that stream protected against appropriations of water. I use that word in the same way I would appropriate your car. I would make it my own by just taking it and that's the way you appropriate water, you simply physically take possession of it and it becomes your real property. You have a right to its use because you have appropriated it to your own use; the right to appropriate is guaranteed by our constitution. So in order to give some validity to the instream flows you are trying to protect, you have to have a mechanism whereby those flows are appropriated. And that's where we don't have anything presently.

Q. On these northern lakes the construction of a dam is appropriation of the water to maintain the lake level . . .

A. As I say, that's what makes them different than the general class of a natural stream. Because there is a physical outlet control dam and therefore constitutionally and as weighed against our water law they probably would hold up as appropriations because they do physically divert it from its natural course by putting a dam there to control it.

Q. What are the operational procedures for accounting for water that's diverted for irrigation or some other use. Do you meter this or are your permits set up as a certain flow rate, but you don't meter the total quantity of it? Is there a time limit of use, or a total quantity of use?

A. There's a time limit of use, but most of them are on a flow rate basis. In other words, the water right is for so many cubic feet per second from a stream at a certain location to be delivered to a certain tract of land with an irrigation season beginning in April and ending in October or some such thing. We recognize that what the effect of that is -- if they diverted all they were entitled to on paper starting April 1st and continuously through the end of October, they would get two to three times what they actually needed to grow a crop, but that's the way the water rights are couched.

Q. Then when you accounted for potential water rights in your diagram did you just account for those on the basis of those flow rates being continuous?

A. No, we did it on the basis of irrigation demand of the crops normally grown in the area. And the consumptive requirements of those crops and then the return flow. Keep in mind that all this water that we're talking about here is water that you're going to have to pump. You're going to apply energy to get it to the land and therefore you're not going

to pump any more than you need, generally. If you look at the high lift pumping projects on the Snake down south of Boise, in the Mountain Home area they don't pump any more water than they need to run through those sprinklers to grow that crop because they're paying dollars for every bit. If you were on the Snake River at some location where it would flow by gravity, yes, I could show you cases where they divert as much as 22 acre feet per acre. Because its physically available, they run it through their canal system and out their wasteways and over the land and back into drains and back in the river, because it's physically available.

Q. But that's not a 22 acre foot per acre loss to the system.

A. No, it isn't a loss to the system, it's a diversion. Even though probably if they were very careful with their irrigation they could get by with 3 to 6 acre feet.

Q. My main reason for asking the question was with respect to determining what the effects of irrigation have been on stream flow records in the past, because what you're ending up with is a net effect.

A. We have not taken the water right figure in cfs to do this, we took the pattern of irrigated land and the location of that land, the crops normally grown on it plus consumptive use return flow pattern that would result from that kind of irrigation. We're talking about a diversion for the Carey Act lands of over 6700 second feet that they're applied for.

Q. Have any other states dealt with the problem of maintaining natural flows that would have a situation similar to Idaho's, like Washington or Oregon?

A. Oregon has a law currently on the books where the water resource board of Oregon does have the authority to designate scenic waterfalls and other flows in order to protect those things. The board does do that and has established those flows in about 1200 separate locations in Oregon. I think it's also significant to point out though, that in the one case that I'm aware of where they were confronted with a direct conflict that they subordinated the stream flow to irrigation demands that came along. They in effect just set aside the flow that they had tried to protect and just suspended that for the time necessary in order to allow the irrigator to go ahead and irrigate.

Q. In your mention of that 50,000 acre feet in Lucky Peak, I didn't pursue that far enough. Do you know whether they've ever used that all at one time?

A. I don't have enough information that would indicate that they have used it all at any one time. It's not always available

every year, the full 50,000. They have to share the amount of water that comes. Their's is a contract, as I understand it, as a secondary. There are irrigation rights in the bottom of the reservoir that in effect get the first block of water. They share the surplus. There is also in that reservoir something like 116,000 acre/feet of unallocated space.

Q. I'm well aware of that. Really there's not much of a mechanism right now to even evaluate it very well. As I recall that was interesting in the history of the water right, it wasn't there originally. It was brought up later. The Bureau of Reclamation first applied for that right and I think it's one of the first cases, other than the one you mentioned about lakes. They did appropriate water (I hesitate to use the word appropriate), they designated a use of storage. The other question is, I was looking at your red marks and you mentioned that all these have some instream regulation type. What is the water right on Dworshak Dam?

A. O.K. There is no water right and you shouldn't get the impression from the little marks over there that each one of those is a water right recognizable in Idaho or in federal courts. What they are primarily, most of them are operating criteria. There is this criteria, but there is no filing on Dworshak. The Corps of Engineers feels that they do not need to get the approval of the state of Idaho in the water right for the operation of Dworshak and the project is authorized by the Congress under the Navigation and the Commerce clause of the constitution.

Q. That is an evidence where I think it would greatly enhance our state if those were even as recognized rights, if we would identify them. That gets into the same thing we're talking about here, instream use. It's obvious that Dworshak Dam regulation can enhance the flows of the Clearwater River.

A. No question about it. Were the Corps of Engineers to apply to us indicating that that was a use of the water stored behind the reservoir, we would authorize it. They have not applied. If we get into that, that's a whole other seminar subject, federal-state conflicts over jurisdiction in water rights.

Q. I was wondering about this graph. You were talking about the interplay between agricultural uses and power production. Is instream water for power production a beneficial use? How do you weigh those against each other.

A. The Idaho Power Company, in connection with its dams on the Snake River and through Hells Canyon has applied to the state and has obtained permits, water right permits. The capacity of their turbines, as I recall, in Hells Canyon is

33,000 second feet. That's the maximum they can put through their turbines at maximum power, and their filings are on that basis. But, every permit that has been issued to them subordinates that use to upstream diversions for beneficial uses. So they cannot, by reason of having a run of the river power plant down in Hells Canyon, demand water continue to come down. If any of you have studied the Hells Canyon legislation, the recreation area legislation, there is, in effect, the same kind of proviso in that. The establishment of a national recreation area in Hells Canyon cannot be used by the federal government as requiring any flows to come down through there under either the Wild and Scenic Rivers Act or the National Recreation Area Act. That, in effect, is subordinated to continued development upstream in the Snake River Basin for other beneficial uses.

Q. Doesn't that say subordinate to existing water rights?

A. And future. The water users in Idaho, and again this is a very effective lobby, the water users in Idaho insisted upon that in the legislation and frankly, both of our senators felt strongly about it that they insisted that be in or they wouldn't support it.

Q. That was a great controversy at the time of the previous attempt by Senator Packwood in what's called the Packwood Bill. He tried to force this through without that proviso in there and he got shot down very profoundly in a congressional committee. So obviously, it'd never go anywhere without that in. Of course, it's interesting how that came up. As I recall it, it came out of a comment when Jordan was in Lewiston and they asked him about this and he challenged this to Packwood. Someone came up and asked him, do you really mean that you wouldn't use some language in there to protect the upstream users? Packwood said, yes, I'm going to stick by what I say. And that just immediately split the congressional people from the northwest. But then they joined forces, Packwood and Senator Church and Senator McClure and Hatfield and said yes, we'll all go along with the proviso. I haven't seen the latest draft. It'll soon be through Congress, we should see it go through in the next few weeks.

Q. In that same respect, are you just sitting on those permits, or are you forced to act on those?

A. No, we're not sitting on them, but we cannot act on them because the Bureau of Land Management, which is the federal agency that administers these desert lands, has not given the state the go-ahead. Some of these have been in our office for a year and a half, but the BLM has not acted. I cannot authorize the development of the project until I get a segregation of the land to the state from the Bureau of Land Management, so we're holding the filings until such time as the BLM moves.

Q. Back to this Supreme Court thing again, where you're talking about the sovereign role of the state in protecting the public interest in the streams, the scenic beauty and so on, would you think that a federal Supreme Court would judge that the federal government has this same sovereign role?

A. I think so. Again, you can argue the federal vs. state jurisdiction question over water resources. You can also argue whether Idaho is in a different position than other states because of the way that we came into the union and what our constitution says compared to other constitutions as they were ratified and approved by the Congress of the United States. Ours has a little bit different language in it, it may be that we came in on a different footing than the other states because of that language in regard to water rights. I think generally the federal government would argue the same thing. We're getting claims now, and I have two cases in the state, where the Forest Service is claiming all of the water within the national forests under the reserved water rights doctrine of the United States. The purpose for needing all of the water within the forest is for instream resource maintenance flows. They're claiming that they have a reserved right to do so.

Q. How are you arguing? Are you arguing for or against?

A. We're arguing against it on the legal grounds that the reserved water rights doctrine is based in the theory that at the time the forest lands were reserved from the public domain for a specific forest purposes that there was reserved, with those lands, sufficient water to allow them to make the use for which the land was reserved, the same kind of priority. In other words, most of the forests in Idaho are 1906-1907. That would establish a date of priority from a water right standpoint for any use that the Forest Service might need to make of water on those lands. Well, we go back to the Forest Practices Act of 1897 which says the purpose of the law which authorized the creation of a National Forest is to protect lands for timber management and to protect the watershed so it will yield water down below for other uses. We don't think it contemplates anything other than that. If that was the purpose for which the land was reserved, then we don't see in that the uses that they're now claiming. From that legal grounds we're resisting.

Q. If I understand what you said, it sounds like the Forest Service position. They want minimum flows to maintain the streams and you're looking for something downstream like irrigation.

A. No, I'm not trying to put words in the Forest Service's mouth. What we see happening is a claim by the United States that when lands are reserved there was reserved with that land "all of the water" within the exterior boundary of that reserve for national purposes. And if that means they need, in the national interest, to put water over in Montana and Wyoming for oil shale or coal development; then one of the purposes of creation of the Sawtooth National Forest in Idaho was to manage the nation's crop so they could divert water to Wyoming and Montana. We see that happening and therefore we are resisting the claim of an unlimited right in the United States to the water within the forests.

Q. In connection with a similar kind of an incident of federal and state interactions, do you anticipate any impacts on western state water programs from the Bureau's Westwide Study?

A. I have not studied the Westwide Study in that detail. I have skimmed through the summary report. In my opinion it is a very quickie review of matters from the standpoint of federal agencies, principally the U.S. Bureau of Reclamation. In my view the report is in furtherance of the desires of that federal agency to extend its useful life and its necessary functions. I see in the outline of those "critical issues in Idaho" that are identified in the report, almost entirely an identification of problems which will require, in their opinion, actions of the federal government, or extensive studies by the U.S. Bureau of Reclamation in order to resolve them. I see the report having that value. We don't think it's authentic. The main complaint of most of the western states was that we were assured in the very beginning when they started the study that there would be extensive opportunity for non-federal input. In the first year or so of the study that was true and we participated as observers and participants. They then said, no we've got to wrap this thing up in a hurry and, because we're going to wrap it up in a hurry there isn't an opportunity for yours, so we don't want your input any more and so the federal government got together and collected material and put it together and here is your report. They're claiming that there was state input. There was not. Because of that, I don't place any real value in the Westwide Study. I think it'll be like numerous other reports, perhaps even like the State Water Plan report, it will eventually sit on a library shelf and gather dust.

Q. In connection with what you said earlier about whatever extra water you had, you'd give it to recreation . . .

A. That was just a facetious comment of mine, it isn't written in there.

Q. Do you think that trend of making some scenic rivers and leaving those rivers which can't be irrigated out of, power plants can't be put on them, leaving those and then using rivers like the Snake to say, okay, you've got the Snake River. Is there any of that attitude?

