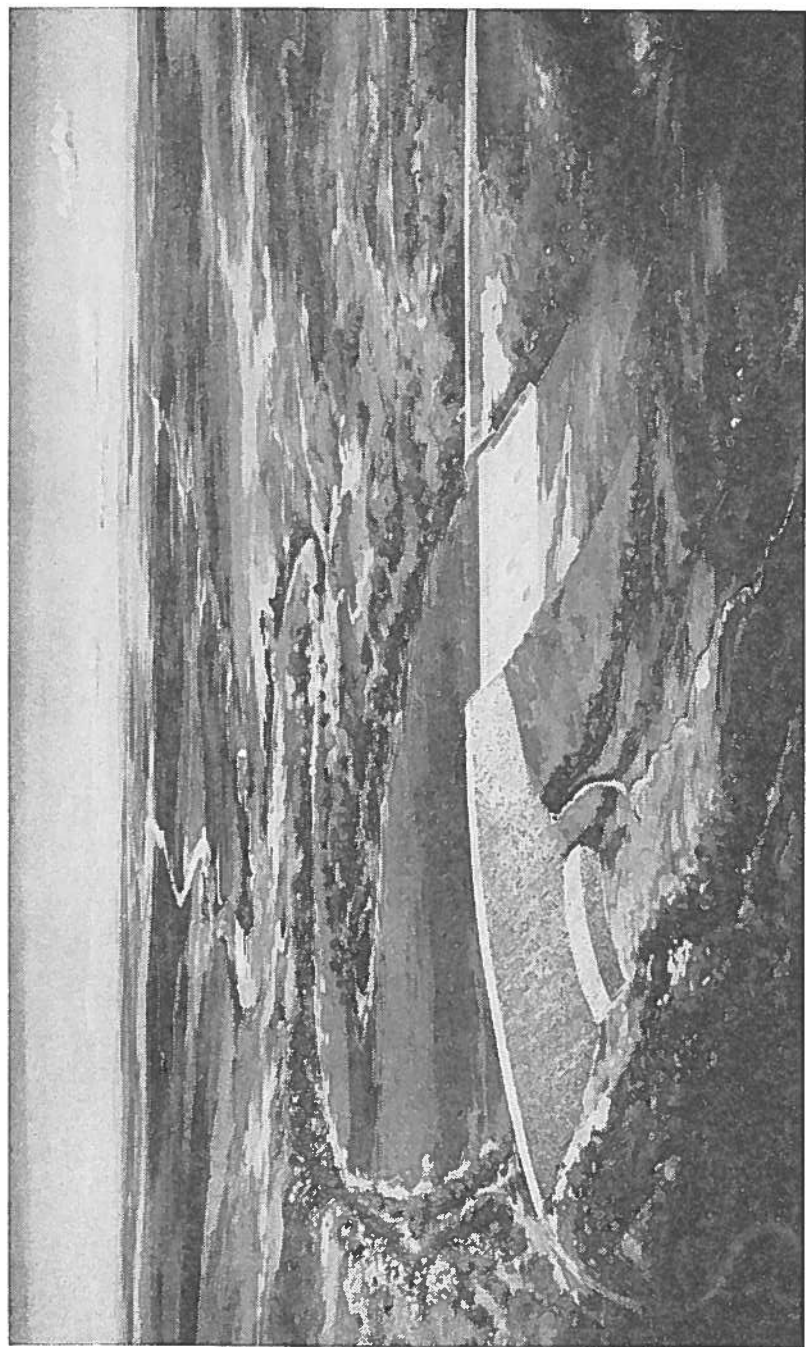


TWENTY-FIFTH BIENNIAL REPORT
OF THE
STATE ENGINEER
OF
NEW MEXICO



Ute Dam, Canadian River, New Mexico. Artist's Conception.

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TWENTY-FIFTH BIENNIAL REPORT
OF THE
STATE ENGINEER
OF
NEW MEXICO



FOR THE 49TH AND 50TH FISCAL YEARS

JULY 1, 1960, TO JUNE 30, 1962

S. E. REYNOLDS
STATE ENGINEER
SANTA FE, NEW MEXICO

THE VALLIANT COMPANY, ALBUQUERQUE, N. M.

The Honorable Edwin L. Mechem
Governor of New Mexico
State Capitol
Santa Fe, New Mexico

My dear Governor:

Transmitted herewith, in accordance with section 75-2-5 of the New Mexico statutes 1953, annotated, is the twenty-fifth biennial report of the State Engineer for the 49th and 50th fiscal years, covering the period from July 1, 1960, through June 30, 1962. Activities of the Interstate Stream Commission for the same period also are reported.

