WATER SUPPLY STUDY

PULLMAN-MOSCOW WATER RESOURCES COMMITTEE

City of Moscow
City of Pullman

University of Idaho
Washington State University

Stevens, Thompson & Runyan, Inc.
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August 1, 1970

LETTER OF TRANSMITTAL

Pullman-Moscow Water Resources Committee
John F. Orsborn, Chairman
Albrook Hydraulic Laboratory
Washington State University
Pullman, Washington 99163

Gentlemen:

Pursuant to your instructions and our agreement of December, 1969, we have completed the engineering studies, including review of potential surface water sources, necessary for selection of a development plan for the Pullman-Moscow Area. Our report of these studies including findings and recommendations is herewith presented.

As set forth in the report, the development of a new water supply system calls for a complete readjustment in the present usage of ground water. Our recommendations propose two alternates: one, the Palouse River with storage at Laird and two, the Snake River at Wawawai. We believe the latter to be the most practical. Annual costs of facilities called for in development of the Snake River project are estimated at $1,000,000 and, depending on federal participation in first stage capital costs, substantial local revenue will be required. However, we are firmly convinced that the system is eligible for federal financial assistance and every effort should be made to maximize such assistance.

A major advantage of the Snake River project, in addition to lowest first cost, is its amenability to early completion when compared to the Palouse plan.

We appreciate having the opportunity to again be of service to your communities and look forward to working with you in accomplishing the objectives you have set.

Respectfully submitted,

STEVENS, THOMPSON & RUNYAN, INC.

By: James A. Crom
Vice President

JAC:dkf

WATER SUPPLY STUDY

A REPORT

PREPARED FOR THE

PULLMAN-MOSCOW WATER RESOURCES
COMMITTEE

ON THE STUDY OF FUTURE WATER SUPPLIES
FOR THE PULLMAN-MOSCOW AREA

AUGUST, 1970

STEVENS, THOMPSON & RUNYAN, INC.
Engineers / Planners
Portland Seattle Boise Anchorage

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INTRODUCTION

STUDY AUTHORIZATION

Historically, all domestic waters required for the Pullman-Moscow urban area have been taken from the ground water basin underlying the region. Recent hydrological and geophysical studies have indicated that the ground water in the Pullman-Moscow basin is being substantially depleted by domestic consumption and could possibly become exhausted before the year 2000. Initial action was taken to resolve the problem and assure availability of a future supply in August, 1966, with the formation of the Pullman-Moscow Water Resource Committee (P-MWRC). The P-MWRC is composed of two members from each of the four legal entities responsible for the major supply of domestic water within the area and includes the City of Pullman, the City of Moscow, the University of Idaho and Washington State University. The purpose of the committee is to study and recommend possible methods of augmenting the ground water supply currently being employed for domestic use. To assist in this accomplishment, the P-MWRC retained Stevens, Thompson & Runyan, Inc., Consulting Engineers, in January, 1970, to undertake an independent study and prepare a report on the feasible sources of surface water which could possibly be developed to augment the present water supply.

The intent of the study is not to imply that any separate entity should provide the major water supply to the entire area, but in the interests of economy and environmental compatibility, the project might be approached from the standpoint of developing a mutual and cooperative solution.

SCOPE

The major emphasis of the engineering report was to be placed on a comparative analysis of all feasible surface water supplies which could be utilized as a common source of domestic water without use of wells. However, in the course of the study, it was determined that an economical solution was not possible without conjunctive use of existing wells on a continuous basis. Thus, conjunctive use of the present wells plus the potential use of low-quality water sources were considered for peaking purposes with the recommendation of the two most favorable sources of surface water. Either of these sources could be deemed feasible to totally provide the entire urban area's annual demand. Development plans for additional ground water supplies were not to be considered.

Additional factors considered by the study included the following:

1. Review and evaluation of the population and water demand projections prepared by the P-MWRC, both prior and during the study period.

2. Review and evaluation of the projects on the North Fork of the Palouse River as outlined and presented by the United States Army Corps of Engineers (USCE).

3. Contacting and maintaining liaison with all interested communities and governmental agencies involved.

4. Recommendation of possible methods of operation for any proposed water utility.

OBJECTIVES

As previously indicated, the primary objective of this study is the selection of one or more alternatives which would provide the urban area with an economical and reliable source of domestic water. Direction of future study and information on the existing wells and aquifer is an indirect objective of this study. Since the potential use of a surface supply of water could permit the existing wells to be relieved of major production responsibilities, observation and study of the recovery characteristics of the wells and the aquifer could still provide valuable information about the capacity of that aquifer. Additionally, the study will serve as a comprehensive and independent analysis of the water shortage problem and the potential solutions.

STUDY DEVELOPMENT

Information on population, water consumption and the existing water systems was gathered for engineering studies. From this data, design parameters and preliminary designs for all feasible water sources were developed. Cost estimates of each alternative were made in a manner which permitted relative economic comparison of the alternate sources with the most favorable sources being fully developed for presentation in this report. Final recommendations were based on careful examination of possible financial plans, project scheduling requirements, long-range flexibility, environmental analysis and additional multiple-use benefits to be achieved.

AREA TO BE SERVED

The ultimate service area considered and defined for the study and planning was not dictated by political boundaries but by the population growth and development of urban communities and associated educational institutions. It is significant to note that agreement and cooperation encompasses environs in two states.

Early in the study, questionnaires were sent to eleven other communities within the general area. The basic purpose of the questionnaire was to inform the communities of the study and determine if such communities could possibly make use of the proposed new water supply. Seven responses to the questionnaire were received which included negative reactions from the communities of Colton, Colfax, Kendrick and Uniontown. The communities of Palouse, Albion and Troy indicated an interest in an additional source of water within the next five to fifteen years. However, the volume of water which might be required in each case is insignificant compared to the total amount required for the Pullman-Moscow area. The sample questionnaire and letters received may be found in the report appendix.

Contacts were made with numerous state and federal agencies on behalf of the study. The Washington State Department of Water Resources and the Idaho State Department of Reclamation reviewed problems of existing and future water rights. Meetings were held with the Planning Staff of the Idaho Water Resources Board (IWRB) in order to coordinate the study with that agency's planning efforts, and also with the Idaho Fish and Game Department to obtain its reaction to the various alternatives being investigated. The Walla Walla District Office of the USCE provided information relative to the evaluation of their proposed project, and a meeting was held with the Troy Watershed Development Committee to review the status of the study and the methods being used to evaluate that particular alternative. Population data was solicited from the Washington State Highway Department and the Whitman Regional Planning Council. Inquiries made to the Department of Housing and Urban Development, Soil Conservation Service and Bureau of Reclamation brought information on project financial assistance.

INFORMATION AND DATA AVAILABLE

In the preparation of this report, full use has been made of previous reports, records, statistical information, maps and other data furnished by the P-MWRC as well as other agencies. Where utilized or reviewed, this information has been referenced or acknowledged. Base maps for preliminary layouts utilized published and preliminary topographic maps of the U. S. Geological Survey.

NOMENCLATURE

AF	-	acre feet
BG/YR	-	billion gallons per year
bgy	-	billion gallons per year
cfs	-	cubic feet per second
gpcd	-	gallons per capita per day
gpm	-	gallons per minute
hp	-	horsepower
JTU	-	Jackson candle unit
KWH	-	Kilowatt hour
M & I	-	municipal and industrial
MAR	-	mean annual runoff
mg	-	million gallons
mg/l	-	milligrams per liter
mgd	-	million gallons per day
ml	-	milliliters
msl	-	mean sea level
rpm	-	revolutions per minute
WTP	-	water treatment plant
umho	-	micro-umhos

POPULATION GROWTH AND FUTURE WATER DEMAND

GENERAL

At the outset of this study, the Pullman-Moscow Water Resources Committee supplied population data for use in development of the water resources plan. The intent of this section of the report is analysis and summary of these projections and adjustments thereto, resulting in the base data necessary to the conduct of the study.

The final projections are subject to certain limitations and should only be considered as probable levels of future activity given past and present trends and certain factors concerning their continuation. It is also important to note that these projections are subject to certain basic assumptions as follows: heavy industry will not develop to any appreciable extent, and the two urban areas will be mainly dependent on the universities for an economic base and growth; light industries and commercial enterprises of a technological nature can be expected because of the presence of the universities but can not be projected because of a lack of historical trend; Washington State University enrollment will stabilize in line with current policy to limit enrollment of a given institution; and finally, the projections are oriented only toward the Pullman and Moscow areas, even though other outlying areas may be involved.

AVAILABLE DATA

Numerous projection procedures are available, including the use of straight line projections, logarithmic trends, constant rate of change projections, the cohort-survival and other more sophisticated mathematical projection techniques. A large multi-economic base population and adequate historic internal trends are the basis for these expressions. This, however, is not the case with either of the two cities under consideration. Pullman has a current population of

22,000, of which only 3,330 or approximately 15% are not directly connected with the University. In Moscow, Idaho, a slightly higher percentage of population is not oriented toward the University. The 1970 census indicated a combined population of 13,731. Thus, university enrollments provide an extremely important external influence, and it becomes readily evident that the conventional population projection techniques must be modified for the Pullman-Moscow study area.

The information supplied for this study varied widely. The U. S. Bureau of Census data has been updated by a special census in the state of Washington, and an update for Moscow is available for 1965. Previous analyses for Moscow/University of Idaho include three reports completed before 1960 and recent information gathered for the Pullman-Moscow Water Resources Committee. The information provided for the Pullman/Washington State University area is quite thorough and includes detailed projections. The latter reflect the impact of the rapid state university enrollment expected in the next few years. 1970 census data was not sufficiently complete in time for this study other than for overall comparison purposes.

P-MWRC PROJECTIONS

The population trends for Pullman/Washington State University completed by Abbey & Copp (10) and the Washington State University office of University Development are thorough in their analysis of the university structure and its relationship to the city. The former report has been projected to the year 2020, while the report by the Office of University Development projected only to the year 1980. The Abbey & Copp projection is based on a methodology consisting of projections of ten factors, ranging from student enrollment through staff and faculty to city population. Utilizing projections of student enrollment and ratios of students to faculty and staff, spouses, and dependents, the full size of the university community can be approximated. The non-university population is projected independently based on economic base trends. If for some reason, the enrollment of a university were fixed at a certain level, the projections computed would be altered and may not reach the ranges shown within the same time frame.

Total and combined population growth trends for the study area developed by the P-MWRC are summarized in Table 2-1.

TABLE 2-1
P-MWRC POPULATION TRENDS

	1980	2000	2020
HIGH ESTIMATE	49,500	74,000	104,000
LOW ESTIMATE	47,500	61,000	72,300

PREPARATION OF AREA PROJECTIONS

More recent basic projection data, including those developed as a part of this study, vary somewhat from the data in the Abbey & Copp work. Therefore, while the latter approach was considered valid and adopted for use in this study, revised trends have been computed and presented in Tables 2-2 through 2-3 and Figure II-1.

As indicated above there are significant limitations in available data on the Moscow/University of Idaho area. Because of this situation it was necessary to develop new projections that could be used as base data compatible to the Pullman/Washington State University data. These population trends were based on available historical data and University of Idaho future enrollment estimates. In view of the similarities between the Pullman and Moscow urban areas, it was concluded that the same projecting methodology utilized for the Pullman/ Washington State University would be appropriate for the Moscow/ University of Idaho community.

The trend as summarized in Table 2-3, was initiated by projecting University of Idaho enrollment from past, present, and near future enrollment as provided by the Department of Institutional Research at the University of Idaho. Since the projections available were only carried to 1979, it was necessary to continue the projection to the year 2020. The results are summarized in line one of Table 2-3.

Based on ratios relating the student enrollment to the required number of faculty and staff as developed for Washington State University, the number of faculty and staff was determined. Using the assumption that the dependent family of each faculty and staff member consisted of two additional members, line 3 was also calculated.

Utilizing a similar methodology, the number of married students and their families was calculated. The family size in this instance was assumed to be an additional 1.5 persons as opposed to two persons for faculty and staff. Finally, the "City" or non-university related population is the result of projections of past "City" populations and possible trends as indicated by the USCE Economic Base Study (21), or about a 1.0-1.5% increase per year.

Total or combined low and high population trends are summarized in Table 2-3, and presented in Figure II-1. Particularly evident from the curves are the significant effect of high rate of enrollment increase at WSU expected through 1980, and the subsequent leveling to about a 1% annual growth. In this latter period the upward trend for Pullman/Washington State University is dependent on area economy factors other than the University. Moscow/University of Idaho exhibits a normal growth curve. A doubling time for the total area population is estimated at twenty-eight years compared to the previous doubling period of twenty-two years.

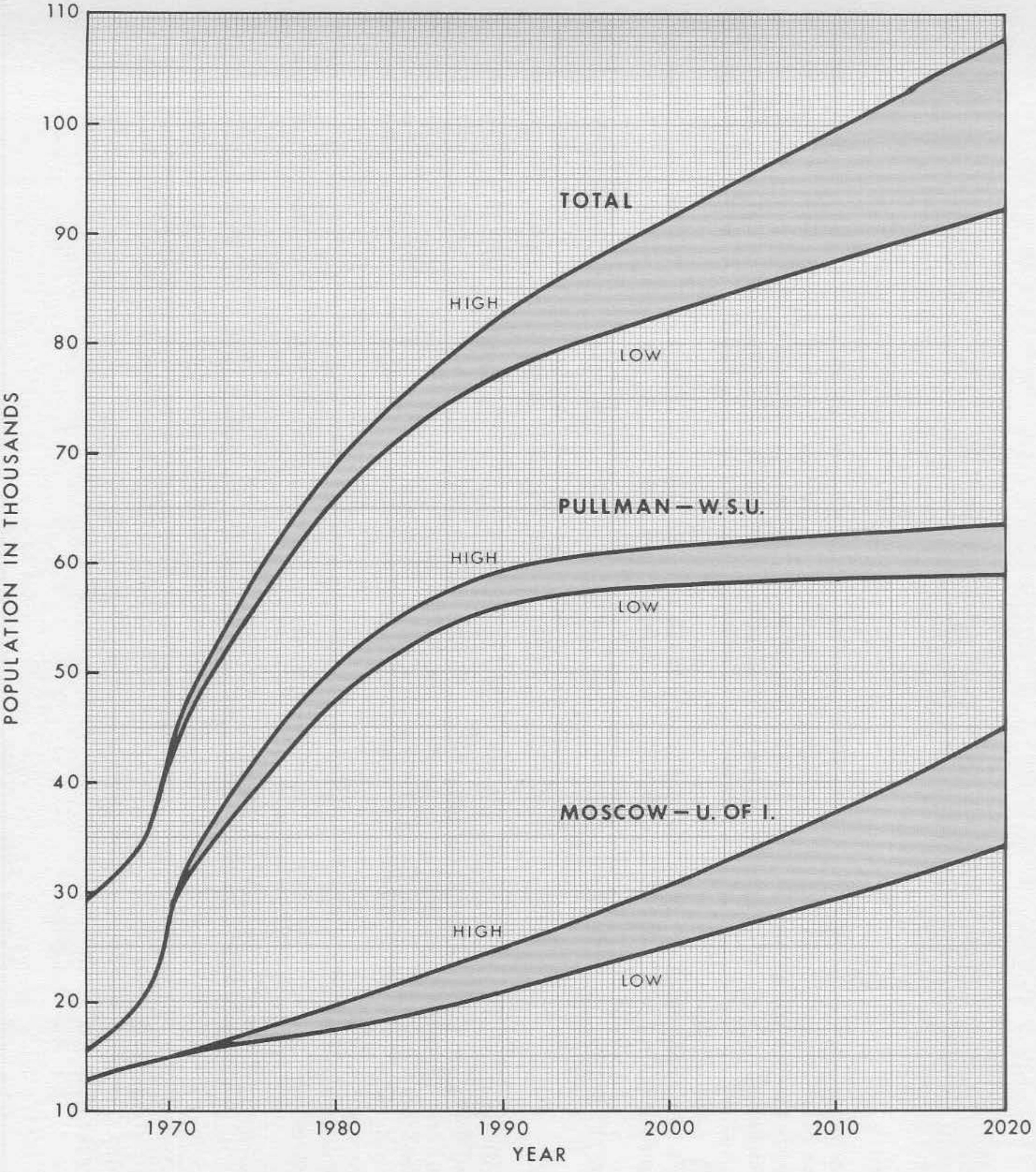
It should be noted that although there are similarities between the Pullman/Moscow areas, there are also differences that may influence the projections. The State of Idaho currently operates under a more lenient policy than Washington regarding the upper limit on university enrollment; state fiscal resources and monetary policies differ; and there is the 1.3 to 1.0 ratio of non-students to student enrollment in the Moscow area as opposed to a ratio of 0.9 to 1.0 in the Pullman area. Although these differences are evident, it is not anticipated that they will adversely influence the basic composite population trends developed.

TABLE 2-2
PULLMAN-WASHINGTON STATE UNIVERSITY
POPULATION PROJECTIONS

Low Projection	1970	1975	1980	1990	2000	2010	2020
A. Total Enrollment	13,136	19,200	24,000	28,000	28,000	28,000	28,000
B. Faculty and Staff[1]	2,955	4,376	5,619	6,580	6,580	6,580	6,580
C. Faculty and Staff Families[2]	5,910	8,752	11,238	13,160	13,160	13,160	13,160
D. Married Students[3]	2,107	3,220	4,350	5,600	5,600	5,600	5,600
E. Student Families[4]	3,161	4,850	6,525	8,400	8,400	8,400	8,400
F. Enrolled Spouses of Students, Faculty and Staff[5]	1,287	1,886	2,370	2,766	2,766	2,766	2,766
G. "City" Population[6]	3,310	3,479	3,656	4,038	4,460	4,926	5,441
TOTAL (A+B+C+E+G-F)	27,185	38,751	48,668	57,412	57,834	58,300	58,815

High Projection	1970	1975	1980	1990	2000	2010	2020
A. Total Enrollment	14,290	20,350	25,000	29,000	30,000	30,000	30,000
B. Faculty and Staff[1]	3,215	4,668	5,896	6,825	7,060	7,060	7,060
C. Faculty and Staff Families[2]	6,430	9,336	11,792	13,650	14,120	14,120	14,120
D. Married Students[3]	2,279	3,485	4,625	5,800	6,000	6,000	6,000
E. Student Families[4]	3,418	5,228	6,938	8,700	9,000	9,000	9,000
F. Enrolled Spouses of Students, Faculty and Staff[5]	1,400	2,001	2,472	2,866	2,965	2,965	2,965
G. "City" Population[7]	3,310	3,474	3,646	4,074	4,551	5,299	6,169
TOTAL (A+B+C+E+G-F)	29,263	41,055	50,800	59,383	61,766	62,514	63,384

1 Lower Division, 17:1, Upper Division, 11:1, and Graduate, 5:1; Staff, 7.3:1 to 4.25:1 after 1990
2 2.0 x Faculty and Staff
3 10% of Under Graduate Staff and 60% of Graduate; 20% of total after 1990
4 1.5 x Married Students
5 8% of Students, Faculty and Staff
6 1.00% per year
7 0.95% per year to 1980, 1.1% per year to 2000, and 1.55% per year to 2020



POPULATION GROWTH PROJECTION

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FIGURE II-1

TABLE 2-3
MOSCOW-UNIVERSITY OF IDAHO AND COMBINED
POPULATION PROJECTIONS

Low Projection	1970	1975	1980	1990	2000	2010	2020
A. Total Enrollment	6,460	7,140	7,800	9,500	11,500	13,600	15,700
B. Faculty and Staff	1,400	1,550	1,700	2,100	2,500	3,000	3,500
C. Faculty and Staff Families	2,800	3,100	3,400	4,200	5,000	6,000	7,000
D. Married Students	920	1,070	1,170	1,400	1,750	2,100	2,400
E. Student Families	1,380	1,605	1,755	2,500	2,625	3,150	3,600
F. Enrolled Spouses	629	695	760	928	1,120	1,328	1,536
G. Projected "City" Population	3,400	3,573	3,755	4,148	4,582	5,061	5,590
TOTAL (A+B+C+E+G-F)	14,811	16,273	17,650	21,120	25,087	29,483	33,854

High Projection	1970	1975	1980	1990	2000	2010	2020
A. Total Enrollment	6,460	7,300	8,200	10,600	13,000	16,400	20,000
B. Faculty and Staff	1,400	1,585	2,200	2,800	3,500	4,400	5,400
C. Faculty and Staff Families	2,800	3,170	4,400	5,600	7,000	8,800	10,000
D. Married Students	1,100	1,095	1,500	2,000	2,400	3,000	3,600
E. Student Families	1,650	1,643	2,250	3,000	3,600	4,500	5,400
F. Enrolled Spouses	629	712	832	1,072	1,320	1,664	2,032
G. Projected "City" Population	3,400	3,568	3,744	4,183	4,673	5,440	6,334
TOTAL (A+B+C+E+G-F)	15,081	16,554	19,962	25,111	30,453	37,876	45,102

Combined Projections	1970	1975	1980	1990	2000	2010	2020
Low Population	41,996	55,024	66,318	78,532	82,921	87,783	92,669
High Population	44,344	57,609	70,762	84,494	92,219	100,390	108,486
Mean Population	43,170	56,317	68,540	81,513	87,570	94,087	100,578

TABLE 2-4
SUMMARY OF AREA CONSUMPTION

YEAR	CITY OF PULLMAN Ave. Day (mgd)	Max. Day (mgd)	Min. Day (mgd)	WSU Ave. Day (mgd)	Max. Day (mgd)	Min. Day (mgd)	MOSCOW Ave. Day (mgd)	Max. Day (mgd)	Min. Day (mgd)	U. OF I. Ave. Day (mgd)	Max. Day (mgd)	Min. Day (mgd)
1954	0.95			0.89								
1955	1.08			0.86								
1956	1.11			1.02								
1957	1.11			1.10								
1958	1.17			1.02			1.03					
1959	1.02			1.11			1.11					
1960	1.14	3.28		1.14			1.17					
1961	1.29			1.21			1.15					
1962	1.11	3.34		1.34			1.37	3.53				
1963	1.29			1.45								
1964	1.23	3.42		1.46			1.12					
1965	1.37			1.56			1.20			0.43		
1966	1.55			1.64			1.38			0.48		
1967	1.63	4.01	0.83	1.71	4.02	0.72	1.48	3.42	.47	0.52		
1968	1.62	4.58	0.85	1.68	4.51	1.20	1.45	3.94	.41	0.47	1.74	0.11
1969	1.95	4.51	0.80					3.77	.36	0.46	2.01	0.14

Data available as of January, 1970, and estimated in part where records were incomplete or compiled by different methods.

PROJECTED WATER DEMAND

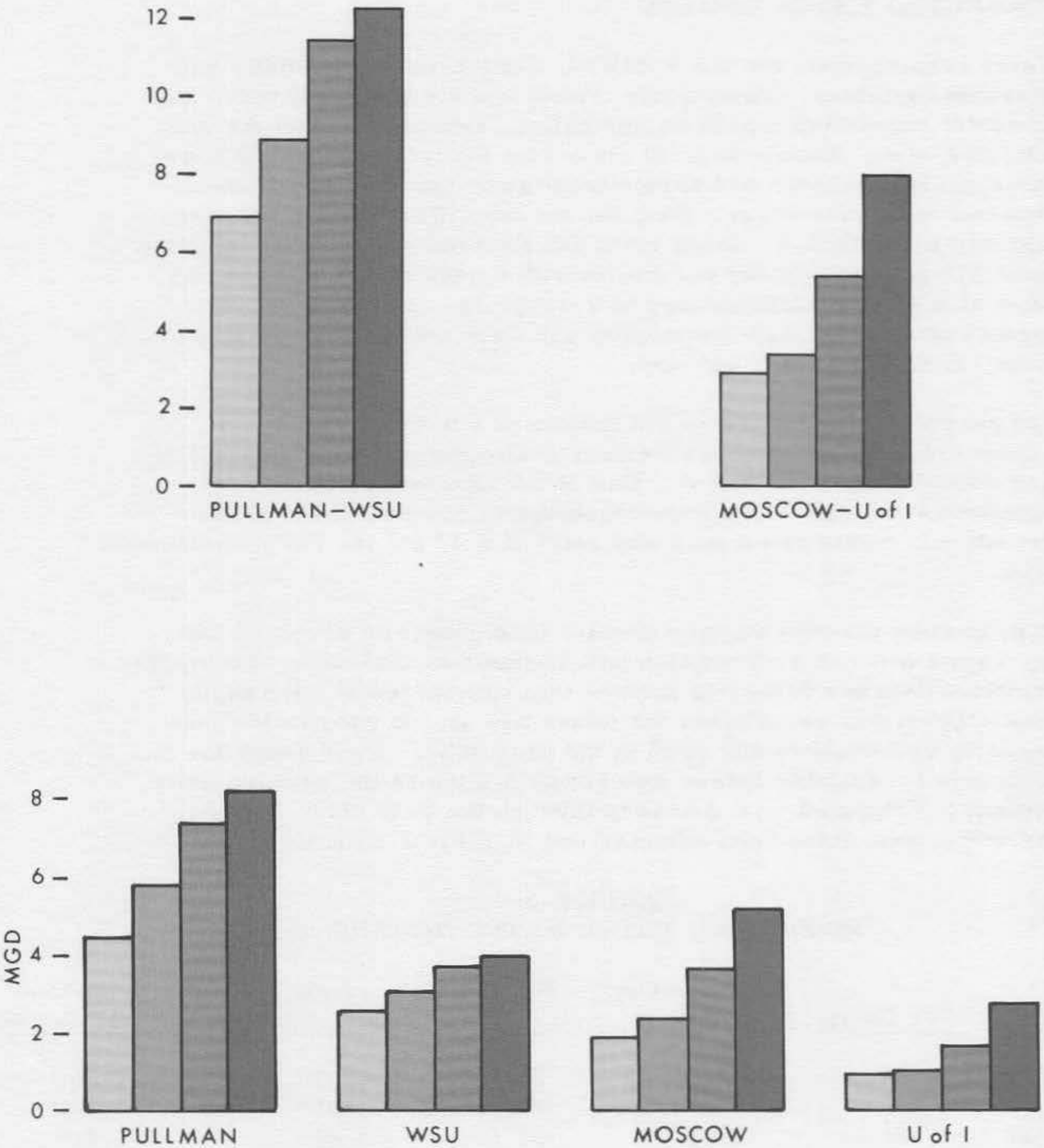
Water requirements for the P-MWRC study area include daily and seasonal variables, consumptive trends and the impact of other than domestic consumption such as sprinkling, agricultural and air conditioning uses. Examination of historical records indicates a wide variation in maximum and agricultural uses; however, such use is seasonal with enrollment. Data for the past fifteen years are summarized in Table 2-4. Mean rates for the total area were calculated to be 173 gallons per day per capita with a peak day to average day ratio of 2.85 and minimum day to average day ratio of 0.50. Per capita rates varied with community and over the years of record from 135 to 190 gallons per day.

