YAKIMA RIVER BASIN
WATER ENHANCEMENT PROJECT
WASHINGTON

PHASE 1
STUDY TEAM REPORT

TO

REGIONAL DIRECTOR
BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION

DIRECTOR
DEPARTMENT OF ECOLOGY
STATE OF WASHINGTON

AUGUST 1982

United States Department of the Interior
WATER AND POWER RESOURCES SERVICE
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY
REFER TO: PN 780

AUG 26 1982

123.-

Memorandum

To: Regional Director, Boise, Idaho

From: Yakima River Basin Water Enhancement Project Study Team, Boise, Idaho

Subject: Study Team Report--Phase 1 Yakima River Basin Water Enhancemet Project (YRBWEP)

Enclosed is the study team's report on Phase 1 of the YRBWEP feasibility study.

The report summarizes problems and needs, potential plan elements, and includes a demonstration plan for the basin to see if study objectives could be met by a plan that would be economically justified. The report also includes the study team's conclusions and recommendations for your consideration regarding further study activity on the project.

Gary Kittenman

Enclosure

United States Department of the Interior
WATER AND POWER RESOURCES SERVICE
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY
REFER TO: PN 780
123.-

AUG 26 1982

Mr. Don Moos
Director, Department of Ecology
Mail Stop PV-11
Olympia, Washington 98504

Dear Mr. Moos:

Enclosed is the study team's report on Phase 1 of the Yakima River Basin Water Enhancement Project (YRBWEP) feasibility study.

The report summarizes problems and needs, potential plan elements, and includes a demonstration plan for the basin to see if study objectives could be met by a plan that would be economically justified. The report also includes the study team's conclusions and recommendations for your consideration regarding further study activity on the project.

Sincerely yours,

Gary Kittenman

Yakima River Basin Water
Enhancement Project Study Team

Enclosure

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

MAPS AND GRAPHICS

INTRODUCTION

This study team report summarizes the progress of the Yakima River Basin Water Enhancement Project (YRBWEP) feasibility study through the preliminary studies (Phase 1) and provides study team conclusions and recommendations. Maps and other graphics supporting the report are appended.

PURPOSE AND AUTHORITY

The purpose of the YRBWEP feasibility study is to ascertain if there are means to alleviate problems and provide for needs related to water resource development and use in the Yakima River basin. The primary objectives of the study are to (1) provide supplemental water to presently irrigated lands, (2) provide water to new lands on the Yakima Indian Reservation, (3) provide water for increased instream flows for aquatic life, and (4) develop a comprehensive plan for the basin to enable efficient management of the existing water supplies. A secondary set of objectives exists which would be addressed only if there are no conflicts with the primary objectives. Secondary objectives include increased hydroelectric power generation, improved municipal and industrial water supplies, new irrigation on nonreservation lands, improved flood control, enhanced water quality, enhanced wildlife, and increased recreational opportunities. If an acceptable plan meeting these objectives can be put together, a recommendation would be made to Congress and to the State legislature to take actions necessary to implement the plan.

The YRBWEP feasibility investigation was authorized by Congress in Public Law 91-162, December 28, 1979. The State of Washington supports the study and has provided $500,000 to help fund the investigation (Substitute Senate Bill 2504, Chapter 263, Laws of 1979, 1st Extraordinary Session).

STUDY ORGANIZATION

The YRBWEP feasibility investigation is being conducted in two phases. In Phase 1 the problems and needs have been documented and plan elements identified and evaluated at a preliminary level using existing data. The primary purpose of this phase has been to determine if detailed studies are warranted. If so, Phase 2 could be initiated to conduct detailed studies of the most promising plan elements to emerge from the preliminary studies and to formulate and evaluate a development plan. Phase 2 would conclude with a feasibility report for public review and possible subsequent congressional and State consideration for implementation.

The study team is composed of Bureau of Reclamation personnel with expertise in hydrology, engineering, economics, sociology, recreation planning, environmental science, and Reclamation policy and planning procedures. The study team also includes one member of the Washington State Department of Ecology. Contact with interested State and Federal agencies and with the Yakima Indian Nation has been maintained throughout the study.

Public participation in this planning effort is considered essential, and throughout the planning process the study team has maintained contact with identified publics. Five newsletters were published to provide the public with an opportunity to comment on the problems and issues that have been identified, the potential plan elements, and the screening process used to evaluate the potential storage sites. The newsletters also attempted to answer concerns voiced at public meetings and through letters of comment.

Three sets of public meetings (June 1981, September 1981, and April 1982) were held to provide the public with an opportunity to communicate directly with the study team. The first public meetings were directed at verification of problems and needs, and the second meetings were directed at quantification of needs and identification of potential plan elements. The third set of meetings were workshops to allow the public to evaluate sample plans and to voice opinions on the acceptability of various potential plan elements. Other meetings were held during the course of Phase 1 with interest groups and individuals to provide information or answer concerns.

SETTING

The Yakima River basin, located in south-central Washington, covers an area of about 6,000 square miles or about 4,000,000 acres. The basin centers around the city of Yakima and includes most of Yakima, Kittitas, and Benton Counties. Topography is characterized by a series of long, rather hilly ridges extending eastward from the Cascades and encircling flat valley areas. Elevations in the basin range from over 12,000 feet in the Cascades to about 350 feet at the confluence of the Yakima and Columbia Rivers.

The Yakima River and its tributaries drain the area. The Yakima River heads near the crest of the Cascade Range, above Keechelus Lake at elevation 2517 and flows for 175 miles generally southeastward to its confluence with the Columbia River near Richland. Major tributaries include the Kachess, Cle Elum, and Teanaway Rivers in the north and the Naches River, which has two major tributaries--Bumping and Tieton Rivers. Ahtanum, Toppenish, and Satus Creeks join the river in the lower portion of the basin. Natural runoff for the basin above Parker averaged about 3.5 million acre-feet annually over the period 1940-76. Natural runoff usually peaks in May and June and drops to its lowest point in August.

The Yakima Project is primarily an irrigation project with hydroelectric power generation, an associated function. Project reservoirs do provide incidental flood control and recreation benefits, and project operation does provide some flows for fish.

The water supply for the Yakima Project comes from natural flow, storage, and return flows. The six Federal reservoirs in the basin which help regulate this supply have a total storage capacity of 1,070,000 acre-feet--Bumping Lake (33,700 acre-feet), Keechelus Lake (157,800 acre-feet), Kachess Lake (239,000 acre-feet), Cle Elum Lake (436,900 acre-feet), Rimrock Lake (198,000 acre-feet),

and Clear Lake (5,300 acre-feet). Other principal features include several diversion dams, two hydroelectric generating plants. canals, laterals, and pumping plants. The Yakima River basin schematic shows the major tributaries and diversions.

About three-fourths of the present storage capacity of the Yakima basin is in the upper Yakima drainage (Lakes Keechelus, Kachess, and Cle Elum). One-fourth of the storage capacity occurs in the upper Naches drainage (Bumping, Clear, and Rimrock Lakes). Upper Yakima reservoirs meet water supply needs in the valley above the Yakima-Naches Rivers confluence and are the main suppliers of storage water to the large irrigation districts in the lower valley. The upper Naches reservoirs provide storage releases to irrigation development in the lower Naches Valley and make a small contribution to the irrigation developments in the lower Yakima Valley. Return flows from irrigation developments in the upper valley are major contributors to some lower valley irrigators.

The six project reservoirs are the key to the regulation and utilization of the Yakima basin water supply. Operation of these reservoirs provides the control necessary to meet the basin's irrigation needs by the storage of winter and spring runoffs for subsequent use during the months of July, August, and September when natural runoff is low and irrigation demands are high. The carryover of water supplies in storage from one irrigation season to the next is an essential ingredient in assuring a continued supply in water deficient years.

The 1945 Consent Decree provides for the allocation of the available water supply in the Yakima Valley to meet the irrigation needs of the parties to the decree. In years of sufficient water supply, it is not necessary to apply the provisions of the decree since there is adequate water to meet the needs of all parties; in water deficient years the decree is the essential tool in distributing the available water supply. The available water supply for purposes of the decree is defined as the natural flows, stored waters, and return flows. Some of the parties to the decree hold what are referred to as nonproratable rights, others hold proratable rights, and others have a combination of these rights. Under the decree, any deficiency in the available water supply is first assessed against the proratable rights. The amount of water which the holders of proratable rights will receive is thus variable, depending upon the type of water year, while the holders of nonproratable rights receive a consistently firm supply unless the total available supply is not sufficient to satisfy even the nonproratable rights, in which event they too would have less than a full water supply.

In recent years the Federal Court has ordered instream flows in specific river reaches to protect anadromous fish spawning and rearing. These orders are considered to be an interim action until a more permanent solution is reached. An annual operating plan is developed each year to meet project authorizations and institutional constraints. Some annual changes or modifications based on court or informal agreements are expected to continue in the absence of adjudication or other solutions.

