UNITED STATES
DEPARTMENT OF THE INTERIOR
Douglas McKay, Secretary

BUREAU OF RECLAMATION
W. A. Dexheimer, Commissioner
E. O. Larson, Regional Director

W A S H O E P R O J E C T
NEVADA-CALIFORNIA

FEASIBILITY REPORT

September 1954

Region 4

Salt Lake City, Utah

SUMMARY--WASHOE PROJECT, NEVADA AND CALIFORNIA

Purpose

The Washoe project would provide irrigation water to supplement present supplies or to provide a full supply to lands in Carson Valley and the Empire, Dayton, and Fort Churchill areas. In addition during dry cycles it would firm existing supplies of the Truckee River Storage and Newlands reclamation projects. Drains would be provided for lands in Carson Valley and under the Truckee River Storage project in Truckee Meadows. Hydroelectric energy would be generated to meet urgent local needs and to provide a portion of the repayment revenues. Project reservoirs would provide stream regulation that would materially lessen flood damage. Benefits to recreation and public health would be created. The project would variously affect fish and wildlife with the net effect to be determined by final structural designs and operating criteria.

Plan

The Washoe project would be integrated with the existing Truckee River Storage and Newlands projects. It would also be coordinated with and dependent on the Truckee River channel improvement that was proposed by the Corps of Engineers and authorized in the Flood Control Act of 1954 with the provision that the authorization would not become effective unless and until the Washoe reclamation project had been authorized.

In the Truckee River Basin the Stampede Reservoir would be built to a capacity of 126,000 acre-feet on Little Truckee River. Reservoir water would be discharged through the Stampede tunnel and Calvada penstock to the 20,000-kilowatt Calvada powerplant on the Truckee River. Below the powerplant the water would be regulated at the 226-acre-foot Calvada Reservoir. It would then flow in the Truckee River channel and through existing facilities to meet and supplement established rights and to replace some of the Carson River water now used on the Newlands project for use higher upstream. On lands of the Truckee River Storage project in Truckee Meadows deep drains would be installed and wells would be constructed to relieve artesian pressure.

In the Carson River Basin the Watasheamu Reservoir on the East Fork of the Carson River would be constructed to a capacity of 115,000 acre-feet. The reservoir would regulate flood flows now running to waste and some water now used by the Newlands project which would be replaced by Washoe project water from the Truckee River. Releases from Watasheamu Reservoir would pass through the 8,000-kilowatt Watasheamu powerplant at the base of the dam. The water would then be regulated at the Dresslar Diversion Dam and Afterbay that would impound 1,040 acre-feet. At the dam some water would be diverted into the potential Carson Canal that would serve new lands along its course in Carson Valley and that would also deliver water to the West Fork of Carson River for distribution by existing canals diverting from that stream. Some water bypassing Dressler Diversion Dam, together with return flows reaching the stream, would be diverted to lands in Carson Valley and in the Empire, Dayton, and Fort Churchill areas. The remaining flows passing Dresseler Dam would continue on to the Lahontan Reservoir of the Newlands project. The existing Allerman Canal in the Carson Valley would be enlarged and extended. Some new laterals would be constructed and existing laterals would be improved and extended as necessary. Systems of main drains would be installed in Carson Valley.

Principal agricultural production

Alfalfa, grain, pasture--dairy cows and beef.

SUMMARY--WASHOE PROJECT, NEVADA AND CALIFORNIA (continued)

Average annual increase in irrigation supply (acre-feet)

For Carson Valley, Empire, Dayton, and Forth Churchill areas	68,300
For existing Truckee River Storage project	1/ 2,600
For existing Newlands project	1/ 1,700
Total	72,600

1/ Supply to be reserved for use in dry cycles.

Land area served (acres)

Project subarea	Full irrigation service land	Supplemental irrigation service land	Supplemental irrigation and drainage service land	Total
Carson Valley	5,100	19,990	18,170	43,260
Empire, Dayton, and Fort Churchill areas	--	6,300	--	6,300
Newlands project	--	70,000	--	70,000
Truckee River Storage project (Truckee Meadows)	--	14,070	12,730	26,800
Total	5,100	110,360	30,900	146,360

Power

Installed capacity (kilowatts)	28,000
Average annual project generation (kilowatt-hours)	95,871,000
Average annual reduction in existing generation (kilowatt-hours)	4,500,000
Average selling rate per kilowatt-hour	9 mills