For purposes of comparison the results of a national survey by Linaweaver, et al. (7), for western communities with heavy sprinkling demands were evaluated. Use of the Linaweaver statistical equations indicated an average consumptive demand of 174 gallons per day per capita and a peak day ratio of 3.12 for the Pullman/Moscow area.

In projecting the consumptive trends, it is generally accepted that per capita rates of consumption will continue to increase. Taking the available data and foregoing factors into consideration, per capita consumption was established for future use as 175 gpcd in 1975 increasing uniformly to 200 gpcd in the year 2020. Peak usage including unaccountable losses was set as 3.0 times the average daily demand. Projected total demands through the year 2020, suitable for design use, have been summarized in Table 2-5 below.

TABLE 2-5
PROJECTED TOTAL WATER DEMAND

Year	Per Capita	Average Day mgd	Peak Day mgd	Total Annual Requirement Acre-Feet	Total Annual Requirement Million Gallons
1970	170	7.55	22.7	8,470	2,760
1975	175	9.86	29.6	11,050	3,600
1980	180	12.3	37.0	13,810	4,500
1990	185	15.1	45.2	16,880	5,500
2000	190	16.6	49.9	18,630	6,070
2010	195	18.4	55.0	20,560	6,700
2020	200	20.1	60.4	22,530	7,340



WATER DEMAND BY USER
FOR 1975, 1980, 2000 AND 2020

FIGURE II-2

These demands are the amount to be supplied from any potential source or combination of sources for a specific user or combination of users as shown. It should be noted that the equivalent population served differs from resident population for any particular user because of off-campus living, or residences, plus the fact that in some cases city systems provide water to university systems. This distribution of water demand for the years 1975, 1980, 2000 and 2020 is depicted in Figure II-2. For example, in 1975, Pullman will be serving an equivalent population of 25,400 or a supply of 4.6 mgd. This is about 41% of the combined demand. This ratio will remain fairly constant through 2020 when the average demand for Pullman will total 8.2 mgd.

CONCLUSIONS

Continued development and growth of the Pullman and Moscow communities and thus the needs of additional water supply will be dependent on conditions which consist of the following:

1. Near future population projections are primarily related to university enrollments and growth, particularly Washington State University which may increase nearly fifty per cent in the next five years.

2. Per capita water consumption rates will continue to increase annually, as long as the cost of water remains near present levels, reaching a rate of 200 gpcd by 2020.

3. Average daily demand on an annual basis should reach 15 mgd by 1990 and 20 mgd by 2020. Peak usage during the summer and early fall seasons will require 3.0 times the average demand.

4. The largest demand will be by the City of Pullman, reaching nearly 4.5 mgd in 1975 and 8.2 mgd in 2020.

WATER SUPPLY SOURCES

GENERAL

Consideration as to available sources of supply, their probable yield and water quality was given to all major surface water sources within a 40 mile radius of the Pullman-Moscow area. Criteria for selection and review of a potential source included that it 1) be a surface supply, 2) be able to provide the maximum development requirements, 3) should have limited existing water rights, and 4) be a potentially approved water supply source as far as health standards were concerned.

For the volumes of water projected for domestic use, the long transportation distances and the seasonal extremes in runoff conditions, it was determined that surface water should be stored at the source in order to meet the summer peak demands. Combinations of watersheds were considered to meet required yields for potential water supply sources in addition to individual watersheds and specific storage sites.

AVAILABLE SOURCES

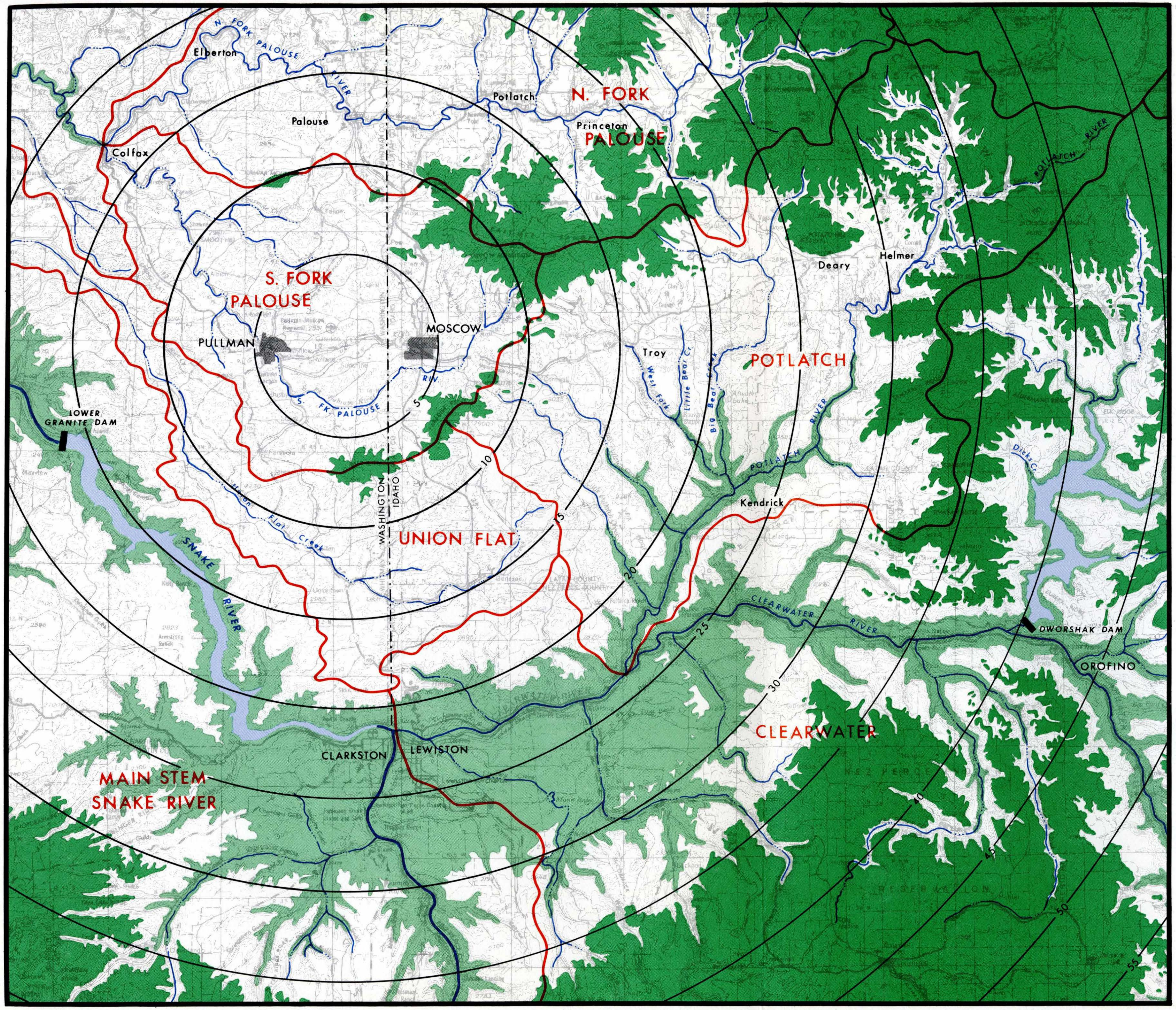
Within the area of study, five different sources were selected for serious consideration. A number of these also had several alternate methods of development. These potential sources, shown in Figure 3-1, lie within four distinct drainage basins or sub-basins: the Snake River, the Clearwater River, the Potlatch River and the Palouse River.

Aside from the distance from the center of the area of distribution, the sites can be characterized by their elevation differences relative to Pullman-Moscow, availability of storage sites, minimum stream flows, raw water quality, regulation of watershed development and existing water rights. Some of these factors have been summarized in Table 3-1. Characteristics such as water treatment requirements, water quality or elevation differences greatly affect the engineering

TABLE 3-1
SUMMARY OF SURFACE WATER RESOURCES

Source	Drainage Area Sq. Mi.	Approx. Elevation above msl	Distance From P-M, Mi	Minimum Flow cfs	Water Quality	Treatment Required	Water Rights	Comments
Snake River at Wawawai	103,500	735	15.4	9000	Ave.	B	USCE Permit	Withdrawal From Lower Granite Pool
Palouse River at Elberton	406	2200	18.1	2	Poor	C	Not Fully Adjudicated	Storage Required
Palouse River at Palouse		2432	12.2	2	Poor	C	Not Fully Adjudicated	Storage and Regulation Required
Palouse River at Princeton	317	2500	17.5	2[1]	Ave.	B	Not Fully Adjudicated	Storage and Regulation Required
Palouse River at Harvard		2560	22.0	2[1]	Ave.	B	Not Fully Adjudicated	Storage Required
Palouse River at Laird	65	2700	25.6	2[1]	Excel.	A-B	USFS Controlled	Storage Required
Moscow Mt. Watershed near Troy	75	2700	15.5	NA	Ave.	B	Purchase Required	Storage Required
Potlatch River at Helmer	121	2620	29.0	8[1]	Excel.	A-B		Storage and Regulation Required
Clearwater River at Arrow	9570	900	23.0	500	Good	B	USCE Permit	
Clearwater River at Dworshak Dam	2400	1600	39.0	655[1]	Excel.	A-B	USCE Permit	Withdrawal From Dworshak Pool
Palouse River at Moscow Sewage Treatment Plant	NA	2500	3.0	2	Poor	D	None	Tertiary Treatment Required

1] Limited records available.



GENERAL MAP
OF
SURFACE WATER RESOURCES

WATER STUDY
PULLMAN-MOSCOW
WATER RESOURCES COMMITTEE

NORTH

5 0 5 10
GRAPHIC SCALE IN MILES

LEGEND

- —5— DISTANCE FROM CENTER OF DISTRIBUTION
- WATERSHED AREA BELOW ELEVATION 2000
- WATERSHED AREA ABOVE ELEVATION 3000
- MAJOR DRAINAGE BASIN BOUNDARY

Stevens, Thompson & Runyan, Inc.
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PORTLAND SEATTLE BOISE

FIGURE III-1

decision making. Sources below the 2000-foot elevation require major pumping schemes, while sources in the same elevation zone or above allow some gravity conveyance. For purposes of this study and the summary in Table 3-1, treatment requirements were determined to be:

A. Filtration and chlorination
B. Coagulation, filtration and chlorination
C. Coagulation, activated carbon addition, filtration and chlorination
D. Complete water reclamation (applicable to reuse of sewage effluent)

WATER QUALITY

Water quality data and summary reports are available for certain stations within the study area. Information obtained from both the records of the Federal Water Quality Administration and U. S. Geological Survey - Water Resources Division through January, 1970, were evaluated in this review. These Data have been summarized for three major drainage basins regarded as potential sources in Tables 3-2 through 3-5. Averages shown are based on all seasons and years of data available. Maximum and minimum values are for the period 1965-1969 or five years. Stations considered important for this study were the following:

Snake River at Wawawai
Palouse River at Palouse
Palouse River at Princeton
Potlatch River at Kendrick

Comparisons of the measured raw water characteristics to standards for drinking water and acceptable ranges for raw water are indicated for each source. Sources with biological characteristics exceeding acceptable limits would be considered marginal sources and require higher degree of treatment and annual expense but still might be made available at a lower cost than a more distant source or one requiring higher pumping heads.

TABLE 3-2
WATER QUALITY
SNAKE RIVER AT WAWAWAI

Item	Mean Recorded	Maximum Recorded	Minimum Recorded	Acceptable Range Of Raw Water For M & I Use[1]	PHS Drinking Water Standards	Desired Treated Water Quality
Dissolved Oxygen, mg/l	11.3	13.8	7.0	5.0		5.0-7.5
Dissolved Oxygen, % Sat.		107	77	70		75
pH, Std. Units	7.7	9.0	6.8	6.5-8.5		6.5-8.5
Temp, °C	11.9	25.0	2.5	20		20
Turbidity, JTU	4.2	305	0.2	10-250	5	1.0
Specific Con, umho	255	417	67	300		300
Color, Std. Units	18	40	1	75	15	3
Coliforms/100 ml.	655	10,000	25	5,000	1.0	none
Total Hardness, mg/l	95	189	21	270		100
Calcium Hardness, mg/l	83	135	12	175		125
Chlorides, mg/l	20	17	1	15	250	15
Phosphates, mg/l[2]	.19	.72	.01	.044		
Nitrogen, as N, mg/l[2]	1.20	4.0	0.3	.034	10	10
Total Dis. Solids, mg/l[3]	165	270	44	200	500	200
BOD 5 day, mg/l		3.2	0.1			

1] California Water Quality Criteria & University of Illinois Conference on Raw Water Characteristics(8)(25).
2] To minimize algae in raw water storage.
3] Computed, based on 0.65 x specific conductance, where not available.

TABLE 3-3
WATER QUALITY
NORTH FORK PALOUSE RIVER AT PALOUSE

Item	Mean Recorded	Maximum Recorded	Minimum Recorded	Acceptable Range Of Raw Water For M & I Use[1]
Dissolved Oxygen, mg/l	9.8	12.7	5.6	5.0
pH, Std. Units	7.1	7.4	6.8	6.5-8.5
Turbidity, JTU	18	35	3	10-250
Specific Cond., umho	83	122	35	300
Coliforms/100 ml.	4,000	10,900	700	5,000
Total Hardness, mg/l	23	35	10	270
Phosphates, mg/l[2]	0.17	0.22	0.08	.04
Nitrogen, as N, mg/l[2]	1.1	2.3	.05	0.03
Total Dis. Solids, mg/l[3]	54	79	23	200

See Table 3-2 for footnotes.

TABLE 3-4
WATER QUALITY
POTLATCH RIVER AT KENDRICK

Item	Mean Recorded	Maximum Recorded	Minimum Recorded	Acceptable Range Of Raw Water For M & I Use
pH, Std. Units	6.9	7.2	6.6	6.5-8.5
Temp °C				20
Turbidity, JTU				10-250
Specific Cond., umho	66	86	46	300
Color, SU	7	10	5	75
Coliforms/100 ml.				5000
Total Hardness, mg/l	26	34	19	270
Calcium Hardness, mg/l	23	30	16	175
Chlorides, mg/l	2.3	3.0	1.5	15
Phosphates, mg/l[2]				.04
Nitrogen, As N, mg/l[2]	0.9	1.0	0.8	.03
Total Dissolved Solids, mg/l[3]	64	78	50	200

See Table 3-2 for footnotes.

Most water sources showed higher than acceptable nutrient levels, which can infer seasonal problems in treatment and storage of raw water. The only potential source subject to prolonged storage immediately prior to treatment is the Snake River. Algal blooms in the Lower Granite Pool could occur. Low flow periods of the Palouse could also present algal problems even with regulated release from an upstream reservoir.

Silt loads can be expected to be a seasonal problem for all potential sources. However, additional treatment requirements would not be necessary for plants withdrawing directly from a damsite/reservoir. Regulated releases would not reduce turbidity levels appreciably because of the influence of unregulated tributaries downstream.

Proper development and design of water supply facilities also requires determination of annual runoff and the adequate or "safe" yields of the potential sources as well as estimates of the raw and probable treated water qualities. Factors affecting the estimate of runoffs and safe yields are discussed in Chapter VII where required for development of alternative plans and are not included in this part of the study.

ENVIRONMENTAL CONSIDERATIONS

The improvement of the overall water supply system is, of course, the prime concern of this project, and to the greatest extent possible without endangering environmental or natural balances. Past use of the ground water system has in certain instances resulted in a gradual degradation of environmental conditions. For example, where artesian conditions previously existed in the Pullman area contributing to surface streamflow, the water table is now over one hundred feet below the surface in some wells. Proper planning of a large scale surface supply system must undoubtedly be influenced by preservation of environmental quality and minimize any adverse changes as such changes could occur far more rapidly than with ground water systems. Practical questions would be: what impact would be placed on a transfer of 10,000-20,000 acre-feet per year of water from one sub-basin into another? Would a ban on all but minimal use of existing wells improve the hydrological system and yet be both beneficial and practical? Would downstream stream conditions be improved or degraded from the added wastewater load of different chemical characteristics? Does the economic optimization of a storage reservoir capacity also optimize ecological conditions?

Changes which may occur in the drainage basins may be broadly classified into (a) those that will affect the ecological systems of the area, and (b) those that will affect the inhabitants of the area. The area in each case may be defined to include the watershed, the downstream area of runoff, the communities themselves and downstream areas therefrom. Each of these two classifications will have some effect by water supply development on a large scale.

EFFECTS ON ECOLOGICAL SYSTEMS

Operation of nearly all of the proposed projects requires a storage area that will result in flooded cropland or forest land. For single purpose projects for municipal and industrial use, it is felt no significant benefits will be lost but that systems and benefits of a greater magnitude will occur. Here can be noted increased fish propagation, additional waterfowl habitat, increases in general aquatic productivity, and ground water recharge. Multi-purpose storage projects would provide the same advantages with even better control of floods, soil erosion and increased downstream cropland productivity.

Streamflow regulation and wastewater releases would both add improvement to existing conditions by eliminating stagnant areas, providing flushing action and lowering dissolved mineral content. Improvement of certain physical conditions such as flooding, erosion and silt loads could be expected with upstream storage.

EFFECTS ON INHABITANTS

The proposed projects with potential surface sources will in general improve water supply quality. Dissolved minerals will decrease notably and hardness would be less than one third the amount of the existing well supplies. Mineralization rates of irrigated and sprinkled lands might be reversed in trend with a gradual leaching out of previously stored calcium and other mineral deposits.

Other benefits include diversification of regional recreational opportunities, added employment in rural areas, and general improvement in esthetics and optimal water resource development. The ability to improve downstream water rights during periods of natural low flow should also be considered.

PREVIOUS STUDIES

GENERAL

Numerous water studies of supplemental or new sources of domestic water for the communities within the Pullman-Moscow region have been conducted. The scope of most of these studies was not adequate to cover the entire urban area or employed demand requirements now outdated; thus, they were only used herein as references. Three significant previous studies, conducted on behalf of the P-MWRC, were oriented towards the purpose of developing a long range, common surface supply for the entire urban area. A discussion of these reports follows.

BUREAU OF RECLAMATION STUDY

A preliminary report on water supply in the Pullman-Moscow area was completed in September, 1967, by the U. S. Bureau of Reclamation. This project made reconnaissance level developments of four different sources of surface water for the Pullman-Moscow urban area. Two of the four projects proposed were single-purpose reservoirs, in excess of 30,000 acre-feet, on the North Fork of the Palouse River. Regulated releases would then be diverted at a downstream point near the City of Palouse into a pipeline and pumped to a terminal reservoir located midway between the communities of Pullman and Moscow. A third scheme featured pumping from the main stem of the Snake River to a terminal reservoir located at Pullman with a re-lift pumping station providing water to the City of Moscow. The fourth scheme envisioned pumping water from a single-purpose reservoir on the Potlatch River near Helmer through a transmission line to a terminal reservoir located midway between Pullman and Moscow.

Water demands were determined by the Bureau of Reclamation to the year 2020 based upon the population projections provided by the four legal entities. The study also assumed conjunctive use of ground water from the existing wells to be available and adequate for peaking requirements through the year 2020.

Estimates of annual costs were prepared for each of the four schemes and summarized in the BOR report. Amortization of the initial construction cost was based on federal financing using a 3 1/8% interest rate for a fifty-year period. Annual operating costs were estimated and added to the annual amortization costs to provide total annual costs. The total annual costs were also presented in terms of cost per unit of consumption, which ranged from \$.04/1,000 gal. to \$.07/1,000 gal.

Evaluation of this particular study shows that several factors require discussion. The annual costs which may be anticipated in the first year of operation are 2 1/2 times greater than those anticipated and shown for the year 2020. The annual costs presented do not include construction and operation of treatment facilities or transmission facilities from the terminal reservoir to the communities of Pullman and Moscow. Subsequent projections calculate the total requirements for the year 2020 to be 22,500 acre-feet instead of 18,500 acre-feet as projected in this particular report. Lack of detailed information on the size and capacity of the major components proposed for the four schemes prevents a more thorough analysis of the study.

SUTHERLAND STUDY

Dr. Robert A. Sutherland conducted a preliminary examination of four possible sources of surface water which were considered to be adequate supplies for the next fifty years. The report of this study reviews the capacity and capabilities of the existing water systems. Population projections and estimates of future water demands were prepared and used in the development of each alternative. The four different schemes are described and the possible development of each is briefly outlined in narrative. The discussion involves the major physical features of each potential source of supply: development of Hatters Creek near Princeton, the Palouse River above Harvard, the East Fork of Potlatch Creek near Bovill, and the Clearwater River east of Lewiston. The report indicated the source on the Palouse River above Harvard to be preferable.

CORPS OF ENGINEERS PALOUSE BASIN STUDIES

The Walla Walla District Office of the U. S. Army Corps of Engineers has prepared the most comprehensive study of the upper Palouse River Basin, including an economic appraisal. This early or preliminary work suggested a single-purpose project on the Palouse River with municipal and industrial use of water in the Pullman-Moscow area as the major beneficiary. Since the measurement of the benefits of a reservoir on the Palouse River which could be applied to a municipal water supply is determined by the least costly alternative, additional water sources outside the Palouse drainage were also investigated. Later revisions to the 1968 study included multi-purpose benefits of the Palouse River sites.

Population and water demand projections were prepared indicating a supplemental supply of 5 billion gallons per year will be required in the year 2020, in addition to a sustained yield of 1 billion gallons per year from the existing wells. The report assumed that sufficient storage will exist within the distribution system for daily peak requirements.

The following five alternatives were investigated and reviewed by the Army Corps of Engineers.

1. A pumped intake on the Snake River near Wawawai which would serve the City of Pullman through a 24-inch pipeline. A booster station would then be required at Pullman to serve the City of Moscow through an 18-inch pipeline.

2. A single-purpose reservoir to be located on the North Fork of the Palouse River at Harvard with a capacity of 24,000 acre-feet. Regulated releases from this storage reservoir would be diverted near the state line and transmitted through a 24-inch pipeline to a point between Pullman and Moscow.

3. A single-purpose reservoir of 20,000 acre-feet to be located on the North Fork of the Palouse River immediately above Laird Park. Diversion and transmission would be the same as proposed for the Harvard site.

4. A dual-purpose reservoir to be located on the Potlatch River near Bovill with a 10,000 acre-foot capacity. A 24-inch transmission line would serve the City of Moscow from the reservoir and continue to Pullman with a 24-inch diameter supply line.

5. A well-field to be developed in the North Fork of the Palouse River ground water basin. Assuming that this ground water basin is capable of producing a sustained yield of 5 billion gallons per year, ten 1,000 gpm wells are proposed with ten miles of 18-inch transmission line serving the urban area.

Cost estimates of each of the above schemes were prepared and amortization calculated using federal financing at the current rate of 4 5/8% interest over a period of fifty years. Comparative costs for each of the five schemes estimate water from the Snake River at $0.125/1,000 gal., Harvard at $0.1406/1,000 gal., Laird at $0.1342/1,000 gal., Potlatch River at $0.159/1,000 gal. and the well-field at $0.0824/1,000 gal. The above unit costs are based upon the water consumption projected for the year 2020 at 5.14 billion gallons per year.