PROBLEMS AND ISSUES

The problems and issues addressed in this study were identified from previous studies, reviewed in newsletters sent to the public, and confirmed at public meetings and by written comments in response to newsletters. Additional detail and quantification of needs were obtained through discussions with basin residents; contact with appropriate Federal, State, and local agencies; and limited fieldwork.

Water Shortage on Presently Irrigated Lands

At present, about 550,000 acres of land are irrigated in the Yakima River basin. Of this total irrigated acreage, about 190,000 acres with proratable water rights and about 20,000 acres of other lands are short of water in varying degrees during dry periods.

The estimate of the need for supplemental irrigation is dependent on the definition of a full water supply and what shortages would be acceptable. In Phase 1 the full water supply is defined as the existing or recognized entitlements and water rights in the basin. The State of Washington is at present conducting an adjudication of water rights and may adjudicate water on the basis of beneficial use. In some cases, there is indication that existing entitlements exceed beneficial use. If so, the adjudicated water rights in the future could be less than existing entitlements. The acceptable shortage definition used for Phase 1 is based on what would be economically tolerable for general crops. The Yakima basin, however, includes many specialty crops, so if Phase 2 is intitiated, a detailed examination would be made to determine economically tolerable shortages based on actual cropping patterns.

On the basis of the foregoing definitions, it was determined that there is a need for an estimated 150,000 to 200,000 acre-feet of storage to reduce shortages to an acceptable level. A change in these definitions is likely and could lead to a greatly altered estimate of the need for supplemental irrigation water.

New Irrigation Development on the Yakima Indian Reservation

The Yakima Indian Nation is interested in protecting its claims to diversionary water rights and developing new irrigation on the Yakima Indian Reservation. Development of about 36,000 acres is being considered in this study, of which some 24,000 acres are presently drylands. An estimated 200,000 acre-feet of storage would be needed to meet these demands.

Anadromous Fish

Anadromous fish populations in the Yakima basin have declined. Today, annual spawning runs, including spring chinook, fall chinook, coho salmon, and steelhead trout, are estimated at 2,000 fish. Steelhead trout account for about one-half of the population, spring chinook account for about one-fourth

of the population, and the remainder is composed of fall chinook and coho salmon. The primary reasons for the decline and continued low populations are inadequate instream flows at times and excessive flows at other times in the Yakima River and tributaries. Minimum and optimum instream flow needs for fishery enhancement were identified for various stream reaches. These preliminary recommendations were developed in cooperation with Federal and State fish and wildlife agencies and are based on existing data and professional judgments. The daily average minimum and optimum flow recommendations for various stream reaches are shown in table 1.

Table 1.--Recommended Daily Average Minimum and Optimum Instream Flows (Listed in Approximate Order Going Downstream)

Stream Reach	Minimum Flow	Optimum Flow
	ft^3/s	ft^3/s
Yakima River near Martin	50	100
Kachess River near Easton	30	90
Yakima River near Easton	150	285
Cle Elum River near Roslyn	95	280
Teanaway River below Forks[1/]	65	125
Yakima River at Cle Elum	210[2/]	625
Yakima River near Umtanum	250	730
Bumping River[1/]	60[3/]	120[3/]
Little Naches River[1/]	30	90
Rattlesnake Creek[1/]	15	45
Naches River above Tieton River confluence	120	365
Tieton River below Tieton Diversion Dam	55	170
Naches River below Tieton River confluence	180	530
Yakima River at Parker	400	1,355
Yakima River at Prosser	560	1,680
Yakima River at Kiona	560[4/]	1,680

1/ Can be provided only if storage is constructed on the drainage
2/ 400 ft^3/s from October 15 to March 1
3/ Without enlargement of Bumping Lake the flows would be 30 ft^3/s minimum and 90 ft^3/s optimum.
4/ From April 15 to June 30 and October 1 to November 15 the minimum flow would be 1,200 ft^3/s.

The storage required to meet the minimum recommendations totals 300,000 acre-feet. Approximately 450,000 acre-feet of storage could provide instream flows midway between minimum and optimum recommendations for about

three-fourths of the time. The amount of storage needed to provide flows midway between minimums and optimums all of the time or for optimum flows all of the time would be much greater and was not calculated.

Other problems include high fishing pressure; poor, lacking, or improperly maintained fish passage facilities; and unscreened or inadequately screened diversions. If minimum instream flow needs and adequate fish passage and protective facility needs are met in the basin, it is estimated that an annual spawning run of 68,000 fish could be realized. Spawning runs of about 100,000 could be expected if enhanced flows (flows midway between recommended minimums and maximums for about three-fourths of the time) were substituted for minimum flows. Annual addition of about 715,000 pounds of hatchery produced smolts to the Yakima River system combined with enhanced flows and fish passage facilities would provide a potential spawning run of 138,000 fish. Total harvest including sport, Indian, and commercial fisheries would be 2.6 million pounds for 68,000 spawners, 3.7 million pounds for 100,000 spawners, and 5.1 million pounds for 138,000 spawners.

Resident Fishery

The resident fishery of the basin generally is considered poor. Present conditions are largely the result of inadequate instream flows to maintain game fish and aquatic invertebrate populations. Other factors include large fluctuations of flows below reservoirs and diversions, very low drafts and lack of minimum pools in some reservoirs, degraded water quality, and unscreened diversions.

Hydroelectric Power

Although projections of the growth rate in electric power demand have declined, power deficits continue to be predicted for the Pacific Northwest power system in the 1990's and beyond. Also, power self-sufficiency continues to be a national objective. A need exists to develop renewable resource power facilities, such as hydroelectric powerplants, especially where environmental effects would be minimal.

Municipal and Industrial Water Supplies

Water supplies for all communities in the basin, except for the city of Yakima, are considered adequate for the present and estimated future expansions. In Yakima the existing supply is considered adequate to meet a present average daily demand of 9,960,000 gallons but too small to meet future growth. By 1990, municipal and industrial requirements of Yakima are expected to surpass the existing supply and capacity of the system. The increase in average daily water use above 1980 levels is projected to be 1,100,000 gallons in 1990, 2,440,000 gallons in 2000, and 4,520,000 gallons in 2010. An additional water supply of about 3,400,000 gallons per day would be needed to meet 2010 needs.

During low flow periods the city of Yakima is unable to divert its full water right because of physical limitations. This problem can be solved by maintaining sufficient instream flows for use of present facilities or by redesigning new facilities capable of diverting the full water right at lower flows.

Flood Control

Average annual flood damages in the Yakima basin are estimated by the Corps of Engineers at $3,888,000 and occur primarily in the low lying lands below Yakima (see table 2). Cost-effective methods of reducing flood losses are needed.

Table 2.--Average Annual Flood Damages Anticipated in the Yakima River Basin

River Reach	Damages
	dollars
Easton to Thrall (Ellensburg)	192,000
Thrall to Selah Gap (Selah)	28,000
Selah Gap to Union Gap (Yakima, Union Gap)	2,220,000
Union Gap to Mabton	640,000
Mabton to Columbia River (Benton City, Richland, and West Richland)	112,000
Teanaway River Valley	132,000
Naches River Valley	282,000
Ahtanum Creek Valley	42,000
Toppenish Creek Valley	120,000
Satus Creek Valley	120,000
Total	3,888,000

Water Quality

Water quality in the lower reaches of the Yakima River and tributaries is severely degraded. Standards set for acceptable levels of fecal coliform, temperature, turbidity, nitrates, and orthophosphates are exceeded at times in all reaches of the river below the towns of Cle Elum and Naches. The most severely affected reaches are below Sunnyside Dam where recommendations and standards on dissolved oxygen, nitrites, and ammonia concentrations cannot be met. Nonpoint source pollution appears to be the major factor causing reduced water quality.

There is a need to improve agricultural practices and water management to reduce pollution from agricultural sources. In addition, the treatment plants at Prosser, Snoqualmie Pass, West Richland, Ronald, and Roslyn need to be improved to meet 1983 effluent limitations.

Wildlife

The most significant wildlife problem is the loss of habitat. While irrigation originally increased habitat for pheasants and Hungarian partridges and some other species, urban and suburban growth and intensive farming practices have reduced the amount and value of that habitat. Also, improvements in irrigation systems in recent years which are intended to conserve water have further depleted habitat by reducing canal seepage and waste water that supported riparian vegetation. Large canals can also affect wildlife by blocking migration. Attempts to cross canals can result in injury or the death of the animals.

In addition to these general problems, the water supply for the Toppenish National Wildlife Refuge is inadequate and needs to be supplemented.

The primary wildlife need in the basin is to protect and preserve existing habitat. Also, enhancement of existing habitat where possible would be desirable.

Recreation

Although the recreational resources of the Yakima basin are extensive, the demands on the resource are also large because of proximity to the Puget Sound metropolitan area. Projections show recreation demand will increase 28 percent in the next 20 years. A demand of this magnitude would indicate a need for a substantial increase in campsites, picnic tables, and boat launch lanes.