A. I don't think there's any direct attitude, there is a lot of interest in the state for preserving scenic rivers. I don't think there are people who are willing to say, okay, you give me the Clearwater and you can go ahead and do what you want with the Snake. I don't think anybody is willing to suggest that kind of tradeoff. We hear comments all the time that the Snake River is a "working river" and that implies that it is something other than a river. We don't see it that way. We think it's the same as any other river. There are locations in the Snake where, of course, it is worked to death and it's completely dry, like at Milner Dam. Yet it replenishes itself through spring flows and return flows and you have a river again. That doesn't mean that just because at one time it was diverted dry that should be the future of that river downstream. I don't see that the Snake River, in its run through the Idaho, should be any different in its consideration than any other river. But yet you need to look for all of the demands that are going to be made upon that river and try to balance it some way. As I say, the people of Idaho tell us that they want preservation and recreation and those values protected, but at the same time they do not want to stifle economic growth. In order to balance that, you have to walk a tightrope. I don't anticipate that there will ever be any real activity to divert the Salmon River for irrigation or such purposes. I don't think that's going to happen. But on the other hand, I don't think there's going to be any lessening of the desire to divert the Snake. Maybe in trying to balance you in effect do make those tradeoffs, but not directly.

Q. There's kind of a small instream water use that's been going on for a number of years. I say small, it's small in quantity but it's rather extensive in distribution, that's instream use of water for livestock watering. That's traditionally just gone on, I'm not aware of water rights appropriations for that particular instream water use. Have there been some?

A. I know of only one in the state that has been recognized by the court and that's on Hayden Lake tributaries where the judge granted water rights for stock watering from the streams as cattle are just free on the open range and did specify the quantity of water because it was based upon a grazing unit in the national forest in which there was an animal limitation AUM (animal use months). Based upon that the court said how much water does that represent and we got out our little calculators and said an animal drinks so

much water per day and therefore it represents so many acre/feet per season and the judge granted it.

Q. But that was an adjudicatory action, it was not by permit.

A. We have not issued any permits for instream . . .

Q. Have there been any filings for that?

A. To my knowledge, no.

Q. If that were to be done, would that be done by the BLM who administers the ground, or the . . . ?

A. Or the private grazing associations that actually own the land or the Forest Service and they would hold the right for the benefit of the permitees on the federal land. That is done in many states. They do, in their adjudication process cover that kind of use. We don't generally in Idaho.

Q. It's my recollection in reading some of the early water rights on the Boise that they did mention water for stock, because I said, I think we were talking last time, what kind of surprised me in reading some of those real early rights on the Boise River is that it mentioned use of it even for sewers.

A. We've done this in our actions with the court where we have prepared proposed adjudications. We have put language in there which the court would recognize that this use takes place, but it's an undefinable use and maybe it can continue, but that right of use may not be transferred to any other use. In other words, it's there, it's consistent with the ownership of the land, the management of the land, and we recognize it takes place. If we started doing that, we'd have to count the bear and the sheep and the goats and the deer and begin worrying about water rights for them.

Q. Except that the livestock watering is very often concentrated at a few points on the stream and therefore somewhat different.

A. Then I'd have a problem once I defined that point on that stream if a cow wandered over 20 feet and drank, I'd say you haven't got a right there, move that cow. We don't want to get into that kind of a description of a water right.

Q. It's very likely that someone else would make that decision anyway.

A. But I say, we have in our recommendations taken care of it by a simple paragraph that says that we recognize this use takes place, it's an undefinable right, the persons who

have the land, who graze the cattle freely and on the open range have a right to water their cattle in the streams that cross the land but the court should not try to determine the extent of that right or define it by location or point of diversion and the court should also say that right is a nontransferrable right.. You can't just simply say, well, I've grazed cattle here for 30 years; therefore I've got a right to 25 second feet of water from this stream, I'm going to now move it down the valley and put in an industrial plant with it. We don't think that should happen. The courts have gone along with us so far.

Q. There are some of the directors, the Idaho Water Users, who are thinking in terms of applying for permits for this purpose in order to maintain some instream flows.

A. That'll be interesting. We'll generate some Supreme Court cases, then.

Presentation by

AL ISAACSON

U.S. Forest Service

I understand my responsibility is to address the question of the reserved water rights claimed by federal land agencies.

We (the Forest Service) went to court last June and the judge hasn't ruled yet on a particular case. I'm going to try to give you both sides of the case so that you can be the judge and jury and see what you think. It's complex and there are a lot of implications in this case, it has nationwide application. The Forest Service and the individual states are particularly concerned.

The case is Avondale vs. U.S. Forest Service, which is concerned with Hayden Lake just north of Coeur d'Alene a couple of miles. It is a small lake and it is a closed basin, there is no outlet. It's heavily used for summer homes and irrigation. Three irrigation companies have irrigated out of the lake since 1911. That's how the lake draws down rather than an outlet, through pumping for irrigation and domestic use.

In 1966 the water became too low during the summer period, and they were having trouble pumping, so they brought an adjudication case before the courts. Part of the reason for this is all the summer home development and housing developments. There were multi-home units, condominiums, hundred-unit housing developments, etc., that were putting in water systems, drawing out of the lake without water rights. In 1966 the state wasn't very well prepared to handle water rights, so most people were using water without an adjudicated right, without a right from the state.

In October of 1966 the three irrigation companies brought suit against all the other users in the basin, who numbered about 8000. The Forest Service was one of those users. We thought this would be a good case to test the reservation doctrine, which hadn't been tested in Idaho. First, we went through on consumptive uses; for example, a campground where you're pumping water out, or summer homes. There were a few summer homes on lease where they're using water.

That went through all right, we received the reservation use for consumptive uses. Keith Higginson, Director of the State Department of Water Resources, was appointed the special master in this case to collect all the facts and bring them together, and to write up a special master's report with a listing of priorities of the water users. He denied our case at that time for grazing. We have several cattle allotments in this basin. At this time, Idaho law said you had to have a diversion works and put the water to beneficial use through the diversion works. Well, we went to

court on that and the judge ruled when the cow drank, that was the diversion works and allowed us the grazing rights.

In April 1971, Keith brought out his findings. In them he denied our reserved rights for non-consumptive use. On August 16, 1971 we appealed, we filed our exemptions to this. On August 30, the district court permitted Idaho State to intervene and the dispute began between the Forest Service and Idaho State Department of Water Resources. The district court upheld that we had a reserved right for a non-consumptive use. But one of the things we asked for there was that we did not have to quantify this use. Our belief is that the reserved right is from here on out into the future as your needs expand, that this was a right given with this land. We'll dig into this much deeper as we go along. Our point was that we didn't have to quantify. Well, this report said that we had to quantify, so it went to the Idaho State Supreme Court. They upheld the district court ruling that we had to quantify, but that we did have a reserved right. We had until last June 9th to quantify our needs as to non-consumptive uses or instream flows.

At that time we presented our case. I want to emphasize one point here; that is, the question wasn't whether we had the reserved right, it was that we had to quantify them. What the Idaho State Supreme Court said was "the existence of federal reserved water right is apparently firmly established and is not disputed by the respondent in this appeal. The doctrine has received extensive analysis and attention in legal publications, governmental permission reports, dissertation where instream development of the doctrine is unnecessary." So we felt the reserved doctrine is firmly established by a history of cases. But in the instream situation, we would have to quantify the use. We complied with that and did quantify the use.

We quantified for 100% flow on national forest lands. This was basically for fish habitat and fish spawning and we felt any lowering of that would significantly lower our fish populations, due to the nature of the streams that were involved. There were three streams: the main Hayden Creek, Mokins Creek and Yellowbanks Creek.

On national forest reserved lands we asked for 100% of the flow. Off the national forests, there's about a half mile stretch between reserved lands and the lake. We asked for a flow of 3.57 cfs, that's a minimum flow for fish passage from the first of April to the first of July. The state contends we have no business there. It depends on how you look at it whether we do or not. The reserved doctrine says flows off of, or downstream flows off of the shed. That is the way it's worded.

We wanted to perpetuate fish spawning and use of the habitat on the reserved lands. We asked just for passage. It has nothing to do with spawning in that area or recreation or any other use.

We developed a program to come up with what we needed for minimum flow for fish passage, and we'll get into that a little bit later. That's what we asked for when we went into court.

We're going to look at several things in the background of the legal case, we'll just talk about the legal aspects. I'll try to present the Forest Service's point of view, plus the state of Idaho's point of view. What I'm using for background are the summation briefs for the case that were submitted to the judge.

The main items are the Winter's Doctrine of 1908, the Arizona-California case of 1963 and the Precreative Act of 1891 which gave the President and Congress the abilities to establish national forests. The Creative Act of 1891 was a followup to the Precreative Act. The Organic Act of 1897 is the main act giving the Forest Service the responsibility that it has to manage the lands. There is also the Multiple Use Act of 1960. I'll try to bring you through these acts and through the history that we've built our case on, where the water does belong to the federal government on federal reserved lands.

Federal reserved lands, let's get the definition straight to start with: "all title to land and water is derived from the United States". These were lands, as far as the Forest Service management is concerned, that were established as part of that national forest or that reserve when that national forest was created. These lands have always stayed in government ownership. For example, the north Idaho area became federal property in 1846 under treaty with Great Britain as part of the Oregon Territory and stayed completely in federal ownership up until the Forest Reserve, or the National Forest, was founded.

Along with that, the water stayed in ownership with the land. "With its ownership of the public lands, the United States acquired the right to use of lands and all rights pertaining thereto. The right to use and dispose of water which may run over, through or under the soil is controlled by the same provisions." There are several court cases: the United States versus California, Utah Power and Light versus the United States; and several others that bear this out. The fact that the United States has property rights in the non-navigable waters of public domain is well established.

There's a summary paper written by a Professor Clark that states this very well and I'd like to quote a little bit of what he has to say. "With admission to statehood, the states acquire those interests in the navigable waters which are an incident of sovereignty. The states, by the mere act of admission, did not acquire title to non-navigable waters any more than they acquired title to the public lands in which those waters were found. It follows, therefore, that unless the United States disposes of such land or such waters, it is still the owner." This is a basic premise that we go on in the reserve doctrine; that we still own that water, that the state doesn't have the right to issue water rights on it.

The only congressional authorization for private individuals to acquire rights to use water pertinent to the public domain is in the Desert Land Act of 1877. In areas that came under the Desert Land Act, private individuals could use water on them. But then, through several more court cases, mainly the Federal Power Commission versus Oregon, it was found in 1955 that the Desert Land Act is not applicable to waters found in reserved lands. That's the only method private individuals could get water on public domain, but it doesn't apply to reserved land.

Q. Could I stop you right there? You use the word public domain and you use reserved land. There must be a distinction.

A. The public domain today is all the lands that aren't in a reservation. Before 1891, all public land was public domain. But now with forest reserves, Indian reserves, wildlife reserves, any of these that are set up with a certain reserve are taken out of public domain. What's public domain now is usually managed by the Bureau of Land Management. There are the lands that haven't been put into a reserve. In some way I guess you could say they're the leftovers that aren't set up for a specific purpose.

Q. You have two types of Forest Service land, too?

A. Right. We have the reserved land and we lump everything else into acquired land. These are lands that have been acquired through donations, land that the county has given over to the Forest Service, which is quite a bit. I don't think people realize how much donated land is part of the Forest Service. In the Idaho Panhandle, we have over 400,000 acres of donated land that people have donated back to the government mainly because they want to see it used for everybody.

Q. So acquired land, under your interpretation, would not entitle the agency to water rights?

A. Acquired land is the same as any other private owner. We have no reserve rights at all on acquired land, just on reserved land. We have a few parcels, in fact, there are some in this Hayden Lake area, that were government ownership, went to private ownership and back to government ownership. Those are acquired lands. They had to stay in continuous ownership to be reserved lands.

The Winter's Doctrine came about in 1908, the case Winters vs. the United States. It established the power of the United States to reserve public lands and unappropriated pertinent water.

I'll quote a little bit from the findings of each one of these. I'm going to use several quotes because one word makes a big difference to how it is applied. In the Winters case,

the Supreme Court said "the power of the government to reserve the waters and exempt them from appropriation under state laws is not denied and could not be". In the Winters case, the Supreme Court ruled that all of the treaties setting apart certain lands for an Indian reservation do not contain an express reservation of rights to the use of the water on the Indian reservation; that the reservation of water must be implied because the use of water on the Indian reservation was necessary if the Indians were to subsist there.