Respectfully submitted,

S. E. Reynolds
State Engineer

Santa Fe, New Mexico
November 30, 1962

INTRODUCTION

The New Mexico State Engineer Office and the New Mexico Interstate Stream Commission are companion though separate agencies. Together they have the principal responsibility for control, conservation, and administration of the State's water resources. The two offices occupy the same quarters in the State Capitol in Santa Fe. The work programs of each supplement and complement the programs of the other, and to the extent that such is feasible the agencies share facilities and personnel. The work programs of each are directed by the State Engineer.

The State Engineer is charged specifically with the responsibility for supervising the apportionment of surface and ground waters in the State in accordance with the permits and licenses issued by him and his predecessors, and with the adjudications of the courts. His rulings may be appealed to the courts.

The Interstate Stream Commission is an executive board charged with responsibility for protecting, conserving, and developing the surface waters of the State, interstate and otherwise. The statutes provide that the Commission shall be composed of seven members, six of whom shall be appointed by the Governor for a term of six years, the seventh being the State Engineer. The statutes provide further that the State Engineer shall serve as Secretary of the Commission. In this capacity, he directs the work of its staff.

On the following pages the work programs of the two agencies during the 25th biennium of New Mexico's statehood (49th and 50th fiscal years) are summarized, along with expenditures during the biennial period. Proposed programs of work for the 52nd and 53rd fiscal years are outlined, and estimates of expenses and proposed budgets are set forth.

Acknowledgments

In the course of the 25th biennium many agencies and individuals cooperated generously with the State Engineer and the Interstate Stream Commission, providing money and services which furthered the work of both organizations and contributed to the effective control, conservation, and development of New Mexico's water resources. For such financial aid and services, acknowledgment is made gratefully to the following:

- U. S. Geological Survey;
- U. S. Corps of Engineers;

U. S. Bureau of Reclamation;
U. S. Soil Conservation Service;
U. S. Bureau of Land Management;
U. S. Forest Service;
U. S. Weather Bureau;

Pecos Valley Artesian Conservancy District, for aid in administering the underground-water laws and for cooperation in completing the hydrographic survey and participating as co-plaintiff in adjudicating the water rights of the Roswell Artesian Basin;

State Oil Conservation Commission and the petroleum industry, for their interest and activity in bringing about the elimination of hazard of oil-field-waste contamination of potable water zones in southeastern New Mexico;

Carlsbad Irrigation District, New Mexico Department of Game and Fish, New Mexico Institute of Mining and Technology, New Mexico Bureau of Mines and Mineral Resources, Lea Soil and Water Conservation District, and the municipalities of Albuquerque, Ruidoso, and Silver City for financial contributions to investigations of water supply; and to all others not specifically mentioned who, during the biennial period, contributed time and service in the conservation and development of New Mexico's most valuable natural resource.

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STATE ENGINEER OFFICE

STATE ENGINEER OFFICE

GENERAL INFORMATION

HISTORY

The office of the Territorial Irrigation Engineer of New Mexico was established under the session laws of 1905. New Mexico's basic water code, enacted in 1907, abolished the office of Irrigation Engineer and created that of Territorial Engineer (later State Engineer). The session laws of 1909 created the New Mexico Good Roads Commission composed of the Governor, the Commissioner of Public Lands, and the Territorial Engineer. In addition to his function as administrator of water rights, the 1909 statute designated the Territorial Engineer as Engineer of the Good Roads Commission and made him responsible for engineering and supervising construction of all roads and highways.

A statute enacted by the third State Legislature in 1917 created a three-member State Highway Commission and vested in it authority to supervise construction and maintenance of State highways. The Commission was directed to appoint a State Highway Engineer to administer its program, with the following proviso: "The Commission may in its discretion designate the State Engineer as the State Highway Engineer, in which event he shall, under direction [of] and until otherwise ordered by the Commission, perform the duties of the State Highway Engineer in addition to those of State Engineer."

The dual function of the State Engineer was continued until the work load of the position reached the point where it was deemed infeasible to administer both road construction and water development and use from one office. In 1921 the two engineering positions were separated and the State Highway Department was created to manage the road program. Since that time the work of the State Engineer has been limited to administration of water.