New Irrigation Development of Nonreservation Lands

An extension of the existing Kennewick Division has been identified as a potential for new land development. The Kennewick Irrigation District is independently studying the development of lands located between Benton City and Richland.

There are other tracts throughout the basin that may have irrigation development potential, but their scattered nature and location makes many of these lands unsuitable for project-type development because of water supply and economic considerations. The need for new irrigation off the Yakima Indian Reservation would be further evaluated if Phase 2 proceeds.

RESOURCE CAPABILITY

With existing water resource development, operated under present institutional constraints, irrigation needs of the basin cannot be fully met about 30 percent of the time, and instream flows for fish are inadequate in some reaches in most years. In good water years the water supply with present development is sufficient for most if not all irrigation and instream flow

needs. In drier years, present storage is inadequate to provide the needs of those with proratable rights, and streamflows in many reaches fall below recommended minimum levels. During the driest years or during a series of dry years, water supply becomes critical because the basin reservoirs provide very little carryover storage from one year to the next.

Conservation measures including lining canals, addition of control structures, and onfarm improvements could reduce shortages for irrigators and could also improve water supplies for instream flows. Institutional changes including adjudication or reallocation of water supplies could also help. However, improving resource use through conservation measures and institutional changes would not meet all irrigation and instream flow needs with the present level of storage development.

The undeveloped water resources of the basin, if developed, appear capable of meeting all existing and future needs. Use of the undeveloped resource requires development of additional storage to control runoff and provide carryover for dry years. To meet all irrigation and instream flow needs, additional storage would need to be developed in the upper Naches River drainage. A minimum of 450,000 acre-feet of storage would be needed to meet supplemental irrigation needs and minimum instream flow recommendations--150,000 acre-feet for irrigation, and 300,000 acre-feet for instream flows. An additional 150,000 acre-feet for a total of 600,000 acre-feet would be needed to meet supplemental irrigation needs and provide enhanced flows for fish (midway between minimums and optimums for about three-fourths of the time). Greater operational flexibility would be achieved if more than one new reservoir was developed and if part of the new storage was located on the upper Yakima River drainage.

The total amount of storage needed to meet supplemental irrigation and instream flow objectives could be reduced by 50,000 to 60,000 acre-feet if the East Selah reregulating reservoir was constructed. The total storage need could be reduced an additional 60,000 to 80,000 acre-feet if water conservation measures were instituted that would improve irrigation efficiency by 4 percentage points.

New irrigation development on the Yakima Indian Reservation could be served from storage developed in any part of the basin upstream from the reservation or by development of storage on the reservation. On the basis of economics and the physical position of reservation lands in relation to water courses, development of water supplies on the reservation would be preferable. Development of about 200,000 acre-feet of storage within the reservation would provide an adequate supply for about 36,000 acres. The potential for ground-water development to meet irrigation needs on the reservation is limited and is not capable of meeting the needs entirely. Integrated use of ground water and storage would increase the amount of land that could be served from reservation resources. Development of new irrigation on the reservation would not conflict with other study objectives related to instream flow improvement and supplemental irrigation water.

MEASURES TO MEET NEEDS

Identification

A variety of potential measures were identified including storage and stream reregulating reservoirs, facilities such as fish screens and ladders, instream flow improvements, recreation facilities, water conservation measures, and other measures to improve efficiency of water use and control. These potential measures were identified from previous studies and through public participation in the study process. Estimated costs provided in this section are based on a July 1982 price level. A list of potential measures including 35 storage sites was eventually compiled.

Because the list of potential storage sites was large and many of the sites appeared to lack real potential, a two-step screening process was used to evaluate the sites and eliminate those with the least potential for development. In the first step of the process, sites were screened on the basis of four evaluation factors--(1) economic aspects, (2) legal/institutional aspects, (3) social aspects, and (4) environmental aspects. Potential storage sites not compatible with these evaluation factors were discarded.

In the second step, storage sites that were considered to be alternatives were arrayed together and ranked. The highest ranked alternative site was kept and the other alternatives discarded. Eleven sites remained after the screening process was completed.

A further evaluation of storage sites and other potential plan elements was made following public workshops. Five sample plans were developed to be presented to the public for comment on the potential plan elements and means of meeting basin needs. The five plans were formulated so that accomplishments related to supplemental irrigation, new irrigation, and fish enhancement would be nearly the same for each; instream flows and hydropower generation of one plan were considerably less than for the other four plans. The primary difference among the plans was the way supplemental irrigation water supply needs would be met. In four of the plans, supplemental irrigation needs would be met through various combinations of new storage using 9 of 11 sites that emerged from the screening process. The fifth plan would use water conservation measures and various nonstructural means to meet some of the supplemental irrigation needs. These plans were presented at public workshops held in Ellensburg, Yakima, and Prosser, Washington.

As a result of public expressions during and following the workshops, one storage site was eliminated and one site discarded in the screening process was reinstated. Table 3 shows the storage sites that were eliminated from further consideration and the reason for elimination.

Table 3.--Potential Storage Sites Discarded During Phase 1

Name	Stream	Reason for Elimination
Bakeoven	South Fork Tieton River	Cost
Casland	North Fork Teanaway River	Cost
Cooper Lake	Cooper River	Cost, wilderness impacts
Cowiche	South Fork Cowiche Creek	Cost
Dog Lake	Clear Creek	Cost
Hole in the Wall	Dry Creek	Cost
Horseshoe Bend	Naches River	Cost, geological problems, anadromous fish passage problem
Hyas Lake	Cle Elum River	Cost, wilderness impacts
Little Rattler	Rattlesnake Creek	Cost, inundates big game winter range and resident fishery
Lost Meadow	Little Naches River	Cost
Lower Canyon	Yakima River	Cost, anadromous fish passage problem
Manastash	Manastash Creek	Cost
Mile Four	Rattlesnake Creek	Inundates big game winter range and resident fishery
Minnie Meadows	South Fork Tieton River	Cost
Naneum	Naneum Creek	Cost
Pleasant Valley	American River	Inundates anadromous fish habitat, recreation area loss
Rattlesnake	Naches River	Anadromous fish passage problem, social effects problem
Soda Springs	Bumping River	Alternative to Bumping Lake enlargement
Swauk	Swauk Creek	Wildlife impacts
Toppenish	Toppenish Creek	Cost
Upper Canyon	Yakima River	Anadromous fish passage problem
Wapatox	Naches River	Anadromous fish passage problem
Waptus Lake	Waptus River	Cost, wilderness impacts
Wenas	Wenas Creek	Under construction

The potential plan elements including 11 storage sites proposed by the study team for further consideration and evaluation if Phase 2 studies are initiated, are listed in table 4. Some of the plan elements listed in table 4 could be eliminated and other elements identified in Phase 2.

Table 4.--Potential Plan Elements
for Consideration in Phase 2

Plan Elements
Reservoirs
Bumping Lake enlargement
Cle Elum Lake enlargement
Devil's Table
East Selah reregulating
Forks
Horsetail
Rimrock Lake enlargement
Satus
Simcoe
Tampico
Wymer
Hydroelectric powerplants
Water conservation measures
Reallocation of water
Waterbank
Irrigation facilities
Fish passage and protective facilities
Fish hatchery
Wildlife protective and enhancement measures
Recreation facilities
Flood control measures
Municipal and industrial water supply
Water quality improvement
Water management plan

Reservoirs and Hydroelectric Powerplants

The 11 reservoir sites identified for further detailed study in Phase 2 are scattered throughout the Yakima basin (see Potential Reservoir Sites map). Four sites (Bumping Lake and Rimrock Lake enlargements and Devil's Table and Horsetail reservoirs) are located in the Naches River drainage, three sites (Cle Elum Lake enlargement and Forks and Wymer reservoirs) are located in the upper Yakima River drainage, three sites (Satus, Simcoe, and Tampico reservoirs) are located on the Yakima Indian Reservation, and the single reregulating site is located near Yakima (see East Selah Reregulating Reservoir map). Hydroelectric generation facilities are included at all sites except East Selah reregulating, Satus, and Tampico. Hydrologic data including hydroelectric

potential at the 11 reservoir sites are shown in table 5. Specific functions were not identified with individual reservoirs, as any reservoir added to the Yakima system would be operated as an integrated facility with the existing reservoir system to accomplish project objectives. A cost comparison of potential reservoirs is provided in table 6. Powerplant costs for Cle Elum Lake and Rimrock Lake enlargements are not shown because powerplant construction at each site is anticipated in the future and is not dependent on findings of this study.