So we start out with the Winters Doctrine, with an Indian reservation as the example. It doesn't say in the reserve doctrine that the water is reserved, but it has to be implied. If you're going to use that land, you must have the right to the water. Then on through we've developed off of Winters onto other reservations. The assumption is made here by the lawyers that "this necessarily implied that water was to be reserved in the Organic Act of 1897, under which the National Forest was established."

Q. It says that it's to be reserved for the purposes for which the forest was established?

A. We'll get into that in detail. That is the key point between the state's argument and the Forest Service's argument, the purposes for which the forest reserves were set up. I hope we will delve into that as we go along.

We'll go back a little more to what Professor Clark had to say on the Winters Doctrine. "It's clear that the United States can reserve large quantities of unappropriated water either navigable or non-navigable. In the case of non-navigable waters on the public states, the United States, based on its original ownership to the lands, has proprietory rights to all waters which has not been divested by valid appropriations under state law." Those would be water rights before the reserve was established. There are very few in Idaho. Sometimes in the state of Montana, the reserved right doesn't mean anything, because all the water was appropriated before the forest was established. But in Idaho there were very few to precede the National Forest.

One way the government immunizes itself against further divestment is to withdraw the public lands from entry. The precise effect of the withdrawal of public land from entry comes to this; appropriations made prior to the date of withdrawal are vested rights and remain uneffected. Appropriations made subsequent to the date of withdrawal are not vested rights.

Then we get into the Arizona-California Case which is a landmark case in water rights. If ever there were doubts that the United States can reserve water rights in the public domain within a state, such doubts were put to rest by the Supreme Court in Arizona vs. California. This culminated a long series of cases

following the Winters Doctrine. The court made it clear that this power of reservation was not restricted to lands reserved for Indians, but was equally applicable to other federal reservations. Thus the Supreme Court found that the very act of establishing a federal reservation implied that intent to reserve the pertinent waters necessary for fulfillment of the purposes of the reservation. So here we proceed from Indian reservations to other federal reservations.

Q. Wasn't there an earlier case of withdrawal for power site reservation?

A. There was, I haven't referenced it in here. There were numerous cases that came up before the Arizona-California case.

That's another principle characteristic of federal reserved water rights. Such rights are not limited by past use and they are not lost by nonuse. This is an important point, because in state appropriated waters, you can lose them by nonuse. They have to be appropriated. The reserve doctrine says you don't lose them by nonuse and they don't have to be appropriated.

An appropriated right initiated after the date of the reservation would be wiped out or at least be subordinate to a federal use under the reservation. It's not developed until long after the date of the appropriation. This is what we were using to say we didn't have to quantify water. And you can see the point it puts the state in. Hanging out here is the federal government with a use that they don't have to quantify and then they call on it anytime they feel like using it. Personally, I agree with the judge that we had to quantify. I think that's only right in the adjudication process. That's what Congress and our forefathers thought about when they set up the reservations.

Then we get into the Organic Administration Act of 1897, which is the managing act of the Forest Service. This supposedly gives judicial recognition to those claimed instream uses as valid purposes for which a national forest was established. So that will answer your question on uses. The question of whether withdrawals of public lands for national forest purposes reserve waters in and on these lands for the above mentioned instream uses has already been answered in the affirmative. It's in the Supreme Court case of Arizona vs. California in which the special master set down these uses: protection of watersheds, maintenance of natural flow in streams below the sheds and production of timber.

The state contends that these are the only two uses of national forests: production of timber and protection of the watershed and a steady flow off of the sheds. Their case was built on the premise that national forests were reserved for

irrigation waters off of the forest and for the production of timber (strictly economical uses). They go on in California vs. Arizona: production of forage for domestic animals, protection and propagation of wildlife, recreation for the general public. This was in the master's report in this case. The report of the master was adopted and approved by the court with respect to this finding. The case of the United States of America vs. District Court of Eagle County reaffirmed the California case.

Let's quickly go back into history before the Organic Act, the Precreative Act which gave the president power to establish national reserves. There's a long history of remarks in congress that could imply that more uses were contemplated than just the production of timber or water for irrigation off of the national forest. There were several references to recreation, to hunting and fishing, and to grazing.

The chief of the Forest Service in 1891 gave a report of objectives which is a background report for the management of the national reserves. First, to assure a continuous forest cover on the soil of mountain slopes for the purpose of preserving and equalizing water flow in streams which serve the purpose of irrigation, and to prevent formation of torrents of soil washing. Second, to assure a continuous supply of wood material from the timbered areas by cutting judiciously with a view to reproduction. That's going over what we just talked about, this is where the state says it stops. In his report he goes on and says secondary objectives such as can and will be served at the same time as those first cited are those of an aesthetic nature, namely to preserve natural scenery and remarkable objects of interest; and to secure places of retreat for those in quest of health, recreation, and pleasure. Both objects are legitimate. The first class is infinitely more important and the second is easily provided for in securing the first.

The interpretation of that is where the whole case lies. The state says production of timber and water flow are the prime management we have and everything else just comes along with that. By managing the timber correctly, we will have recreation. But we don't have the right to manage for recreation sake. The same with fish and wildlife; if we manage timber correctly, we will have fish and wildlife, but we can't manage separately for those. We say they are two separate things and both are important.

Q. In building the state's case, has the state ever raised the constitutional issue wherein the people gave certain rights to the federal government and specifically stated in the constitution that all rights not specifically given were reserved by the people? Water rights were never specifically given to the federal government and were therefore reserved by the people.

A. No, they didn't bring it up that way. The case that the federal attorneys presented was that they were given to, or retained by, the federal government.

Q. Nothing is ever retained by the federal government in the constitution. In the constitution, the people have the rights, and they gave certain of those rights to the federal government. The constitution specifically states that those rights which are not specifically identified as being given to the federal government are reserved by the people. Water rights are one thing that was never specifically given to the federal government, therefore, it still resides with the people and always has, by the constitutional argument.

A. No, they didn't bring that up. I think that was argued in the Arizona-California case. This was already argued, as it has to do with consumptive uses. But, no, that never came up in this case.

Q. It's basically on that premise, the constitutional argument, that the Bureau of Reclamation applies for water rights.

A. That didn't come up in this case.

We go into several other points, we asked for part of that instream use for fire control where we were given responsibility for fire control.

The bill indicates that there are more uses for national forests than just timber or water. The third point we bring up, the officials charged with administration of national forests have consistently construed the Organic Act of 1897 to claim instream uses as a valid purpose of the national forest. Ever since the forest was established, we've been going under that premise. The court has upheld that a great weight should be given to the interpretation of statutes by those officials charged with the duty of enforcing such statutes. There are numerous court cases that back that up.

Q. Would you say then that the Forest Service has never applied for a state water right on reserved land?

A. Yes, that's right, in fact that's been our direction from the Washington office.

Q. But if you went back through all of the state's appropriations, you'd never find a Forest Service application for use on reserved lands?

A. You're not supposed to.

Q. I imagine there have been slip ups, I bet there have been cases where there have been actual applications.

A. I think there were some, but during the sixties, we went back and contested that they weren't needed, particularly in Montana. The problem in searching out whether the rights might have been applied for on acquired land, is very difficult sometimes, particularly if your land status records aren't very good, to know what's reserved and what isn't. It's kind of difficult to ascertain at times. So I wouldn't say there aren't because there probably are.

The multiple use concept has always been implied by the foresters. We've asked for funds from congress for recreational facilities, for fish and wildlife research, for a variety of reasons, and they have always granted the funds. Approval of the type of management has been part of several court cases. If Congress approves, they give you money for management. This goes clear back to the beginning of the forests. Functional items for different multiple items besides timber management and water have been funded.

The next point is that of judicial sanction of agency sponsored use as valid purposes of a national forest. In several cases, we were told by the court that grazing, skiing, and hunting were uses. That told us that general recreation, over which we had gone to court with several different people, is a valid use of the national forests, and one that we should be managing for.

Appropriated acts are just as effective to legislate as our ordinary bills relating to a particular subject. Appropriations acts are often regarded as ratification of administrative construal of a particular statute. There are some cases on this. When Congress finances it, they put their blessing on it. Most of the time they don't know what they're financing anyway, but they do it.

Clearly, through the years, since passage of the Organic Administration Act in 1897, Congress has been aware of the sanction. All uses for which Forest Service functions which require stream flow and natural water body maintenance are claimed.

Another case that I thought was really interesting was Redline Broadcasting Company vs. Federal Communications Commission. The court stated that 30 years of consistent administration construction, left undisturbed by congressional dissent until that construction was expressly accepted, can be construed as congressional ratification. So we've been going on with 70 years of managing the forests the same way.

Now we get up to the Sustained Yield Act of 1960. The state's contention was a reservation after 1960 would follow the way our thinking goes, but before the Sustained Yield Act, we didn't have those rights. We're saying we always had them and that the Sustained Yield Act was just a reaffirming of those rights.

In the Senate and House, reports on this act before it was passed, they both say "for the greatest good of the greatest number in the long run", which is a wording right out of the Organic Act. Passage of the bill would continue this policy. Administration of the national forests has long been under the policies of multiple use sustained yield. The purposes of this act are declared to be supplemental to, and not in derogation of, the purposes for which the national forests were established. Our interpretation is the Sustained Yield Act is just a reaffirming of our management over the years. The states' interpretation is that act is what gave us the right and that we have only had the right since 1960.

In the act it is stated: "through the years, by a number of congressional enactments, including appropriations for carrying out specific activities and functions, court decisions, policy directives and statements, maintain the national forests on the principle of multiple use and thoroughly recognize and accept it. These resources are listed in alphabetical order and each has equal consideration with others over the national forest system as a whole. They will neigher upgrade nor downgrade any resource."

That pretty much brings us up to the present. During our court case we presented evidence of why we needed the quantities that we asked for. The state did not contest any of our testimony. Their argument was strictly on a legal ground that the federal government did not have the right for instream nonconsumptive flows as part of the reserve doctrine, and asked for a summary judgment right at the beginning of the case. So if that was granted, then the rest of the testimony would be wiped out, that stops the proceedings right there. The judge said he would take it under advisement and we went on with our testimony into what we were asking for under the reservation.

There is recent background in Idaho. Have you gone into the water rights case in the Caribou National Forest? The judge made several points in that case that are quite important. A lot of people have the concept that if the federal government owns the water on reserved lands, they can do with it what they want. Sidney Smith made that statement and he was wrong, but he hasn't backed down from it. The waters in a reserve are used only in that reserve. So if they're in the Coeur d'Alene National Forest they cannot be transported out of the Coeur d'Alene National Forest somewhere else, like to California.

This is a big fear of the states, that if a water right is given to the national forests that they can say, okay, we're going to interbasin change that to a water-short area. This is not legal under the reserve doctrine at all, and we don't contend that it is. In fact we're saying that we would not even change within the reserve, but that it will stay right there in those streams that we ask for, there wouldn't be any transfer at all. I think that is one of the bigger misunderstandings of the

reservation doctrine. The states are very concerned that if the federal government has a water right they'll transfer the water to a water short area.

Discussion Questions and Answers

Q. By the same token, if the reserve right is granted, then the state would not be able to make interbasin transfers using that water. It might be in the best interest of the state to do so, but by granting the reserved right it would be prohibited.

A. In this particular case, that's the very thing we are afraid of, particularly in this lower part for the fish passages. As the Rathdrum Prairie continues to grow, this is a nice source of water that could be gravity fed down to the prairie. We can see housing developments going in and drying up this creek completely. When you look at 3 cfs, that's not much, but it's enough to get by what our needs are. We were trying to prevent a transfer, and Idaho state, I think, will prevent it when they get the mechanism through the legislature to be able to do it. They've been trying for years. We talked about this last year in discussing objectives packages; instream flows is one of their objectives, but they haven't been able to get it through the legislation. Even now, I guess, their committee report was for just north Idaho, that they would have an instream program but just for north Idaho. If the state had the mechanism, we wouldn't have gotten involved in this case. But we thought it was too important to let it sit, so we got involved.