Flood control

Annual reduction in flood damages	$288,900

Costs

Construction costs	$41,458,000
Annual operation, maintenance, and replacement costs	$210,540

Benefit-cost ratio

Average annual benefits would compare with average annual equivalent costs in ratio of 1.8 to 1.0

Repayment

Irrigation and drainage payments up to the ability of the water users would be made for 50 years after suitable development periods for various project lands. The power investment would be amortized in 50 years at 2.5 percent interest. Interest paid to the Federal Treasury would amount to $14,734,000. Net power revenues accruing for 14 years after repayment of the power investment would fully repay the part of the irrigation and drainage allocation beyond the repayment ability of the water users.

Allocations and repayment of project costs

Purpose served	Cost allocation			Source of payment revenue	
	Construction cost	Interest during construction	Total reimbursable cost	Irrigation and drainage payments	Power revenues
Irrigation and drainage	$17,391,000	--	$17,391,000	$8,180,000	$9,211,000
Power	18,247,000	$720,000	18,967,000	--	18,967,000
Flood control (nonreimbursable)	5,820,000	--	--	--	--
Total	41,458,000	--	36,358,000	8,180,000	28,178,000

Annual costs for operation, maintenance, and replacement paid by each purpose would be: irrigation and drainage, $51,130; and power, $152,850. Annual costs for flood control in the amount of $6,560 would be nonreimbursable.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 4
Post Office Box 360
Salt Lake City 10, Utah

September 17, 1954

To: Commissioner

From: Regional Director

Subject: Report on Washoe Project, Nevada-California

1. This letter and the attached substantiating materials are submitted as a basis for securing Congressional authorization of the potential Washoe project, an economically justified and urgently needed reclamation development in west-central Nevada and east-central California. The project would provide storage regulation to control surface runoff for irrigation, power production, and flood protection. Also, through drainage and proper distribution of irrigation water, it would lower damaging ground water tables, increase usable water supplies, and improve public health. Opportunities for recreational development would be provided in an area of National recreational significance, and fish and wildlife benefits might be provided.

2. The Washoe project plan is the result of extensive investigations made under the sponsorship of the Bureau of Reclamation with the cooperation of the Fish and Wildlife Service, National Park Service, Corps of Engineers, Public Health Service, Geological Survey, Forest Service, Soil Conservation Service, and Federal Power Commission. Some of the cooperating agencies have prepared statements, which are appended to this report, on the project's probable effects on the interests with which they are concerned. Numerous State and local organizations have also cooperated in project investigations.

3. Authority to make this report and supporting investigations is provided in the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto).

Introduction

Project area

4. The Washoe project area includes the drainage basins of the Truckee and Carson Rivers which lie adjacent to each other on the eastern slope of the Sierra Nevada. Each basin consists of several separate areas formed by natural physiographic features. Of particular importance to the project in the Truckee River Basin is Truckee Meadows, near the center of

the basin. Particularly important to the Carson River Basin are Carson Valley and, in succession down the Carson River, the Empire, Dayton, Fort Churchill, and Lower Carson areas. Locations of the various areas are shown on the frontispiece map.

5. Chief cities of the project area are Reno and Sparks, located in Truckee Meadows on the Nevada side of the project area. Also important communities in the Nevada portion of the area are Carson City, the State's capital; and the agricultural communities of Fallon, Gardnerville, and Minden. Only small communities, including Truckee, Markleeville, Woodfords, and Tahoe City, are on the California side of the area. Lake Tahoe, lying astride the Nevada-California State line high in the Sierra Nevada, is a resort center of National prominence. Although Tahoe City is the only incorporated town on the lake shores, the lake is rimmed with homes, cabins, and resorts on both its Nevada and California sides and attracts thousands of tourists each year.

Needs of the area

6. Better regulation of the available water supply is urgently needed in the Washoe project area. Runoff of the Truckee and Carson Rivers, formed largely from melting snows in the high Sierra Nevada, comes as torrential floods in the spring but drops sharply after midsummer. The high spring flows run unused, destroying property along the Lake Tahoe shoreline, damaging Reno and Sparks, and inundating farm lands in both the Truckee and Carson River Basins. Also surplus ground water exists in both the Truckee and Carson River Basins. It menaces health and property in the vicinity of Reno and Sparks and seriously hinders crop production in Truckee Meadows and Carson Valley. Although damages are being caused by the excessive surface and ground water, thousands of acres of farm land produce only part of their potential because of late season water shortages. Other lands, capable of sustained crop production, are still in sagebrush for lack of water. Despite opportunities on the Truckee and Carson Rivers for new power production, demands for electic energy are outgrowing the supplies and large amounts of power must be imported across the high Sierra Nevada from California. In most cities existing domestic water supplies are adequate for the foreseeable future. Needs for domestic water, however, are outgrowing the available supplies in resort areas around Lake Tahoe and in the vicinity of Markleeville and Woodfords.