A more detailed evaluation of this study is covered in a subsequent chapter. Multi-purpose projects on the Palouse River are discussed at some length.

REVIEW OF

U. S. CORPS OF ENGINEERS PROJECT

GENERAL

The water resource development program proposed in previously described studies by the U. S. Corps of Engineers (23)(24) would yield benefits in the following areas of multiple use: (a) municipal and industrial supply, (b) recreation, (c) potential irrigation, (d) flood control, (e) water quality control, and (f) downstream fish propagation. A proper review of the past feasibility studies would necessarily need to cover all of these areas. However, since the primary objective of this report is to examine single-purpose water supply projects, only a brief review will be made of other water uses with greater attention to the M & I allocation plans and facilities. USCE studies to date have been directed at development of the North Fork Palouse basin with alternatives found in other areas.

The reservoir capacities at potential Palouse River sites were optimized based on the needs of the above potential uses estimated in earlier work. In general, areas of both Idaho and Washington were involved. This indicated the highest excess benefit to be for reservoir sites near Harvard and Laird for gross storage volumes of 70,000 acre-feet at Laird and 104,000 acre-feet at Harvard. For these sizes, approximately 20-35% of the annual yield would be utilized for M & I use in the Pullman-Moscow area by the year 2020, with allowance for demands as shown in the following table, Table 5-1.

Annual costs of the dam-storage reservoir alone contain some confusion as reported. While revisions have apparently occurred during the Corps' studies, some values are reported for a 100-year project, others for a 50-year project. It is important to note that capitalized annual costs of treatment and terminal storage facilities have not been included. Also, raw water cost, delivered to Pullman-Moscow, is based on the full contract use or 2020 demand.

TABLE 5-1
PALOUSE STORAGE SITES

	Harvard Site	Laird Site
Gross Storage, AF	104,000	70,000
Annual Yield, AF	95,000	54,000
M & I Use, AF	18,200	18,200
Irrigation Use, AF	70,700	27,500
Benefit Cost Ratio	2.2	1.8
Total Annual Cost, $	940,000	560,000
M & I Annual Cost, $	72,000	72,000

PUMPING AND TRANSMISSION FACILITIES

Both alternates proposed by the Corps maintain the least costly alternate of delivering M & I water is through regulated release to the North Fork and pumping from a river intake near the state line or the town of Palouse, elevation 2,440 msl. The transmission line would follow the general route of the Great Northern Railroad right-of-way to Fallon rising some 325 feet with the pipeline then splitting to both Pullman and Moscow city limits. It is assumed that intermediate or terminal storage would be located at the terminus of each line. The USCE reports do not indicate whether raw or treated water would be pumped, but that the amount would be equal to the average daily demand for the ultimate design year. Our analyses indicate that if adequate terminal storage were provided, this capacity would prove satisfactory but the selection of pipeline sizes would differ because of higher demands. For economic and maintenance reasons, pumping of treated water is also preferred. A summary of the costs of the Corps' participation is presented in the following table, Table 5-2.

TABLE 5-2
SUMMARY OF USCE
ANNUAL COSTS FOR M & I USE

	Size	2020 Annual Costs
Raw Water Storage (Multi-Purpose)	70,000 AF	
Raw Water Costs	18,200 AF	$ 72,000
Water Treatment Facility	NA	
Water Treatment O & M	14 mgd	$231,000
Transmission Costs (Incl. O & M)	24-inch	$320,000
Terminal Storage Facility	NA	
TOTAL		$623,000
Cost/mg (2020)		$ 118

Further evaluation of the USCE costs indicate power or energy costs, placed at 3 mils/KWH, may be low for the proposed application. Because of the high demand charge to total use requirements, it is doubtful that millage rates will approach the 3 mils employed. Unless a special rate structure can be negotiated, charges can be expected to be closer to 5 mils. In addition, annual costs for water treatment, based on experience and available data for Northwest water treatment plants and the expected raw water quality, are expected to run $0.02 to $0.04/1,000 gal. treated above the costs employed in the USCE estimates. Such costs are for treatment of stored water. Regulated river flow would be higher by approximately $0.01/1,000 gal. because of silt removal requirements.

EFFECT OF REGULATED RELEASE

The Palouse River Basin above Palouse is spotted with agricultural development, dairy and beef cattle pasturing areas, and low density urban community development. Stream quality undergoes a significant change from above Harvard to Palouse. Examination of coliform levels, nitrates or total organic carbon content indicates three to four-fold increases. Low stream velocities, high nutrient loadings, and poor channel conditions can be blamed for such water quality degradation. Evidence to date indicates an extremely marginal quality for raw water if withdrawn near Palouse, with present stream conditions. While there is a need for better data, the quality is expected to remain considerably improved above the developed areas or in the reach near Harvard or Princeton. The limited data for the Palouse at Princeton indicates a satisfactory raw water quality. A comparison of desired raw water quality to measured conditions was given in Table 3-3. To meet the desired water quality requirements, either the intake and facilities have to be economically optimized for additional treatment costs versus site location, or stream velocities, pollution control measures and channel improvements are required. Sizing of either the Harvard or Laird projects for multiple use should accomplish provision of adequate minimum flows for dilution and flushing. For example, for a 54,000 AF annual yield at the Laird reservoir, a regulated flow near 65 cfs could be obtained with releases for both downstream irrigation and water supply uses but with substantial drawdown and possible loss of recreational benefit.

CONCLUSIONS

The studies undertaken by the Corps of Engineers provide the best analysis of potential water resource development on the North Fork of the Palouse to date. However, unless the project as proposed can be more closely scaled for M & I use and made available within a time frame according to community needs, economic justification alone is doubtful. The analysis was also incomplete as to costs and physical plant requirements. It is concluded that the following revisions would be necessary in order to proceed with the program:

1. The dam-storage reservoir would have to be resized for a first-stage single-purpose use. This would eliminate consideration of the Harvard site and place all effort on a two-stage development of an optimal facility at the Laird site.

2. In order to reduce the costs of treatment and improve treated water quality, as well as esthetic conditions, withdrawals would require regulated river flow or that the intake and treatment site be moved above the developed region of the basin.

3. Consideration should be limited to pumping of treated water only to optimize pipeline and pumping plant sizing and operational costs.

4. Further investigations should be requested for USCE evaluation of scheduling, eligible phases for financing, and multi-stage reservoir construction.

5. Consideration could be given to a temporary reservoir site further upstream, possibly Poorman Creek, to provide approximately ten year's requirements and allow time for the USCE multi-purpose project to be approved, designed and constructed. This requires, however, commitment to the Palouse Basin source of supply.

ALTERNATE COMPARISON CRITERIA

GENERAL

To obtain comparative evaluation of the different sources of water supply, a preliminary engineering design and cost estimate for each alternate was required. This preliminary engineering on each of the projects further implied the need for common design criteria which would permit an optimum design of each particular alternate, yet yield a common basis for relative comparison.

The following discussion develops the design criteria used for this report. The discussion also outlines the application of the design criteria to the major components of the physical facilities and its basis for unit costs used to estimate the project costs. The discussion additionally outlines the methods used to expand both the estimated construction cost and the annual operating costs into an economic comparison of alternate plans.

FLOW REQUIREMENTS

A prerequisite to the preliminary engineering and cost estimation of any alternate is the determination of the flow requirements to be accommodated by that particular facility. The first attempt to design and estimate the cost of each alternate assumed that the water treatment plant and conveyance facilities would be capable of supplying the total peak daily demand at all times, thus eliminating the need for any sustained use of the existing wells. See Table 2-6. The cost of accommodating this flow requirement was considered excessive, indicating a definite need for the consideration of conjunctive use of the existing wells. Consequently, alternative projects were redesigned and re-estimated with the assumption that the maximum capacity of the existing wells could be used for peaking requirements and lowering the capacity of long distance conveyance systems. Although this reduced demand from the surface supplies required less physical plant, the estimated costs of these facilities were still considered excessive. Therefore, flow requirements were once again reduced in magnitude until the water treatment plants and conveyance facilities would be capable of supplying sufficient water to meet the projected average daily demand at all times, with peak demands met by conjunctive use of existing wells and terminal storage.

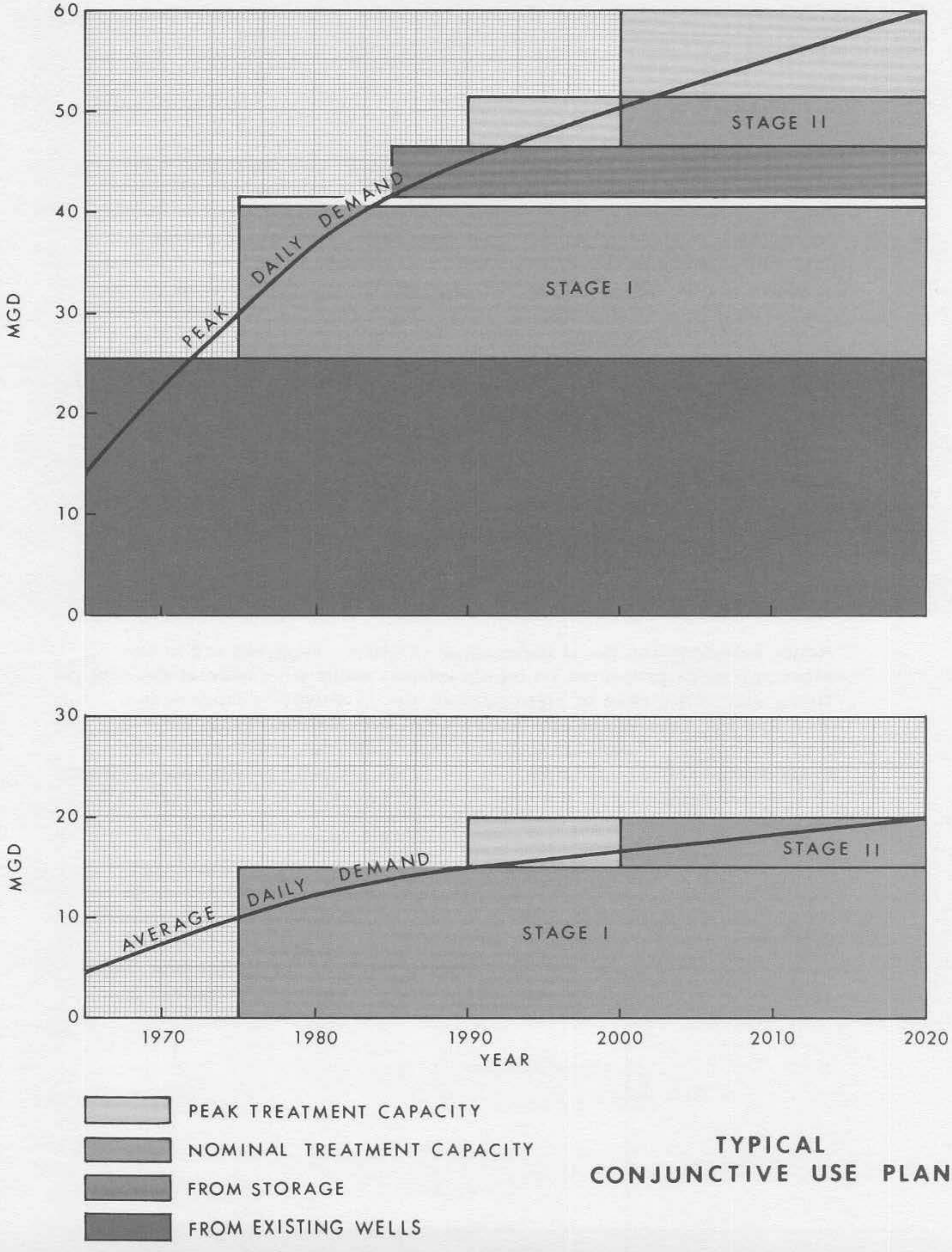
CONJUNCTIVE USE PLAN

The purpose of this analysis, as discussed in earlier sections, was to more economically employ all available sources, notably existing wells, storage, and waste water reuse with the potential surface supply. Existing well data indicates a total availability in capacity of about 25.5 mgd, excluding poorer quality wells. Natural recovery conditions of the aquifer are presently unknown, however, such a withdrawal magnitude would not be expected to occur more than two or three times a year and should significantly relax demands on ground water supplies. Less than 300 AF would be pumped in 1985 and only about 1,000 AF in 2020 compared to over 8,000 AF at present.

The reuse of waste water appears feasible, at least for irrigation purposes, for effluent from the Moscow sewage treatment plant. Golf courses, play field areas, and croplands could potentially utilize about 1 mgd during peak periods and thus offset demands on the potable supply system. This water would be used primarily by the University of Idaho.

A typical plan for conjunctive use of potential supply sources has been outlined for average and peak day conditions over the design period and presented in Figure VI-1. Flexibility is readily apparent in project staging, use of peak production capacities and demand on storage of treated water. Examination of the peak day demand curve indicates insufficient capacity of the present system by 1973.

Sufficient storage was assumed to be available in the local systems, presently about 12 mg, to handle peak hourly demands and fire demand. Final determination of future requirements for local storage would depend on a more detailed study of the distribution systems utilizing the demands projected by this report but beyond its scope of study.



TYPICAL CONJUNCTIVE USE PLAN

FIGURE VI-1

FLOW CRITERIA

The nominal design capacity of each alternate was essentially the same but the physical differences between the alternates indicated that the most economical design would undoubtedly differ for each alternate. It was therefore imperative that a common criteria for the rate of ultimate water delivery be developed which would permit variation in the design capacity of the pipelines, the pumping plant, and the quantity of terminal storage. Such criteria would necessarily permit both the optimum design for each alternate, and still allow a relative comparison between all alternates. The delivery criteria selected to satisfy these conditions stipulated that the combined capacity of all sources of water supply, (including the surface supply developed, the existing wells and the water reuse where applicable) combined with the total quantity released from terminal storage would supply three consecutive days of peak daily demand (Table 2-6) at any given time. Development and cost estimation of the affected components were consequently based upon this criteria.

PIPELINES

Route selection for the transmission facilities required for each alternate were projected on topographical maps with special consideration given to the ease of right-of-way and to elevation limitations. Profiles for each of the alternates were then drafted from the topographical maps. A determination of the hydraulic grade lines was made and superimposed upon the profiles, thereby permitting analysis of the water pressures encountered and the selection of the strength of pipe required to withstand such pressures.

Unit costs for each of the various combinations of pipe sizes and weights required were developed for common use on all projects. The basis for these unit costs was data received from various manufacturers of both reinforced concrete cylinder pipe and steel pipe. Allowances were made for installation, right-of-way, clearing, appurtenances, and special conditions such as railroad or highway crossings and canyons.

TERMINAL STORAGE

The capacity of the terminal storage required for each particular project was dependent upon the optimum design as determined by the basic delivery criteria previously developed. However, for those alternates containing extremely complex transmission facilities, the required capacity of the terminal storage was increased to provide three consecutive days of average flow during emergency conditions. Due to the magnitude of all storage facilities herein proposed, the cost estimates are based on a design utilizing reinforced concrete covered storage structures.

The unit prices developed for terminal storage facilities were obtained from similar facilities which have been recently constructed in the Northwest. Allowances to these unit prices were made to account for such miscellaneous items as site acquisition, access, site preparation, chlorination, and telemetering.

PUMPING PLANTS

The capacity of the pumping plants for each particular alternate were also individually selected based upon the common delivery criteria.

Cost estimates of the pumping plants were derived from material provided by the U. S. Bureau of Reclamation (18). The design life of the pumps and the prime movers were estimated to be not more than twenty-five years or reflect a total replacement of these units with second stage construction.

Both high lift plants and conventional booster stations were incorporated in various alternative plans. A typical layout of a high lift pumping plant has been shown in Figure VI-2.

Cost of operation and maintenance of the pumping plants was obtained from a paper presented in the Irrigation and Drainage Journal of ASCE, (3). Determination of the costs by this procedure made allowance for the variables of flow, head, seasonal operation and local wage rates.

STORAGE RESERVOIRS

For those alternates requiring impoundment of streams where the total runoff might be considered marginal, the storage capacity provided was 1.5 times greater than the total water demand for any particular year. Where the stream flow was sufficient to substantially augment the supply in storage, the required capacity of the reservoir equaled the net annual water demand for any particular year.

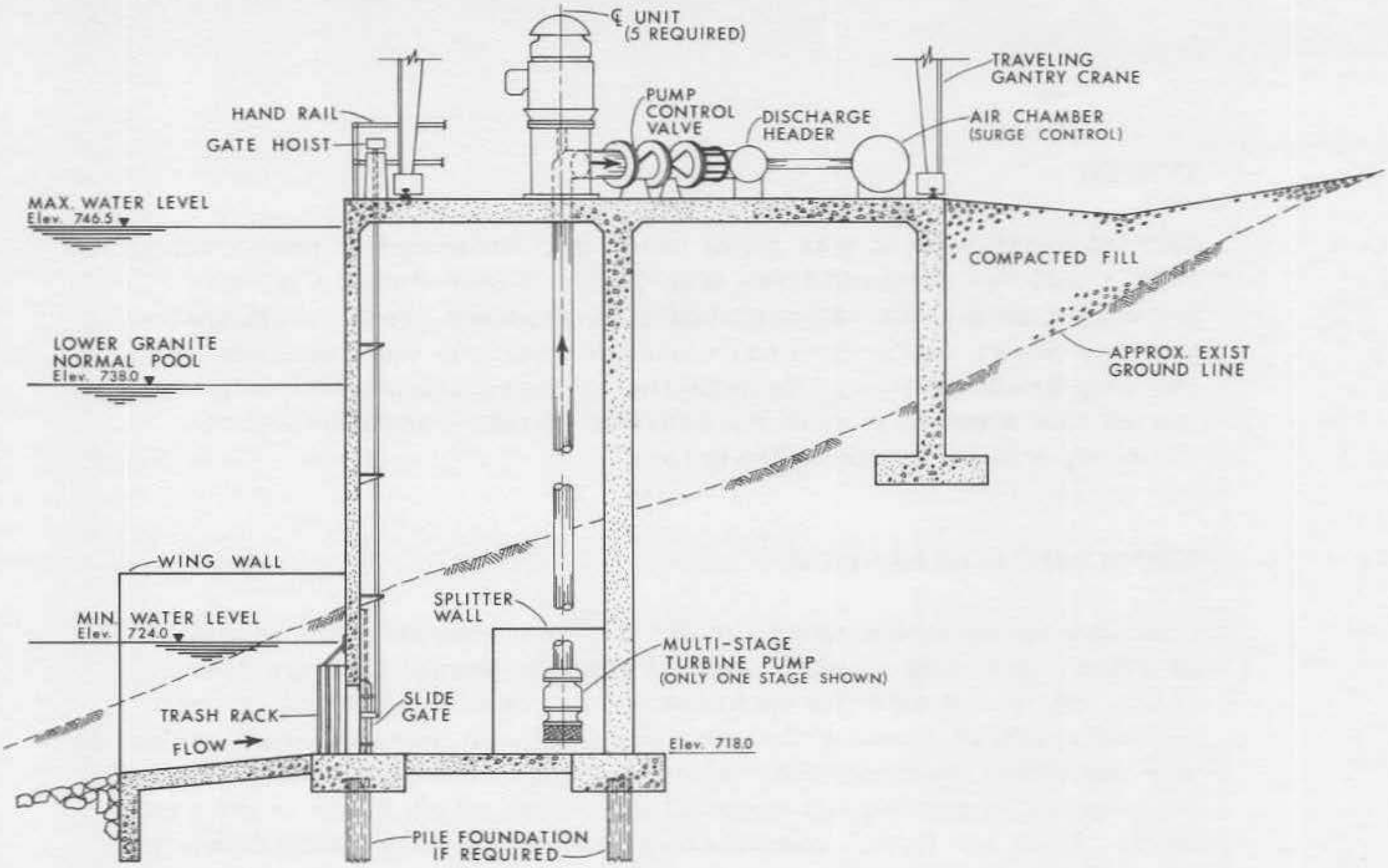
Cost estimates of the required storage reservoirs were derived from actual construction costs encountered by this firm and the U. S. Army Corps of Engineers data and estimates for regional reservoir projects.

WATER TREATMENT

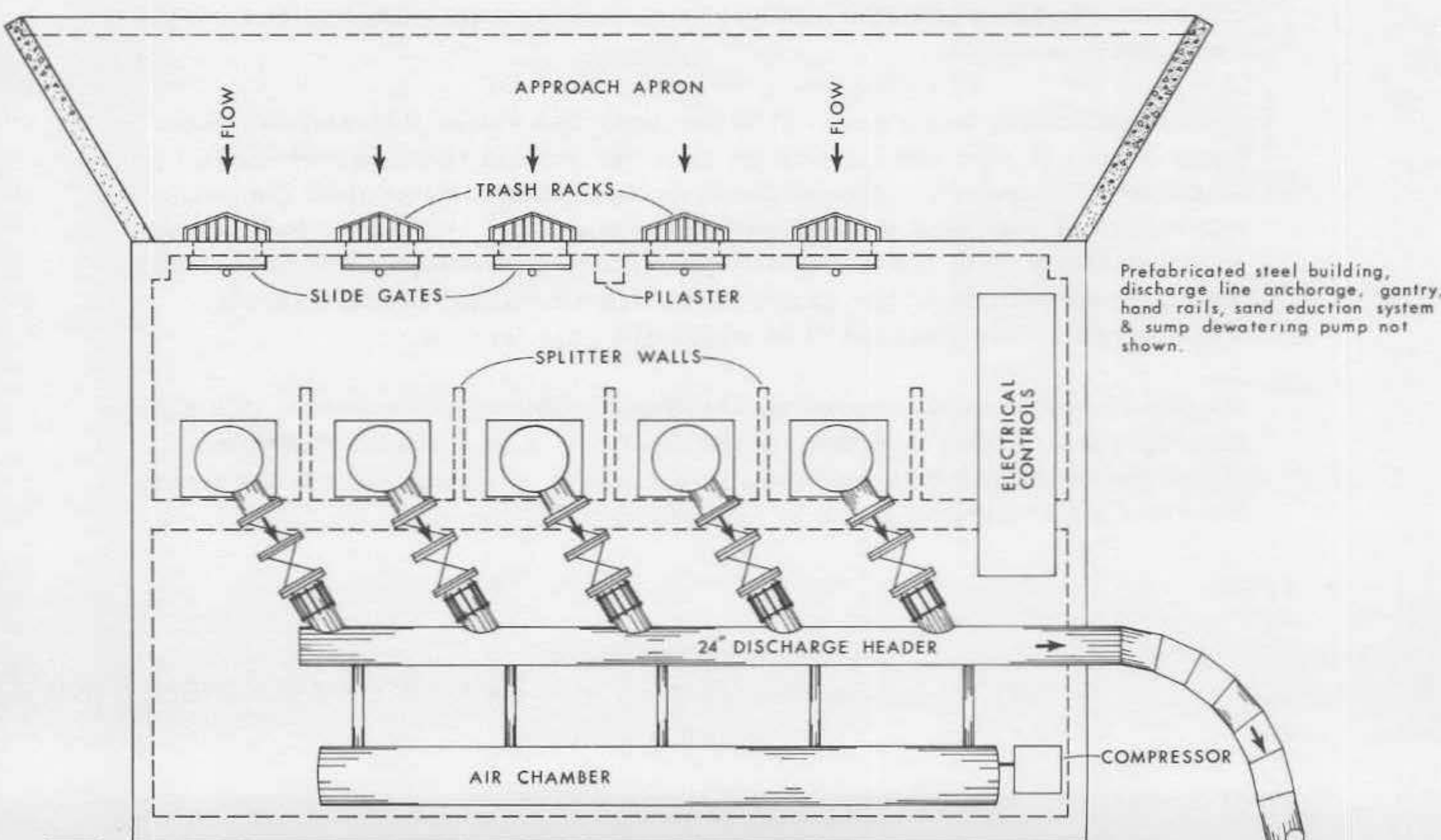
As previously indicated, the nominal capacity of proposed water treatment plants was sufficient to provide the projected average daily flow at any period of time. To account for maintenance, down time, backwashing, and some peaking capability, the actual sustained yield of filtration plants proposed exceeds the nominal capacity by a factor of 1.3. In addition, as shown in Figure VI-3, optional use of pre-sedimentation and seasonal use of carbon addition are proposed, depending on raw water conditions.

Cost estimation of water treatment plants was based upon expenditures experienced in the construction of similar facilities throughout the Northwest. The variable costs incurred for access, additional chemical treatment, pre-sedimentation, intake structures and clearwell storage were given due consideration where applicable. Additional consideration was given to the design life of the water treatment plant mechanical equipment by providing a replacement cost equal to sixty per cent of the original construction cost in the proposed expansion stage.