In southern Idaho, the same thing was going on in a case called Sotterman vs. Kackley, which was an adjudication. The Forest Service entered into that and on January 8, 1975 the district court entered a preliminary memorandum decision of upholding the claim of the United States to a nonconsumptive use of entire natural stream flow. There were three streams. They went through the same premise, and the court upheld that we had nonconsumptive reserved right in those streams. The state appealed that to the state Supreme Court last June. We think the Hayden Creek case is going to be appealed also. Our whole court presentation was entering evidence that we wanted to have go to the Supreme Court. We feel that this will be a Supreme Court case, if the state pushes it. And if we lose, we'll push it.

Q. I think some of the students would be particularly interested in knowing how you developed your instream flow requirements, because that's what we've directed our attention to in this class. But I do appreciate you bringing up the law aspect of it, because we haven't addressed this very much. I can see some philosophical differences in trying to solve some of the

problems. I think one of the really critical problems that I can see is when you're trying to identify that right, how do you quantify it? I'm glad you are conceding they've got to quantify a water use if it is termed a right.

A. How to quantify is pretty tough.

Q. Don't you mean, rather than how to quantify, who is going to determine whether the quantification is right?

A. Who, how, for how long; it is a complex situation. We dragged our feet, we were hoping somebody would come up with a method. It got close to court time and nobody came up with one, so we developed one on the forest that we think works pretty well. It does have drawbacks. We were at an advantage in this case in that where we quantify, we just quantify for passage for fish. So we went through a two mile area and looked at critical riffles. We started out with five of them that we thought were important. We surveyed those and we threw two of them out which cut it down to three. Eventually we weeded two of those out and got down to one critical riffle area over which we had to have a certain depth of water to pass fish. Then we tried to get the fisheries biologists to tell us how much depth the fish need at that point.

Q. So flow then is based on depth, rather than on actual quantity?

A. It's quantified, but it's quantified for the depth over that riffle.

Q. That's assuming that the riffle stays the same shape?

A. That's right, this is one thing I want to get into. That's one of the most complex problems. We asked for 4/10 of a foot depth over this critical riffle, which turned out to be the 3.57 cfs. There's a U.S.G.S. gauging station about 3/4 of a mile upstream from where this critical riffle is with a concrete weir. You could look at that and say, well, we could just take the records from there and use that. But downstream there's an aggrading stretch of stream which is building with gravels and on through your low flow periods the flow is quite a bit lower on the surface down there than it is at the gauging station. In fact, it's about half of what the gauging station records, so in the 3/4 mile there's much more flow through the gravel instead of on the surface. So we had to pick our critical site. We thought we could run a regression with the gauging station, but the way the elevations and the snowmelt patterns lie, before about mid-May the downstream site was higher flow as the lower elevations melted off. But then as you get into the summer, the reverse comes about. The reverse we couldn't run a correlation on, they were just scattered all over. I guess people with more hydrologic experience would know that, but we tried it anyway.

We used the critical riffle. We put in a series of cross sections with a process we call a sag tape measurement, which is a steel tape stretched across the stream with tension on a spring scale. The we read from there at intervals; we used one foot intervals to the bottom. It runs through a computer program called Cross X that redraws your bottom profile. To get the flow in that cross section, we used a manipulation of Mannings Formula. We did that in a series of cross sections in this critical riffle. This was the procedure we presented to the judge for a couple of reasons. 1) It's one we could understand, and 2) it's one that's fairly simple to explain to a lawyer and to a judge. We thought we had to have something that the judge could understand.

His decision doesn't come about when you're there in the court. The case was heard last June and he has just now written his decision, but it's not published. So he made the decision during the last month. Months after you present it to him, he's going back through the drawings and the presentations and everything to make that decision. So we had to have something that a person without any hydrology background at all could understand. So this is the method that we've used. We've presented it at a couple of instream workshops; one at Utah State last year with about 70 or 80 people from the western states.

We came out with a much more complex problem than anybody realizes, and nobody really has a good method or all the answers. We're talking about fish. How much do you lose if you cut the spawning area by 20%? Or if you cut the rearing area?

Q. What kind of fish are you talking about?

A. In this case we're talking spring spawning trout. That's why we had that timing of April 1 to July 1.

Q. They're migrating down to the lake?

A. They're migrating from the lake up into the rearing and spawning area in the creek and then going back to the lake. But let's say you had a fall run, or you have anadromous fish. It's a very complex situation. Recreation is very important, as are aesthetics. How much is a loss of 30% of the flow? Should we take out the riffles to where the aesthetically pleasing nature of the stream is gone or not?

Q. Back on the Hayden Creek, you asked for 3.57 cfs. Are you undercutting other water rights by that plan?

A. No, we had the cooperation and the blessing of the other users, because they are consumptive rights downstream in the lake, so this is getting water down to them where they use it. It would prevent people using the water upstream in the watershed from them.

Q. Can I interrupt on one point there? Are there existing state water rights or applications for rights above the Forest Service?

A. No, there aren't.

Q. So, in some respects, the nature of this case is very specialized in the fact that's it's a closed basin in the lake. Giving those rights is not very damaging to the state. I can see that they'll fight you, but in other cases, if you were reserving those rights for certain other storage upstream, that would be a different story. There's not very likely any need for storage upstream, because you've got the storage in Hayden Lake itself.

A. You're right, and we brought this up to our lawyers. Another very important aspect that isn't a factor in this case is where you have intermingled ownership, different riparian owners. In this case, it's blocked from where the reserved lands meet the stream. But if you had intermingled riparian owners, using the reserve doctrine would be very difficult if not impossible. This is what Oregon is faced with with these rivers that are 50-60 miles long and have irrigation drawouts and return flows and the whole complex system.

Q. How much do you know about the history of that Hayden Creek before the dam was built? There was an outlet from the lake, isn't that right?

A. Yes, there was, but it was subterranean. And they went in and bentonited the bottom.

Q. In it's natural state, was there any surface outflow?

A. No, it just flowed out into some fields and stopped. There was no river that went down, it just went out on the prairie there.

Q. This is a very unusual situation in our state. You realize that Great Salt Lake is like this, but in our state this is very unusual. At one time it may have had an outlet, but it's not been man that's changed it, it was that way before man came to the area.

Q. So it could never claim navigability?

Q. No, it certainly couldn't be navigable. There is an interesting history to this, and I might comment on it. When I first came to Idaho in 1947-49, I was called in by the state engineer to advise on that very point. There was at that point in time almost exactly opposite to what he mentioned here that there was too much lowering of the lake. There had been a raising of water level. The Post Falls Irrigation District

had discontinued taking water out of Hayden Lake. But about in the period 1949-50, the lake level started to rise and in the spring when the flood flows came in it started to flood the lands where some of these very expensive homes were built, and they were going to sue the state for this flooding. Well, it was a natural occurrence, but one of the things that I was called in for and I advised them on was the cause for that flooding. There was a plugging up of the natural subterranean drainage of that lake. It was actually a reduction in the amount of water that was draining out into the Rathdrum Prairie and eventually into the Spokane River. But there is no surface outlet and there hasn't been for quite a long time. At one time, no doubt, in the glacial period, it was closed and I think that sometime in geologic history there was a surface drainage there.

A. That came up in this case, too, I forgot to mention it. On the other side of the irrigators were the lakeshore owners which, if the water gets too high it wrecks their docks and they were on the other side of the fence. So now part of the special master's report was a high level and a low level of the lake. They were established as part of this. I hope it was a happy compromise for everybody.

Q. How important are these streams to fish production in the lake?

A. They are extremely important, because they are the only spawning and rearing trout habitats that exist.

Q. They don't spawn much in the lake at all?

A. No. And now, about a week after we went to court, the state introduced early spawning kokanee. We were hoping that we could use that, but they wouldn't let us introduce it into court, it had to be the existing uses. But that would have extended the time period; instead of the first of July we would have gone into the fall. They just put this early spawning kokanee in one tributary with hopes of building up a trophy kokanee fishery. They wanted to have one run that would build size fish instead of a large population. These tributaries are extremely important.

Q. But there you couldn't claim that was what your reserve was set up for.

A. We sure tried, though.

Q. In this particular case, I can see that you could say your responsibilities are growing.

A. We even had Bill Goodnight, fishery biologist for the state, testify for us on the fish species that were there and he

didn't know how to go testify against another state agency. But he still has his job, I guess he didn't say too much. But we thought the fisheries were very important. In fact, we went as far as to say, if the fisheries requirements were met, the aesthetics and other uses would also be met. We could make the assumption that there wasn't any aesthetic, fire, or ecology uses or anything else that would outweigh the fish use. So our whole case was based on the fisheries case.

Q. Are the streams themselves open to fishing?

A. Yes. They're open with a special season. They don't open until the first of July because of the spawning. That's another point that we brought out strongly, that it was important enough to have special regulations, one of the few streams there that has special regulations.

Q. I guess you're open more for general questions. We haven't got a great lot of time.

A. This philosophy thing is mentioned, it is very important. I think you could become very strong in your feelings, about state rights and federal rights. The interpretations are open to question. You can read through these once and get one interpretation, then read them again and get another idea entirely. I'd hate to be the judge interpreting it, because it's an open case and it's become extremely important in the western states.

Q. I'm surprised they didn't raise the constitutional question, though? I can see in this particular case that it doesn't involve all the situations. Let me present a hypothetical and yet a realistic situation. Let's take Deadwood Reservoir. I presume Deadwood Reservoir is in a forest reserve area, in Boise National Forest. Here's a case, see that's different than that. There is a water right that's been established by a federal agency. They have applied for a water right. Here I would argue if I were the devil's advocate against you in the Forest Service, I'd say, how come you guys didn't object to them having a water right in that particular case? And I doubt if there was any objection raised. Maybe there was an objection raised in the reserve doctrine, but there's precedent of a water right being granted. That was on reserved land and you let it go through with no questions asked.

A. First thing, we'd have to decide if it was reserved land.

Q. What about groundwater rights? The Forest Service used to apply for groundwater rights. I don't know how common it was but they did it. Then as soon as the Arizona-California decision was made, they quit. Then there were directives sent out to the military reservations to stop the licenses even that had already been applied for.

A. That's right. Our instructions before that were not to ask for a surface water right on reserved lands, but we didn't know about groundwater, so we did ask for groundwater rights. That's exactly right, the directive did come out to quit, so we did. Luckily we weren't in too bad trouble, cause we'd never done this in the first place, just because we hadn't gotten around to it.

Q. When did this case start that you're talking about?

A. The Hayden Lake case started in 1966. It's been almost ten years.

Q. What's happened to this flow that you're trying to protect in the meantime?

A. It's still okay. What we're worried about there is a large private holding right at the mouth of the lake, where the creek goes into the lake. We're worried about when the private land owner gets ready to sell, the water necessary to serve that land might dry the creek up. It's all riparian land, level land, beautiful homesite land. It would go for a high value. Land on Hayden Lake is very expensive, and there's a lot of money on the lake for summer homes. This was our main concern, that water would either be piped out of the drainage over to the Rathdrum Prairie or this land would be subdivided and homes built on it. If they used water the way people around the lake do, to water their lawns and this type of thing, that would dry it up in a hurry. Another reason we set on the 3.57 cfs is that is very close to historical records. During the summer it gets down quite low.

Q. It's got to be 3.5 cfs or else historical. You can't insist on it being 3.5 cfs without some regulation.

A. No, it has gone below the 3.5 cfs at times. What I want to say is that is very close to the historical low.

Q. But you worded your request to be 3.5 cfs.

Q. Not 3.5 or historical? But what do you mean by that?

A. 3.5 is during the fish passage time, up to the first of July. It didn't go below that.

Q. But what if it naturally went below 3.5 cfs during that period?

A. I don't know.

Q. It could very possibly happen that as you develop water for campgrounds and so on above there that it could go below 3.5 cfs.

A. Yes, it is possible, because it's gotten down around 4.5 and 5 cfs.

Presentation by

JAMES H. MILLIGAN
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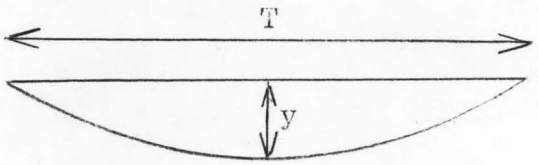
University of Idaho

To begin with, I want to pick up on some of the things that Dr. Falter was talking about earlier. If you recall, there was some discussion about the reduction in the surface area of the stream with reductions in depth or reductions in flow rates. I have the idea that the concepts involved here were very loose. I'd like to put a few numbers on those loose concepts, so that we can see just exactly how much we're talking about in terms of surface area reductions.