7. Improved irrigation practices in the Carson River Basin are essential to effective distribution of the available water resources. Because of the inadequate late-season supplies, farmers irrigate excessively in the spring in an attempt to keep the ground wet throughout the summer. Also, because of the lack of adequate storage regulation, they install checks to hold back water in numerous small impoundments on streams and sloughs. Such practices, although established in an attempt to use the limited water supplies to best advantage, result in waste of the available supply. They cause excessive evaporation and transpiration losses and contribute to the damaging high water table.

REPORT OF THE REGIONAL DIRECTOR

Existing developments

8. Some regulation of the Truckee and Carson River flows already has been accomplished but the control provided to date is only a part of that required for optimum utilization of the water resources. The largest reclamation developments on the rivers are two projects previously undertaken by the Bureau of Reclamation--the Truckee River Storage project constructed in 1937-39 and the older Newlands project constructed in 1903-15. These projects are briefly discussed below.

9. The Truckee River Storage project regulates flows of the Little Truckee River, chief tributary of the Truckee River, for irrigation of about 26,800 acres in Truckee Meadows in the Truckee River Basin. Regulation is provided at Boca Reservoir with a capacity of 40,900 acre-feet. The Washoe County Water Conservation District operates the project and is repaying the project construction costs under a contract with the Federal Government.

10. The Newlands project utilizes water of both the Truckee and Carson River systems for irrigation, principally in the Lower Carson area, and for the generation of hydroelectric energy. Contracts have been made to provide irrigation water to 70,000 acres. Water of the Truckee River is conveyed to the project area by the Truckee Canal. Truckee River water is regulated at Lake Tahoe, which provides 732,000 acre-feet of storage capacity for the project. Since construction of the Truckee River Storage project, some regulation has also been provided at Boca Reservoir for Little Truckee River water utilized under the Newlands project. In the Lower Carson area, the 290,900-acre-foot Lahontan Reservoir provides storage for Carson River water and for water of the Truckee River imported by the Truckee Canal. Power is generated at the Lahontan powerplant at the base of the Lahontan Dam. The Truckee-Carson Irrigation District has contracted with the United States for operation of the Newlands project and for payment of construction costs.

Plan of Development

11. The Washoe project would be integrated with the existing Truckee River Storage and Newlands projects. Also it would be closely coordinated with the development proposed by the Corps of Engineers and conditionally authorized by Congress for enlarging and deepening the Truckee River channel. The authorization for the channel improvement included in the Flood Control Bill of 1954 will not become effective unless and until the Washoe reclamation project shall have been authorized pursuant to law.

12. The Washoe project would increase irrigation supplies at canal heads by an average of 72,600 acre-feet annually. This increase would provide for the full irrigation of 5,100 acres of land in Carson Valley, the supplemental irrigation each year of 38,160 acres in Carson Valley, and

the supplemental irrigation each year of 6,300 acres in the Empire, Dayton, and Fort Churchill areas. In addition, during dry cycles it would firm the existing supplies for the 26,800 acres of land in the Truckee River Storage project and the 70,000 acres under water right contract in the Newlands project. Local electric power supplies would be increased by a net annual amount of 91,371,000 kilowatt-hours. Control of the water provided by the project would reduce flood damages by an average annual amount of $288,900 and would alleviate seepage on 18,170 acres in Carson Valley and 12,730 acres in Truckee Meadows. The project is expected to incidentally improve public health and increase recreational values. It would variously affect fish and wildlife resources but its net effect on these resources will be dependent on structural and operational refinements not yet fully evaluated. The project does not provide for increasing domestic water supplies but, if warranted by the demand, it could be readily adjusted to meet the growing needs for domestic water around Lake Tahoe and in the vicinity of Markleeville and Woodfords. The project would not increase the supplies of Indian lands in the area as these lands are now using only a small portion of the water available to them. It would, however, in no way infringe on the Indians' existing rights.