Table 5.--Hydrologic and Hydroelectric Power Data for Potential Reservoirs

Reservoir	Water Source	Maximum Storage Capacity	Average Annual Runoff	Power-plant Capacity	Hydro-electric Power
		acre-feet	*acre-feet*	*kilowatts*	*average annual kilowatt-hours*
Bumping Lake enlargement	Bumping River	458,000 (424,000 new)	213,000	6,000	23,000,000
Cle Elum Lake enlargement	Cle Elum River	482,000 (45,000 new)	680,000	18,000	49,100,000
Devil's Table	Rattlesnake Creek	50,000	69,000	3,200	12,100,000
East Selah reregulating	Yakima River	3,000 (offstream)	Not applicable	None	Not applicable
Forks	Teanaway River	400,000	260,000	10,800	40,700,000
Horsetail	Little Naches River	143,000	177,000	7,400	27,600,000
Rimrock Lake enlargement	Tieton River	220,000 (22,000 new)	370,000	19,000	51,700,000
Satus	Satus Creek	80,000	105,000	None	--
Simcoe	Simcoe Creek Toppenish Creek	80,000	21,000 39,000	1,700	6,300,000
Tampico	Ahtanum Creek	55,000	65,000	None	--
Wymer	Squaw Creek Yakima River	300,000	25,000 100,000	21,000[1/]	67,800,000[2/]

1/ Includes two powerplants, a 16,800-kW plant at Wymer Dam, and a 4,200-kW plant in the carriage system at potential Manastash tunnel.

2/ Net power production is 34,800,000 kWh; about 33,000,000 kWh would be required to operate Swauk pump used to fill Wymer Reservoir.

Table 6.--Cost Comparison of Potential Reservoirs
(July 1982 Price Level)

Reservoir	Construction Cost		Annual Operation, Maintenance, and Replacement		Storage Cost per Acre-foot of Capacity[1]
	Dam	Powerplant	Dam	Powerplant	
	dollars	*dollars*	*dollars*	*dollars*	*dollars*
Bumping Lake enlargement	150,900,000	9,200,000	100,000	230,000	330
Cle Elum Lake enlargement	60,700,000	--	5,000	--	1,350
Devil's Table	73,000,000	5,200,000	40,000	130,000	1,460
East Selah reregulating	11,000,000	--	56,000	--	Not applicable
Forks	255,000,000	10,100,000	105,000	200,000	640
Horsetail	95,700,000	9,390,000	60,000	235,000	670
Rimrock Lake enlargement	31,000,000	--	5,000	--	1,410
Satus	85,000,000	--	45,000	--	1,060
Simcoe	66,000,000	2,700,000	45,000	85,000	830
Tampico	101,000,000	--	360,000	--	1,840
Wymer	292,200,000	19,600,000[2]	100,000[3]	390,000[4]	970[5]

1/ Includes all costs for construction of dam and associated facilities (but does not include power generation or irrigation distribution system costs) divided by total active capacity for new reservoirs and added capacity for enlargements; cost per acre-foot of actual yield would be higher

2/ Includes $15,100,000 for powerplant at dam and $4,500,000 for powerplant at outlet of Manastash Tunnel

3/ Includes Swauk pumping plant--$12,000,000, Kittitas Reclamation District Canal enlargement and improvement--$11,700,000, and Manastash Tunnel--$38,000,000, which are facilities required to fill Wymer Reservoir

4/ Includes $300,000 for powerplant at dam and $90,000 for powerplant at outlet of Manastash Tunnel

5/ Includes $359,000 for Swauk pumping plant (includes power) and $51,000 for Kittitas Reclamation District Canal improvement and enlargement and Manastash Tunnel

Water Conservation Measures

Many of the existing irrigation canal systems are old and could be rehabilitated and modernized. Water losses could be reduced through measures such as lining canals and adding water control structures. The potential to save water by improving carriage system efficiency exists, and improvements would result in a net decrease in diversions. However, reduction of diversions at some points would reduce return flows, and water savings would be partially offset by increased diversion requirements in other areas that normally depend on those return flows. An additional consideration is that seepages from canals provide wildife habitat that could be lost if canals are lined.

Data are not available to make accurate estimations for water savings through improved carriage system efficiency, but rough estimates have been made. These rough estimates indicate that a major reduction in canal losses could be achieved by lining about 25 percent of the canal reaches and adding control structures. Total carriage efficiency would be expected to improve from the present 80 percent to 85 percent after the improvement, with a reduction in annual diversion of about 120,000 acre-feet. This diversion reduction is not the same as water savings because of water reuse and in most years the supply exceeds needs. Before any significant volumes of water could be effectively controlled for use, storage would be needed to make that water available during the months when it is required for fish flows or other uses. To provide this storage would require agreement with the present owners of storage space in existing reservoirs or development of new storage in the system. A diversion reduction of 120,000 acre-feet would be equivalent to development of 50,000 to 80,000 acre-feet of new storage. Capital costs for making such improvements are estimated at $80,000,000.

Onfarm improvements are other potentials for saving water through improved efficiency. Onfarm improvements could include ditch and gate modifications, tailwater recovery ponds, ditch realinement, and land leveling where surface irrigation systems are retained. Closed pipe delivery systems could also be installed to improve onfarm efficiency. Conversion from gravity to sprinkler or drip application probably would result in the most savings but would involve an annual pumping charge, as few areas in the basin provide an opportunity for gravity pressure systems. If a 5-percent efficiency improvement could be achieved in the Yakima basin through onfarm changes, the annual diversion would be reduced about 180,000 acre-feet. This reduction would provide about the same benefits as development of 75,000 to 100,000 acre-feet of new storage.

The cost of making onfarm changes would vary widely depending on the exact changes made and how extensive the changes were throughout the basin. For comparative purposes the total capital cost for conversion of all irrigated land not presently under sprinkler irrigation (about 416,000 acres) to sprinkler application would be about $208,000,000. Annual operation, maintenance, replacement, and power costs would be an additional $9,987,000, about $24 per acre.

Onfarm improvements would be the responsibility of farm operators, and funding would need to be from sources other than the Federal Reclamation Project Program.

Reallocation of Water

Several reallocation potentials exist. State adjudication of the Yakima basin could alter the supply to which each water user is entitled. Reallocation possibilities should be investigated.

Waterbank

A potential plan element is waterbanking, which is the short-term exchange of water between willing sellers and willing buyers with the objective of redistributing water supplies to minimize losses and damages caused by drought. Establishment of a waterbank would have no effect on instream flows and water supplies, as water would not be saved but only redistributed during periods of shortage; i.e., a farm operator could decide to not grow annual crops one season and sell his unused water to another farmer. The most effective way to handle this type of exchange would be through a third party or "banker." In the Yakima basin the third party could be the Bureau of Reclamation, the Washington State Department of Ecology, or an independently established entity.

Implementation of a waterbank may require changes in existing water laws to allow temporary transfer of water distribution among users.

Irrigation Facilities

The irrigation facilities identified in Phase 1 are representative of new development that could be accomplished on the Yakima Indian Reservation. Any new development on the reservation will depend upon direction from the Yakima Indian Nation. Also identified are facilities that could additionally provide a supplemental supply to some lands adjacent to the reservation. Since this could be accomplished with very little added cost, these lands have been included in the discussion. The facilities have been arranged in three groups for cost analysis and are referenced by service area (see Potential Irrigation Service Lands map).

Satus

A pressure pipe distribution system could be constructed to serve about 10,000 acres up to elevation 1300 feet on the slopes above the existing Satus Unit of the Wapato Project. Such a system would include buried pipelines, pumping plants on Satus reservoir, booster pumping stations, and field irrigation systems. These facilities would deliver water for sprinkler irrigation.

Construction costs for this distribution system are estimated at $52,000,000. The total annual operation, maintenance, replacement, and power costs are estimated at $1,150,000, which includes $850,000 for power.

Simcoe

A canal carriage system, buried pipe laterals, two diversion dams, a pumping plant, and several wells could provide a supplemental water supply to about 8,000 acres and serve about 11,000 acres of new lands. About 14,000 acres of these lands are in the vicinity of White Swan and would be served through an open canal and pipe laterals. About 5,000 acres of new lands would be located on the south slope of Ahtanum Ridge and would receive a water supply through a new south slope canal. Water now used for the Wapato Irrigation Project would be pumped from the existing Wapato Canal to the new south slope canal to serve the 5,000 acres. Replacement water for the Wapato Irrigation Project would be provided by constructing wells and pumping ground water.

Simcoe reservoir normally would be filled from Simcoe Creek flows and by diverting flows from Toppenish and Agency Creeks to a canal to be constructed from Toppenish Creek to Simcoe reservoir. During dry years, water could be diverted from the Yakima River to the existing Wapato Canal and pumped to the new south slope canal to help fill Simcoe reservoir. Use of excess flow in the Yakima River during the nonirrigation season would improve the water supply and could reduce the size of Simcoe reservoir.

Construction costs for these facilities are estimated to total $40,900,000. Annual operation, maintenance, replacement, and power costs are estimated at $690,000, of which about $298,000 is for power.