We were talking about a stream cross section that is parabolic in nature as it is an approximation of a natural channel cross section. Let's say that the top width is T and we have a depth at the mid-section of Y. The area of a parabolic cross section is 2/3 x T x Y. In order to calculate the flow rate in a stream channel, we can use a number of formulas, such as the Manning formula. The hydraulic radius is a measure of the relationship of the area and the wetted perimeter, that being the water contact area. The coefficient n is a roughness coefficient, so that the flow is inversely proportional to the roughness coefficient, proportional to the area, to the hydraulic radius to the 2/3 power and the slope to the 1/2 power.

Let's assume some values here. Let's assume an n value of .04, which is probably a fairly good estimate for a large type stream with a large boulder bottom over at least part of it. We also have some large number of bed forms, and possibly some vegetation, etc. Let's assume that this top width is in the neighborhood of a thousand feet, that's the kind of a channel that Dr. Falter was talking about. Assume a depth of 20 feet and a slope of .001. I'm not sure just what the slope is in that section of the Snake River that he was talking about. For this kind of channel dimensions and characteristics, we can calculate the flow rate using the Manning formula, and it turns out to be 83,288 cfs. So this is roughly in the neighborhood of the type and size of channel that he was talking about. For this particular channel, the mean velocity, the discharge divided by the cross sectional area, is 6.25 feet per second. He also talked about the relationship of the flow rate to the surface area. For this particular channel that turns out to be 83.3 cfs per foot.

Let's take another assumption. Assume the same n value, cut the depth in half, down to 10 feet. For parabolic channel, the depth is proportional to the square of the top width so that when you calculate what that top width is for that same kind



Parabolic Section Properties

Area = 2/3 Ty

W.P. = $T + 8/5\ y^2/T$

$R_h = \frac{2T^2y}{3T^2 + 8y^2}$

T = 3/2 A/y

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

assume n = .040
T = 1000
y = 20
S = .001

A = 2/3 (1000)(20) = 13,333

$R_h = \frac{2(1000)^2 (20)}{3(1000)^2 + 8(20)^2} = 13.32$

$R_h^{2/3} = 5.59$ $S^{1/2} = .03$

Q = 83,288 cfs Q/A = 6.25 fps Q/T = 83.3 cfs/ft

assume n = .040
y = 707 (depth prop. to square of top width)
S = .001

A = 2/3 (707)(10) - 4714

$R_h = \frac{2(707)^2 (10)}{3(707)^2 + 8(10)^2} = 6.66$

$R_h^{2/3} = 3.54$

Q = 18.653 cfs Q/A = 3.96 fps Q/T = 26.4 cfs/ft

$Q_1/Q_2 = 4.47$

Thus a 50% reduction in depth is associated with a flow reduction to less than 25%. Similarly, the amount of surface area per cfs is about 3 times greater at the 50% flow depth. There is less than a 50% reduction in velocities.

of parabolic section, the top width would be 707 feet. Assume that n and the slope stay the same. Those probably don't really stay the same, but it's only a slight change for purposes of what we are talking about. I think that we can make those assumptions without too much effect. For this case now, the discharge would be 18,653 cfs; average velocity, Q/A is 3.96 feet per second; and Q/T is 26.4 cfs per foot. So by cutting the depth in half we have cut the flow in just about a quarter, as the ratio of Q_1 to Q_2 here is 4.47.

It was said that if you cut the flow depth in half you would have an associated drastic reduction in flow rate, or a drastic reduction in surface area per cfs. Let's put some numbers on those terms. We see that we have just about 25% of the original flow rate here by cutting the flow depth in half, and just about the same amount of reduction inflow per foot of width. This quantifies some of the thinking that was involved in the discussion last time. These relationships wouldn't hold exactly in a natural channel, but since we were assuming a parabolic channel in our discussion last time, I think this is in order.

My discussion today was supposed to be on the water quality needs for various uses as related to waste discharge. I think that in order to talk about this topic, it's necessary to go back and understand some of the hydrology of low flows as well as some of the qualitative aspects of low flows that we've been talking about and that we will talk about in relationship to waste discharges. In any drainage basin, or drainage basin system, there are a large number of interactions, both natural and man-caused. There are those natural forces which affect what we call base flows.

Base flows can be distinguished from what we have been calling minimum flows. Base flows are the sustained flows that occur during the fair weather period of time, usually during the period after spring runoff, under natural conditions, without modifications by man. Minimum flows, on the other hand, are low flows that are subject to the activities of man. When we are talking about natural forces that affect the base flows, we can think in terms of fire, earthquake, landslides; a number of things which are natural events that may temporarily or permanently change the basin characteristics. When the basin characteristics are changed, then the base flows can be changed as well.

When we start talking about the effects of activities of man on the flows, there's a whole host of possibilities. One of the most overt activities of man that affects minimum flows is diversion, and here in the west especially, diversions are a very important part of the economy and something that has gone on ever since the first people came and settled in the west. Diversions from streams have a drastic effect on minimum flows. Usually when people think about the effect of diversions, however, they neglect to think also in terms of return flows from these diversions. If we have a diversion works that diverts water from a

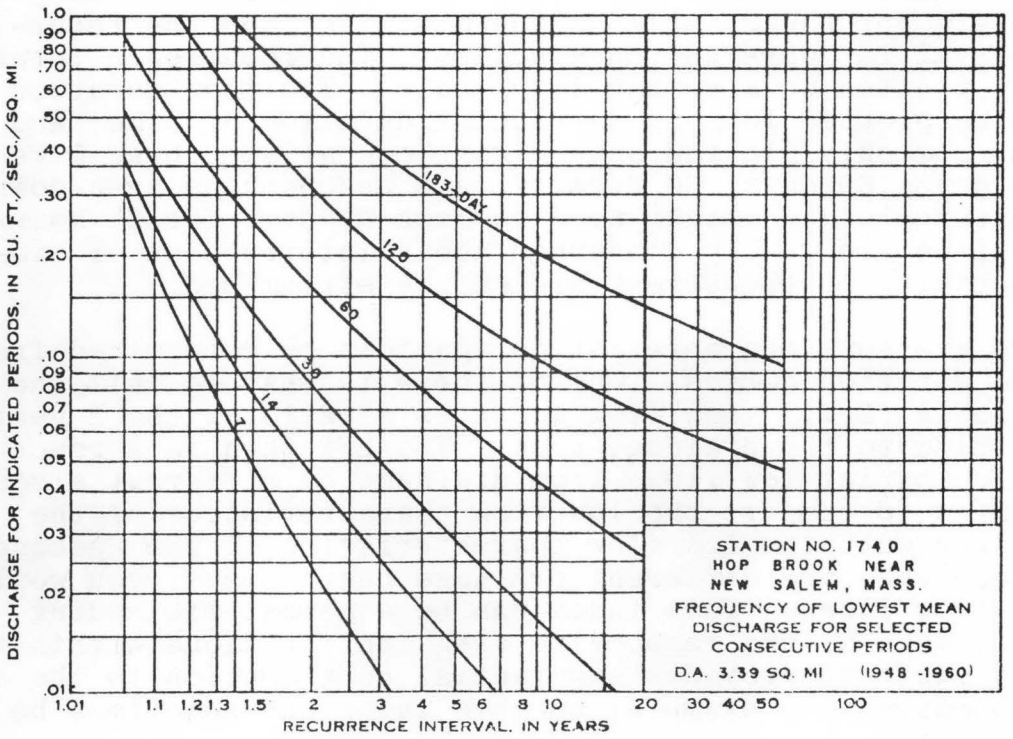
main stream channel for irrigation purposes, we irrigate, we collect the excess water at the end of the canal, and we collect water out of the drain, and usually discharge those back into the stream at some point. This augments the low flow that was the result of a diversion to begin with, so when we talk about diversions and their effects on low flows, we have to also consider the effect of the return flows. Those return flows are very often of a substantially different quality than the quality of the diversion water, and that's another parameter in the consideration of the effect of diversions.

Another activity of man that affects the low flows is storage. Flood protection storage may actually augment the low flows. Storage for irrigation may augment the low flows in certain reaches. There are a number of storage facilities that are built with releases in the natural channel for diversion farther on down the channel, so that in that reach of the channel which is carrying the irrigation releases, you may have an augmentation of natural low flows rather than a depletion of low flows.

Storage for power may or may not deplete the low flow in a reach, depending on the timing of the power production. Here in Idaho our peak power demands are in the summertime. That's the time when Idaho is a power importer rather than a power exporter. So there may be some substantial low flow augmentation due to power production during the critical low flow season of the year. On the other hand, both irrigation and power storages may cause unnaturally low flows at critical times when operators are augmenting or accumulating storage. In other words, if storage accumulation begins in the wintertime, you may have unnaturally low flows. That is, the normal stream flow may be depleted in the wintertime, due to the storage operations.

What I'm trying to build here is the idea that these various activities are quite complex. In order to fully understand the low flow picture on any particular stream, or reach of a stream, one must look at the characteristics of that stream and the structures on it. This has to be done on a stream by stream basis. You can't say that any stream that has irrigation storage on it is going to have low flows affected in such and such a way. It's a one by one analysis that is needed here.

Still talking in terms of hydrology as it affects the low flows, a typical method of displaying low flow records is what we call flow duration curves. I'd like to talk about these curves just a little bit. With the computer technology that we currently have available we quite often go to much more sophisticated methods of examining low flows, but there are some characteristics of the flow duration curves that are useful in planning.


DISCHARGE FOR INDICATED PERIODS, IN CU. FT./SEC./SQ. MI.
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.07
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.04
.03
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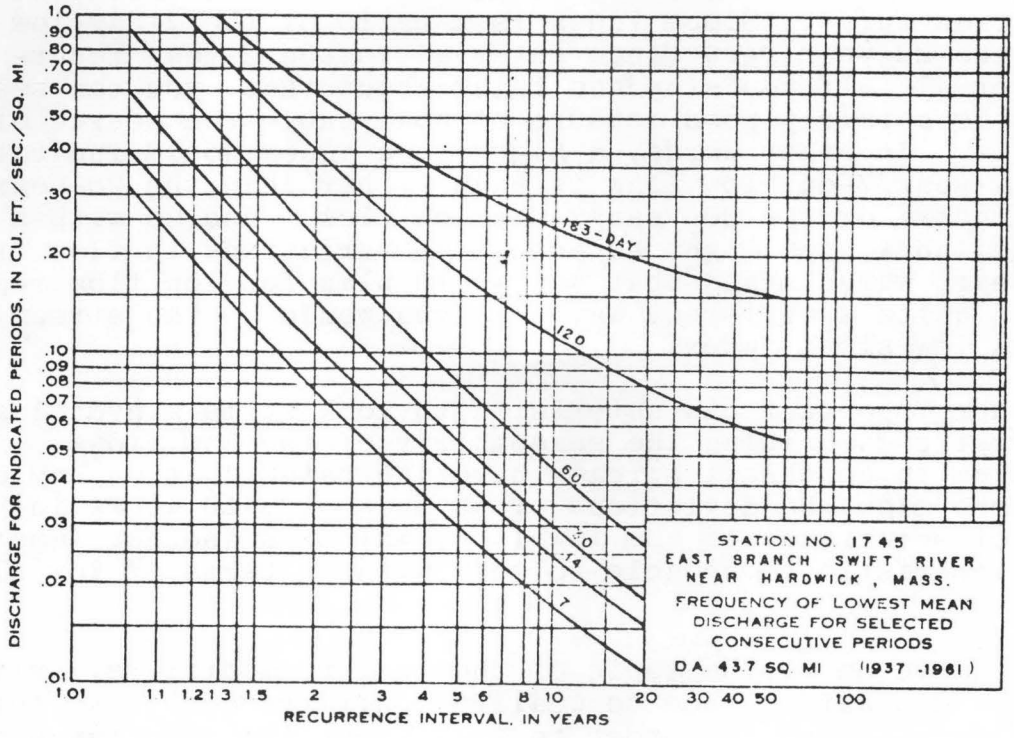
183-DAY
120
60
30
14
7
1.01
1.1
1.2
1.3
1.5
2
3
4
5
6
8
10
20
30
40
50
100
RECURRENCE INTERVAL, IN YEARS
STATION NO. 1740
HOP BROOK NEAR
NEW SALEM, MASS.
FREQUENCY OF LOWEST MEAN
DISCHARGE FOR SELECTED
CONSECUTIVE PERIODS
D.A. 3.39 SQ. MI (1948 -1960)


DISCHARGE FOR INDICATED PERIODS, IN CU. FT./SEC./SQ. MI.
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1.3
1.5
2
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6
8
10
20
30
40
50
100
RECURRENCE INTERVAL, IN YEARS
STATION NO. 1745
EAST BRANCH SWIFT RIVER
NEAR HARDWICK, MASS.
FREQUENCY OF LOWEST MEAN
DISCHARGE FOR SELECTED
CONSECUTIVE PERIODS
D.A. 43.7 SQ. MI (1937 -1961)

A flow duration curve is a plot of mean annual discharge in cfs; with cfs per square mile as the ordinate, and the recurrence interval in years as the abscissa. The recurrence interval is usually plotted on a probability scale. The flow duration curve can be plotted for any particular duration of time, and some of the more commonly plotted ones might look at something like 183 days, 120 days, 60 days, 30 days, 7 days and perhaps even down to shorter intervals. We might need to look at some for 24 hour duration if we are really concerned about interruption of biological activity in the stream and on the stream bed.