Operation, maintenance and chemical costs for individual treatment plants were obtained from records taken from existing water treatment plants with allowances for the degree of treatment provided and the size of the plant.



SECTION



PLAN

TYPICAL HIGH LIFT PLANT (WAWAWAI)

FIGURE VI-2

POWER

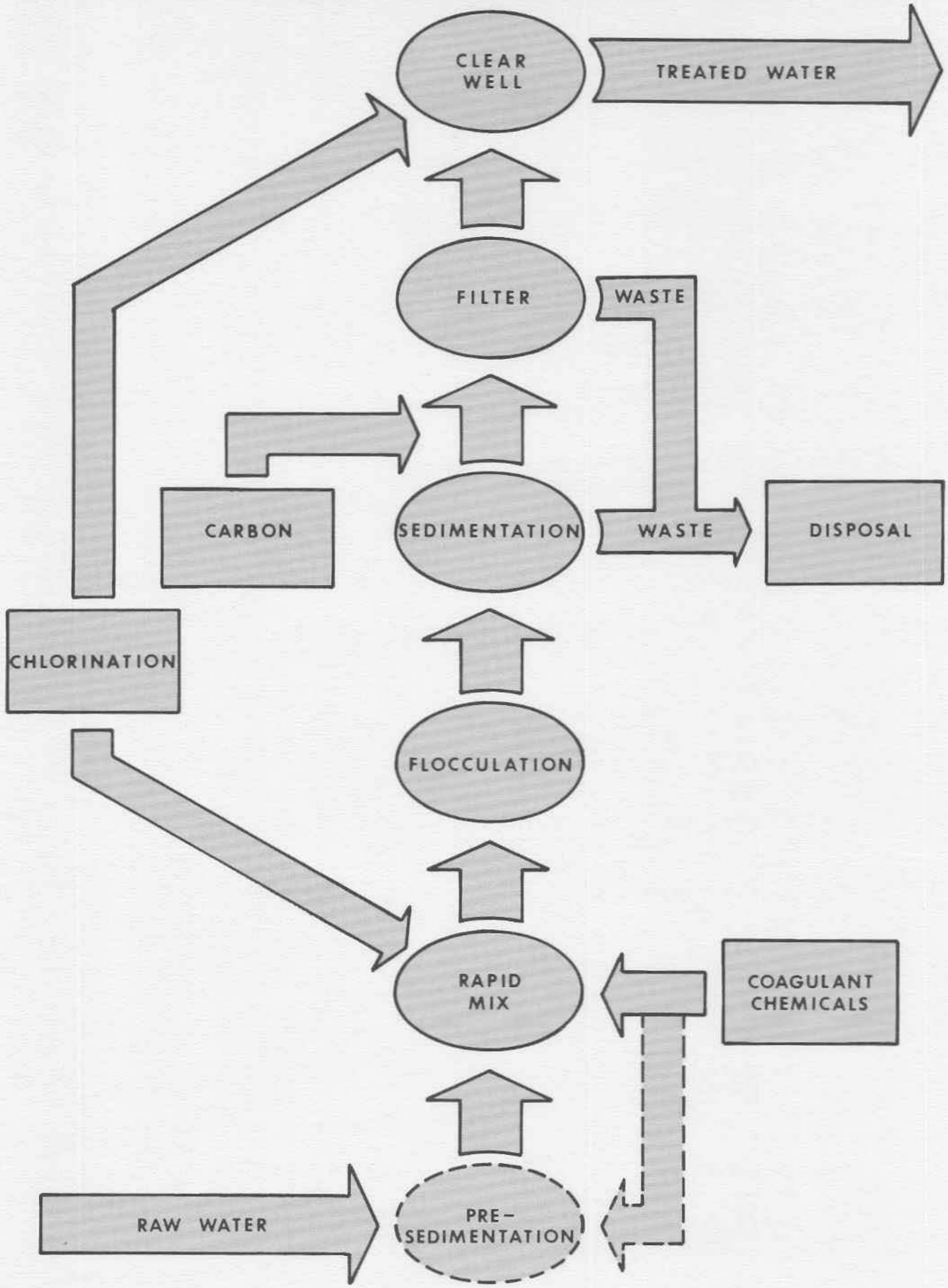
Special consideration was given to the determination of power costs. Rate schedules obtained from Washington Water Power Company were used as a basis for calculating such power costs. Anticipated monthly power costs were calculated for various combinations of pumping head and flow. Examination of these calculated costs revealed that a power cost of $0.005/kwh could be used throughout the study without appreciable error.

ECONOMIC COMPARISON

Once the construction costs for the physical components, such as pipelines, pumping plants, water treatment plants, storage reservoirs, dams and pipeline appurtenances, were established, a relative comparison between the cost of any two or more alternate schemes was possible. Such economical comparison of each alternate was accomplished by placing all costs on a present worth basis to the year 1975. Since the initial construction costs were anticipated in the year 1975, the present worth of such initial construction equaled the estimated cost. Plant expansion and replacement of mechanical facilities in the pumping stations and water treatment plants estimated and planned to be accomplished in later years were capitalized as to present worth in the year 1975, thereby becoming equivalent to the initial construction costs.

All annual costs were estimated for both the year 1975 and for the year 2020. It was then assumed that the annual increase of these costs would conform to a gradient series analysis and that the present worth of the total amount of each annual cost would be calculated in accordance with the economic procedures developed for such cases. The present worth of the gradient series of annual costs was also capitalized to the year 1975 to maintain consistency.

As the above procedure placed the initial construction costs, the future construction costs, and the annual costs on a par value, the sum of those three values was then used as a basis of economic comparison between all alternate plans proposed.



TYPICAL WATER TREATMENT PLANT FLOW SHEET

FIGURE VI-3

ALTERNATIVE PLANS OF WATER SUPPLY

GENERAL

Preceding chapters of this report have been devoted to a description of the available surface water sources and drainage basins of the Pullman-Moscow region, the benefits and qualities of these sources, and previously proposed development schemes. Factors affecting water demand have been reviewed and future needs established. Additionally, unit design factors and general design criteria have been developed for storage and transmission facilities, treatment works and pumping plants and finally, unit and other costs have been established for the purpose of estimating construction costs, present worth of future staged construction, operation and maintenance, and amortization of all proposed construction.

Information in this chapter deals primarily with the development of several alternative plans selected as being the most feasible from the standpoint of engineering and construction feasibility, production of a high quality potable water supply, and practical facilities operation. The chapter also provides greater details as to recommendations of staged construction, specific design conditions and project costs. Complete financial plans for the most favorable alternates are presented in Chapter 8. The basic purpose of the work summarized in this chapter was to review all possible alternatives to at least a reconnaissance level to insure selection of the most adequate and economical surface water supply development for the Pullman-Moscow area.

The water supply planning is based primarily on serving the study area as defined earlier in the report. In the case of specific alternates, it is possible to include other communities in future planning. For example, alternates involving the North Fork of the Palouse River Basin could serve the communities of Potlatch, Palouse and Onaway, some of which expressed an interest in the future regional planning for water supply. Similarly, the community of Troy could also be included in plans for the Troy Watershed or the Potlatch River.

With the Snake River Project, it is doubtful that service to other communities would be possible without additional major transmission facilities construction. Several potential water supply sources received rather thorough review with reconnaissance level development and layout. Those included were the following:

1. Construction of a pumped intake and treatment of water from the Snake River above the Lower Granite Dam.

2. Construction of a storage facility on the North Fork of the Palouse River near Laird with treatment and pumping facilities at Princeton.

3. Development of a series of dams and reservoirs in the Troy/ Moscow Mountain area with treatment facilities near Helmer.

4. Construction of a storage facility on the East Fork of the Potlatch River with treatment and pumping facilities near Helmer.

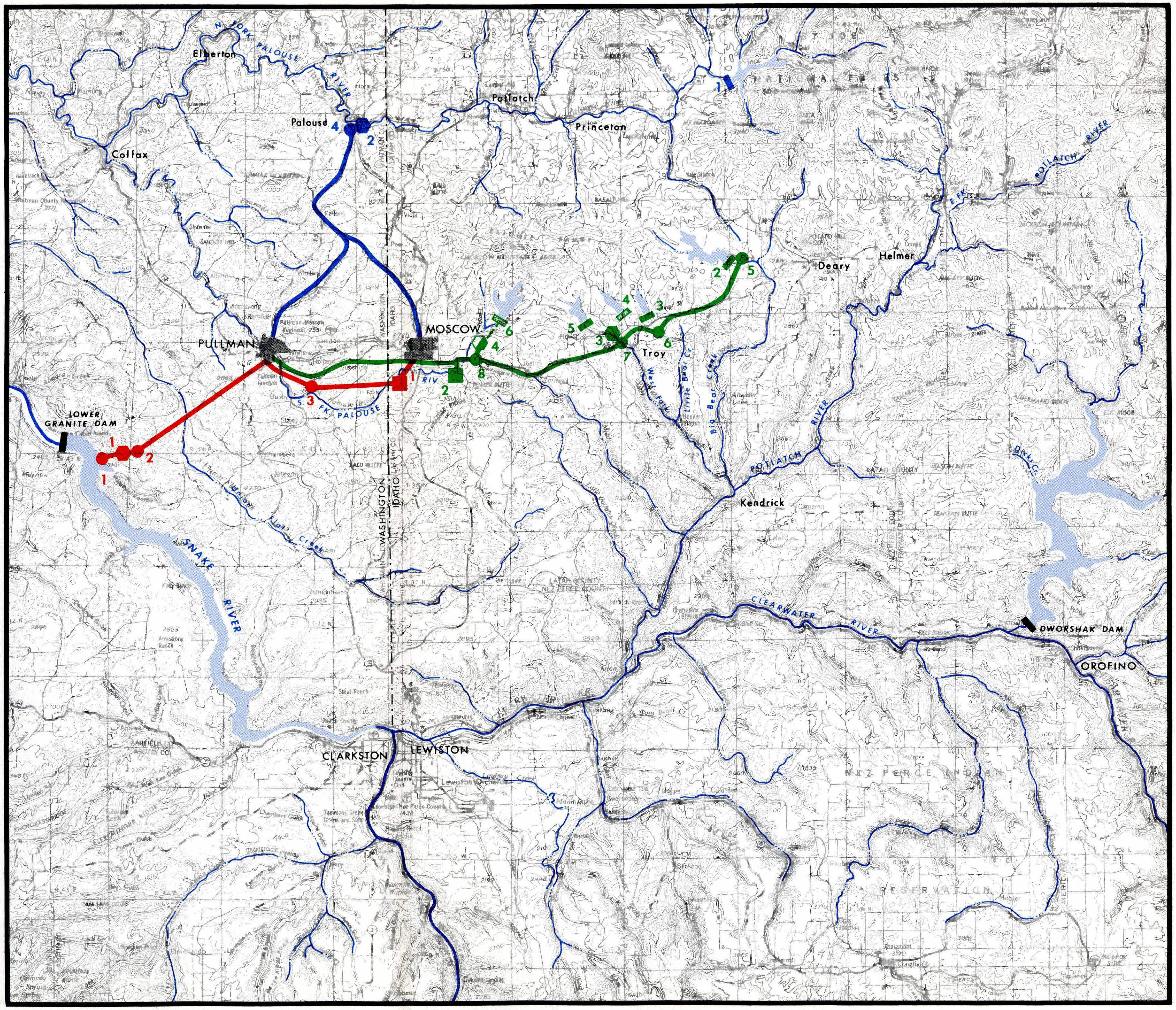
5. Construction of a pumped intake and treatment of water from the North Fork of the Clearwater River above the Dworshak Dam.

6. Construction of a storage facility on the North Fork of the Palouse River near Laird with treatment and pumping facilities at Palouse and following a route previously proposed by the Corps of Engineers.

General routes and locations of the proposed facilities, including pumping plants, water treatment plants, and damsite/reservoirs are presented in two location maps, Figures 7.1 and 7.2. Details as to each alternate are discussed in the specific sections of this chapter.

ALTERNATIVE PLANS FOR WATER SUPPLY

LOCATION MAP A



LEGEND

- PUMPING PLANT
- WATER TREATMENT PLANT (1st stage)
- WATER TREATMENT PLANT (2nd stage)
- TERMINAL STORAGE RESERVOIR
- DAMSITE / RESERVOIR (1st stage)
- DAMSITE / RESERVOIR (2nd stage)

SNAKE RIVER PROJECT

1 WAWAWAI P. P.
1 MacMURRAY CANYON W. T. P.
2 MacMURRAY CANYON P. P.
3 SUNSHINE P. P.
1 TERMINAL RES.

U.S.C.E. PALOUSE BASIN PROJECT

1 LAIRD REGULATING RES.
2 PALOUSE W. T. P.
4 PALOUSE P. P.

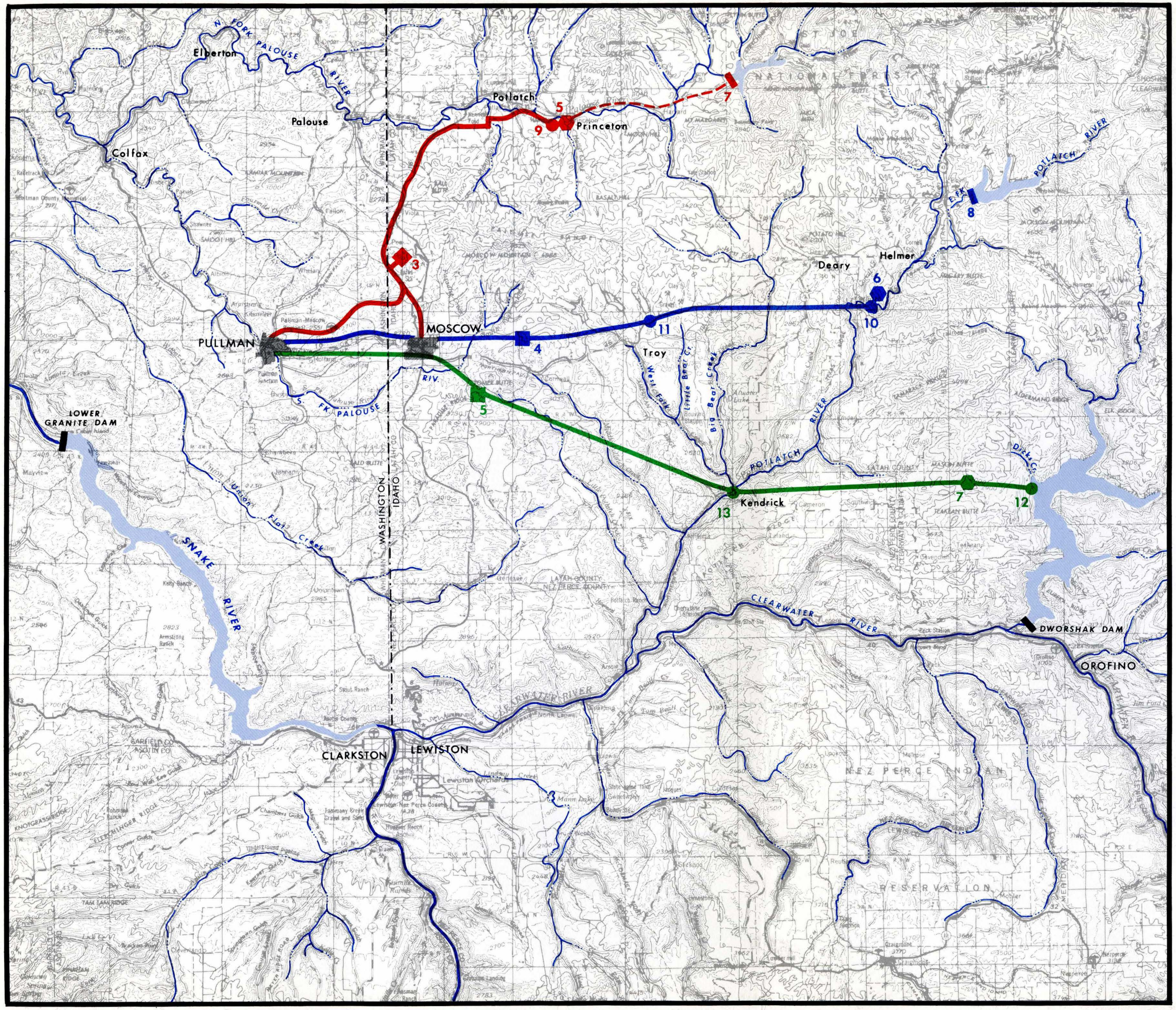
TROY WATERSHED PROJECT

2 BIG BEAR RES.
3 SPRING VALLEY RES.
4 BIG MEADOW RES.
5 LITTLE BEAR RES.
6 ROBINSON RES.
5 BIG BEAR P. P.
6 SPRING VALLEY P. P.
7 TROY P. P.
8 SOUTH PALOUSE P. P.
2 TERMINAL RES.
3 TROY W. T. P.
4 SOUTH PALOUSE W. T. P.

FIGURE VII-1

ALTERNATIVE PLANS FOR WATER SUPPLY

LOCATION MAP B



NORTH

5 0 5 10

GRAPHIC SCALE IN MILES

LEGEND

- ● PUMPING PLANT
- ⬢ WATER TREATMENT PLANT
- ■ TERMINAL STORAGE RESERVOIR
- ▬ DAMSITE / RESERVOIR

PALOUSE BASIN PROJECT

- 7 LAIRD REGULATING RES.
- 5 PRINCETON W. T. P.
- 9 PRINCETON P. P.
- 3 STATELINE STORAGE RES.

POTLATCH RIVER PROJECT

- 8 POTLATCH REGULATING RES.
- 6 POTLATCH W. T. P.
- 10 POTLATCH P. P.
- 11 SPRING VALLEY P. P.
- 4 EAST MOSCOW TERMINAL RES.

CLEARWATER RIVER PROJECT

- 12 DWORSHAK P. P.
- 7 DWORSHAK W. T. P.
- 13 MIDDLE POTLATCH P. P.
- 5 TOMER BUTTE TERMINAL RES.

FIGURE VII-2

SNAKE RIVER PROJECT

The Snake River Project would consist of a system of facilities to withdraw and treat water from the Snake River and deliver treated water to Pullman and Moscow. The project would have capacity to meet the estimated demand for water in year 2020, although some features would be constructed in two stages.

The main pumping plant would be located at Wawawai and would pump from the pool to be formed behind Lower Granite Dam. The treatment plant and additional pumping facilities would be located near Almota Creek, more than 1,800 vertical feet above the river. About twenty-five miles of pipeline would be required to deliver water to the project service area along the general route shown in Figure VII-1. Profiles of the proposed plan have also been presented in Plate Six found at the end of this chapter.

The estimated demand for water from the project described herein is given in Chapter II. The conjunctive use of ground water supply is anticipated to provide a peaking capacity of 26.5 mgd, including 1 mgd from reuse of treated waste water.

The main pumping plant of the project would be located at Wawawai on the Snake River about 11.3 miles southwest of Pullman and 1.7 miles upstream from the proposed Lower Granite Dam, in Whitman County.

The pumping plant would lift water from Lower Granite pool, whose normal water surface elevation is 738 feet above sea level, to elevation 2,570 feet at the top of the canyon near Almota Creek. At minimum pool elevation, the maximum static pump lift would be about 1,850 feet; during operation the maximum total dynamic head on the pumping plant would be about 1,950 feet when delivering the peak-day discharge in the design year.

The first stage plant employed is based on the following preliminary design assumptions:

1. Outdoor-type pumping plant.

2. Five pairs of pump and motor units, each pair consisting of two 7-stage vertical turbine pumps arranged in series; the rated capacity of each pump is 2, 500 gpm at 1, 000 feet total dynamic head.

3. Motors: 800 hp, 1, 770 rpm vertical solid shaft induction motors; drip proof, weather protected enclosure; 3-phase, 60-cycle, 2, 300-volt operation.

4. Surge suppression by means of an air chamber and control valves.

5. Suction pool level would be as controlled by Lower Granite Dam. If construction of the dam were delayed beyond start-up time for the pumping plant, an additional interim pumping facility and related discharge conduit would be required.

6. Plant capacity would be adequate to pump continuously at a rate of 16. 0 mgd or 11, 100 gpm. A second pumping plant would be required in about 1995, to operate in parallel with the first plant.

From Wawawai pumping plant to the water treatment plant, approximately 15, 000 feet of 24-inch diameter pipeline would be required in the first stage. A parallel line of 20-inch diameter would be added in the second stage in 1995. The first 7, 400 feet would be welded steel pipeline supported above ground on concrete piers, and anchored by large concrete blocks at about 1, 000-foot intervals. This part of the pipeline includes the steep portion of the Snake River Canyon, with ground slopes of up to twenty-five percent.

The treatment plant would be located near the head of MacMurray Canyon, about one-half mile from Almota Creek. Ground elevation is about 2, 570 feet above sea level in the area around the plant site.

The nominal capacity of the first stage treatment plant would be 15 mgd. It would have the capability of delivering about 20 mg on days of peak demand. The plant would provide flocculation and sedimentation, filtration and chlorination. Based on the projected water demand, a second stage treatment plant would be required in year 2000.

From the MacMurray water treatment plant, treated water would be delivered to Pullman and Moscow through a system of transmission lines and pumping plants. Both the Sunshine Creek pumping plant (booster station) located about 3.5 miles southeast of Pullman and the MacMurray plant adjacent to the water treatment plant would be expanded in about 1995.

The transmission system would be designed to deliver water at a rate to meet peak day demand in conjunction with the existing well capacity and about 5 mgd from terminal storage. Transmission lines in the present plan would be adequate until about 1995, at which time a parallel 20-inch pipeline would be constructed. Branch lines would have sufficient initial capacity to meet 2020 demand. From the treatment plant, the transmission line would be 24-inch diameter all the way to the terminal reservoir, some 16 miles. A branch line consisting of about 6,000 feet of 24-inch pipeline would extend into Pullman, and about 6,300 feet of 20-inch pipe to the WSU campus.

The main 24-inch transmission line would continue past the Sunshine Creek pumping plant site to the terminal reservoir about two miles south of Moscow. From the reservoir, a 20-inch diameter line would extend about 14,000 feet into Moscow. From this line, a branch of 16-inch diameter would extend to the University of Idaho campus. Under peak flow conditions, the transmission system would deliver water at the pressure gradient elevations given below to various locations.

1. Pullman (city)	2,662 feet
2. WSU	2,650 feet
3. U of Idaho	2,745 feet
4. Moscow (city)	2,670 feet

In case of a power outage, Pullman and WSU would be supplied by reverse flow from the terminal reservoir. Pipelines have been planned generally to traverse cross-country over rolling hills and farmland to hold the mileage of pipeline as low as possible.

A convenient site for a terminal reservoir has been selected from consideration of the required elevation and closest possible location to the service area. The site is a ridge located about two miles south and slightly west from Moscow, where the ground elevation is about 2, 880 feet above mean sea level.

The cost estimates are based on the use of prestressed concrete reservoirs of 30-foot nominal height. Terminal storage capacity is predicated on the provision of three consecutive peak day requirements in the design year, without draining on existing storage in the service areas. The existing capacity is estimated to be 12. 4 mg. To meet the 1995 requirement under this criterion, a reservoir of 16 mg would be constructed. A second reservoir of about 8 mg would be added in 1995 to meet the full requirement in 2020.

Other factors pertaining to the Snake River project which warrant consideration are noted below. Evaluation of these factors in terms of economic cost or benefit has not been made.

1. The plan as formulated presumes that Lower Granite Dam and Reservoir on the Snake River will be in existence by the time project water deliveries are planned(1975±). If the construction of the dam proceeds as now scheduled, this condition will be met.

2. The cost of electrical energy for pumping represents a substantial part of the capitalized project cost over the 45-year period of analysis. This estimate is based on a rate of 5 mils per kwh. Possibly a lower rate could be negotiated, resulting in considerable reduction of capitalized project cost.

3. The unique feature of the Snake River project is the high-head pumping plant which would be located at Wawawai. The total dynamic head of about 1, 950 feet which the plant would develop, is exceeded by few pumping installations in the United States.

Engineering research and development during the past six years has been undertaken for the Tehachapi pumping plant of the State of California water project. The lift at Tehachapi is almost identical to that required at Wawawai, although the design flow at Tehachapi is 4,100 cfs compared to about 46 cfs at Wawawai. The Tehachapi plant is currently under construction.

A two-lift system for the Wawawai plant does not appear practical due to the topography of the Snake River Canyon, but should not be ruled out until detailed engineering studies are made of both alternative systems. The canyon wall does not appear to contain an ideal site for locating a second-lift plant.

The capital cost of the first stage of construction is estimated to be \$9,014,000 and the total capitalized cost of all project expenditures during the period 1975 to 2020 is estimated to be \$17,712,000. The approximate annual cost of the first year of project operation (1975) including amortization at seven per cent for thirty years is \$1,143,400. The resulting unit cost of water in 1975 would be \$318 per million gallons. Capital costs for each required stage are shown in Table 7-1.