Ahtanum

A pressure pipe distribution system could serve about 7,300 acres on the south side of Ahtanum Creek (2,600 acres of new lands and 4,700 acres of existing irrigation). Such a system would include pipelines and pumping plants to deliver water to farm units at sprinkler pressure. About 8,100 acres of presently irrigated land on the north side of Ahtanum Creek would receive water from Tampico reservoir and would be served through the existing open ditch system.

The total construction cost for the irrigation distribution system is estimated at $16,408,000. Annual operation, maintenance, replacement, and power costs are estimated at $360,000, which includes $37,000 for power.

Fish Passage and Protective Facilities

A variety of potential facilities including fish ladders, bypasses, screens, barriers, and low flow channels were identified in cooperation with Federal and State fish and game agencies. Potential facilities for inclusion in plans are shown in table 7, and locations are indicated on the Fish Passage and Protective Facilities map.

Table 7.--Potential Fish Passage and Protective Facilities
(Listed in Approximate Order Going Downstream)

Site	Facility
Easton Diversion Dam	1 ladder, fish screens, bypass
Westside Canal Diversion	Fish screens, bypass
Thorp Mill Diversion	Fish screens, bypass
Town Diversion Dam	1 ladder, fish screens
Roza Diversion Dam	1 ladder, fish screens, bypass
Stevens Ditch Diversion	Fish screens, bypass
Naches/Cowiche Diversion	1 ladder
Roza Powerplant Wasteway	Fish barrier
Wapato Diversion Dam	3 ladders, improve bypass
Old Reservation Canal Diversion	Fish screens
Sunnyside Diversion Dam	3 ladders
Snipes/Allen Diversion	Fish screens, bypass
Toppenish Creek Diversion	1 ladder, fish screens, bypass
Marion Drain Diversion	1 ladder
Toppenish Creek/Satus Unit Diversion	1 ladder, fish screens, bypass
Satus Creek Diversion Dam	1 ladder, fish screens, bypass
Prosser Diversion Dam	1 ladder, low flow channel
Horn Rapids Diversion Dam	2 ladders

The estimated construction cost for all the fish passage and protective facilities is $12,900,000. Annual operation, maintenance, and replacement costs for these facilities are estimated at $129,000.

Other potential fishery protective elements include establishment of a minimum pool in Rimrock Lake and regulation of flow releases from storage facilities for improved habitat.

Fish Hatchery

A fish hatchery to produce anadromous fish smolts for Yakima River basin streams is included as a potential plan element. The hatchery could be located within or outside the basin and could produce fish for other purposes at times. Hatchery produced smolts added to Yakima River basin streams would augment fish passage facilities and improved instream flows to enhance the anadromous fishery. A hatchery capable of supplying about 715,000 pounds of anadromous fish smolts each year appears to be an optimum size. The estimated construction cost is $30,000,000. Annual operation, maintenance, replacement, and power costs are estimated at $1,600,000.

Wildlife Protective and Enhancement Measures

Potential wildlife measures include providing water for wildlife areas, establishment of wildlife food plots, purchase of easement or title to some riparian lands, goose nesting facilities, and protective facilities along some irrigation canals. Costs associated with these measures and facilities have not been estimated.

Recreation Facilities

Potential recreation elements include boat ramps, campgrounds, and picnic facilities at newly developed reservoirs. Specific facilities would depend on the reservoir sites selected for development.

Flood Control Measures

Flood control functions would be included at new reservoirs, but identification of exclusive or joint use with specific reservoir sites has not been made at this time. Channel improvements, which could include brush removal and channel deepening in some reaches of the lower Yakima River, would improve floodwater passage. Exact river reaches and cost estimates for channel improvements would require more detailed study.

Municipal and Industrial Water Supply

Some storage space at new reservoirs in the Naches drainage could be used for municipal and industrial use. Specific facilities and allocation of space in specific reservoirs have not been identified at this preliminary stage of planning. Meeting minimum instream flow recommendations would assure that the city of Yakima would be able to divert its water supply using existing facilities.

Water Quality Improvement

Instream flows for protection and enhancement of fish and other aquatic organisms would improve water quality. It is possible that additional streamflow could be provided in some river reaches to achieve additional dilution effect and further improve water quality.

Water Management Plan

It is expected that the present practice of developing an annual operating plan for the basin will continue until the YRBWEP study is completed. If Phase 2 proceeds, a comprehensive water management plan would be developed and would be based on facilities and institutional changes in any recommended plan.

DEMONSTRATION PLAN, COST ALLOCATION, AND REPAYMENT

Various potential plan elements were combined to see if study objectives could be met by a plan that would be economically justified. Plan elements were selected that would achieve major study objectives, costs and benefits were analyzed, and plan components were adjusted to reach a demonstration plan in which benefits would exceed costs. The demonstration plan includes three reservoirs, fish enhancement and protective facilities, a fish hatchery, irrigation carriage system improvements, a waterbank, recreation facilities, and powerplants at new reservoirs. The reservoirs included are Bumping Lake enlargement (256,000 acre-feet of new storage), Forks reservoir (200,000 acre-feet), and East Selah reregulating reservoir (3,000 acre-feet). The fish passage and protective facilities are shown in table 7.

It is recognized that any storage site will have some opposition. Known public opposition exists at both the Bumping Lake enlargement and Forks reservoir sites. These reservoir sites and sizes were used only for the demonstration plan. The purpose of Phase 2 would be to subject reservoir sites and other potential plan elements to further scrutiny on the basis of economic, environmental, and social considerations and public acceptability.

A possible allocation or assignment of costs to different functions is provided for the demonstration plan, and guidelines for repayment of costs assigned to the different functions are discussed.

The demonstration plan does not include facilities for new irrigation development on the Yakima Indian Reservation. New land and some supplemental irrigation on the reservation could require development of up to three new reservoirs with a total storage capacity of about 200,000 acre-feet. New irrigation development on the reservation would be dependent upon direction from the Yakima Indian Nation, and those programs must meet economic, environmental, and social justification tests. Economic justification of proposed new irrigation development in recent studies of other geographic areas has been difficult under current economic criteria. However, if economic benefits are not adequate it may be possible to recognize other benefits related to furthering social and economic well-being on Indian related projects.

Demonstration Plan Accomplishments

The plan provides about 456,000 acre-feet of new storage in the upper Yakima River basin for improved instream flows and to satisfy supplemental irrigation needs. Instream flows midway between minimum and optimum recommendations (see table 1) would be met three-fourths of the time, and minimum recommendations would be met the remaining one-fourth. These flows combined with other plan elements (a fish hatchery and fish passage and protective facilities) would realize an average annual fish spawning return of 138,000 anadromous fish. Resident fish populations would increase with instream flow improvement and reservoir fishery development, and this would result in a substantial increase in angler use over present levels.

Water shortages would be reduced to acceptable levels (as defined in the Phase 1 study) for about 190,000 acres of presently irrigated land needing a supplemental water supply. This includes lands in the Kittitas Reclamation District, Roza Irrigation District, and Wapato Project (see Potential Irrigation Service Lands map).

Powerplants included at Bumping Lake enlargement and Forks reservoir would produce about 50,700,000 kilowatt-hours annually. Other plan accomplishments include increased recreation opportunities and enhanced flood control.

Cost Analysis

The costs of the demonstration plan are based on a July 1982 price level. The estimated construction and annual operation, maintenance, replacement, and power costs are shown in table 8.

Table 8.--Demonstration Plan Costs

Item	Cost
Construction	$410,000,000
Annual operation, maintenance, replacement, and power	$2,500,000

New irrigation development on the Yakima Indian Reservation could range in cost up to $360,000,000 with development considered in this study. Actual costs would be dependent upon the extent of irrigation development desired by the Yakima Indian Nation.

Cost Allocation

A preliminary cost allocation, assignment of costs by function, for the demonstration plan was made to provide an indication of how costs would be distributed among the various beneficiaries. About 76 percent of the total investment costs and a similar proportion of the operation, maintenance, replacement, and power costs would be allocated to the anadromous fishery function, and about 4 percent of the costs would be allocated to the irrigation function. The remaining costs would be allocated to resident fishery, recreation, power, and flood control.

The cost allocation for the demonstration plan is shown in table 9.

Table 9.--Cost Allocation of Demonstration Plan

Item	Function					
	Anadromous Fish	Resident Fish	Irri-gation	Power	Recre-ation	Flood Control
Investment costs (percent)	76	10	4	7	<1	3
Annual operation, maintenance, replacement, and power costs (percent)	76	8	-2 1/	16	<1	<1

1/ *The negative sign indicates a net savings or reduction in costs that would result from increased operating efficiency of the existing Yakima Project. The reduced costs are recognized as a benefit. Whether existing costs would be reduced slightly would depend on how repayment contracts were written.*

Repayment and Cost Sharing

Federally constructed water resource projects require repayment or cost sharing by project beneficiaries for most of the project functions. Some functions under current policy are nonreimbursable; i.e., the Federal Government absorbs the cost, while some functions require full repayment of allocated or assigned costs.