There are some characteristics that can be determined from these flow duration curves. One of these is what we call the low flow index (LFI). Low flow index is a ratio of the 2 year-7 day low flow to the drainage area. The LFI then is a rouch method of comparing low flows from drainage of different sizes. If you wanted to compare the low flow characteristics of the Palouse River with the low flow characteristics of the Spokane River, since they are different drainage basin sizes, you would use a low flow index. This index can be somewhat misleading however, because of the respective area contributions within the drainage basin that provides substantial contribution to the stream from groundwater, for example; so this index can sometimes be quite misleading.

Another index is the slope index, also obtained from the flow duration curve. Slope index is a ratio of the 7-day low flows at the 20-year recurrence interval to the 2-year recurrence interval. If you stop and think about that, you can see that this is a fairly good measure of how stable the source of low flow is. In other words, a high slope index would indicate that the 2-year/7-day low flow is much higher than the 20-year low flow index, or the 20-year/7-day low flow. And so with a high slope index, you might expect large variations in flow from year to year, which means that you would plan for low flow regulation in quite a different way than you would on the stream that had a low slope index.

Another important characteristic to look at is a hydrologic characteristic describing the seasonality of the low flows. Some studies in northwest streams have indicated that on any one stream there might be deviations of as much as 8-10 weeks in the time of occurrence of the low flow, which is another important characteristic to be able to work with in terms of low flow management.

Let's move on to the topic of the quality modifiers, primarily waste water discharge. How do quality modifiers come into this minimum flow picture? In order to talk about the importance of waste water discharges, we need to ge back to another concept that Dr. Falter presented last time.

Oxygen depletion was mentioned as a water quality problem, particularly as we are concerned with low flows. The oxygen sag curve is often used to describe graphically the deficiency of dissolved oxygen. Dissolved oxygen concentration is plotted as the ordinate, against time or distance downstream as the abscissa. When a waste discharge enters a stream it exerts a BOD or biochemical oxygen demand which tends to deplete the dissolved oxygen in the stream. The amount of the depletion depends upon several factors including the relative concentrations and flow rates of the waste discharge and the stream. For a given discharge the depletion is more severe in a receiving stream at low flow than at high flow. This logic is based upon the dilution principle. The dissolved oxygen depletion or sag recovers with time so that at some downstream point the amount of oxygen depletion will not be as severe, provided there is not another waste discharge somewhere downstream of the first one.

Not all oxygen depletions are bad, however. Depletions below some critical level required by some water use, instream or diverted are what we desire to control. Obviously, this control can be achieved either by supplying more water in the receiving stream for dilution (increasing the minimum streamflow) or by limiting the waste discharge (sewage treatment plants, etc.). Some other schemes, such as instream aeration, are also available to control oxygen depletion.

There are a number of other quality measures which are also applied in the case of minimum stream flows and waste discharges. One of these has health and sanitation significance and that is coliform levels. One human in a day discharges on the order of 100 - 200 billion organisms in waste materials. That is a very large number and somewhat difficult to comprehend. A brief story may help to comprehend such large numbers.

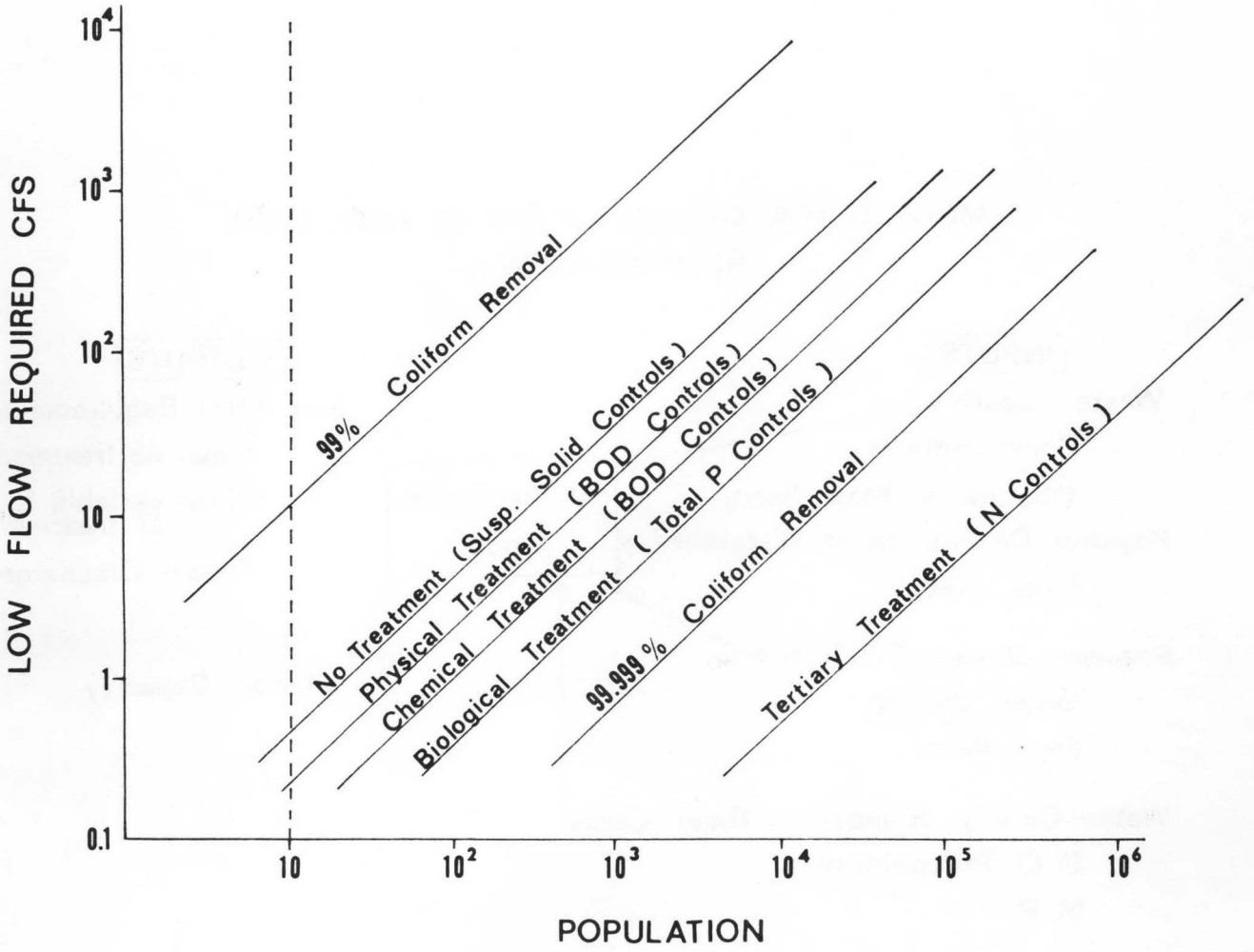
There was a very wealthy man who gave his wife a million dollars and told her to go out and spend a thousand dollars every day. She went out and started spending this money at the rate of a thousand dollars a day. She came back in three years and said the money was all gone. So the man said, here's a billion dollars, go out and spend a thousand dollars a day. She didn't come back for three thousand years.

That's a little bit of an idea of what kind of numbers we are talking about. Fortunately the survival rate of human organisms in natural water is not very great. In fact, human organisms degrade more rapidly in polluted water than they do in clean water. The survival rate is also higher in cold water than it is in warm water. The streams that we are more concerned with are those that have warm water and those that already have a degree of pollution. These coliform organisms are primarily indicator organisms. Coliform organisms themselves don't cause any harm to us, but they are an indicator organism of other organisms which are

pathogenic. Fortunately, most of these organisms, including most pathogenic organisms, don't have very high survival rates in streams. However, there are some pathogenic organisms that may have survival rates up to 30-35 days. This is the reason waste discharges should at least be disinfected.

There are some other quality parameters that we are concerned with. Among these are phosphorous and nitrogen concentrations and turbidity or suspended solid concentrations. Once certain stream quality standards are established with respect to BOD, coliform level, phosphorous, nitrogen and suspended solids, then knowing the daily production rates of these parameters in waste waters, we can then apply the dilution principle to determine what the minimum flows would have to be in order to maintain particular standards. Let's say, for example, that we're looking at a standard that requires maintenance of fairly high quality, something like suspended solids of 1 milligram per liter (mg/l), dissolved oxygen at around 9½mg/l, nitrogen at not more than 1 mg/l, phosphorous at about .15 mg/l and coliforms at about 240 per hundred milliliters. Our low flow requirements, in units of cfs, could be plotted then against population as seen in the following figure.