PALOUSE RIVER BASIN PROJECT

Under this plan, the Pullman-Moscow area would be served by a major water supply development of the North Fork of the Palouse River with a damsite/reservoir at Laird and an intake above Princeton in Idaho. A water treatment plant and pumping facility, located near Princeton, would provide the treated water which would be conveyed by a 30-inch transmission line to terminal storage near Viola. Gravity lines would feed the major intermediate level distribution storage reservoirs in Moscow, Pullman and Washington State University. The University of Idaho would be served by a booster station joined from the Moscow distribution system. Water would also be available for the towns of Potlatch, Onaway and other small communities in the Palouse River Basin, either treated or untreated on a contractual basis.

TABLE 7-1
SNAKE RIVER ALTERNATE
PROJECT COST SUMMARY

First Stage (1975) Capital Costs		
Transmission Line & Appurtenances		$ 2,783,800
Terminal Reservoir		743,800
Wawawai Pumping Plant		1,407,700
MacMurray Pumping Plant		380,800
Sunshine Pumping Plant		79,200
Water Treatment Plant		1,538,500
	Subtotal	$ 6,933,800
	18% Contingencies	1,248,100
	12% Engineering	832,100
	TOTAL	$ 9,014,000
Second Stage (1995) Capital Costs		
Transmission Line & Appurtenances		$ 1,800,800
Terminal Reservoir		412,300
Wawawai Pumping Plant		1,123,000
MacMurray Pumping Plant		280,800
Sunshine Pumping Plant		53,800
	Subtotal	$ 3,670,700
	18% Contingencies	660,700
	12% Engineering	440,600
	TOTAL	$ 4,772,000
Third Stage (2000) Capital Costs		
Water Treatment Plant		$ 689,200
	Subtotal	$ 689,200
	18% Contingencies	124,100
	12% Engineering	82,700
	TOTAL	$ 896,000

1975 ANNUAL COST

Amortization of First Stage Capital Costs		
(30 years at 7% per annum)		$ 726,400
Operation and Maintenance of Physical Plant		250,000
Power		167,000
	TOTAL	$ 1,143,400

The plan presented would provide the demands in two stages through the year 2020. Initial stage construction in 1975 would include a 15,000 acre-feet storage reservoir at the Laird site with gravity release and downstream withdrawal at an intake near the water treatment plant. Early use of the stored water would be for primarily M & I use with additional volume for downstream water rights and fish propagation. Recreational use would also be possible during the early years of the design period but become restricted as seasonal drawdowns increase.

The first stage of the water treatment plant would provide a nominal capacity of 15 mgd with a peak production capacity of approximately 20 mgd. The plant would incorporate conventional alum treatment and filtration but be preceeded by siltation or presedimentation basins during spring runoff periods when high silt loads can be expected in the Palouse. Such basins could be of earth construction and also act as sludge disposal facilities. An additional 5 mgd of nominal capacity would be required as part of the second stage construction or about year 2000. Peak capacity would make available about 6 mgd for local use by nearby communities.

Pumping plant and storage facilities would also be staged with additions required in 1990-2000. Pipeline capacities for ultimate needs would be provided in the first stage.

The initial construction cost, including engineering and contingencies, is $14,599,500, with a first year annual cost of $1,456,900. Total capitalized cost, including the present worth of future operation expenses and second stage construction is $19,970,600. Estimated staged construction costs and first year annual costs are summarized in Table 7-2.

The proposed Palouse project offers a good quality water supply with further flexibility to increase the storage capacity to 70,000 acre-feet to provide multiple use and if required, a raw water gravity pipeline from the dam to the treatment site.

TABLE 7-2
PALOUSE BASIN ALTERNATE
PROJECT COST SUMMARY

First Stage (1975) Capital Costs		
Transmission Line & Appurtenances		$ 4,193,500
Stateline Storage Reservoir		554,500
Princeton Pumping Plant		497,500
Laird Regulating Reservoir		3,810,000
Water Treatment Plant		1,675,000
Palouse Intake & Diversion Dam		500,000
	Subtotal	$11,230,500
	18% Contingencies	2,021,500
	12% Engineering	1,347,500
	TOTAL	$14,599,500
Second Stage (1990) Capital Costs		
Princeton Pumping Plant		$ 265,500
	Subtotal	$ 265,500
	18% Contingencies	47,800
	12% Engineering	31,900
	TOTAL	$ 345,200
Third Stage (2000) Capital Costs		
Stateline Storage Reservoir		$ 970,000
Water Treatment Plant		750,000
Laird Gravity Line		1,404,800
	Subtotal	$ 3,124,800
	18% Contingencies	562,500
	12% Engineering	375,000
	TOTAL	$ 4,062,300

1975 ANNUAL COSTS

Amortization of First Stage Capital Costs (30 years at 7% per annum)		$ 1,176,000
Operation and Maintenance of Physical Plant		234,500
Power		46,400
	TOTAL	$ 1,456,900

Possible participation of Federal agencies should still be considered in the storage reservoir if negotiations can determine early construction (1975) and approval of a single purpose project, or single purpose project for the first stage only, with subsequent elevation of the dam to incorporate future multiple use. Costs of the raised dam have not been estimated but would be similar to estimates in the USCE Palouse Basin alternate.

Profiles for the proposed route of the Palouse alternate are shown in Plates One and Two (A-1 through A-4) and follow the general route presented in the general location maps. Project construction lies primarily in the State of Idaho.

TROY WATERSHED PROJECT

The Troy Watershed Project proposed would consist of a system of facilities to conserve, treat, and deliver municipal water to Moscow and Pullman, with water also available for the town of Troy. The project envisioned is independent of the RC & D proposal prepared by the Troy Watershed Development Committee and the material presented is the least costly alternative for development of this source. Construction of the facilities would be staged over the project period to meet the projected water demand in the most economical way. The plan as presented herein would have capacity to provide the water required in the year 2020. The project would include five dams, two water treatment plants, five pumping plants, a terminal storage reservoir, and approximately thirty-three miles of pipeline.

The plan as formulated would include two dams in the first stage and three additional dams constructed singly as required. The first stage dams are the Little Bear Dam on the West Fork of Little Bear Creek, about two miles upstream from Troy, and the Big Bear on the West Fork of Big Bear Creek, about seven miles northeast of Troy. The estimated firm yield of these two proposed reservoirs is 11,500 acre-feet per year. The future dams are Spring Valley (required in 1985) on the creek of the same name, located about two miles northeast of Troy, Big Meadow on Big Meadow Creek (required in 1995) and a new Robinson Dam on the South Fork of the Palouse River (required 2016).

A detailed study of the hydrology of the Troy watershed was not made but accepted as sufficiently accurate such data as the mean annual runoff for each site as estimated by others (17). For this project it was assumed that a firm annual yield of eighty per cent of the mean annual runoff (MAR) could be developed with a storage reservoir with capacity of about 1.5-1.6 times the MAR. In addition to the active storage capacity, a sediment pool would be provided which is included in the gross reservoir capacities.

Physical data pertaining to the five dams and reservoirs is contained in Table 7-3. For the present study, all dams and reservoirs are planned for a single purpose of municipal water supply use. There may be incidental recreation or flood control benefits resulting from the reservoirs but no attempt has been made herein to evaluate such benefits. Reservoir operation would have to be strictly in accordance with the requirements for providing a reliable water supply and could not be modified to embrace other goals unless larger reservoirs are provided. All dams were assumed to be earth-fill type embankment dams with shaft spillways.

Transmission of water from the reservoirs to treatment plants and thence to Moscow and Pullman terminal storage would require about 33 miles of pipeline. The sizes of these lines would range from 16-inch to 27-inch diameter. In 1995, an additional 16-inch line would be required to parallel the original 24-inch in the reach from Moscow to Pullman. The general route profile is presented in the plates following this chapter.

The 1975 proposed system would begin at Big Bear Creek with stored water from both Big Bear and Little Bear reservoirs released to the streams and subsequently diverted and pumped to the Troy water treatment plant. Treated water would be pumped through the Troy transmission line generally following State Highway 8. Treated water would also be available to serve Troy, but would require an additional short branch line, not included in this plan as presently estimated. The flow of the Troy transmission line would be boosted by pumping near the point where the line would cross South Fork Palouse River to provide sufficient pressure for delivery to Moscow, Pullman, and the offline terminal reservoir. A small pumping installation would

TABLE 7-3
PHYSICAL DATA ON PROPOSED DAMS AND RESERVOIRS

Name of Reservoir	Year of Construction	Sec.	Township	Range	Maximum Height of Dam feet	Normal Pool Elevation feet, MSL	Active Storage Capacity Normal Pool Acre-Feet	Estimated Firm Annual Yield Acre-Feet
Big Meadow	1995	NW 1/4 Sec. 6	39N	3W	90	2,730	7,260	3,500
Little Bear	1975	SW 1/4 Sec. 2	39N	4W	81	2,681	9,900	5,000
Robinson	2016	W 1/2 Sec. 1	39N	5W	62	2,732	4,250	2,100
Big Bear	1975	NW 1/4 Sec. 19	40N	2W	73	2,764	12,800	6,500
Spring Valley	1985	NE 1/4 Sec. 5	39N	3W	80	2,710	6,000	3,000

be required at Big Meadow Reservoir when this facility is added to the project. It would pump water over the reservoir rim at a low saddle and release it into a tributary of Little Bear Creek for subsequent diversion at the Troy water treatment plant. By about 2016, the proposed Robinson Reservoir would be required. A 14-inch pipeline from the dam to the second water treatment plant site on the South Fork is planned. Water from Robinson Reservoir, treated at this point, could then be pumped into the Troy transmission line.

The proposed Spring Valley Dam construction is projected for 1985. The yield from this reservoir would be pumped into the Big Bear pipeline, and thence to Troy and the service area.

The 1975 Big Bear pipeline plans require delivery of only the ultimate average-day rate flow from the two reservoirs which supply it. The peak-day increment in excess of the average-day flow could be met from the other reservoirs.

The pumping plants of the first stage are to be designed for the projected requirements in the year given as follows:

Big Bear Pumping Plant............	2020
South Palouse Pumping Plant........	1990
Troy Pumping Plant...............	1995

Under maximum flow conditions, delivery pressure in Pullman would be at hydraulic gradient elevation of 2,662 feet, msl. In Moscow, pressure will be sufficient to fill the existing high tank at the University of Idaho (elevation 2,810 feet).

The terminal reservoir for treated water in the planned system is to be located on a north spur of Paradise Ridge near Moscow. The bottom elevation of the reservoir would be about 2,910 feet, msl. with overflow at about 2,940 feet.

To meet the requirement until the year 2012, an initial terminal storage capacity of 16 mg would be constructed. A second stage reservoir of about 14 mg would be added in 2012.

The plan requires one water treatment plant initially located near Troy. Ultimately, a small plant would be required to treat water from Robinson Reservoir. Nominal capacity would be about 18 mgd at the Troy plant and about 2 mgd at the South Palouse plant. Together they could deliver a peak demand of about 30 mgd.

There may be intangible costs or benefits worthy of consideration for this alternate project but for which no dollar value has been placed in the present study. Some intangibles are noted below.

1. The location of certain project features near Troy would make it feasible to deliver water to the town of Troy.

2. The complex of dams and reservoirs as planned have capacity only for municipal and industrial water supply. However, it may be feasible to enlarge the storage capacity to provide for flood water storage for protection of downstream areas. As a multiple purpose project, the cost for each purpose may decrease due to economies of scale.

3. Existing water rights have not been investigated. If such rights exist downstream from the reservoirs, it may be necessary to purchase the rights in order to operate the planned project.

4. Moderately high sediment yields are expected from the Troy watershed under existing conditions of cover and land use. Water treatment costs may be slightly higher during parts of the year than would be experienced with less turbid water. Sediment pools (dead storage) are provided in each reservoir with the capacities estimated to be adequate for at least fifty years under the conditions of sediment production now existing in the watershed.

The capital cost of the first stage of construction is estimated to be $14, 544, 000, and the total capitalized cost of all project expenditures during the period 1975 to 2020 is estimated to be $23, 288, 000. The approximate annual cost of the first year of project operation (1975) including amortization is estimated to be about $1, 435, 100. This would result in a unit water cost of $399 per million gallons of water produced. Staged construction costs have been summarized in Table 7-4.

TABLE 7-4
TROY WATERSHED ALTERNATE
CAPITAL COST SUMMARY

First Stage (1975) Capital Costs		
Transmission Line & Appurtenances		$ 3,646,000
Terminal Reservoir		750,000
Big Bear Pumping Plant		113,000
Troy Pumping Plant		273,000
S. Palouse Pumping Plant		171,000
Big Bear Reservoir		2,240,000
Little Bear Reservoir		2,310,000
Water Treatment Plant		1,685,000
	Subtotal	$11,188,000
	18% Contingencies	2,013,000
	12% Engineering	1,343,000
	TOTAL	$14,544,000
Second Stage (1985-2000) Capital Costs		
Transmission Line & Appurtenances		$ 755,000
Spring Valley Pumping Plant		42,000
Troy Pumping Plant		500,000
S. Palouse Pumping Plant		231,000
Spring Valley Reservoir		2,600,000
Big Meadow Reservoir		2,890,000
	Subtotal	$ 7,038,000
	18% Contingencies	1,266,000
	12% Engineering	845,000
	TOTAL	$ 9,149,000
Third Stage (2000-2020) Capital Costs		
Robinson Transmission Line		$ 158,000
Robinson Reservoir		2,850,000
Terminal Reservoir		645,000
S. Palouse Pumping Plant		254,000
S. Palouse Treatment Plant		378,000
	Subtotal	$ 4,285,000
	18% Contingencies	772,000
	12% Engineering	515,000
	TOTAL	$ 5,572,000

1975 ANNUAL COSTS

Amortization of First Stage Capital Costs (30 years at 7% per annum)		$ 1,172,000
Operation and Maintenance of Physical Plant		215,800
Power		47,300
	TOTAL	$ 1,435,100

POTLATCH RIVER PROJECT

This alternative plan proposes diversion of water from the main Potlatch River at a point due south of Helmer, Idaho, and transmitting the water from that point to the communities of Pullman and Moscow. Augmented flow into the river is proposed by regulated releases from a storage reservoir to be constructed on the East Fork of the Potlatch River in the vicinity of Bovill, Idaho. The reservoir has a planned capacity of 22,000 acre-feet stored behind an earth-filled dam and a normal pool elevation near 3,000. The regulated release from this reservoir would be diverted by a gravity intake located at the point of diversion previously described.

Water treatment facilities are proposed to be located at the same site and fed directly by the gravity intake. The initial capacity of the water treatment plant is projected to be 15 mgd, a nominal capacity which would be sufficient until the year 2000. At this future date, the treatment plant is scheduled to be expanded to a nominal capacity of 20 mgd and capability of providing sufficient water until the year 2020.

The transmission facilities required to convey the water to the terminal storage site would follow the route shown in the general location map and require approximately twenty miles of pipeline. First stage construction of this transmission facility is proposed to be a 24-inch diameter pipe, providing sufficient capacity until the year 1995. In 1995, second stage construction is scheduled, specifying duplication of the original 24" diameter pipeline.

Two pumping plants would be required to lift the water to the site of terminal storage. The first, and largest plant, would be located at the point of diversion immediately adjacent to the water treatment plant. The total head provided by this initial pumping plant would be sufficient to convey the water approximately seventeen miles, at which point a booster station would be required to transmit the water the remaining distance to the site of terminal storage. The booster station is located at the intersection of the transmission line and Spring Valley Creek.

Terminal storage facilities are provided through three different construction stages. Initial construction in 1975 would call for a 25 mg facility which would be sufficient until the year 1980. The second stage of construction would take place in the year 1980 and would require a 11.3 mg facility whose capacity would be sufficient until the year 2000. The site selected for terminal storage is located on the ridge between the Palouse drainage and the Potlatch drainage, immediately north of the community of Joel, Idaho, at an elevation of 2,900 msl.

Additional stage construction is proposed for the transmission facility between the terminal storage site and the community of Moscow. The first stage of construction schedules a 30-inch diameter pipe, providing sufficient capacity until the year 1995, at which time an additional 30-inch diameter facility must be constructed to provide adequate capacity until the year 2020. The transmission facility beyond the point of delivery for the City of Moscow also projects construction of a 30-inch diameter pipe, however, the capacity of this facility as initially constructed should be sufficient until the year 2020.

The initial project cost of this plan is $15,555,000. The first year operating costs are $1,515,700, an amount which projects the cost of water during the first year to be $421 per million gallons. The total capitalized cost of the project is calculated to be $21,608,000. Staged construction costs for the Potlatch alternate are summarized in Table 7-5.

One major advantage of this alternate is the excellent water quality and water quantity expected from the source of supply. The protected watershed in the upper reaches of the Potlatch River produces a high quality of water of proven quantity. Another possible advantage is the possible enhancement to the fisheries on the mainstem of the Potlatch provided by the regulated release and augmented flow. It should be additionally noted that the routing of the transmission line would provide convenient service to the communities of Troy and Deary.

The obvious disadvantage of this scheme is the high cost, a factor which prohibits serious consideration of this alternate.

TABLE 7-5
POTLATCH COST SUMMARY

First Stage (1975) Capital Costs		
Transmission Line & Appurtenances		$ 3,986,000
Terminal Reservoir		990,000
Potlatch Pumping Plant		453,500
Spring Valley Pumping Plant		355,000
Regulating Reservoir		4,120,000
Water Treatment Plant		1,710,000
Water Treatment Plant Intake		351,250
	Subtotal	$11,965,750
	18% Contingencies	2,153,800
	12% Engineering	1,435,900
	TOTAL	$15,555,400
Second Stage (1980) Capital Costs		
Terminal Reservoir		$ 525,000
	Subtotal	$ 525,000
	18% Contingencies	94,500
	12% Engineering	63,000
	TOTAL	$ 682,500
Third Stage (1995) Capital Costs		
Transmission Line & Appurtenances		$ 2,621,900
Terminal Reservoir		525,000
Potlatch Pumping Plant		90,000
Spring Valley Pumping Plant		70,000
Water Treatment Plant		1,396,000
	Subtotal	$ 6,302,900
	18% Contingencies	1,134,500
	12% Engineering	756,300
	TOTAL	$ 8,193,700

1975 ANNUAL COST

Amortization of First Stage Capital Costs (30 years at 7% per annum)		$ 1,253,400
Operation and Maintenance of Physical Plant		212,800
Power		49,500
	TOTAL	$ 1,515,700

CLEARWATER RIVER PROJECT

Another source of surface water studied was the backwater pool which will be formed upon completion of construction of Dworshak Dam on the North Fork of the Clearwater River. The plan proposes to pump water from the Dworshak Reservoir to a water treatment plant and then transmit the treated water to the communities of Pullman and Moscow.

Water would be taken from the reservoir through a pumped intake located at Dick's Creek. Due to an anticipated drawdown of 144 feet within this reservoir, a major intake facility would be necessary.

Approximately 31.5 miles of transmission line will be required between the pumped intake and the terminal storage facility. The pipeline is to be built in two stages; the first of which will accommodate the flows anticipated up to the year 1995, and the second providing the necessary additional capacity to accommodate flows until the year 2020. The first construction stage specifies construction of a pipeline 24-inches in diameter, and in 1995, the second stage of construction will require a similar 24-inch diameter conduit. Due to the varying topography along the transmission line route, portions of the pipeline will be constructed to withstand pressures up to 600 psi. However, approximately twenty miles of this facility would be subjected to pressures less than 100 psi.

The proposed water treatment facilities are to be located adjacent to the transmission line route approximately four miles west of the intake. The water treatment plant is designed to have a nominal capacity of 15 mgd and be sufficient until the year 2000. To accommodate the flows anticipated between 2000 and 2020, second stage construction in the year 2000 will require the capacity of the plant to be expanded for an additional flow of 5 mgd.

The pumping units at the intake will supply sufficient energy to transmit the water to the water treatment plant. Due to the magnitude of the head (1,680 feet) required for such transmission, these pumping units will be very complex and will require a considerable amount of electrical power. From the water treatment plant, gravity flow can be achieved for approximately eighteen miles at which point an additional pumping station must be installed to lift the water into terminal storage. This proposed booster station should be located at the point where the transmission line crosses Little Bear Creek.

The required terminal storage facilities are identical to those described in the Potlatch Alternate, scheduling construction of 25 mg facility in the year 1975, a 11.3 mg facility in 1980, and an additional 11.3 facility in the year 2000. The storage facilities are planned to be constructed on Tomer Butte immediately southwest of Moscow at an elevation of 2,900 MSL.

The initial construction stage specified a 30-inch diameter transmission facility to be constructed between the terminal storage site and the city of Moscow. By the year 1995, the need for additional capacity will require a similar 30-inch diameter pipeline to be constructed. Initial construction of the transmission line beyond the city of Moscow specified continuation of the 30-inch diameter pipe, however, the capacity of this pipe will be sufficient until the year 2020.

The initial project cost for the Dworshak supply is estimated to be \$14,498,400. The operating costs anticipated during the first year total \$1,555,700, and would result in a consumption cost of \$432 per million gallons. The total capitalized cost for this alternate is \$23,334,000 as summarized in Table 7-6.

Although this source of supply would provide a superior quality of raw water from a virtually inexhaustible source of supply, the extensive length of the required transmission line results in a prohibitive cost for construction. Additionally, the high pressure encountered along the transmission line would likely require excessive maintenance.

USCE PALOUSE BASIN ALTERNATE

General interest in the water supply plan which had been proposed by the U. S. Corps of Engineers and which was reviewed in Chapter V has resulted in an analysis similar to those in preceding sections. A chief variation from previous alternative plans is that portions of the

TABLE 7-6
CLEARWATER COST SUMMARY

First Stage (1975) Capital Costs		
Transmission Line & Appurtenances		$ 5,700,700
Terminal Reservoir		990,000
Dworshak Pumping Plant		1,641,000
Bear Creek Pumping Plant		760,000
Water Treatment Plant		1,710,000
Dworshak Intake		351,200
	Subtotal	$11,152,900
	18% Contingencies	2,007,200
	12% Engineering	1,338,300
	TOTAL	$14,498,400
Second Stage (1980) Capital Costs		
Terminal Reservoir		$ 525,000
	Subtotal	$ 525,000
	18% Contingencies	94,500
	12% Engineering	63,000
	TOTAL	$ 682,500
Third Stage (2000) Capital Costs		
Transmission Line & Appurtenances		$ 4,188,700
Terminal Reservoir		525,000
Dworshak Pumping Plant		350,000
Bear Creek Pumping Plant		160,000
Water Treatment Plant		1,396,000
	Subtotal	$ 6,619,700
	18% Contingencies	1,191,500
	12% Engineering	794,400
	TOTAL	$ 9,505,600

1975 ANNUAL COST

Amortization of First Stage Capital Costs (30 years at 7% per annum)		$ 1,168,200
Operation and Maintenance of Physical Plant		220,500
Power		167,000
	TOTAL	$ 1,555,700

project eligible for USCE participation would have independent design, construction and financing. Only facilities connected with treatment, storage and local distribution would be undertaken by the local communities. This condition influenced the structure of the system somewhat as will be shown later.

Optimum development of the Palouse River Basin, and particularly the Laird site, has been shown to be construction of a multi-purpose reservoir. By reasons of the multiple benefits and the economy of scale, M & I participation in a much larger reservoir than employed for the previous Palouse alternate could promote some savings in annual costs in addition to sizeable financing benefits, such as deferred principal payment and lower interest rates. The USCE scoping study (24) showed the benefit cost ratio to be in a potentially feasible project range for a 70,000 acre-feet reservoir. Based on water resource studies an annual yield near 54,000 acre-feet could be realized. Approximate dam height is 184 feet with a seasonal drawdown of about ten feet.

The project proposed is a redesign of the USCE concept based on the common design criteria of this study. Thus, transmission line sizes and pumping plant capacities differ from earlier reports. Pumping of treated water has been assumed with all terminal storage located within the city limits of both Pullman and Moscow.

With the location of a diversion dam and raw water intake just upstream from Palouse, conveyance facilities would follow the route of the Northern Pacific Railroad right-of-way some 16.5 miles to Pullman. A master metering station and beginning of a separate transmission line to Moscow would be just beyond Fallon. Transmission lines were designed for ultimate sizes of 30-inch and 24-inch which was found to be more economical than staging for this alternate.

A 15 mgd water treatment plant, identical to the proposed plant in the Palouse Alternate would be located at the point of diversion. A second stage addition of 5 mgd would be required by the year 2000.

The high lift pumping plant would pump in a single stage, 782 feet lift, an ultimate flow of 27.5 mgd. The flow would be supplemented by 6 mgd from storage and 26.5 mgd from existing wells and water reuse to meet the ultimate peak demand. Storage has also been staged with initial 1975 requirements being a 10 mg prestressed-concrete covered reservoir for Pullman and a 6 mg reservoir for Moscow. An additional 4 mg in the Moscow area would be necessary by 2000. Reservoir overflows would be adequate to serve the intermediate systems of both communities.