Project works

13. Except for new distribution facilities that would be required for expanded irrigation in the Carson River Basin, practically parallel project works would be constructed in the Truckee and Carson River Basins. In each basin the project would involve Federal construction of a storage reservoir to control fluctuating streamflows, a plant and appurtenant works to utilize reservoir releases for hydroelectric power production, a small reservoir to reregulate the powerplant tailwater, facilities to transmit the power generated to the nearest load center, and drainage works to relieve waterlogging and salvage water for beneficial uses. In the Carson River Basin the project also would include Federal construction of new and enlarged canal and lateral systems. In both the Truckee and Carson River Basins small farm drains would be constructed by private interests. Brief descriptions of the project works are given in the following paragraphs.

Truckee River Basin

14. In the Truckee River Basin, storage would be provided at Stampede Reservoir to be built to a capacity of 126,000 acre-feet on the Little Truckee River. Water from the reservoir would be discharged through the potential Stampede tunnel and Calvada penstock to the Calvada powerplant that would be constructed on the main stem of the Truckee River. The plant would have a capacity of 20,000 kilowatts and an average annual generation of 61,939,000 kilowatt-hours. Its power output would pass through a substation near the plant and would then be transmitted about 7 miles to the Reno market area for delivery into existing systems. Water releases from the Calvada plant would be regulated at the 226-acre-foot Calvada Regulatory Reservoir on the Truckee River just below the plant. The water

then would flow in the Truckee River channel and existing facilities to meet established rights, to supplement supplies in dry cycles on the existing Truckee River Storage project lands, and to replace some of the Carson River water now used on the Newlands project for use upstream in Carson Valley and the Empire, Dayton, and Fort Churchill areas.

15. As a part of the project in Truckee Meadows, deep drains would be installed and some wells would be constructed to relieve artesian pressure. Small lateral drains also would be constructed by private interests to supplement the project drainage system.

Carson River Basin

16. In the Carson River Basin storage would be provided at the Watasheamu Reservoir to be constructed to a capacity of 115,000 acre-feet on the East Fork of the Carson River. This reservoir would regulate flood flows now running to waste and water that would be usable upstream in the Carson River Basin in exchange for Truckee River water provided the Newlands project. Releases from the reservoir would be dropped through a penstock to the 8,000-kilowatt Watasheamu powerplant to be located at the base of the dam. Power from this plant--an average annual amount of 33,932,000 kilowatt-hours--would pass through a substation near the plant and would then be transmitted about 25 miles to the Carson City market area for delivery into existing systems.

17. Below the Watasheamu powerplant, water would be regulated at the potential Dressler Diversion Dam and Afterbay that would impound 1,040 acre-feet of water. At the dam some water would be diverted into the potential Carson Canal and the remaining flow would continue down the East Fork and the main stem of the Carson River. Water diverted by the Carson Canal would be supplied to lands in southern Carson Valley--part being distributed to full service lands along the canal course and part being conveyed to the West Fork of Carson River and then distributed by existing facilities to supplemental service lands. Some water bypassing Dressler Diversion Dam on the East Fork, together with return flows reaching the stream, would be diverted to full and supplemental service lands in eastern Carson Valley and to supplemental service lands in the Empire, Dayton, and Fort Churchill areas. The remaining flow would continue to Lahontan Reservoir for use on the existing Newlands project. Diversions in Carson Valley would be made through the existing Allerman Canal that would be enlarged and extended, through new laterals that would be provided, and through existing laterals, some of which would be improved. In the Empire, Dayton, and Fort Churchill areas, diversions would be made through existing laterals that would be rehabilitated as necessary. In the Newlands project area, the existing distribution systems would continue to be utilized without modification.

18. Systems of main drains would be installed in Carson Valley as part of the project, and supplementary farm lateral drains would be constructed by private interests. Artesian relief wells for Carson Valley are not included in the project but may be found desirable at some future date.

REPORT OF THE REGIONAL DIRECTOR

Project operation

Irrigation

19. The increased irrigation supply provided by the project (72,600 acre-feet annually) would include 62,400 acre-feet for Carson Valley, 5,900 acre-feet for the Empire, Dayton, and Fort Churchill areas, and 4,300 acre-feet for the existing Truckee River Storage and Newlands projects. Approximately 2,600 acre-feet would be provided to the storage project and 1,700 acre-feet to the Newlands project.