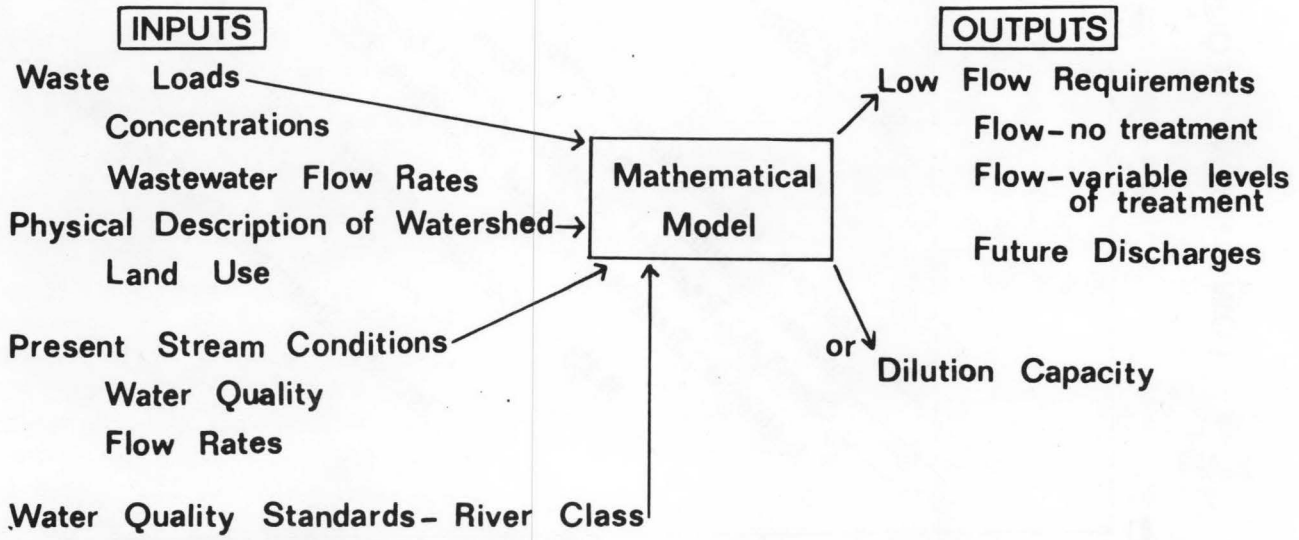
With no treatment then, 99% coliform removal in the natural streamflow would let us look at something like 10 cfs for 10 people minimum flow as shown on the figure. For no treatment with suspended solids controlling, less flow per capita would be required to maintain the same standard. Coliform control then is more stringent than the suspended solids control. Now, if we go to physical treatment or primary treatment, then BOD is the controlling parameter. For the same minimum flow we can have more people. If we go to chemical treatment, that's a little more effective than physical treatment, but again, BOD is still the controlling parameter. We go to secondard treatment, or biological treatment, then the control is total phosphorous rather than BOD. BOD is the more commonly used control parameter to gage the effectiveness of the treatment facilities, still phosphorous here is the controlling parameter over low flow requirements. If we put up a measure here of 99.999% coliform removal, that's about what we could get with biological treatment plus chlorination. If we go still further to what we've been calling tertiary treatment, we can get by for a certain number of people with still a lower minimum flow requirement. If the low flow requirement is fixed, or if the low flow available is fixed, then as the number of people increases, we've got to increase the degree of treatment. That is essentially what is happening, there aren't very many large cities that are decreasing in population very fast. Most of our cities are increasing in population. The whole country is increasing in population, so for a fixed minimum flow, that means that we've got to increase the degree of treatment.



Low Flow Requirements Based on Class AA Standards

S.S	1.0 mg/l
D.O	9.5 mg/l
N	1.0 mg/l
P	0.1 mg/l
Coliform	240/100 ml

METHOD FOR DETERMINATION OF LOW FLOW REQUIREMENTS



We can prepare this kind of graph and actually plot the numbers on here for various water quality standards. If we put this kind of information together with physical description of the watershed and the description of present stream conditions, the existing water quality, the existing flow rates, the projected streamflows, and water quality standards into a mathematical model, we should be able to get as output the actual low flow requirements; whether we have flow with no treatment, or flow with various degrees of treatment. As an alternative to determination of the low flow requirements, we might actually determine that the stream still has some additional dilution capacity.

That kind of a mathematical model is what we'd like to have as a tool for minimum flow planning, but obviously it would take some pretty good data in terms of describing the waste load concentrations and flow rates. It would take data on various land use practices and their effect on flow rates in the stream and sediment loads in particular. It would take data on the existing stream characteristics, mainly the water quality characteristics as measured by these various parameters and the flow rates of the stream. It would also require an input of water quality standards.

What percent of the streams in Idaho have that kind of data? Still, what percent of funds that are spent in the water area go for data collection? A very small percentage of total dollars that are spent in water in Idaho are spent in actual data collection. So, what do people end up doing? They end up synthesizing the data, put it in a mathematical model and write regulations based on the output of that kind of a mathematical model, and how good is that if you synthesize the data to start with? What I'm trying to say is that one of the large problems in minimum flow planning and operation management is getting the right data to be able to use the tools that we have available with current technology.

One area I didn't see any indication of as a topic for discussion in our outline was the economic factors involved in planning minimum flows. I think this is an important dimension to consider in any discussion of minimum stream flows. This is a point that I was trying to raise last time when Dr. Falter indicated that all that engineers really thought about was the sludge in the stream. It really comes back to this question right here. How many bucks are people willing to pay for their activities? Traditionally, the concept that most people have about the waste discharges is that as soon as it's out of sight, it's out of mind. We recognize that something has to be done about it, but let's not spend any more money on it that we absolutely have to.

STUDENT PRESENTATIONS

Twelve students made oral presentations and submitted outline reports on problems they considered to be potentially fruitful research topics to help in identifying instream flow needs under the reality of the many competing uses for water in Idaho streams.

These presentations were influenced greatly by each student's background of interest. The professional diversity of students often made for a very questioning and searching attitude in the seminar.

To summarize the students' presentations, the topic title suggested by each student is listed, statements of problem or problems and a brief presentation on objectives of the research that would need to be undertaken is identified. Finally, a brief bibliography of pertinent literature developed by the students is presented. It is hoped this summary will preserve the ideas for the consideration of investigators in the future.

1. Richard G. Allen — Agricultural Engineering

Topic: Utilization of sediment control structures in streams of forested watersheds, irrigation drainage channels and major river tributaries

Problem and Objectives: The basic problem is sediment control in the stream to meet the many competing uses of water both in the stream and out of the stream.

a. Analyze the necessary design parameters to construct efficient settling ponds on various types of rivers, canals and streams in Idaho.

b. Monitor the effect of decreasing sedimentation of rivers and streams upon the fish life and species diversity, aquatic insects, and streambed composition.

c. Analyze the impact of sediment structures upon the aesthetic value of cleaner, more natural stream, and also the aesthetic value of the pond and structure itself.

d. Obtain information on the cost and maintenance required by various designs of settling structures.

Selected References:

Ballard, F.L., 1974. Analysis and Design of Settling Basins for Irrigation Return Flow. M.S. Thesis, Dep. of Civil Engineering, University of Idaho.

Bjornn, et al., 1974. Sediment in Streams and Its Effect on Aquatic Life. Water Resources Research Institute, University of Idaho, Moscow, Idaho.

Dendy, F.E. Sediment Trap Efficiency of Small Reservoirs, Transactions, American Society of Agricultural Engineers, Vol. 17, No. 5, page 898.

Guy, Harold P., and George E. Ferguson, 1962. Sediment in Small Reservoirs Due to Urbanization, Proceedings, American Society of Civil Engineers.

Kelly, Thomas L., 1974. Methodology for Instream Rehabilitation of a Silted Stream. M.S. Thesis, Department of Civil Engineering, University of Idaho.

Leudtke, R.J., 1973. Benthic Insect Community Changes in Relation to Instream Rehabilitation of a Silted Stream. M.S. Thesis, University of Idaho.

Morrill, C.F., 1972. Migration Response of Juvenile Chinook Salmon to Substrates and Temperatures. M.S. Thesis, Fisheries Management, University of Idaho.

Oliver, A.E., 1974. Analysis of Settling Basins. M.S. Thesis, Department of Civil Engineering, University of Idaho.

Platts, Wm. S., 1974. Acid Mine Influences to a Salmon and Steelhead Environment in a Tributary of the Salmon River, Idaho.

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2. Thomas V. Dechert — Plant and Soil Science

Topic: Ecological theory as a framework for interdisciplinary communications

Problem and Objectives:

The problem is the need to correlate information from social sciences and the physical and biological sciences. The rising

awareness that some sort of interdisciplinary approach is needed for problem solutions.

Objectives would be to:

a. Establish a study area, probably a watershed,
b. Give consideration of parameters to be studied,
c. Give consideration to energy flow as a common denominator,
d. Give consideration to network(s) of species described according to trophic levels,
e. Give consideration to structure of ecosystem integration,
f. Give some means of integration of human and biological patterns.

This is striving for a philosophical basis for the decisions that need to be made.

Selected References:

Baker, Herbert G., 1966. Reasoning About Adaptations in Ecosystems. Bioscience 16:35-37.

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Doerksen, Harvey R. et al., 1975. Regional Problem Analysis in the Pacific Northwest: Part A: Instream Flow Needs. Washington State University, Pullman, Washington, pp. 25-62.

Kormondy, Edward J., 1969. Concepts in Ecology. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 209 pp.

Kuhn, Thomas S., 1962. The Structure of Scientific Revolutions. University of Chicago Press. 172 pp.

Marks, Peter L., 1971. A vision of Environment. The American Scholar 40:3 pp 421-431.

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Packard, Alpheus S., 1901. Lamarck; the Founder of Evolution; His Life and Work. Longmans, Green & Co., N.Y. 451 pp.

Teilhard de Chardin, Pierre, 1959. The Phenomenon of Man. Harper and Row, N.Y. 219 pp.

Towers, Bernard, 1973. Time and the Growth of Complexity (in Browning, G.O. et al. above) pp. 115-128.

Wagner, Philip L., 1960. The Human Use of the Earth. The Free Press, Glencoe, Illinois. 270 pp.

Young, Gerald L., 1974. Human Ecology as an Interdisciplinary Concept: A Critical Inquiry, in Advances in Ecological Research (A. MacFadyen, Ed) Vol. 8, pp. 1-105. Academic Press, N.Y. 418 pp.

3. Wayne R. Dorband — Fishery Management

Topic: The effects of flow patterns on the benthic community of the Snake River

Problem and Objectives:

On the Snake River, construction and maintenance of storage dams above Shoshone Falls on the Snake River have reduced flows over the years to almost zero. There is interest in establishing defined minimum flows for maintenance of resources.

Completion of Lower Granite Dam on the Lower Snake River has eliminated all free flowing sections of the River below Lewiston. There is interest in defining the effects of the impoundments.

a. Snake River below Lewiston

i. can any change in upstream storage practices (a sustained minimum flow at, for example, 300 cfs) benefit the quality of the Snake River below the falls for fisheries and aesthetic purposes,

ii. can the evaluation of benthic communities serve as an indicator of any improvements or damages caused by such flow manipulations.

b. Lower Snake River

i. evaluation of benthic communities and their changes through time following impoundment,

ii. to find if any correlation exists between substrate parameters and the composition of benthic communities,

iii. to determine whether benthic communities in a reservoir can be used as indicators of fishery potential and environmental effects.

Selected References:

Berner, L.J., 1951. Limnology of the Lower Missouri River. Ecology. 32:1-12.

Carlson, C.A., 1968. Summer Bottom Fauna of the Mississippi River Above Dam 19, Keokuk, Iowa. Ecology. 49(1):162-69.

Ellis, M.M., 1931. A Survey of Conditions Affecting Fisheries in the Upper Mississippi River, U.S. Bureau of Fish Fishery Circular. 5:1-18.

Harrel, R.C., J. Asheraft, R. Howard, M. Welsh, R. Russell, 1973. Macrobenthos as Indicators of Ecological Change. National Technical Information Service as PB-234424.

Hruska, U., 1973. The Changes of Benthos in Slapy Reservoir in the Years 1960-1961. In Hydrobiological Studies 2. Academia Publishing House, Prague, pp. 213-247.

Kreis, R.D., and W.D. Johnson, 1968. The Response of Macrobenthos to Irrigation Return Water. Journal, Water Pollution Control Federation 40:1614-1621.

4. Patrick J. Graham — Fishery Management

Topic: Some factors influencing overwintering of aquatic organisms in streams

Problem and Objectives:

Instream flow needs of the aquatic resource must be studied for all life stages and during all seasons if dynamic systems are to be maintained. The season with the least amount of available data is winter. Low flows and ice buildup in streams during winter has been a low priority research subject, probably due to the difficulty associated with outdoor studies during winter.

The objectives are as follows:

a. Determine effects of ice (anchor, frazil, and surface) formations on aquatic insect and fish populations

   i. how ice buildup affects velocity and volume of water and the effects of these flows on the aquatic biota,

   ii. how changes in flow affect ice buildup quantitatively and qualitatively,

iii. the actual effect of various ice formations on the various life cycles of the aquatic animal populations.

b. Determine spawning escapements related to reduced streamflow during winter.

i. number of adults that spawn,

ii. the resultant yield of fry.

c. Monitor movements of fish in fall and winter with emphasis on space requirements and habitat preference.

Selected References:

Bjornn, T.C., 1971. Trout and Salmon Movements in Two Idaho Streams as Related to Temperature, Food, Stream Flow, Cover and Population Density, Trans. Amer. Fish Soc., Vol. 100, No. 3, 423-438.

Brown, C.V.D., et al., 1953. Observations on Ice Conditions in the West Gallatin River, Montana, Proc. Mont. Acad. Sci. 13, 21-7.32, 205.