Profiles of this alternate, similar to other proposals, have been developed and presented in Plates Three and Four. Capital costs for the various stages proposed and the first year's annual cost are given in Table 7-7. Based on providing 3.6 billion gallons the first year, a unit cost near $250 per million gallons can be expected.

First stage capital costs include those borne by the Corps of Engineers totaling $8,776,000. Included is $3,125,000 as the estimated M & I cost allocation. Actual reservoir cost may total $11,000,000 for a 70,000 AF project.

SUMMARY

A general comparison of the six alternative projects, describing the required facilities and stages of construction is summarized in Table 7-8. The capital costs, by stage, and first year annual cost are summarized in Table 7-9.

Engineering studies involved a review and evaluation of various alternatives of surface water supply development. Included were design factors, criteria, conditions prevailing with use of each source, and finally, the development of basic cost data.

TABLE 7-7
USCE PALOUSE BASIN ALTERNATE
PROJECT COST SUMMARY

First Stage (1975) Capital Costs		
Transmission Line & Appurtenances		$ 3,090,000
Terminal Reservoirs		865,000
Palouse Pumping Plant		886,800
Laird Reservoir (M & I share)		2,404,000
Water Treatment Plant		1,675,000
Palouse Intake & Diversion Dam		510,000
	Subtotal	$ 9,430,800
	18% Contingencies	1,697,500
	12% Engineering	1,131,700
	TOTAL	$12,260,000
Second Stage (1990) Capital Costs		
Palouse Pumping Plant		$ 231,100
	Subtotal	$ 231,100
	18% Contingencies	41,600
	12% Engineering	27,800
	TOTAL	$ 300,500
Third State (2000) Capital Costs		
Palouse Pumping Plant		$ 520,000
Water Treatment Plant		1,740,000
Terminal Reservoir		100,000
	Subtotal	$ 2,360,000
	18% Contingencies	425,100
	12% Engineering	283,300
	TOTAL	$ 3,068,400

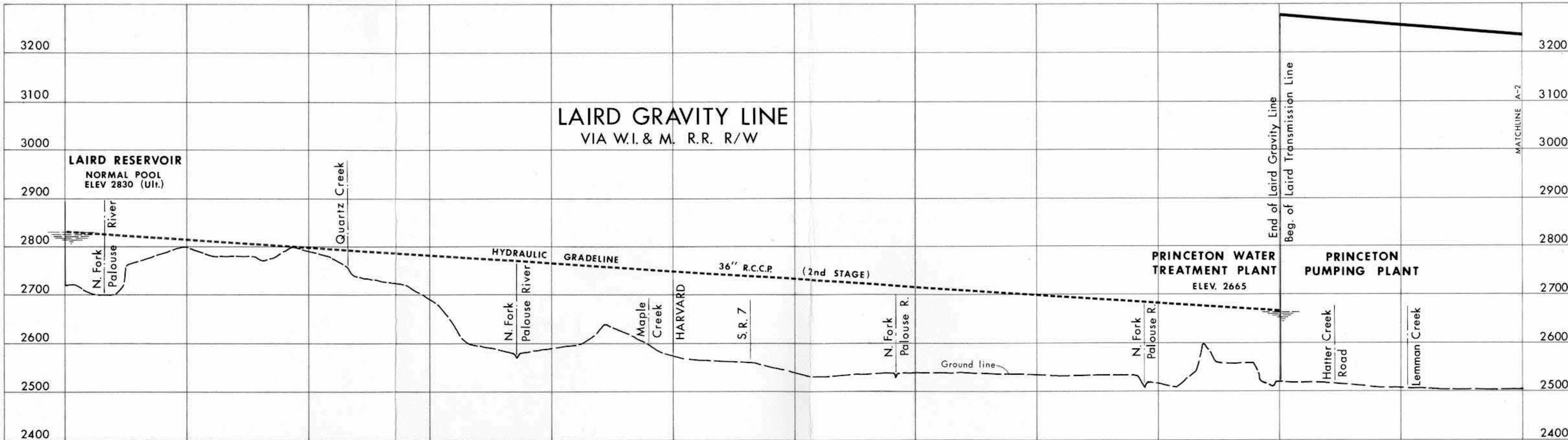
1975 ANNUAL COSTS

Amortization of First Stage Capital Costs		
(30 years at 7% per annum)		$ 280,700
(50 years at 3 1/8% per annum)		363,400
Operation and Maintenance of Physical Plant		233,290
Power		29,700
	TOTAL	$ 907,090

TABLE 7-8
SUMMARY OF MAJOR FACILITIES

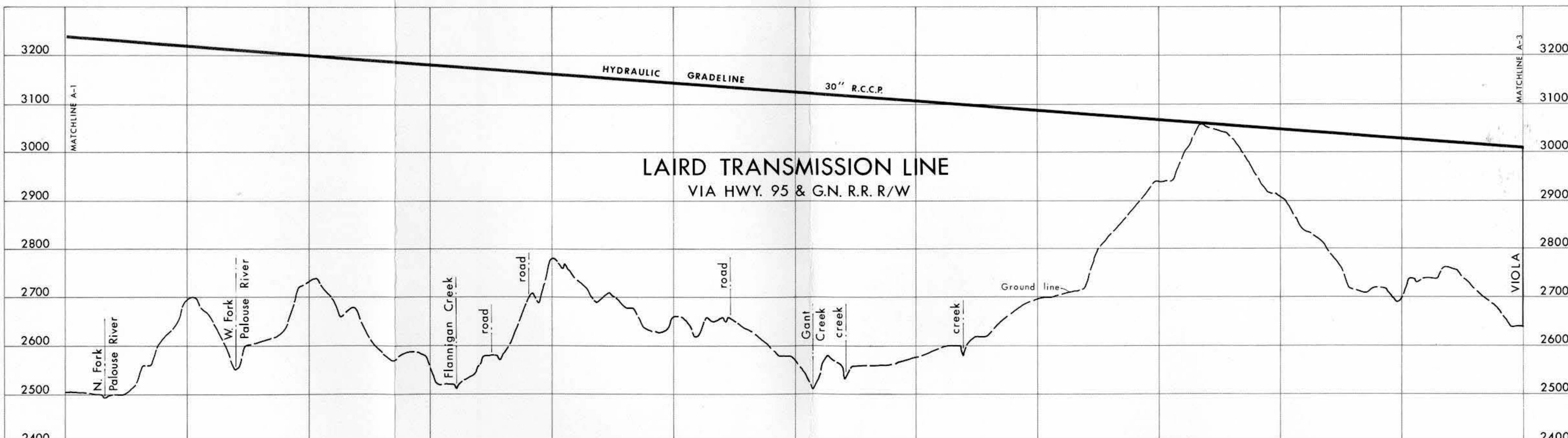
Facility and Construction Staging	Potlatch River	Clearwater River	USCE Palouse Basin	Snake River	Palouse River Basin	Troy Watershed
Dam & Reservoir						
First Stage	22,000 AF (1)	None	70,000 AF (1)	None	15,000 AF (1)	22,700 AF (2)
Second Stage						13,260 AF (2)
Third Stage						4,250 AF (1)
Pipelines						
First Stage	20 miles	31.5 miles	24 miles	27.5 miles	31 miles	33 miles
Second Stage				19 miles		9.5 miles
Third Stage	20 miles	31.5 miles			9.5 miles	2 miles
Treatment Plants						
First Stage	15 mgd	15 mgd	15 mgd	15 mgd	15 mgd	18 mgd
Second Stage*						
Third Stage*	5 mgd	5 mgd	5 mgd	5 mgd	5 mgd	2 mgd
Pumping Plants						
First Stage	2	2	2	2	2	3
Second Stage*			1	2	1	3
Third Stage*	2	2	1			2
Terminal Storage						
First Stage	25 mg	25 mg	16 mg	16 mg	10 mg	16 mg
Second Stage	11 mg	11 mg		8 mg		
Third Stage	11 mg	11 mg	4 mg		20 mg	14 mg