Repayment and cost-sharing policy is presently under review and likely will be revised to accent economic justification and financial feasibility. Emphasis is expected to be placed on greater recovery of development costs from project beneficiaries and repayment within the full ability to repay. Greater emphasis also is expected to be placed on the states to assume more responsibility for financing a part of the project costs.

Current cost-sharing and repayment policies for Federal water projects are shown in table 10.

Table 10.--Current Cost-sharing and Repayment Policies for Federal Water Resource Projects

Function	Related Project Features	Repayment and Cost Sharing
Fish and wildlife		
Anadromous fish	Storage, passage, hatchery	Nonreimbursable under current policy
Resident fish	Storage, passage	25 percent of the costs associated with resident fish enhancement with interest over a 50-year period, plus annual operating costs
Irrigation	Storage, canal lining	Payment of allocated construction costs without interest and annual operating costs up to the user's ability to pay; contract may be for a period of 50 years Indian landowners, under the Leavitt Act, pay annual operating costs; payment of capital costs is deferred
Municipal and industrial water	Storage	Total repayment of allocated costs with interest in 50 years plus annual operating costs
Recreation	Storage, land, and facilities	50 percent of costs associated with recreation with interest over a 50-year period, plus annual operating costs
Power	Storage, powerplant, and associated facilities	Total repayment of construction costs with interest over a 50-year period and annual operating costs
Flood control	Storage	Nonreimbursable under current policy
Historical preservation and archeological salvage	Historical and archeological resources	Nonreimbursable

A preliminary estimate of the annual capital cost for a supplemental irrigation water supply to proratable lands in the existing Yakima Project is $2 to $3 per acre. Repayment obligation of these allocated costs by irrigation interests would be based on the user's ability to pay or the allocated costs, whichever is less.

CONCLUSIONS

The study team has concluded that:

1. An estimated 210,000 acres of irrigated land in the basin experience unacceptable water shortages in dry years. A need exists to reduce shortages to acceptable levels.

The definition of a "full" and an "adequate" water supply are critical to defining supplemental water needs for irrigation.

Present entitlements and water rights along with economically tolerable shortages for general crops were used as the basis for the supplemental water needs quantified above. However, this basis for need will require review if Phase 2 begins. If the ongoing basin adjudication is completed, its findings will serve as the basis for determining supplemental water needs. In the absence of the adjudication, the need as estimated in Phase 1 would be reexamined with consideration of beneficial use and other factors, and the need could be reduced.

2. There may be opportunity for new irrigation development associated with the Yakima Indian Reservation. Three project-type developments have been considered in Phase 1. With these projects, up to 36,000 acres, including 24,000 acres now dry, could have new irrigation service. These projects could require up to 200,000 acre-feet of storage to be obtained by onreservation facilities. This requirement might be reduced through limited ground-water development and surface-water exchange. Development of new irrigation on the reservation would not conflict with other study objectives related to stream-flow improvement and supplemental irrigation water. The Yakima Indian Nation needs to determine the extent of irrigation development it would like to have pursued.

3. Improved streamflows are needed in the basin to preserve and enhance anadromous fish runs. Provision of these flows, combined with improvements in passage and protective facilities, would result in an estimated spawning run of 68,000 fish for minimum flow levels and 100,000 fish for the higher flow level. These runs would be in sharp contrast to the presently estimated run of 2,000 fish. These enhancement levels could be further increased by a supplemental stocking program including hatchery facilities.

A major study item in Phase 2 would be the determination of the timing and frequency of streamflows above recommended minimums that would provide the greatest level of enhancement. In addition, shortage criteria for instream flows during severe drought periods would be considered.

4. Flood control and municipal and industrial water supply needs have been identified during Phase 1. There are opportunities for hydroelectric power generation, enhancement of resident fish and wildlife resources, water quality improvement, and water related recreation development.

5. Phase 1 studies confirm that existing Yakima Project storage facilities and operational flexibility cannot meet the identified water needs. Adjustments to Yakima Project storage operations will continue to be made to accommodate water needs. However, these adjustments must be made within the framework provided by project authorizations, contractual commitments, and court-directed operations.

6. Water conservation has promise for meeting a portion of the basin's water needs provided that adequate regulation of the "saved" water can be achieved with existing or potential storage features. Conservation measures should be pursued and included in any basin development plan to the extent that they are economically justifiable and institutionally acceptable.

7. Waterbanking, or short-term exchange of water between willing sellers and willing buyers with the objective of redistributing water supplies in periods of poor water supply, would be an effective tool in basin water management.

8. Additional facilities are needed in the basin to store and regulate water supplies to meet irrigation, instream flow, and municipal and industrial needs. This capability would be especially important in poor runoff years and under conditions of drought when storage water "carried over" from good runoff years could be made available for critical agricultural and instream flow uses.

An estimated 450,000 acre-feet of storage is needed including 150,000 acre-feet for supplemental irrigation and 300,000 acre-feet to meet minimum instream flow recommendations. An additional 150,000 acre-feet would be needed to provide anadromous fish enhancement beyond that associated with minimum flow levels.

The total amount of storage needed to meet supplemental irrigation and instream flow objectives could be reduced by 60,000 acre-feet if a reregulating facility was developed at the East Selah site. A 4-percentage point increase in irrigation efficiency through improvements to canal carriage systems could further reduce the storage need by 60,000 to 80,000 acre-feet.

9. A large amount of carryover storage capacity is needed if streamflow enhancement and supplemental irrigation needs are to be met. From an operational standpoint the best program would be to have the storage at two sites, one in the Naches River drainage and one in the upper Yakima River drainage area.

10. There are good storage sites in the Naches River and upper Yakima River areas. Bumping Lake enlargement on the Bumping River and Horsetail on the Little Naches in the Naches River drainage and the Forks storage site on the Teanaway River and the Wymer storage site on Squaw Creek in the upper Yakima River drainage offer the best potential for large, new storage development.

Development of Bumping Lake enlargement and the Forks sites has drawn opposition from individuals who have interest in lands within or adjacent to the sites. Conversely, many groups have expressed support for the Bumping Lake enlargement. All potential storage sites in the basin have a level of controversy. However, in consideration of overall basin water needs, detailed information on those sites with the best potential should be collected and impacts of development analyzed and evaluated. This detailed information on the water supply capability and the economic, environmental, and social aspects of each site would be available to the citizens of the basin for use in arriving at a plan. Involvement of the public in the planning process is necessary to develop a plan that will have viability and general acceptance. Trade-offs among resources and compromises among various basin interests will be needed if an enhancement plan is to be realized.

11. It appears from Phase 1 studies that a plan which would meet supplemental irrigation and streamflow enhancement water needs can be economically justified and would have about three-fourths of its cost allocated to anadromous fish with the remaining costs distributed among other benefiting functions.

12. Public involvement activities indicate that many individuals and groups want to pursue the enhancement study and arrive at a plan to meet basin water needs. Previous efforts to supplement water supplies have not been successful. Poor runoff conditions of recent years and anadromous fishery concerns have magnified the need to develop and implement an acceptable program.

13. Preliminary studies indicate that some potential plan elements have economic justification and public support and should be implemented as soon as possible. Implementation of the East Selah reregulating reservoir, fish passage and protective facilities, and a waterbank program would have benefits with or without implementation of other plan features. Detailed studies have been done previously on the reregulating reservoir and fish passage and protective facilities.