20. In Carson Valley the 5,100 acres of full service land would experience an average annual shortage of only about 3 percent. The 38,160 acres of supplemental service land in the valley also would realize an average annual shortage of only about 3 percent compared with an existing shortage of about 30 percent. On the 6,300 acres of supplemental service land in the Empire, Dayton, and Fort Churchill areas, existing shortages, averaging about 23 percent, would be eliminated.

21. The project water provided to the Newlands and Truckee River Storage projects would be held over until dry cycles and then used to offset shortages. On the Truckee River Storage project the water would be used in a dry cycle such as the 1931-35 period and then would reduce shortages from 16 to 5.8 percent. On the Newlands project the water would be used over a period similar to the 1929-35 dry cycle and then would reduce shortages from 17.4 to 15.6 percent.

Drainage

22. The drainage program would be provided for supplemental irrigation service land, including 12,730 acres of land in Truckee Meadows under the Truckee River Storage project and 18,170 acres of land in Carson Valley. The ground water table would be lowered by the drains and artesian relief wells to be provided as part of the project, the supplementary farm lateral drains to be constructed by private interests, and the improved distribution of irrigation water which would be effected with project development. Successful operation of the drainage system in Truckee Meadows also would require improvement of the Truckee River channel proposed by the Corps of Engineers and recently authorized conditionally by Congress. Also in Carson Valley it would be necessary for farmers to remove many of the checks installed to hold back water in streams and sloughs. Only a few such checks would be required after late season irrigation was assured with project development.

23. It was not found practicable to provide drains to alleviate existing problems in the Empire, Dayton, and Fort Churchill areas. Damaging high ground water tables adjacent to the Carson River in these areas would be lowered, however, as a result of flow regulation provided by the project. The existing drainage system of the Newlands project is being extended and improved by the Truckee-Carson Irrigation District and would not be affected by the Washoe project development.

Power

24. The Calvada and Watasheamu powerplants to be constructed as a part of the Washoe project would produce an average of 95,871,000 kilowatt-hours of energy annually. Approximately 91,866,000 kilowatt-hours of the energy would be available for marketing and 4,005,000 kilowatt-hours would be lost in transformation and transmission. The marketable energy would be sold at an average rate of 9 mills a kilowatt-hour.

25. The project would decrease the output at existing plants of the Sierra Pacific Power Company by about 4,500,000 kilowatt-hours annually. The company would be compensated for its losses in production, probably by a lump sum payment. Such a payment has been included in the estimated cost of power features. The project is expected to increase production at the existing Lahontan powerplant by about 1,243,000 kilowatt-hours annually but this increase has not been taken into account in the project analyses.

Flood Control

26. The Washoe project would reduce floods along the Little Truckee and Truckee Rivers below Stampede Reservoir, including the Reno-Sparks area; along the Carson River; and along the East Fork of the Carson River below Watasheamu Reservoir. Further reductions of floods along these reaches of the rivers and reductions of floods at Lake Tahoe could be accomplished with the conditionally authorized Truckee River channel improvement planned by the Corps of Engineers and with developments outlined in paragraph 47.

27. The Washoe project's reduction of flood flows would be accomplished through coordinated operation of new and existing reservoirs. Inviolate storage space would be reserved for rain floods during the rainy season, from November through March. Storage space would be evacuated for snowmelt floods when heavy spring discharges were threatened. Water released to provide the regulatory capacity needed would be conserved in another reservoir lower on the river system for subsequent use in irrigation and power production.

Other Project Purposes

28. The National Park Service and the Forest Service recognize an important recreational potential at the Stampede Reservoir. The minor seasonal fluctuations of water surface elevation, suitable sites for recreational facilities, pleasant views, nearness to population centers, and access by good roads all foretell intensive recreational use.

29. The project effect on fish and wildlife resources can be definitely appraised only when final structural designs and operating criteria are determined. It is planned that a fish ladder be constructed at the

Calvada Dam. Whenever justified protective devices for wildlife such as deer crossings on canals and appropriate fences would be provided at project facilities and water releases from reservoirs would be made to protect fish. Through continued cooperation of the Fish and Wildlife Service with the Fish and Game Commissions of California and Nevada and with the Bureau of Reclamation, such adaptations as are justified will be made in project plans to best protect and enhance fish and wildlife values.