Chapman, D.W., 1966. Food and Space Regulators of Salmonid Populations in Streams, The Amer. Nat., Vol. 100, No. 913, 345-355.

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Shumway, Dean L., Charles E. Warren and Peter Doudroff, 1964. Influence of Oxygen Concentration and Water Movement on the Growth of Steelhead Trout and Coho Salmon Embryos, Trans. Amer. Fish. Soc., Vol. 93, No. 4, 342-356.

5. John Michael Harker — Agricultural Economics

Topic: The effects of minimum stream flow maintenance on the agricultural industry of the Upper Snake Region of Idaho

Problem and Objectives:

The hypothesis is stated that "realizing that the quantity of potential instream water is of a fixed amount within any given year, the amount of water available for recreation is the residual of total water less diverted water. The statement is further made that minimum stream flow maintenance will thus have the effect of further reducing the amount of potential water available for diversion for agricultural use. The problem herein being approached is a need for evaluation of whether this limitation of potential stream water for diversion to agricultural use will economically affect the agricultural industry of the Upper Snake River Region and if so, to what extent?"

Study objectives are to assess the following economic characteristics:

a. The projected economic demand function of water for agricultural use in the Upper Snake River Region over the next 25 years,

b. The economic supply function of instream water of the Upper Snake River Region,

c. The economic supply function of the groundwater of the Upper Snake River Region,

d. The aggregate economic supply function of all water of the Upper Snake River Region,

e. The reassessment of the above economic supply functions when subjected to various levels of minimum stream flow maintenance.

Selected References:

Bailey, W.C., 1975. Economic Evaluation of Idaho's Water Supply. M.S. Thesis, University of Idaho, Moscow.

Idaho Water Resource Board, 1972. Interim State Water Plan, State of Idaho, Boise.

_____, 1971. Agricultural Water Needs. Planning Report No. 5, State of Idaho, Boise.

Henderson, J.M. and R.E. Quandt, 1958. Microeconomic Theory: Mathematical Approach, McGraw-Hill Book Company, New York.

6. Ned Horner — Fishery Management

Topic: The effects of man-caused flow fluctuations on small mouth bass in the Clearwater River, Idaho.

Problem and Objectives:

Little is known about the effects of rapidly fluctuating water levels on downstream fishery. Are high flows more damaging than low flow periods? What effects do fluctuating water levels have on various life stages of fishes? Are cold water, warm water and anadromous fishes differently affected? Does the rate of fluctuation have an effect on fishes? The Clearwater River supports a variety of recreational activities and has an important power generating unit on it. This area would provide an excellent opportunity to study the relations between the two.

The specific objectives are:

a. Determine what is "normal" for small mouth bass in the Clearwater River by studying sections of the river above the Dworshak Dam outflow,

b. Determine what effect fluctuating flows caused by electrical power generation of Dworshak Dam have on smallmouth bass.

Selected References:

Ball, Kent and Wesley Cannon, 1973. Evaluation of Game and Rough Fish Populations Below Dworshak Dam and Relationships to Changes in Water Quality. Job Performance Report, Idaho Department of Fish and Game, DSS-29-3, Job 3.

Keating, James F., 1970. Growth Rates and Food Habits of Smallmouth Bass in the Snake, Clearwater and Salmon Rivers, Idaho 1965-67. M.S. Thesis, University of Idaho. 40 pp.

Munther, Gregory L., 1967. Movement and Distribution of Smallmouth Bass in the Middle Snake River. M.S. Thesis, University of Idaho. 29 pp.

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White, Robert G., 1975. A Proposed Methodology for Recommending Stream Resource Maintenance Flows for Large Rivers. Pages 3-20 in R.G. White and T. Cochnauer ed. Stream Resource Maintenance Flow Studies 1975, a cooperative study. Idaho Department of Water Resources.

7. Mark Lindgren — Civil Engineering

Topic: The development of a general survey technique and method of analysis to use in the study of minimum flows in streams and rivers.

Problem and Objectives:

Presently there is a lack of information available to evaluate the effect of reducing the flow in streams and rivers. Techniques are not available to compare minimum flow requirements for a number of rivers in a regional system. In other words there is no way to get the general view of the effects that minimum flow regulation would have.

The primary objectives would be as follows:

a. Development of a methodology to 1) evaluate type and amount of insect life, 2) evaluate type and amount of fish and certain types of water oriented game, 3) evaluate the hydraulic characteristics of the river,

b. Conduct a survey that covers 1) amount and position of spawning grounds of fish, 2) the reproduction and living areas for insects, 3) the habitat of nearby water fowl,

c. The use of a statistical analysis to evaluate the general nature of the stream from a small number of cross-sections,

d. To place all this material into a program that would demonstrate the effects of changing flows on each of the above,

e. An adjustment for yearly cycles from gathered data, similar instances, or logical extensions of the presently known facts.

Selected References:

Fread, D.L., 1973. A Dynamic Model of State-Discharge Relations Affected by Changing Discharge. NOAA Technical Memorandum, NWS Hydro-16 November, 1973.

Macon, T.T., 1974. Fresh Water Ecology. Halsted Press, a Division of John Wiley and Sons, Inc. New York, NY.

8. James Osiensky — Geology

Topic: A proposal of studies concerning the ramification of irrigation induced thermal vacillation in the Snake River.

Problem and Objectives:

The problem is to aid in solving the lack of information concerning the effects irrigation return flow in the Snake River. Specific study needs to be direct toward temperature changes in the river caused by irrigation, and the effects of these changes on indigenous organisms.

The specific objective of the study would be determination of the existence of problems within the river's ecosystem caused by irrigation induced thermal changes.

Selected References:

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Ralston, Dale R. and Eugene Kozak, 1969. Groundwater Development in Idaho. Idaho Department of Reclamation.

Thomas, C.A., 1969. Inflow to the Snake River Between Milner and King Hill, Idaho. Idaho Department of Reclamation.

Walker, Eugene H., 1969. Historic Changes in Discharge and Water Levels of the Snake Plain Aquifer of Southern Idaho. Idaho State Water Conference.

9. Joseph P. Pessutti — Geography

Topic: The relationship of lakeshore development to water quality on Lake Coeur d'Alene

Problem and Objectives:

Limnologically, Coeur d'Alene Lake is mesotrophic in the north and undergoing natural eutrophication in the south. Although the quality of the lake has deteriorated drastically in recent years, it is still capable of flushing itself clean. This area of increased pollution is one area of concern where the lake can no longer take any added strains.

Specific objectives would be to determine the public health significance of water-related recreational activities and to determine its loading and impact on shoreline development. Also to look at other non-point sources of pollution such as mining, agriculture, forest practices and most important, the direct impact of individual sub-surface sewage disposal systems.

10. Cary R. Schaye — Entomology

Topic: The relation of irrigation canal maintenance to mosquito and black fly population

Problem and Objectives:

A marked increase in the number of mosquitos frequently accompanied the expansion of land under irrigation. Mosquitoes and black flies can both have a serious impact on the health of humans and animals, economic and recreational welfare of people. Poor maintenance practices tend to contribute to the problem.

The specific objectives would be to:

a. Monitor the resident mosquito and black fly populations,

b. Determine their biology, ecology, phenology, distribution and migration,

c. Develop a method of clearing the irrigation canals of vegetation and to scarify the banks of canals.

Selected References:

Busch, J., 1975. Evaluation of Irrigation Systems and Water Management Practices and Their Effects on Water Quality in the Boise Valley. Idaho Agricultural Experiment Station, University of Idaho, Moscow.

Davis, S., 1961. Soil, Water and Crop Factors that Indicate Mosquito Production. Mosquito News, 21:44-47.

Fredeen, F.J.H. and J.A. Chemanchuk, 1960. Black Flies of Irrigation Systems and Saskatchewan and Alberta, Canada. Canadian Journal of Zoology, 38:723-735.

Fredeen, F.J.H., 1969. Outbreaks of the Black Fly Simulium arcticum Malloch in Alberta. Quaestiones Entomologicae, 5:351-372.

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Water Use Studies, Minidoka Project. Summary Report 1957-1962. Department of Agricultural Engineering, University of Idaho, Moscow.

11. Robert J. Schott — Entomology

Topic: Determining the effects of thermal pollution on aquatic insects for the establishment of heated effluent standards.

Problem and Objectives:

Up until the present time, the effects of thermal pollution haven't been drastic but the proposed expansion of power producing facilities for the coming years is causing concern among ecologists. There is a need to determine some of the factors which must be considered in setting water quality standards for heated effluents.

Specific objectives would be:

a. To determine how far the natural temperatures of the insects' environment can be exceeded,

b. To determine the possible synergistic reactions of high water temperature with toxins in water,

c. To determine which form of hot water outflow would produce the least detrimental effects on particular bodies of water.

Selected References:

Britt, N.W., 1972. Biology of Two Species of Lake Erie Mayflies, Ephoron album and Ephemera Simulans. Bull. Ohio Biol. Surv. 5:70.

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12. James E. Stanton — Entomology

Topic: Growth, distribution, reproductive success, and species interaction of brown trout stocked in the St. Maries River.

Problem and Objectives:

The problem is there is lack of quality stream trout fisheries in northern Idaho and there is too heavy dependence on hatchery trout in most fisheries.

The specific objectives are as follows:

a. Determine growth rate and condition of brown trout stocked in St. Maries River in 1973,

b. Determine spawning success, spawning, and spawning period of these trout,

c. Study movement patterns and range of these trout,

d. Determine effects of stocked brown trout on other game and non-game fish present,

e. Make recommendations as to the advisability of continued stocking of brown trout in northern Idaho.

Selected References:

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OBSERVATIONS AND RECOMMENDATIONS

It would seem appropriate that as the editors of this proceedings and as faculty members who presided over the seminar and continuously monitored the discussions we should close this report with a few observations and recommendations.

Obviously the present attitude of people demands that serious consideration be given to providing for instream uses for streams. The question in many streams in Idaho does not mean just free flowing status because all too often diversion type uses have already been made and have been established with an active water right. Honoring that water right is a legal obligation, and yet there may, through mitigating compensation, be ways to change from a diversion use to an instream use. This was hinted at a few times in the seminar, but that possibility needs much more careful investigation. The consequences are not always just those of the present holder of the water right. It is obvious that flow modification has effects all the way down the stream, for example, in modifying flows for power production.

There was a strong interest expressed throughout the seminar in having methodology for quantifying instream needs, particularly with respect to biological and environmental demands. Progress is being made but it will take time and funding to make such evaluations, no matter what criteria are specified. It is recommended that allowance for this be provided in planning efforts. Research in methods for quantifying and expressing instream needs must be accelerated to meet this need.

An obvious concern for instream use centers around recreational use of the stream, both as an active place for the recreational user to be and as an aesthetic resource to be viewed. Little mention of methodology for quantifying this came to the fore in the seminar. Yet, it is known that it has great significance. Student reaction and participation seemed to center around identification of instream use for fish and for wildlife consideration. The accomodating of man as part of the environment inevitably seems to polarize views between conventional diversion type development versus free-flowing non-use. More innovative attempts at meeting a compromise of views must be encouraged.

Two of the students addressed the problem of developing an overall, integrated way of measuring and analysing instream flow requirements. This idealistic to speak of but it certainly would be fruitful if an approach could be developed that was simple and authoritative. Such an approach would have to be understood by all concerned and at the same time possible to accomplish within reasonable limits of time and cost for making the determination.

Of consequence always is the relation of the water flowing in the stream and the ownership of land. The presentation by Mr. Isaacson pointed out the interest and active role of federal land management agencies' claims and the fact that they are willing to go to court to establish a pattern for future claims to water on public lands.

It is recommended that efforts that bring interdisciplinary groups together be encouraged to ensure that all views are exposed, and that greater technical expertise be used to arrive at solutions rather than dependence upon emotional decisions based on singular prejudices. Data collection and analysis by various disciplinary specialists must continue, but avenues of communication between various points of view must be encouraged. We hope this seminar has contributed in that respect.