* Additions or Modifications
( ) Denote number of storage sites



A-1 PALOUSE BASIN PROJECT

STATIONING IN THOUSANDS OF FEET



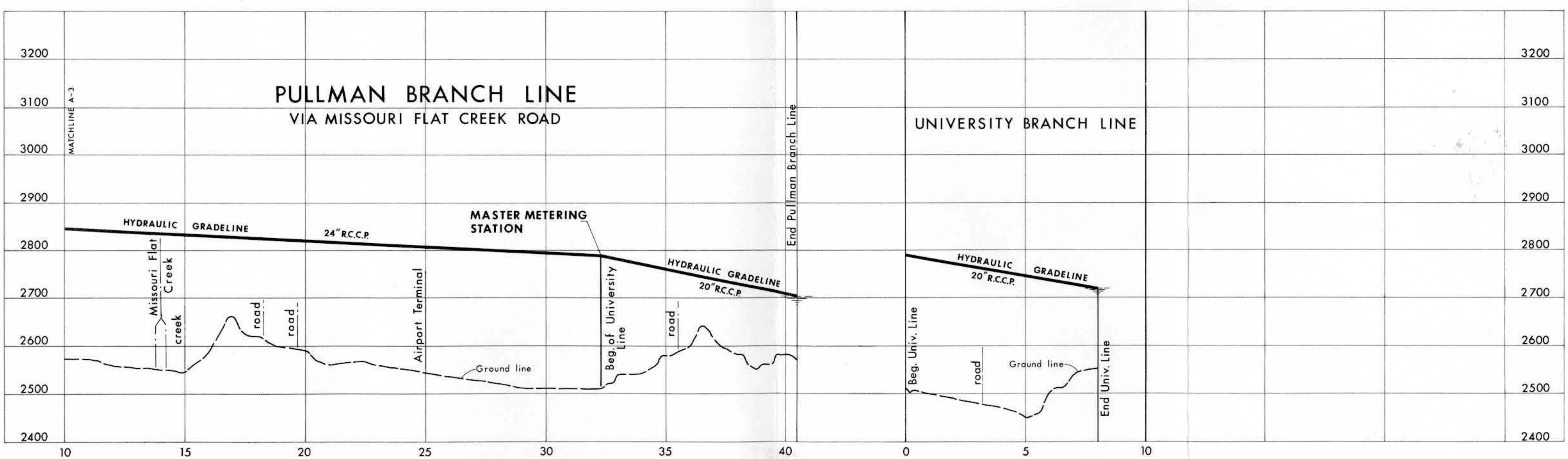
A-2 PALOUSE BASIN PROJECT

PLATE 1

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE BOISE

STATIONING IN THOUSANDS OF FEET

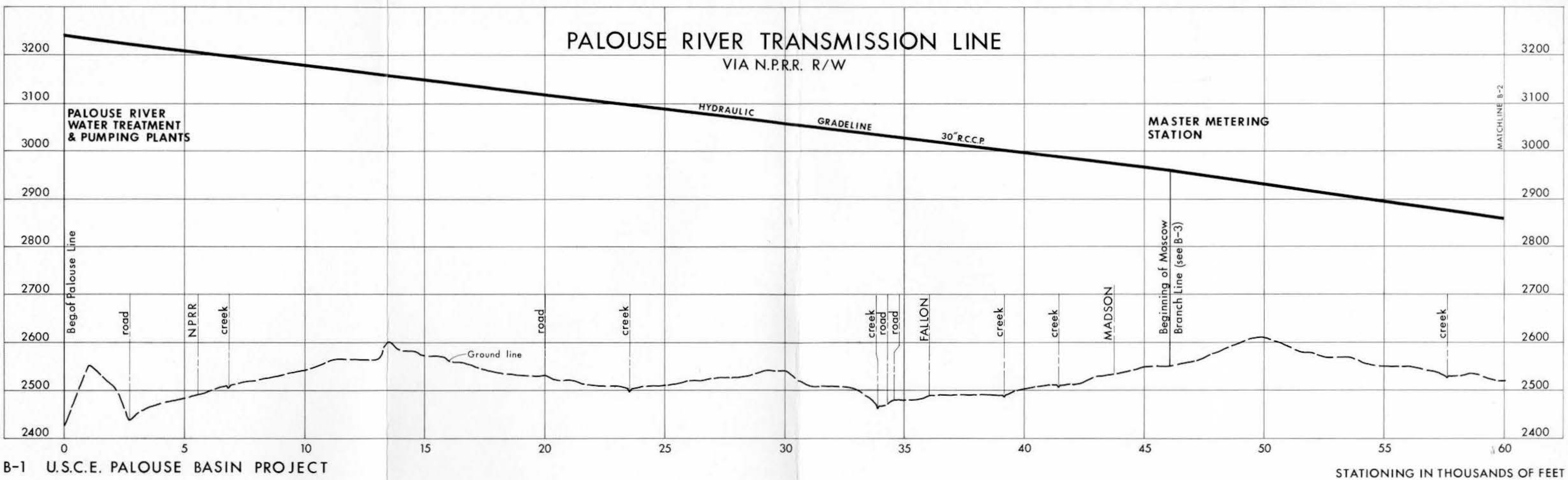
PALOUSE BASIN PROJECT A-3



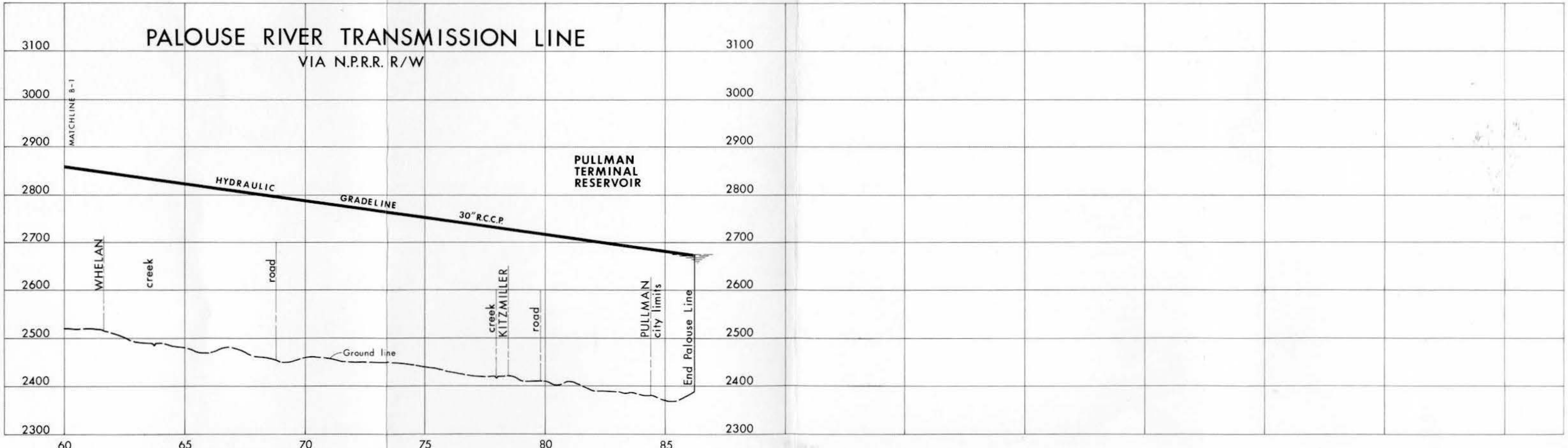
PALOUSE BASIN PROJECT A-4

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE BOISE

PLATE 2



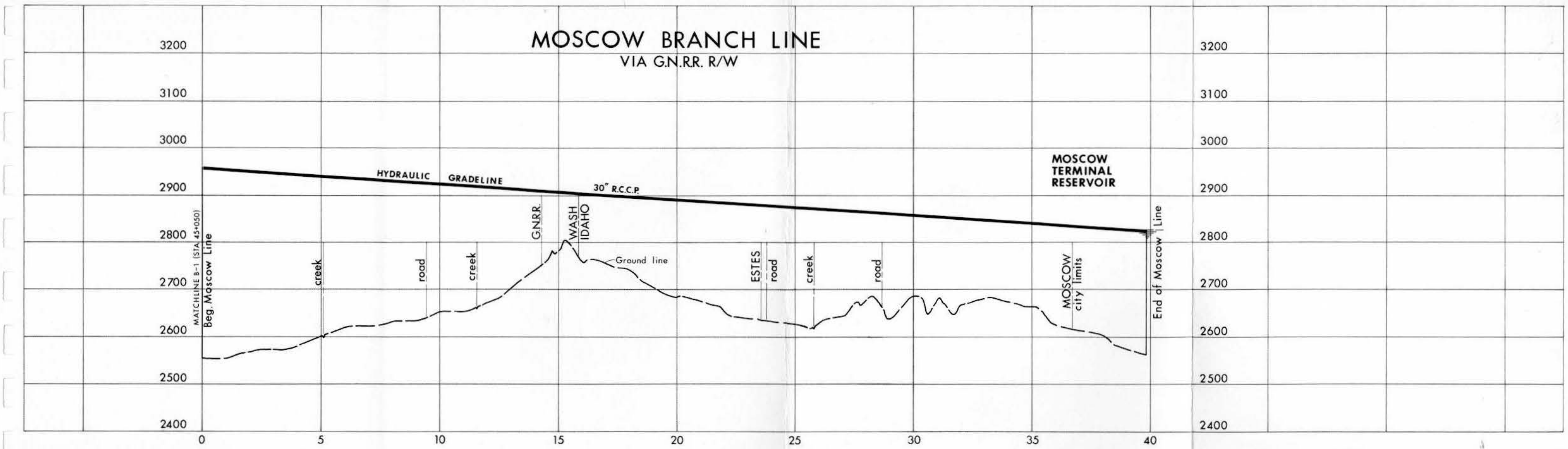
B-1 U.S.C.E. PALOUSE BASIN PROJECT



B-2 U.S.C.E. PALOUSE BASIN PROJECT

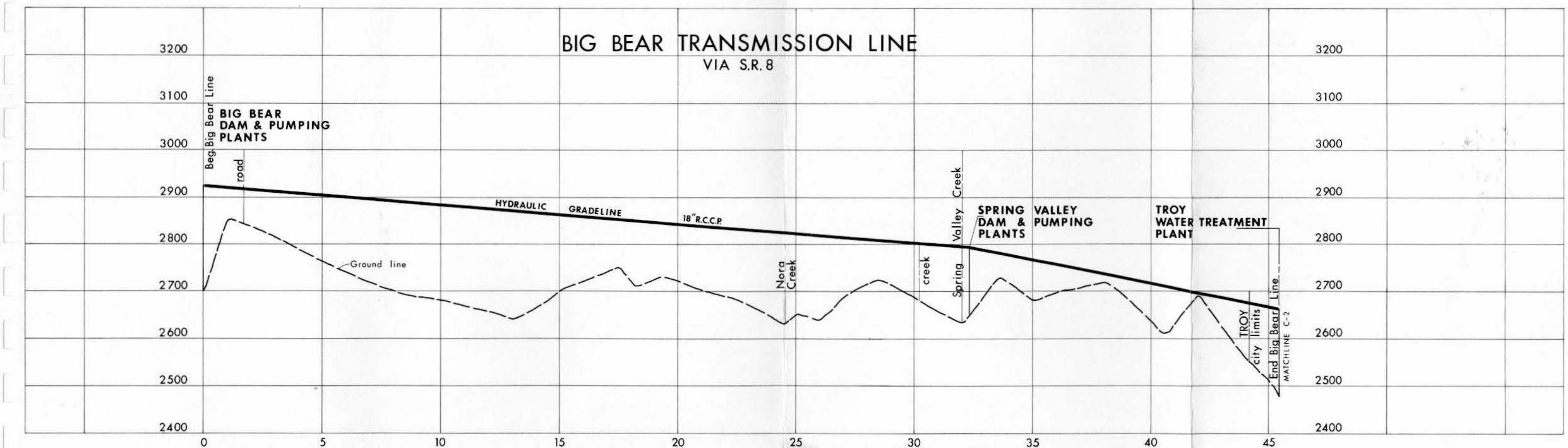
PLATE 3

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE BOISE



STATIONING IN THOUSANDS OF FEET

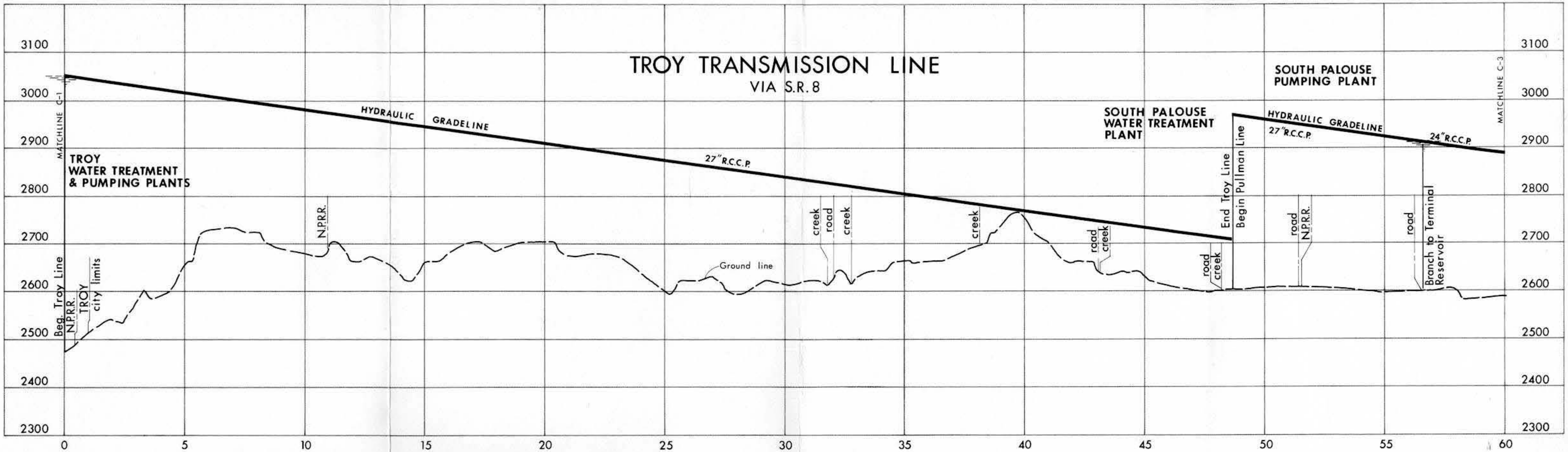
U.S.C.E. PALOUSE BASIN PROJECT B-3



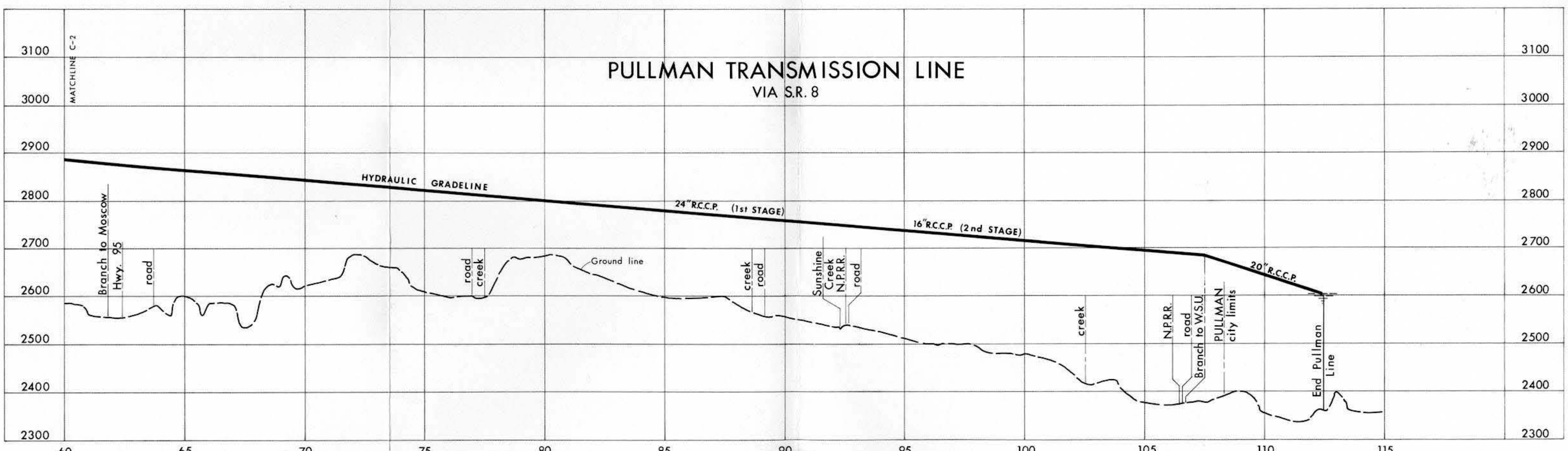
TROY WATERSHED PROJECT C-1

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE BOISE

PLATE 4



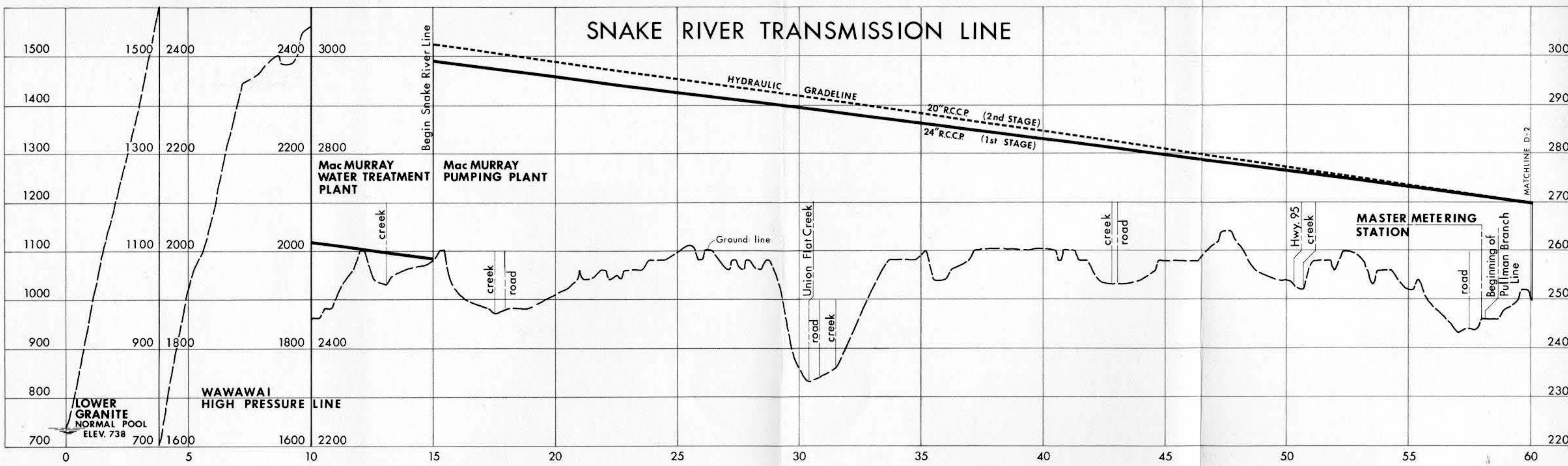
C-2 TROY WATERSHED PROJECT



C-3 TROY WATERSHED PROJECT

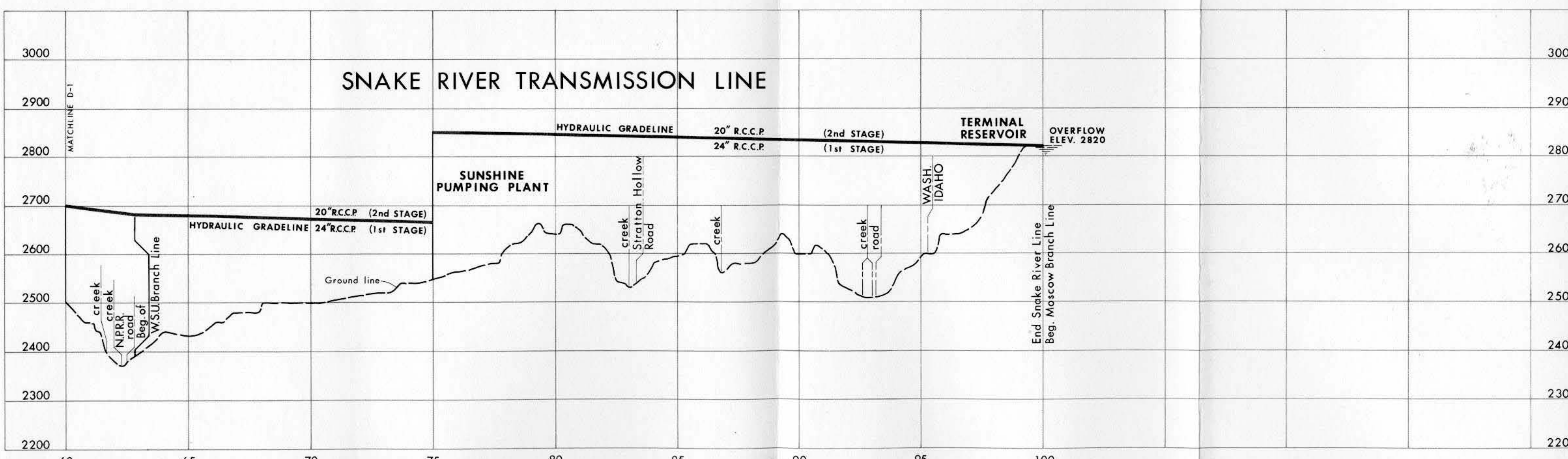
PLATE 5

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE BOISE



STATIONING IN THOUSANDS OF FEET

SNAKE RIVER PROJECT D-1



SNAKE RIVER PROJECT D-2

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE BOISE

PLATE 6

TABLE 7-9
SUMMARY OF CAPITAL COSTS ($1,000)

Alternative Project	First Stage	Second Stage	Third Stage	First Year Annual Costs
Snake River	$ 9,014	$ 4,772	$ 896	$ 1,143
Palouse River Basin	$14,600	$ 345	$ 4,062	$ 1,457
Troy Watershed	$14,544	$ 9,149	$ 5,572	$ 1,435
Potlatch River	$15,555	$ 683	$ 8,194	$ 1,516
Clearwater River	$14,498	$ 683	$ 9,506	$ 1,556
USCE-Palouse Basin	$12,260	$ 301	$ 3,068	$ 907

In developing specific alternatives, two such schemes evolved as the better approaches of the six selections. Under the plan for the Snake River Project, the shortest conveyance distance would occur; the project could be made available sooner than any other scheme; and the lowest first stage capital cost would be required. The project does require, however, sizable construction requirements in the second stage.

The project indicating the lowest annual cost is through joint construction of a multi-purpose project on the North Fork of the Palouse River. Since much of the studies and design would be accomplished by the USCE, this project would in contrast, probably have the longest implementation and construction period, up to 10 or 15 years. Unless the communities to be served proceeded with an interim development plan, such as a seasonal use Palouse River intake or temporary dam structure, considerable expenditures will be required to expand the existing well system, until the project is available.

ORGANIZATION AND FINANCING

GENERAL

Equally important to the requirements of engineering design, planning and feasibility, are the organization and financing aspects of water supply. Organization should allow an early, orderly start of the project, benefit all future users, and be capable of efficiently operating as a regional function. Financing of the proposed surface water supply schemes must consider an equitable cost to all users, a rate schedule comparable to present rates or a minimum of initial increase, full advantage of available federal financing methods and the advantages of a central "wholesale" water supply agency.

OPERATING STRUCTURE

Ideally, the implementing body responsible for the ultimate operation of the proposed water system should have the authority to appropriate and transfer surface water, construct, operate and finance the water project and contract for the sale of wholesale water to the communities. These capabilities as well as many others such as the authority to hold elections, set district boundaries, and bonding ability are essentially those powers available to a normal water district or municipality.

Obviously the creation of an operating structure is complicated by the political subdivision of the Pullman-Moscow area. To create this structure, the legal implications of the political subdivision would require extensive research and the probable enactment of special legislation in both states. Since by direction of the scope of the report, the legal aspects involved with the entire project were to be excluded, the recommendations contained herein concerning the creation of this implementation body are presented in theory only, assuming that the legal mechanics required to create such a structure will be given due consideration by future study.

Contact was made with representatives of the International Utilities Corporation to discuss the possibility of private ownership of the proposed water system as opposed to public ownership. The obvious advantage of such private ownership is that the aforementioned legal difficulties encountered by the creation of a public authority would be significantly reduced. Private ownership would have the advantage of being able to use its own capital and methods to construct, operate and finance the water project, yet the consumer would be protected by regulations imposed by public utility commissions. The obvious disadvantage of private ownership which prevents serious consideration of such action is the high project development cost involved. The water rates which would result from such action would undoubtedly be higher because the private corporation would not be eligible for federal grants, taxes would have to be incorporated into the rate of return, and additionally, the market value of private capital would greatly exceed that required through tax exempt bonds. Private "money" will simply cost more because of the demand for a higher yield.

Consideration was given to the possibility of one of the legal entities individually taking over the operating structure and in turn selling the water to other communties. Such procedures would permit the creation of an operating structure under existing law, thereby again eliminating the legal problems encountered with the multiple ownership concept which crosses political boundaries. Two factors prevent recommendation of this type of ownership of operating structure. First, such operation would result in unequal representation in the administrative authority thus creating a tremendous potential for dissatisfaction. Secondly, the high cost of any proposed projects would probably exceed the financing capabilities of the legal entity sponsoring the project.

The recommended type of operating structure envisions multiple ownership through an interstate wholesale water district. It is recognized that the creation of this type of structure would undoubtedly require the same empowering legislation to be passed in both states. However, this is the only readily apparent manner in which the operating structure can be empowered with the proper authority to implement and operate the water system. The basic concept of this type of ownership provides equal representation for all four legal entities and maintains independent control in all matters concerning the operation of the water system. This type of operating structure could then contract for the sale of wholesale water to each of the four legal entities and use the revenue therein derived to operate and amortize the physical plant. This concept has the obvious advantage in that it does not require any division of the ownership in proportion to the consumption of any particular legal entity involved.

It is therefore recommended that legislation empowering the creation of this interstate wholesale water district be carefully drafted and submitted to the respective state legislature for approval. The basic authority granted by such legislation should be essentially the same provided for an intrastate water district and additionally make provision for the formation, operation and dissolution of the administrative body.

To maintain equal representation of all four legal entities, yet permit the operating structure to remain independent, it might be suggested that the operating structure be composed of seven individuals, one appointed member from each legal entity, one elected member from each community at large and a general manager of the water system with equal voting rights.

PROJECT FINANCING

Due to the initial high construction cost of all the alternates proposed, it was considered imperative to investigate all possible sources of federal funding. Representatives from the U. S. Army Corps of Engineers, the U. S. Bureau of Reclamation, the Soil Conservation Service, and the Department of Housing and Urban Development were consulted to determine the feasibility of either federal grants or loans from the respective agencies. Programs which provided feasible assistance were then incorporated into financial plans of the more favorable alternates.

U. S. ARMY CORPS OF ENGINEERS (USCE)

Discussions with representatives of the USCE revealed that M & I water projects can be financed under the Water Supply Act of 1958 as amended (Title III Public Law 85-500). The primary objective of this legislation is the development of multiple use projects, but the act does contain specific provisions for the inclusion of M & I water supply as one such possible use. Under certain conditions the act further provides federal financing for the construction of M & I storage and conveyance facilities at interest rates specifically outlined by the legislation. As there has been little precedent for such projects, especially the inclusion of conveyance facilities, the eligibility of any project would ultimately be based on the interpretation made by the Office of the Chief Engineer.

The actual interest rate involved for repayment under the Water Supply Act is currently 3.342 per cent, a factor which provides significant advantages to participation under this act. For M & I allocations principle and interest are based only on the amount of water used. Additionally, the interest can be deferred for the first 10 years after which time the annual interest on the entire M & I allocation must be paid. The entire loan must be repaid within a period of fifty years. Due to the advantages involved with this particular federal program, a detailed financial plan utilizing the USCE concept has been prepared and is presented in a later section.

U. S. BUREAU OF RECLAMATION (BOR)

The regional office of this agency, located in Boise, Idaho, was contacted in order to determine the possible financial assistance which may be available. The Bureau of Reclamation can also provide financial assistance for M & I water under the Water Supply Act of 1958 with the same provisions allowed the USCE. However, such application would have to involve Bureau sponsorship of a multiple use project, similar to the one previously presented the P-MWRC by officials of that agency.

Additionally, a fund program provided by the Small Reclamation Projects Act, (70-1044), Public Law 984, permits the Bureau of Reclamation to fund an M & I water supply provided that such a supply is an incidental use of a multiple purpose project whose primary purpose is irrigation. Public Law 984 also stipulates that the maximum project cost cannot exceed $10,000,000. Since most of the alternates herein presented propose single-purpose storage facilities and exceed a cost of $10,000,000, it is apparent that Public Law 984 cannot be of significant assistance.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

This federal agency can provide either a direct grant or loan to municipal water supply and distribution projects. However, the regional office of HUD has established an administrative grant limitation of $500,000 and a maximum loan limitation of $1,000,000 per project. Due to present budget limitations, no funds are available for either large grants or loans. Since construction is not anticipated before the year 1975, it would be reasonable to expect some financial assistance from this agency if immediate application were made, thus permitting HUD to anticipate and budget the expenditure by the year 1975.

Although this agency indicated that little financial assistance could be provided in the immediate future, the HUD offices did display a keen interest and verbal approval of the proposed project. The concept of the four legal entities uniting to seek a common water supply has special appeal because it is somewhat unique and highly consistent with the objectives of this particular federal program.

Since federal funds from this agency cannot be confirmed at this time, it would not seem prudent to include them in the financial plans herein developed. It is strongly recommended that immediate application be made to this agency as this additional federal assistance would result in a reduction of the water rates herein proposed.

SOIL CONSERVATION SERVICE (SCS)

Under Public Law 566, municipal and industrial water projects can receive loans from the Farmers Home Administration through the Soil Conservation Service, provided the watershed being developed contains less than 250,000 acres, or can be broken into increments of less than 250,000 acres, and the project for each watershed does not exceed a cost of $5,000,000. A federal loan may be advanced for the portion of the future storage contained in the reservoirs. However, the cost allocated for future M & I storage cannot exceed thirty per cent of the total cost of the reservoir. No federal monies may be secured for the construction of transmission lines, pumping stations, water treatment plants or storage reservoirs, except in cases of joint use for irrigation.

These conditions indicate that eligible projects would include the Potlatch River Project, the Palouse River Project, and the Troy Watershed Development. It must be noted, however, that even if the maximum allotment, thirty per cent of the proposed cost of the reservoirs, were to be received, none of these projects could be completed at a cost less than that anticipated for the Snake River Plan.

FINANCIAL PLAN - SNAKE RIVER

A conventional financial plan indicated that the wholesale water cost would range from 35.8 cents per thousand gallons to 16.6 per thousand gallons if only revenue bonds were employed and wholesale water costs adjusted annually to generate sufficient revenue. See Plan A, Table 8-1. This aspect of straight financing is a hardship during the first few years when not only the entire debt service payments will be made in addition to the O & M cost, but a revenue bond guarantee fund must be established resulting in an extremely high cost for the first five years. Due to the wide range in these costs, it would also not appear feasible to stabilize a water cost based on the 35 cents as initially encountered because the revenues would be far too excessive in the ensuing years.

TABLE 8-1
SNAKE RIVER PROJECT - FINANCIAL PLAN A

Year	Staged Capital Costs	First Bond Issue		Second Bond Issue		Third Bond Issue		O & M	Power	Total Annual Cost	Q Bg/Yr	Rate ¢/1000 gal.
		Payment	Guarantee Fund	Payment	Guarantee Fund	Payment	Gurantee Fund					
1975	9, 014, 000	726, 400[1]	145, 300[2]					250, 000	167, 000	1, 228, 700	3. 6	35. 8
1976		726, 400	145, 300					254, 000	170, 750	1, 296, 450	3. 8	34. 2
1977		726, 400	145, 300					258, 000	174, 500	1, 304, 200	3. 99	32. 7
1978		726, 400	145, 300					262, 000	178, 250	1, 311, 950	4. 18	31. 5
1979		726, 400	145, 300					266, 000	182, 000	1, 319, 700	4. 35	30. 3
1980		726, 400						270, 000	185, 750	1, 182, 150	4. 5	26. 3
1981		726, 400						274, 000	189, 500	1, 189, 900	4. 62	25. 7
1982		726, 400						278, 000	193, 250	1, 197, 650	4. 74	25. 3
1983		726, 400						282, 000	197, 000	1, 205, 400	4. 85	24. 8
1984		726, 400						286, 000	200, 750	1, 213, 150	4. 96	24. 4
1985		726, 400						290, 000	204, 500	1, 220, 900	5. 06	24. 1
1986		726, 400						294, 000	208, 250	1, 228, 650	5. 16	23. 8
1987		726, 400						298, 000	212, 000	1, 236, 400	5. 26	23. 4
1988		726, 400						302, 000	215, 750	1, 244, 150	5. 36	23. 2
1989		726, 400						306, 000	219, 500	1, 251, 900	5. 46	22. 9
1990		726, 400						310, 000	223, 250	1, 259, 650	5. 56	22. 6
1991		726, 400						314, 000	227, 000	1, 267, 400	5. 62	22. 5
1992		726, 400						318, 000	230, 750	1, 275, 150	5. 68	22. 4
1993		726, 400						322, 000	234, 500	1, 282, 900	5. 74	22. 3
1994		726, 400						326, 000	238, 250	1, 290, 650	5. 80	22. 2
1995	4, 772, 000[3]	726, 400		385, 000	77, 000[2]			330, 000	242, 000	1, 760, 400	5. 86	30. 0
1996		726, 400		385, 000	77, 000			334, 000	245, 750	1, 768, 150	5. 92	29. 8
1997		726, 400		385, 000	77, 000			338, 000	249, 500	1, 775, 900	5. 98	29. 7
1998		726, 400		385, 000	77, 000			342, 000	253, 250	1, 783, 650	6. 04	29. 6
1999		726, 400		385, 000	77, 000			346, 000	257, 000	1, 791, 400	6. 10	29. 4
2000	896, 000[4]	726, 400		385, 000		72, 300	14, 500[2]	350, 000	260, 760	1, 808, 950	6. 16	29. 3
2001		726, 400		385, 000		72, 300	14, 500	354, 000	264, 500	1, 816, 700	6. 22	29. 2
2002		726, 400		385, 000		72, 300	14, 500	358, 000	268, 250	1, 824, 450	6. 28	29. 1
2003		726, 400		385, 000		72, 300	14, 500	362, 000	272, 000	1, 832, 200	6. 34	29. 0
2004		726, 400		385, 000		72, 300	14, 500	366, 000	275, 750	1, 839, 950	6. 40	28. 8
2005				385, 000		72, 300		370, 000	279, 500	1, 106, 800	6. 46	17. 2
2006				385, 000		72, 300		374, 000	283, 250	1, 114, 550	6. 52	17. 1
2007				385, 000		72, 300		378, 000	287, 000	1, 122, 300	6. 58	17. 1
2008				385, 000		72, 300		382, 000	290, 750	1, 130, 050	6. 64	17. 0
2009				385, 000		72, 300		386, 000	295, 500	1, 137, 800	6. 70	17. 0
2010				385, 000		72, 300		390, 000	298, 250	1, 145, 550	6. 76	16. 9
2011				385, 000		72, 300		394, 000	302, 000	1, 153, 300	6. 82	16. 9
2012				385, 000		72, 300		398, 000	305, 750	1, 161, 050	6. 88	16. 9
2013				385, 000		72, 300		402, 000	309, 500	1, 168, 800	6. 94	16. 8
2014				385, 000		72, 300		406, 000	313, 250	1, 176, 550	7. 00	16. 8
2015				385, 000		72, 300		414, 000	320, 750	1, 184, 300	7. 06	16. 8
2016				385, 000		72, 300		418, 000	324, 500	1, 192, 050	7. 12	16. 7
2017				385, 000		72, 300		422, 000	328, 250	1, 199, 800	7. 18	16. 7
2018				385, 000		72, 300		426, 000	332, 000	1, 207, 550	7. 24	16. 7
2019				385, 000		72, 300		430, 000	335, 750	1, 215, 300	7. 30	16. 6
2020				385, 000		72, 300				1, 223, 050	7. 36	16. 6

1 Revenue bonds @ 7% for 30 years.
2 Equal to one annual payment in five years.
3 Second stage costs
4 Third stage costs

TABLE 8-2
SNAKE RIVER PROJECT - FINANCIAL PLAN B

Year	Bond No. 1 Payment	Staged Capital Costs	O & M	Power	Total Annual Cost	Q Bg/Yr	Rate ¢/1000 gal.	Total Revenue Annual	Annual Net Revenue	Annual Revenue Invested	Value of Investment	Cash on Hand
1971					0	2.93	20			586,000	--	
1972					0	3.10	20			610,000	--	
1973					0	3.27	20			654,000	--	
1974					0	3.34	20			668,000	--	
1975	545,000 [1]	9,014,000	250,000	167,000	962,000	3.6	25	900,000	657,000	900,000	3,883,000 [2]	657,000
1976	545,000		254,000	170,750	969,750	3.8	25	950,000	(19,750)	0	0	637,250
1977	545,000		258,000	174,500	977,500	3.99	25	1,000,000	22,500	0	0	659,750
1978	545,000		262,000	178,250	985,250	4.18	25	1,045,000	59,750	0	0	719,500
1979	545,000		266,000	182,000	993,000	4.35	25	1,090,000	97,000	0	0	816,500
1980	545,000		270,000	185,750	1,000,750	4.50	25	1,125,000	124,250	100,000	107,000	840,750
1981	545,000		274,000	189,500	1,008,500	4.62	25	1,155,000	146,500	100,000	--	887,250
1982	545,000		278,000	193,250	1,016,250	4.74	25	1,185,000	168,750	100,000	--	956,000
1983	545,000		282,000	197,000	1,024,000	4.85	25	1,212,500	188,500	100,000	--	1,044,500
1984	545,000		286,000	200,750	1,031,750	4.96	25	1,240,000	208,250	100,000	--	1,152,750
1985	545,000		290,000	204,500	1,039,500	5.06	25	1,265,000	225,500	200,000	--	1,178,250
1986	545,000		294,000	208,250	1,047,250	5.16	25	1,290,000	242,750	200,000	--	1,221,000
1987	545,000		298,000	212,000	1,055,000	5.26	25	1,315,000	260,000	200,000	--	1,281,000
1988	545,000		302,000	215,750	1,062,750	5.36	25	1,340,000	277,250	200,000	--	1,358,250
1989	545,000		306,000	219,500	1,070,500	5.46	25	1,365,000	294,500	200,000	--	1,452,750
1990	545,000		310,000	223,250	1,078,250	5.56	25	1,390,000	311,750	300,000	--	1,464,500
1991	545,000		314,000	227,000	1,086,000	5.62	25	1,405,000	319,000	300,000	--	1,483,500
1992	545,000		318,000	230,750	1,093,750	5.68	25	1,420,000	326,250	300,000	--	1,509,750
1993	545,000		322,000	234,500	1,101,500	5.74	25	1,435,000	333,500	300,000	--	1,543,250
1994	545,000		326,000	238,250	1,109,250	5.80	25	1,450,000	340,750	300,000	4,470,000 [3]	1,584,000
1995	545,000	4,772,000 [3]	330,000	242,000	1,117,000	5.86	25	1,456,000	348,000 [3]	0	0	1,630,000
1996	545,000		334,000	245,750	1,124,750	5.92	25	1,480,000	355,250	300,000	321,000	1,685,250
1997	545,000		338,000	249,500	1,132,500	5.98	25	1,495,000	362,500	300,000	--	1,747,750
1998	545,000		342,000	253,250	1,140,250	6.04	25	1,510,000	369,750	300,000	--	1,817,500
1999	545,000		346,000	257,000	1,148,000	6.10	25	1,525,000	377,000	300,000	1,332,000 [4]	1,894,500
2000	545,000	896,000 [4]	350,000	260,760	1,155,750	6.16	25	1,540,000	384,250	300,000	788,000	1,978,750
2001	545,000		354,000	264,500	1,163,500	6.22	25	1,555,000	391,500	300,000		2,070,250
2002	545,000		358,000	268,250	1,171,250	6.28	25	1,570,000	398,750	300,000		2,169,000
2003	545,000		362,000	272,000	1,179,000	6.34	25	1,585,000	406,000	300,000		2,275,000
2004	545,000		366,000	275,750	1,186,750	6.40	25	1,600,000	413,250	300,000		2,388,250
2005			370,000	279,500	649,500	6.46	20	1,292,000	642,500	300,000		2,730,750
2006			374,000	283,250	657,250	6.52		1,304,000	646,750	500,000		2,877,500
2007			378,000	287,000	665,000	6.58		1,316,000	651,000	500,000		3,028,500
2008			382,000	290,750	672,750	6.64		1,328,000	655,250	500,000		3,183,750
2009			386,000	295,500	680,500	6.70		1,340,000	659,500	500,000		3,343,250
2010			390,000	298,250	688,250	6.76		1,352,000	663,750	500,000		3,507,000
2011			394,000	302,000	696,000	6.82		1,364,000	668,000	500,000		3,675,000
2012			398,000	305,750	703,750	6.88		1,376,000	672,250	500,000		3,847,250
2013			402,000	309,500	711,500	6.94		1,388,000	676,500	500,000		4,023,750
2014			406,000	313,250	719,250	7.00		1,400,000	680,750	500,000		4,204,500
2015			410,000	317,000	727,000	7.06		1,412,000	685,000	500,000		4,389,500
2016			414,000	320,750	734,750	7.12		1,424,000	689,250	500,000		4,578,750
2017			418,000	324,500	742,500	7.18		1,436,000	693,500	500,000		4,772,250
2018			422,000	328,250	750,250	7.24		1,448,000	697,750	500,000		4,970,000
2019			426,000	332,000	758,000	7.30		1,460,000	702,000	500,000		5,172,000
2020			430,000	335,750	765,750	7.36		1,472,000	706,250	500,000		5,378,250

1 6 3/4 million @ 7% for 30 years
2 Use entire amount for construction in 1975
3 Second stage costs
4 Third stage costs

An alternative financial plan, Plan B, Table 8-2, developed for the Snake River alternate, presents a better picture. Basically, it initiates an immediate charge of 20 cents per thousand gallons for all water used by the four agencies, which by the year 1975 would raise a revenue of $3, 883, 000. If a portion of this investment is used to lower the initial capital cost to $6, 750, 000, the annual amortization of the first bond issue is greatly reduced, consequently reducing the cost of the water for the first year. A cash reserve fund would also continue to be available. The net result of this plan is that in the first year of actual use, the water costs only need be raised to 25 cents per thousand gallons. It should be noted that during the first year, the proposed plan requires a deficit operation; however, this does not deplete the total cash on hand to an amount less than the annual payment required, a factor which will not prevent a proper bond sale. The possible effect of grants has not been shown which would in effect improve the cost requirements.