30. Various aspects of the Washoe project would contribute to public health. The lowering of ground water tables by project drains and by stream regulation would eliminate areas of pollution and mosquito breeding and would facilitate sewage disposal. The increase in minimum stream flows in sections of the Truckee and Carson Rivers would also benefit sewage disposal.

Water Rights

31. Rights to store or divert any water for the Washoe project would be established through appropriate applications to the California and Nevada State Engineers. In order that the most economical use of the water for the entire project area may be effected, agreements would be required with users of both Truckee and Carson River waters for modification of certain established water rights and for exchanges of water among the various users. Among agreements that would be required are those mentioned below.

1. An agreement for modification of the Truckee River Agreement of 1935 and the Truckee River Final Decree of 1944 to permit exchanges of storage water among and releases from Lake Tahoe, Boca, and Stampede Reservoirs without materially reducing flows of the Truckee River at Iceland below the Floriston Rates.

2. A stipulation for the entry of a decree on the Carson River to provide a water right for the Newlands project of not to exceed 424,100 acre-feet of gross irrigation diversions annually from all sources of supply.

3. An agreement with the Truckee-Carson Irrigation District to permit temporary storage in Stampede and Watasheamu Reservoirs of water which otherwise would be stored in Lahontan Reservoir. (Water thus stored would ordinarily be released during the nonirrigation season but would also be subject to call to supply irrigation needs within established rights for Newlands project lands.)

4. An agreement by water users in the Carson Valley to limit their diversions of water to ideal irrigation requirements.

Cost Estimates

32. Federal construction costs of the Washoe project are estimated at $41,458,000 and annual operation, maintenance, and replacement costs of features to be Federally constructed are expected to amount to $210,540. The construction costs are based on July 1954 prices. Annual costs of power features are based on July 1954 prices while costs of other features were estimated on the projected price level of 180 (1939=100). Replacement costs were computed for a 50-year period on a sinking fund basis at 2.5 percent interest.

33. Construction costs and annual operation, maintenance, and replacement costs for individual project features to be Federally constructed are itemized below.

Estimated cost of Washoe project features

Feature	Construction cost 1/	Annual operation, maintenance, and replacement costs
Stampede Reservoir and Dam	$7,920,000	$8,900
Watasheamu Reservoir and Dam	10,050,000	10,800
Calvada Regulatory Reservoir and Dam	993,000	2,230
Dressler Diversion Dam and Afterbay	1,081,000	2,600
Stampede tunnel	8,867,000	5,690
Calvada penstock and surge tank	2,133,000	15,900
Carson Canal	1,193,000	7,400
Allerman Canal enlargement and extension	855,000	6,300
Laterals	912,000	10,300
Drains		
Truckee Meadows	1,385,000	7,000
Carson Valley	1,494,000	7,700
Calvada powerplant 2/	2,101,000	55,050
Watasheamu powerplant	1,662,000	43,900
Calvada substation and transmission system	378,000	15,170
Watasheamu substation and transmission system	434,000	11,600
Total	41,458,000	210,540

1/ Costs shown do not include interest during construction.
2/ Cost of Calvada powerplant includes lump sum payment to Sierra Pacific Power Company for decrease the project would cause in generation at the company's plants.

Economic Analyses

Cost allocations

34. Federal costs of the project have been allocated to irrigation and drainage, to power, and to flood control by the separable cost-remaining benefits method. Costs of interest during construction have been included in the reimbursable power allocation but excluded from the irrigation and drainage and flood control allocations. The allocations made are shown in the tabulation below.

Cost allocations

Purpose	Construction cost	Reimbursable interest during construction	Reimbursable investment	Average annual operation, maintenance, and replacement costs
Irrigation and drainage	$17,391,000	--	$17,391,000	$51,130
Power	18,247,000	$720,000	18,967,000	152,850
Flood control	1/ 5,820,000	--	--	1/ 6,560
Total	41,458,000	--	36,358,000	210,540

1/ Nonreimbursable.

Project repayment

35. Costs allocated to flood control would be nonreimbursable. The irrigation and drainage allocation would be reimbursable without interest while the power allocation would be repayable with interest at 2.5 percent. Power revenues in excess of power operation, maintenance, and replacement costs would be used to assist in payment of the irrigation and drainage allocation after payment of the power allocation was completed.