RECOMMENDATIONS

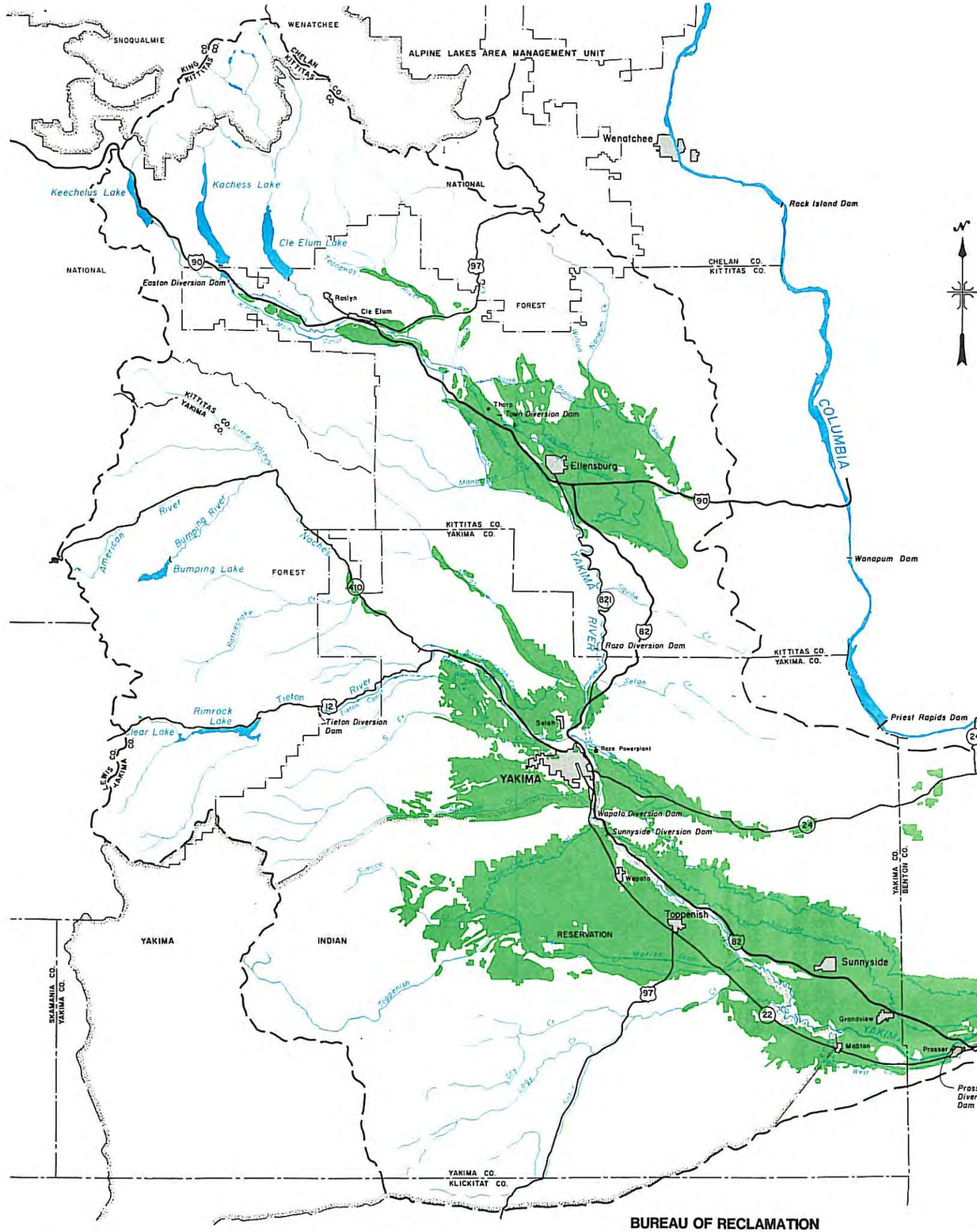
The study team recommends that:

1. Phase 2 of the Yakima River Basin Water Enhancement Project Feasibility Study proceed

2. Necessary legislation and funding be pursued for early construction of the East Selah reregulating dam and the fish passage and protective facilities and for implementation of the waterbank concept