Beyond the first year, revenues steadily increase so that by 1980, investments may be placed in a sinking fund. Investments are gradually increased until by the time the second stage construction is required in 1995, $4, 470, 000 would be accrued and could be applied against the anticipated second stage construction cost of $4, 472, 000. Some additional expenditures would be required, however, by that date, and it is anticipated the cash balance of $1, 630, 000 can be so applied. A $300, 000 annual investment can be continued beyond 1995 and will accrue funds sufficient for the third stage of construction in the year 2000. Beyond the year 2000, the revenues increase at an accelerating rate indicating that a rate reduction could be feasible. Consequently, a rate reduction to 20 cents per thousand gallons is shown in the year 2005. At this time, the annual sinking fund is also increased to $500, 000 and the revenue continues to increase as well as the cash balance on hand. By the year 2020, the value of this investment has grown to $20, 296, 000 with a cash balance of $5, 378, 000. Projections are extremely difficult to anticipate at this time beyond the year 2000; however, from the above information and the financial plan, it appears that possibly the 20 cents could be further reduced to 15 cents and still permit a positive cash balance to be shown at the year 2020.

Consideration was given to a third alternate financial plan for the Snake River. This plan suggest the sale of general obligation bonds prior to the year 1975 in the amount of $3, 883, 000. These funds would be used in the same manner as the revenue funds which were created prior to the year 1975 in Plan B. Consideration was given to this concept in the event the public would accept a tax increase more readily than the immediate rate increase required in Plan B. Subsequent investigations concerning permissible debt limitations and interest limitations indicated that the sale of such bonds would be doubtful. The mechanics of combining a common bond issue, passing the separate referendums, and securing the necessary legislative action are extremely complex considering that the state law for both Washington and Idaho must be mutually satisfied. It also appears doubtful that sufficient money could be raised through a general obligation bond issue to appreciably reduce the initial capital cost. As an example of the limitations on such funds, it could be emphasized that the State of Idaho has a total debt limitation of $2, 000, 000 with the current indebtedness being $1, 965, 000. The community of Moscow has an indebtedness limitation of $845, 000 and an indebtedness of $125, 000, and the City of Pullman at the end of 1969 had an indebtedness of $1, 001, 000 in general obligation bonds. In view of these facts, it becomes readily apparent that general obligation bonds could not be used to lower the initial cost of the project without revision of Idaho law or significant reduction of current indebtedness.

FINANCIAL PLAN - USCE PALOUSE BASIN PROJECT

Due to the advantages involved with the federal financing available under the Water Supply Act of 1958, an additional financial plan, Plan C, Table 8-3, is presented for the general concept developed by the USCE on the Palouse River. It must be noted, however, that this particular project cannot merit serious consideration without revision of Idaho Law. The 40th session of the Idaho legislature passed a bill which would permit reciprocal water transfer between the States of Idaho and Washington, however reciprocity is limited to municipal and industrial use only in the community of Pullman, Washington. Obviously, such a restriction eliminates downstream irrigation use in the State of Washington and negates the multiple use concept proposed in the USCE project. Therefore, the presentation of Plan C is predicated upon the assumption that this particular legislation can be revised to allow a multiple use project on the Palouse River.

TABLE 8-3

USCE - PALOUSE BASIN PROJECT - FINANCIAL PLAN C

Year	Staged Capital Costs	Federal Loan 50 yr.@3.342%[1]	Revenue Bond 30 yr.@7.0%[2]	O & M	Power	Total Annual Cost	Q Bg/Yr	Rate ¢/1000 gal.	Total Annual Revenue	Net Annual Revenue	Cash on Hand[6]
1973							3.27	10[5]	327,000	327,000	327,000
1974							3.34	10	334,000	334,000	661,000
1975	12,046,000	363,400	280,700	233,290	29,700	907,090	3.6	20	720,000	(187,090)[7]	473,910
1976		363,400	280,700	237,010	31,650	912,760	3.8	20	760,000	(152,760)	321,150
1977		363,400	280,700	240,730	33,600	918,430	3.99	20	798,000	(120,430)	200,720
1978		363,400	280,700	244,450	35,550	924,100	4.18	20	836,000	(88,100)	112,620
1979		363,400	280,700	248,170	37,500	929,770	4.35	20	870,000	(59,770)	52,850
1980		363,400	280,700	251,890	39,450	935,440	4.50	20	900,000	(35,440)	17,410
1981		363,400	280,700	255,610	41,400	941,110	4.62	20	924,000	(17,110)	300
1982		363,400	280,700	259,330	43,350	946,780	4.74	20	948,000	1,220	1,520
1983		363,400	280,700	263,050	45,300	952,450	4.85	20	970,000	17,550	19,070
1984		363,400	280,700	266,770	47,250	958,120	4.96	20	992,000	33,880	52,950
1985		363,400	280,700	270,490	49,200	963,790	5.06	20	1,012,000	48,210	101,160
1986		363,400	280,700	274,210	51,150	969,460	5.16	20	1,032,000	62,540	163,700
1987		363,400	280,700	277,930	53,100	975,130	5.26	20	1,052,000	76,870	240,570
1988		363,400	280,700	281,650	55,050	980,800	5.36	20	1,072,000	91,200	331,770
1989		363,400	280,700	285,370	57,000	986,470	5.46	20	1,092,000	105,530	437,300
1990	300,500[3]	363,400	280,700	289,090	58,950	992,140	5.56	20	1,112,000	119,860	256,660
1991		363,400	280,700	292,810	60,900	997,810	5.66	20	1,132,000	134,190	390,850
1992		363,400	280,700	296,530	62,850	1,003,480	5.68	20	1,136,000	132,520	523,370
1993		363,400	280,700	300,250	64,800	1,009,150	5.74	20	1,148,000	138,850	662,220
1994		363,400	280,700	303,970	66,750	1,014,820	5.80	20	1,160,000	145,180	807,400
1995		363,400	280,700	307,690	68,700	1,020,490	5.86	20	1,172,000	151,510	958,910
1996		363,400	280,700	311,410	70,650	1,026,160	5.92	20	1,184,000	157,840	1,116,750
1997		363,400	280,700	315,130	72,600	1,031,830	5.98	20	1,196,000	164,170	1,280,920
1998		363,400	280,700	318,850	74,550	1,037,500	6.04	20	1,208,000	170,500	1,451,420
1999		363,400	280,700	322,570	76,500	1,043,170	6.10	20	1,220,000	176,830	1,628,250
2000	3,068,400[4]	363,400	409,400	326,290	78,450	1,177,540	6.16	20	1,232,000	54,460	114,310
2001		363,400	409,400	330,010	80,400	1,183,210	6.22	20	1,244,000	60,790	175,100
2002		363,400	409,400	333,730	82,350	1,188,880	6.28	20	1,256,000	67,120	242,220
2003		363,400	409,400	337,450	84,300	1,194,550	6.34	20	1,268,000	73,450	315,670
2004		363,400	409,400	341,170	86,250	1,200,220	6.40	20	1,280,000	79,780	395,450
2005		363,400	128,700	344,890	88,200	925,190	6.46	15	969,000	43,810	439,260
2006		363,400	128,700	348,610	90,150	930,860	6.52	15	978,000	47,140	486,400
2007		363,400	128,700	352,330	92,100	936,530	6.58	15	987,000	50,470	536,870
2008		363,400	128,700	356,050	94,050	942,200	6.64	15	996,000	53,800	590,670
2009		363,400	128,700	359,770	96,000	947,870	6.70	15	1,005,000	57,130	647,800
2010		363,400	128,700	363,490	97,950	953,540	6.76	15	1,014,000	60,460	708,260
2011		363,400	128,700	367,210	99,900	959,210	6.82	15	1,023,000	63,790	772,050
2012		363,400	128,700	370,930	101,850	964,880	6.88	15	1,032,000	67,120	839,170
2013		363,400	128,700	374,650	103,800	970,550	6.94	15	1,041,000	70,450	909,620
2014		363,400	128,700	378,370	105,750	976,220	7.00	15	1,050,000	73,780	983,400
2015		363,400	128,700	382,090	107,700	981,890	7.06	15	1,059,000	77,110	1,060,510
2016		363,400	128,700	385,810	109,650	987,560	7.12	15	1,068,000	80,440	1,140,950
2017		363,400	128,700	389,530	111,600	993,230	7.18	15	1,077,000	83,770	1,224,720
2018		363,400	128,700	393,250	113,550	998,900	7.24	15	1,086,000	87,100	1,311,820
2019		363,400	128,700	396,970	115,500	1,004,570	7.30	15	1,095,000	90,430	1,402,250
2020		363,400	128,700	400,490	117,600	1,010,190	7.36	15	1,104,000	93,810	1,496,060

1 Eligible project cost for USCE financing = $8,776,000.
2 Project cost financed by local funding = $3,270,000 (First Stage), $1,500,000 (Third Stage).
3 Second stage capital costs from cash on hand = $300,500.
4 Third stage capital costs from cash on hand = $1,568,400.
5 Rate instituted prior to project use to accumulate cash reserve.
6 Investment at short term interest rates not shown.
7 ( ) indicate deficit year.

The financial plan presented for the Palouse River proposes an initial water cost of ten cents per thousand gallons be levied before 1973, two years prior to project use. Assuming construction will be complete in 1975, the revenue will raise $661,000. A portion of this fund could be invested to create a sinking fund for future construction purposes, and the remainder of the fund used to offset the deficit operation expected during the early years of operation. It should be noted that construction grants could possibly reduce or eliminate a deficit operation by lowering first stage bonding requirements. Another possible plan could utilize a deferred principle plan, but might require higher interest rates. By the year 1982 sufficient revenue is projected to pay the annual costs and accrue a sinking fund from the surplus revenue for second and third stage capital costs as shown.

Physical plant expenditures for the USCE Palouse Project are proposed in four different forms. The first two are the annual amortization costs incurred from the initial physical plan construction. The annual payment on the portion of the plant which is eligible for federal financing under the Water Supply Act amounts to $363,500 per year, and $280,700 per year is required to meet payments for that portion of the first stage physical plant not eligible for federal financing under the Act (water treatment plant and terminal storage). In the year 1990, second stage construction on the pumping plants will require an additional expenditure of $300,500. However, the invested cash on hand at that date has sufficient value to meet this expenditure; consequently, the financial plan projects a cash payment of this particular construction phase. In the year 2000, additional construction is required and will cost an estimated $3,068,400. Again, the value of the sinking fund is sufficient to partly cover this expenditure and the financial plan accordingly projects a $1,500,000 revenue bond to raise the additional funds. Beyond the year 2000, additional investments are projected to offset the anticipated construction expenses beyond the year 2020. However, it should be noted that a rate decrease to 15 cents per thousand gallons can be effected in the year 2005 and still permit a reasonable rate of return.

USCE FINANCING - SNAKE RIVER

An obvious alternative method of financing the proposed Snake River Project is the application of federal funding through the Water Supply Act of 1958, similar to that previously presented for the USCE Palouse River Plan. Through the application of the low interest rate provided by the Water Supply Act to the conveyance facilities required for the development of the Snake River supply, considerably lower amortizing costs are realized. Such application results in water costs very similar to those experienced by the Palouse River Plan during the year 1975. For example, in the year 1975, the total annual cost for the Palouse River Plan was presented at $907, 190, and similar financing would result in a total annual cost in the year 1975 for the Snake River of $923, 200. It is obvious from comparison of these two figures that the water rate of 20 cents per thousand gallons would be additionally sufficient to finance the development of the Snake River alternate under similar conditions.

Two factors prevent serious consideration of this concept. The first being that the second stage costs involved with the Snake River Plan greatly exceed those anticipated for the USCE Palouse River Plan, and these higher future costs would require either an increase in the rate of 20 cents per thousand gallons or continuation of such rate far beyond the year 2005. More importantly, application of the Water Supply Act of 1958 to financing of the Snake River Plan would be much more difficult to secure. Guidelines used by the USCE for application of the Water Supply Act indicate that... "criteria for considering whether or not water supply is authorized in a completed project by the Water Supply Act of 1958 should be somewhat more restrictive than in the case of adding water supply as a purpose prior to construction." Since Lower Granite Pool essentially constitutes a "completed project," it seems reasonable to assume that application of the Water Supply Act would definitely show preference to the USCE Palouse River Plan rather than the Snake River Project under similar conditions. This preference compounded with the lack of clear definition and precedent for the funding of the conveyance facilities for either project, concludes that the USCE Palouse River Project has definite advantages over the Snake River Project for development under the Water Supply Act of 1958.

FINDINGS

AND

RECOMMENDATIONS

Implementation of a plan for developing a surface water supply should take place immediately. Demands for domestic water will outstrip the capabilities of the present system by 1975. Additional development of a ground water supply is recognized as being severely limited and future use should be only on a seasonal basis to supplement periods of peak use.

From the studies of potential surface water supply and development needs it is concluded that:

1. Water for the communities of Pullman and Moscow and the related universities will be in short supply within the next decade. Population trends indicate a definite need for area-wide water resource development.

2. Growth in urban communities will continue to be oriented towards the universities. The combined enrollment is estimated at 32,500 in 1980 and nearly 47,000 in 2020. By extension of projections to the entire Pullman-Moscow area, the served population is estimated at 68,500 in 1980 and 100,600 in 2020.

3. Virtually all surface water sources will require treatment and pumping for delivery to the communities. Assurance as to continual watershed protection is impossible and economics dictate use of withdrawal points subject to uncontrolled upstream use.

4. Water requirements for the Pullman-Moscow Area depend on daily and seasonal variables, consumptive trends and types of use. Peak demands of three times the average daily demand can be expected. The rate of consumptive use, while varying by type of user, can be expected to increase during the design period to about 200 gallons per day in 2020. Sprinkling has a significant effect on the demands, particularly during the months of June through September.

5. The greatest benefit would be realized for participation in multipurpose projects where irrigation, flood protection, prevention of soil erosion, fish propagation, waterfowl habitats and possibly power generation can be incorporated. Sites on the North Fork of the Palouse River and Snake River provide the widest range of such benefits.

6. The plan for surface water supply development can be effectively carried out only on a regional basis.

7. To insure an adequate supply through a fifty year design period, a source capable of producing 7.4 billion gallons per year is required. First stage facilities should be provided with an average daily capacity of 15 mgd, expandable to 20 mgd by 2020.

8. The proposed water system should be operated by an agency having the authority to appropriate and transfer surface water, construct, operate and finance the project and contract for the sale of wholesale water to the communities. It should also have the capabilities to hold elections, set district boundaries and possess bonding ability.

9. Financing of the proposed water system must consider an equitable cost to all users, a rate schedule comparable to present rates or a minimum of initial increase, full advantage of available federal financing methods and the advantages of a central wholesale water supply agency.

10. Economic evaluation indicates two of the six projects reviewed in detail as the most feasible. The Snake River Project has the lowest first stage cost and the USCE Palouse Basin, a joint sponsored project, has the lowest annual costs.

In order to consolidate all recommendations pertaining to the planning, analysis, preliminary design, construction and financing of the water supply facilities, major points are summarized below. It was considered desirable to separate recommendations which imply general implementation from those which are specific to a particular alternate selection and allow final decisions by the Committee. In brief, it is recommended that:

1. The Pullman-Moscow Water Resources Committee review the report and make certain recommendations to the represented bodies as to its adoption and implementation.

2. A decision be made as to selection of the specific long range plan of water supply to be pursued.

3. Action be taken to secure appropriate state legislation which will establish and empower an interstate water district with the authority to appropriate water, sell revenue bonds, have equitable representation, construct and operate water treatment and conveyance facilities, and sell wholesale water in both Washington and Idaho.

4. A revenue system or appropriation program be implemented which will be sufficient to meet the financial requirements of the plan selected.

5. The adopted plan along with an application for construction grant and loan assistance be submitted as soon as possible to the Department of Housing and Urban Development.

6. The ground water and aquifers in the Pullman-Moscow Basin and areas south and east of Moscow continue to be investigated so to assure adequacy of conjunctive use with the surface water supply plan throughout the study period and beyond.

7. A detailed program and work schedule for implementation, financing, planning, manpower requirements, design and construction of the proposed facilities be developed immediately.

In the event the Snake River Project is selected, it is recommended that:

1. The Corps of Engineers be requested to review and study possible application of the Water Supply Act of 1958, as amended, to the proposed Snake River Project.

2. Immediate application be made to the Corps of Engineers for a withdrawal permit from the lower Granite Pool and Snake River for an initial amount of 22,500 acre-feet.

3. The undertaking of preliminary engineering studies to include route surveying, soils investigations and facilities design be authorized as soon as possible in recognition of the time requirements for the proposed facilities.

In the event the Palouse Basin Project is selected, it is recommended that:

1. The report be immediately submitted to the Corps of Engineers with the request for a decision on participation in development of the proposed plan under the Water Supply Act of 1958, as amended, and a time schedule for engineering and construction.

2. Revisions be requested for the present Idaho Legislation (HB 509) on reciprocal exchange of water with the State of Washington limiting use of water to M & I only so to allow a multi-purpose project to be constructed to the benefit of both states.

3. A continuous water quality monitoring program be established on the Palouse River to obtain seasonal flow correlated data.

4. The appropriate water rights and agreements be secured in line with the proposed program of storage and stream flow regulation.

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Stevens, Thompson & Runyan, Inc.

Engineers / Planners

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Fifty Years
1920-1970

Portland
Seattle
Boise
Anchorage

B-100.001

January 27, 1970

Mayor ----

Dear Mayor:

Our firm has been retained by the Pullman-Moscow Water Resource Committee (P-MWRC) to perform a water study. The committee is composed of representatives from the City of Pullman, Washington State University, the City of Moscow and the University of Idaho. Their primary purpose is to investigate alternate methods of augmenting their domestic water supplies from a common source.

The requirements of the water study include contacting and maintaining liaison with all interested parties, particularly neighboring communities, which are contemplating expansion of their water system. Consequently, we would appreciate the completion and return of the enclosed questionnaire concerning the future planning of your community's water system. Use of the information provided will be limited to the P-MWRC Water Study and will not obligate your community in any manner.

If you desire more information concerning this project, please feel free to request the same from this office. Your early response will be most appreciated.

Very truly yours,

STEVENS, THOMPSON & RUNYAN, INC.

Richard Day

By: Richard O. Day, P.E.
Resident Manager

ROD:plk

cc: Portland
Seattle

ESVELT & SAXTON
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JOHN S. TUNISON, ASSOCIATE
TELEPHONE (509) 624-9161

January 30, 1970
E/S File 95-C

Mr. Richard O. Day, P.E.
Stevens, Thompson & Runyan, Inc.
827 La Cassia Drive
Boise, Idaho 83705

Subject: Pullman - Moscow Water Study

Dear Mr. Day,

The City of Colfax has asked us to respond to your questionnaire regarding their domestic supply and potential water use.

Nearly three years ago we prepared a comprehensive engineering report covering every aspect of the City's domestic water supply and distribution system. Many recommendations were made to improve the overall supply and distribution picture and a major construction project was completed in 1968 as a result of these recommendations.

The project, however, did not include increasing the high quality water supply which amounts to 2100 gpm from two deep water wells and one artesian well. We recommended that another 500 gpm well be investigated to provide Colfax with a new source of supply which will be needed within the next twenty years if their current rate of water usage continues.

Although there is no immediate need for additional water, there is reason to believe that the artesian supply can be substantially reduced following sucessive low runoff years as was experienced between 1916 - 1926. This does not hold true, however, for the deep-water wells which have not shown a measurable drawdown since their completions.

Reasonably anticipating that the aquifer presently being used holds an abundance of the same high quality water, Colfax will not need another source of supply until at least 2010 when the population could be 4500. If after this time, further wells in the area prove not feasible, the City will be most interested in considering a "common area" source.

I hope this has sufficiently answered your questions. If you have need for further information, please contact us.

Very truly yours,

Michael A. Kennedy

Michael A. Kennedy
ESVELT & SAXTON
MAK/ch

cc: City of Colfax

P-MWRC QUESTIONNAIRE
BY
STR ENGINEERS/PLANNERS

Name of Community: City of Troy, Idaho

Does your community have any current plans, ideas or concepts concerning the expansion or replacement of your water supply? No

If so, please give a brief description of such plans, ideas or concepts:

We are just completing the expansion of our Mountain Reservoir which should take care of our requirements for next 10 to 15 years.

Do you think that your community should consider the possibility of using water provided by a source serving the Pullman-Moscow urban area (assuming that such a scheme was economically feasible)? Yes

If so, when might your community need the water? 10 to 15 years

Would you like to discuss this matter in more detail with a representative of our firm? We wish to cooperate.

Please provide any additional comments you wish: ____________

By: /s/ Eldon T. Strom
(Person answering questionnaire)

Mayor
(Position)

P-MWRC QUESTIONNAIRE
BY
STR ENGINEERS/PLANNERS

Name of Community: Kendrick, Idaho

Does your community have any current plans, ideas or concepts concerning the expansion or replacement of your water supply? No

If so, please give a brief description of such plans, ideas or concepts:

Do you think that your community should consider the possibility of using water provided by a source serving the Pullman-Moscow urban area (assuming that such a scheme was economically feasible)? No

If so, when might your community need the water? ____________

Would you like to discuss this matter in more detail with a representative of our firm? No

Please provide any additional comments you wish: ____________

By: /s/ Robert Watts
(Person answering questionnaire)

Mayor
(Position)

P-MWRC QUESTIONNAIRE
BY
STR ENGINEERS/PLANNERS

Name of Community: Palouse

Does your community have any current plans, ideas or concepts concerning the expansion or replacement of your water supply? ______

If so, please give a brief description of such plans, ideas or concepts:

Our water meter count has increased from 350 to 400+ in two years. Our pumps were running at 100% capacity last summer. We are making plans to systematically replace the whole system a little at a time. We have 500,000 storage and are looking into building another storage tank. So, yes we are interested in more water. Per capita water consumption is up also.

Do you think that your community should consider the possibility of using water provided by a source serving the Pullman-Moscow urban area (assuming that such a scheme was economically feasible)? Yes

If so, when might your community need the water? 5 years

Would you like to discuss this matter in more detail with a representative of our firm? Yes

Please provide any additional comments you wish: ______

We cleaned out sand last year which increased our capacity somewhat. We also lowered the pump 20 feet. We have one drilled well plus an artesian well that we use in the summer.

By: /s/ Leo J. Schmidt
(Person answering questionnaire)

Mayor
(Position)

P.S. - Council meet 1st Tuesdays 7:30 PM

P-MWRC QUESTIONNAIRE
BY
STR ENGINEERS/PLANNERS

Name of Community: Uniontown, Washington

Does your community have any current plans, ideas or concepts concerning the expansion or replacement of your water supply? Not at this time

If so, please give a brief description of such plans, ideas or concepts:

Do you think that your community should consider the possibility of using water provided by a source serving the Pullman-Moscow urban area (assuming that such a scheme was economically feasible)? Not at this time

If so, when might your community need the water? ________

Would you like to discuss this matter in more detail with a representative of our firm? No

Please provide any additional comments you wish: ________

By: /s/ Maurice Moneymaker
(Person answering questionnaire)

Mayor
(Position)

P-MWRC QUESTIONNAIRE
BY
STR ENGINEERS/PLANNERS

Name of Community: Colton

Does your community have any current plans, ideas or concepts concerning the expansion or replacement of your water supply? No

If so, please give a brief description of such plans, ideas or concepts:

Do you think that your community should consider the possibility of using water provided by a source serving the Pullman-Moscow urban area (assuming that such a scheme was economically feasible)? No

If so, when might your community need the water? ______

Would you like to discuss this matter in more detail with a representative of our firm? Not at present

Please provide any additional comments you wish: ______

By: /s/ Delbert Meyer
(Person answering questionnaire)

Councilman
(Position)