Irrigation and Drainage Repayment

36. Irrigation and drainage interests would pay their annual operation, maintenance, and replacement costs and would pay toward construction costs for a period of 50 years. Payments toward construction costs would be started after suitable development periods, ranging up to 8 years, on various land areas. The payments would vary for the different types of service land. Water users on full irrigation service land would pay at the rate of about $3.75 an acre and water users on supplemental irrigation service land would pay about $1.65 an acre-foot. Farmers would pay approximately $1.65 an acre for drainage in Carson Valley and about $2.20 an acre for drainage in Truckee Meadows. At the estimated rates of payment the irrigation and drainage interests would pay a total of about $163,600 a year. Thus in 50 years they would contribute $8,180,000 toward the irrigation and drainage allocation. The remaining portion of the allocation, amounting to $9,211,000, would be paid from net power revenues accruing in the 14-year period after payment of the power allocation was completed.

The irrigation and drainage repayment would be completed in 52 years after the close of the last development period.

Power Repayment

37. With marketable energy sold at an average rate of about 9 mills a kilowatt-hour, power revenues would amount to $826,795 annually. These revenues would pay power's full operation, maintenance, and replacement costs and within 50 years would pay off power's total allocation of construction costs with an interest rate of 2.5 percent on the unamortized balance. The interest, amounting to a total of $14,734,000, would be returned to the Federal Treasury. Net power revenues that would accrue for 14 years after repayment of the power allocation, amounting to $9,211,000, would be used to pay the portion of the irrigation and drainage allocation that could not be paid by the irrigation and drainage interests. In the last year of project repayment, surplus revenues of about $428,000 would be accrued.

Summary of Repayment

38. Anticipated returns on Federal construction costs are shown in the summary below.

Nonreimbursable cost		
Flood control allocation		$5,820,000
Repayment of reimbursable cost		
Irrigation and drainage allocation		17,391,000
From irrigation and drainage interests	$8,180,000	
From net power revenues (accruing after payment of power allocation)	9,211,000	
Power allocation (repaid from power revenues)		1/18,967,000
Total repayment		36,358,000
Interest on power allocation returned to Treasury		14,734,000
Earned surplus in last year of project repayment		428,000

1/ Costs include interest during construction

39. Water conservancy districts similar to those authorized by the laws of Colorado and Utah would be the most desirable entities to contract with the United States for repayment of reimbursable costs. Such districts would have the broad powers necessary to coordinate the various purposes and divergent interests of the project. Neither Nevada nor California yet has laws authorizing the formation of conservancy districts. The early enactment of such laws, particularly in Nevada, would be an aid to water resources development.

Benefit-cost analysis

40. Evaluated benefits from the overall Washoe project would compare with the attendant Federal costs in a ratio of 1.8 to 1 over a 100-year period of analysis beginning with the first year of full project operation. Benefits from each purpose of the project would exceed the attendant costs. The comparison of benefits and costs was made by computing both benefits and costs for each purpose of the project as average annual equivalents at 2.5 percent interest over a 100-year period.

41. Analyses made to date indicate that a total average annual benefit value of $2,900,000 would be realized over a 100-year period. This value includes $1,530,000 from irrigation and drainage, $1,081,100 from power production, and $288,900 from the project's control of flood flows. Incidental benefits are expected to result from recreation, mosquito abatement, and improvement of sanitary conditions. Fish and wildlife benefits may also be realized.

42. Annual equivalent costs of the Washoe project are expected to average $1,619,010 over a 100-year period. Approximately $535,830 of the annual equivalent costs would be attributable to irrigation and drainage, $913,920 to power, and $169,260 to flood control. The annual equivalent costs include an allowance for amortizing over the period of analysis the allocation of Federal construction costs made to each project purpose and include each purpose's share of the annual operation, maintenance, and replacement costs of Federally constructed facilities.

Alternative Plans and Ultimate Development

43. After construction of the Washoe project as outlined in this report, potentialities still would exist for substantial further development of Truckee and Carson River waters for irrigation, power generation, flood control, and other purposes. In the project area 115,300 acres of arable land would still need water, including 98,400 acres without any irrigation supply. Various possibilities for developing new water supplies for some of these lands or of transferring developed supplies from places of less efficient use are worthy of further study and could lead to a favorable plan for modifying and expanding the Washoe project. Any plan for expansion, however, would require full cooperation of river and reservoir operations and would depend on whether an agreement permitting such operation could be reached by the various water users and landowners affected. The magnitude of the plan would depend on the results of further investigations concerning water requirements for the Newlands project.