YAKIMA RIVER BASIN

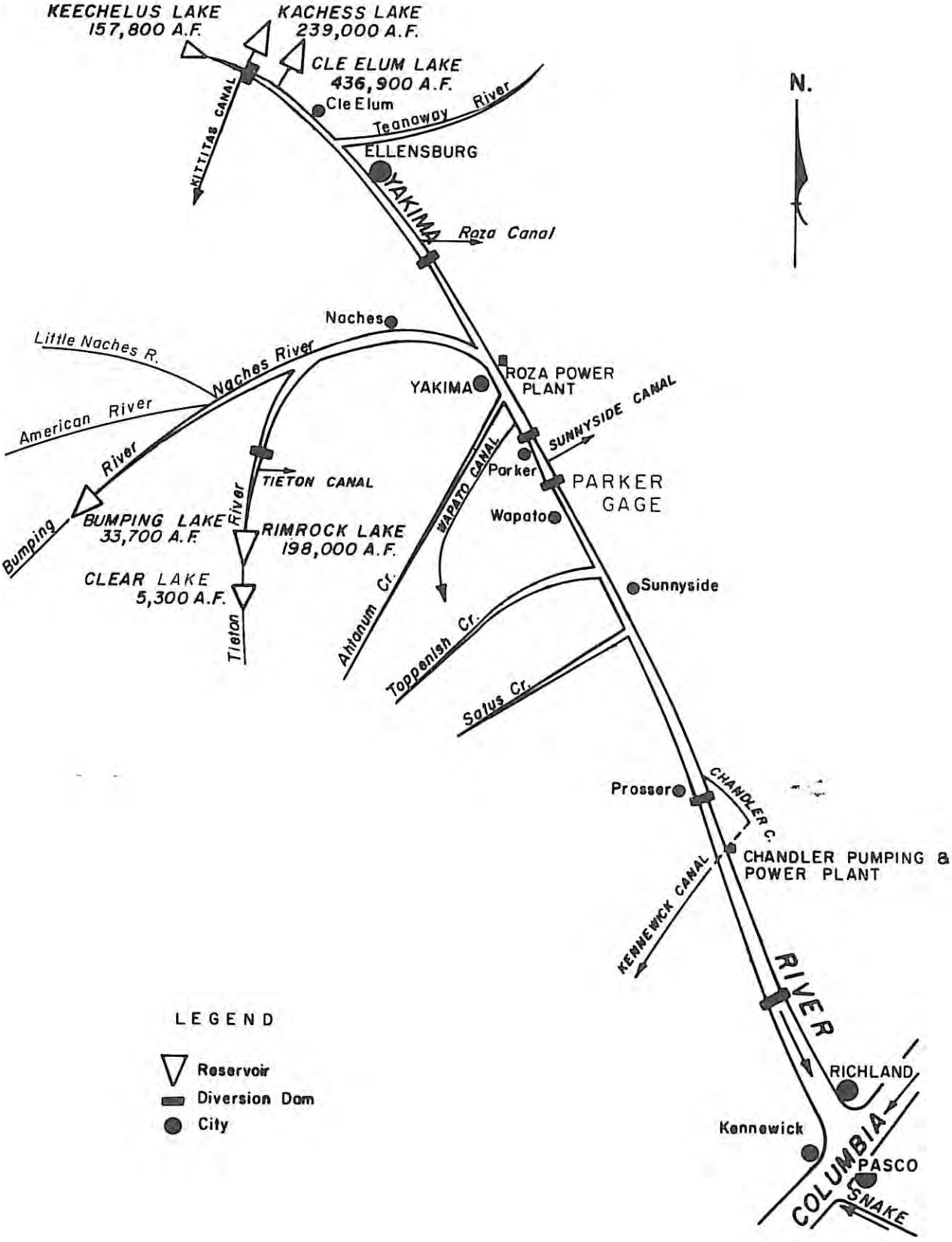
PRESENTLY IRRIGATED LANDS



BUREAU OF RECLAMATION

AUGUST 1982

33-100-441

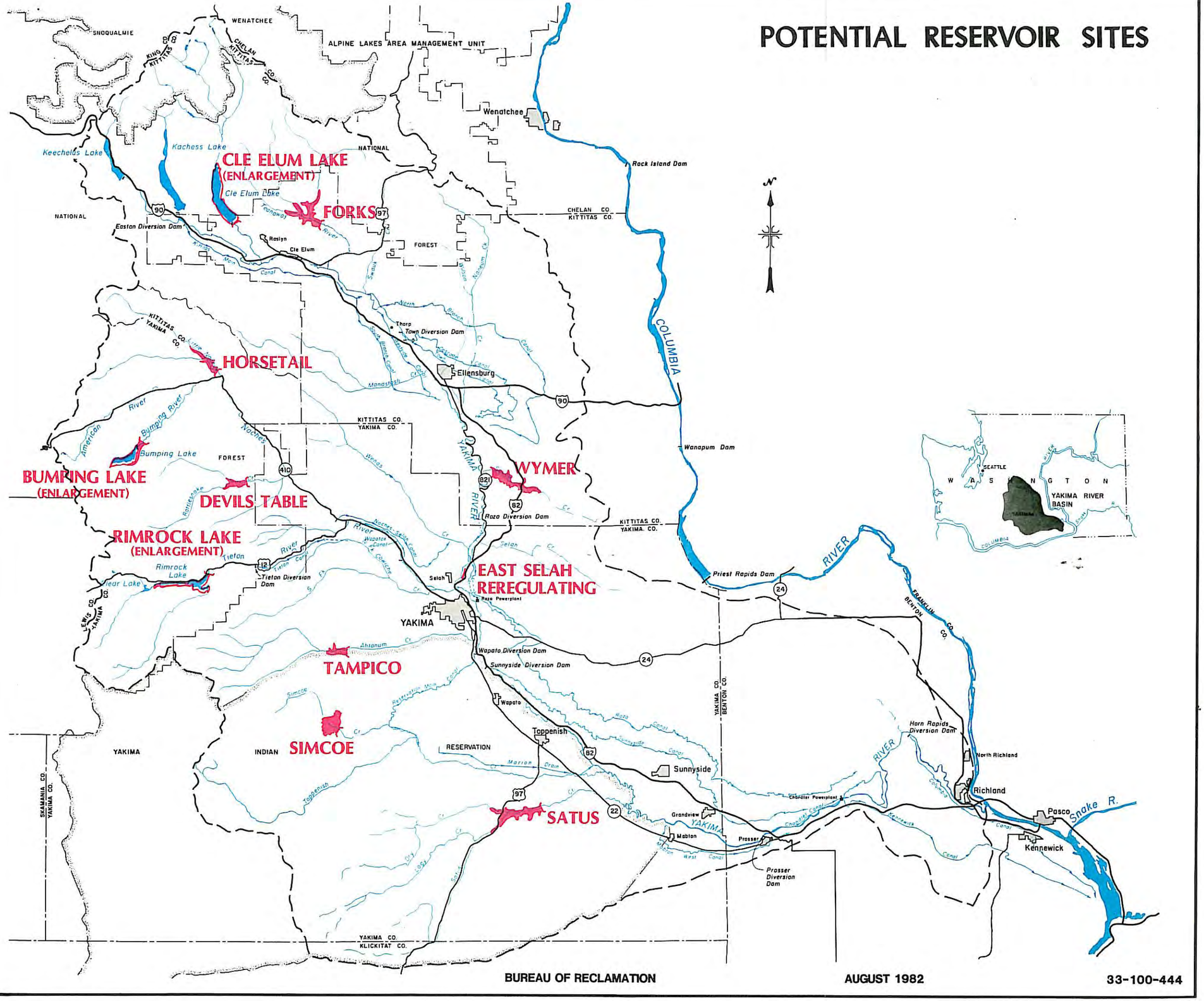


SCHEMATIC
YAKIMA RIVER BASIN

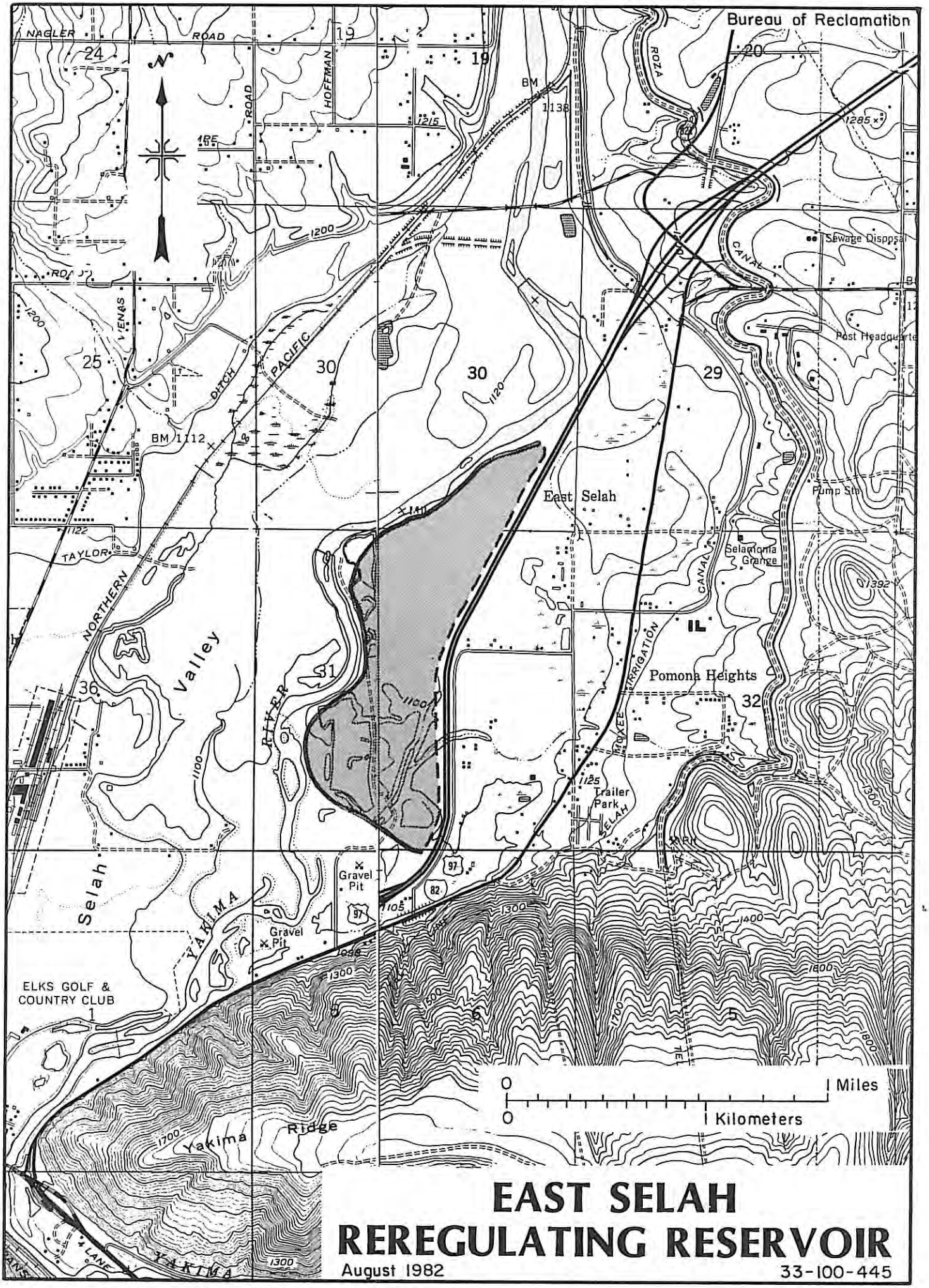
Bureau of Reclamation

August 1982

POTENTIAL RESERVOIR SITES



BUREAU OF RECLAMATION AUGUST 1982 33-100-444



EAST SELAH REREGULATING RESERVOIR

August 1982

33-100-445

POTENTIAL IRRIGATION SERVICE LANDS

YAKIMA AND WAPATO PROJECT LANDS (SUPPLEMENTAL SERVICE)

NEW PROJECT DEVELOPMENT (SUPPLEMENTAL AND FULL SERVICE)

KITTITAS

AHTANUM

ROZA

SIMCOE INDIAN RESERVATION

WAPATO

SATUS

ALPINE LAKES AREA MANAGEMENT UNIT

NATIONAL FOREST

SNOQUALMIE NATIONAL FOREST

WENATCHEE NATIONAL FOREST

YAKIMA INDIAN RESERVATION

Wenatchee

Rock Island Dam

Wanapum Dam

Priest Rapids Dam

Roza Diversion Dam

Tieton Diversion Dam

Easton Diversion Dam

Cle Elum Dam

Keechelus Lake

Kachess Lake

Cle Elum Lake

Rimrock Lake

Bumping Lake

Clear Lake

Roslyn

Cle Elum

Thorp

Thorp Diversion Dam

Ellensburg

Selah

YAKIMA

Wapato Diversion Dam

Sunnyside Diversion Dam

Wapato

Toppenish

Sunnyside

Grandview

Mabton

Prosser

Prosser Diversion Dam

Horn Rapids Diversion Dam

North Richland

Richland

Pasco

Kennewick

Snake R.

COLUMBIA RIVER

YAKIMA RIVER

Naches River

American River

Bumping River

Tieton River

Teanaway River

Manastash Cr.

Wilson Creek Canal

Kittitas Canal

Wapato Canal

Sunnyside Canal

Chandler Powerplant

Horn Rapids Canal

Yakima River Basin

KING CO. KITTITAS CO.

CHELAN CO. KITTITAS CO.

KITTITAS CO. YAKIMA CO.

YAKIMA CO. KLICKITAT CO.

LEWIS CO. YAKIMA CO.

SKAMANIA CO. YAKIMA CO.

YAKIMA CO. BENTON CO.

FRANKLIN CO. BENTON CO.

SEATTLE

WASHINGTON

BUREAU OF RECLAMATION

AUGUST 1982

33-100-443

FISH PASSAGE AND PROTECTIVE FACILITIES

LEGEND

1 - Horn Rapids Diversion Dam
2 - Prosser Diversion Dam
3 - Satus Creek Diversion
4 - Toppenish Creek/Satus Unit Diversion
5 - Toppenish Creek Diversion
6 - Marion Drain Diversion
7 - Snipes/Allen Canal
8 - Sunnyside Diversion Dam
9 - Old Reservation Canal
10 - Wapato Diversion Dam
11 - Roza Powerplant Wasteway
12 - Naches/Cowiche Diversion Dam
13 - Wapatox Diversion Dam
14 - Stevens Ditch
15 - Roza Diversion Dam
16 - Town Diversion Dam
17 - Thorp Mill Ditch
18 - Westside Ditch
19 - Taneum Diversion Dam
20 - Easton Diversion Dam

□ FISH LADDER IMPROVEMENTS

○ FISH SCREEN AND/OR BYPASS IMPROVEMENTS

0 5 10 15 Miles
0 5 10 15 Kilometers

BUREAU OF RECLAMATION

Rev. 3/84

33-100-442