44. Since existing water shortages on the Truckee River Storage and Newlands projects are within permissible limits, the water that would be provided in the Washoe project to firm the supplies of the existing projects could be used to irrigate a substantial amount of nonirrigated land located elsewhere.

45. Water supply studies made for the Washoe project allowed prior water rights for the Newlands project on the basis of existing irrigation efficiencies for 70,000 acres of land. Rough studies show, however, that the irrigation efficiencies could be increased to make the same water supply serve a larger acreage. Any irrigation water made available through increased irrigation efficiencies could be utilized on additional arable lands in the Newlands project area or on other arable lands.

46. Long-time holdover storage could be provided by construction of the potential Washoe Reservoir at the site of the existing Washoe Lake and the potential Hope Valley Reservoir on the West Fork of the Carson River. These reservoirs would conserve for use in irrigation and hydroelectric power production the Truckee and Carson River flows remaining unused after full economical development of the Newlands and Washoe projects. Some Lake Tahoe storage would be transferred to Washoe Reservoir to reduce flood damages at the lake. Facilities would be constructed for generation of hydroelectric energy and appropriate water distribution works would be provided.

47. In order to reduce flood damage the maximum water surface elevation at Lake Tahoe could be reduced by a transfer of some of the lake's top storage capacity to Washoe Reservoir, as mentioned in the preceding paragraph. A reduction in the active storage requirement at Lake Tahoe might also be realized through reduced irrigation demands on the Newlands project, provided the water saved were not transferred to other lands. A reduction in the required storage capacity at the lake might also result if the supplemental water intended to be furnished by the Washoe project to Truckee River Storage and Newlands project landswere eliminated from the plan. To the extent that such elimination would reduce storage requirements at the Stampede and Watasheamu Reservoirs, capacity would be provided to replace present storage space at Lake Tahoe. Some flood damage at Lake Tahoe might be prevented without reducing the present active storage capacity by lowering both the maximum and minimum permissible water surface elevations to the position where the least shoreline damage would result from lake level fluctuations between the two limits.

Conclusions

48. The Washoe project plan is a practicable means of obtaining beneficial utilization of surplus surface and ground water in the Truckee and Carson River Basins. It is coordinated with existing projects and additional potentialities for future development. Successful operation of the project is dependent on improvement of the Truckee River channel as planned by the Corps of Engineers and as authorized by Congress in 1954.

49. The Washoe project would have a benefit-cost ratio of 1.8 to 1, with consideration given only to benefits from irrigation and drainage, power production, and flood control. A higher ratio of benefits to costs

would be realized with consideration given to the benefits to recreation mosquito abatement, and sanitation that are anticipated from the project and to possible benefits to fish and wildlife.

50. Reimbursable Federal costs of the project would be returned to the Treasury in a period of 53 years following appropriate development periods for project lands. Water conservancy districts similar to those authorized by the laws of Colorado and Utah would be the most desirable entities to contract with the United States for repayment of reimbursable costs. The early enactment of laws authorizing the formation of such districts in Nevada and California would be an aid to project development.

Recommendations

51. It is recommended:

1. That the plan of development of water resources described in the report be approved;

2. That authority be sought for the Secretary of the Interior, acting pursuant to the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and acts amendatory thereof or supplementary thereto), to construct, operate, and maintain the works required for the Washoe project as described in this report, with such modifications of, ommissions from, and additions to the works as the Commissioner of Reclamation, with the approval of the Secretary, may find proper; provided that no construction shall be commenced until:

(a) A contracting entity satisfactory to the Secretary has been organized;

(b) An agreement with the project power customer or customers has been made which will assure payment for power and energy sold at rates approved by the Secretary; and

(c) Necessary agreements are made for river and reservoir operation including, but not necessarily limited to, those mentioned in paragraph 31 of this letter;

3. That land drainage be considered a component of the irrigation plan and that costs allocated jointly to irrigation and drainage be reimbursable without interest;

4. That the Secretary, upon consideration of all appropriate factors, shall determine what part of the estimated construction costs allocated to irrigation and drainage shall be paid by the owners of the lands benefited in annual installments over a period of 50 years and that costs so allocated in excess of such amount shall be paid from net revenues from the sale of project power after the costs allocated to power have been repaid with interest.

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