LOCATION

Since the time of its creation, the central office of the State Engineer has been located in the State Capitol in Santa Fe. In 1927 a suboffice was established in Roswell to administer ground-water development in the Roswell Artesian Basin. With establishment of the Carlsbad, Lea County, Portales, Hondo, Penasco, and Jal Underground Water Basins, administration of ground-water rights in those areas likewise was made a responsibility of the Roswell field office. In 1951 it became necessary to establish a second suboffice to supervise water rights in the southwestern part of the State. This office, located in Deming, has jurisdiction

over the Mimbres Valley, Hot Springs, Virden Valley, Animas Valley, Playas Valley, Gila-San Francisco, San Simon, Lordsburg, and Nutt-Hockett Underground Water Basins. On December 3, 1956, a third suboffice was established in Albuquerque to administer ground-water rights in the newly created Rio Grande Underground Water Basin. The Albuquerque office also administers ground-water uses in the Estancia and Bluewater Underground Water Basins, formerly administered from the main office in Santa Fe. All surface-water rights and uses in the State are administered from the central office in Santa Fe.

POWERS AND FUNCTIONS

The functions of the State Engineer are broadly defined by statute. Specifically, New Mexico laws make him responsible for the "general supervision of the waters of the state and of the measurement, appropriation, and distribution thereof." They empower him to make hydrographic surveys preparatory to adjudication of water rights, to conduct studies to obtain basic hydrologic data, and to make other types of studies of water supply and use as required for enlightened administration of the water resource. Other official functions are: 1) to review plans and specifications for all dams impounding more than 10 acre-feet of water or exceeding 10 feet in height (stock dams storing less than 10 acre-feet of water and works designed solely for retention of silt are excepted), to assure that structures will be constructed in compliance with safe engineering practices; 2) to make final inspections of completed structures in order to insure that they have been constructed in accordance with approved plans and specifications; 3) in the course of his duties, or upon request, to inspect impoundment structures and order corrective action if required; 4) to formulate plans for the orderly development of the State's water resources; and 5) to coordinate the work of the various Federal, State, and local agencies engaged in programs of water research, development, conservation, and use.

FINANCE

Activities of the State Engineer are financed by direct appropriation from the State General Fund, and by special funds. Special funds from which money is available to the State Engineer are the Hydrographic Survey Fund, established by legislative action in 1907 to finance water-use surveys prior to adjudication of water rights; and the Underground Water Fund, established in 1931 to assist in financing administration of the ground-water statutes. The Hydrographic Survey Fund receives income from fees charged by the State Engineer for services pertaining to surface-water rights as well as from appropriations from the General Fund. The fund is intended to be a revolving one, with costs of hydrographic surveys for adjudications being levied against the lands to which water rights are adjudicated, and returned to the fund. The Underground

Water Fund receives income from fees levied for the processing of documents pertaining to underground-water rights.

ORGANIZATION

The State Engineer Office is made up of three operating divisions: Administrative, Technical, and Water Rights. Each division is headed by a chief who is directly responsible to the State Engineer. The Technical Division is subdivided into five sections: Design and Construction, Drafting, Hydrographic Surveys, Reports, and Water Resources and Development. The Water Rights Division is subdivided into two sections: Ground Water and Surface Water. The section heads are responsible to the division chiefs.

LEGISLATION

The 25th Legislature of New Mexico modified several sections of the State water code.

Chapter 32, laws of 1961, amended section 75-11-8, New Mexico Statutes Annotated, 1959 supplement to 1953 compilation, which pertains to forfeiture of water rights after 4-year periods of nonuse. The amendment provides that periods of nonuse of ground water "when water rights are acquired and placed in a water conservation program adopted by an artesian conservancy district shall not be computed as part of the four-year forfeiture statute."

Chapter 60, laws of 1961, added section 75-15-5.1, to New Mexico Statutes Annotated, 1953 compilation, relating to community acequias or ditches. The new section provides: "No person, who has after written notice failed or refused to do his work or pay the amount assessed against him in lieu of such work upon the community ditch or acequia, shall be allowed to take or use any water from such community ditch or acequia or lateral thereof, while in default in such payment or failure to do such work."

Chapter 67, laws of 1961, amended section 75-28-48, New Mexico Statutes Annotated, 1959 supplement to 1953 compilation, and added sections 75-28-49 through 75-28-67, to provide a nonconflicting election code for certain conservancy districts in existence in the State. Chapter 123, laws of 1961, added section 75-30-4.1, New Mexico Statutes Annotated, 1961 supplement to 1953 compilation, to require that certain conservancy districts hold elections for approval of levies and assessments for construction, to prescribe the form of ballot to be used, and to set forth general procedures to be followed in such elections.

Chapters 181, 182, and 183, laws of 1961 (uncodified), appropriated to the State Engineer from the New Mexico Irrigation Works Construction Fund the sum of \$135,000 to finance rehabilitation of small irrigation projects in Guadalupe, San Miguel, and Taos Counties. These

statutes, and subsequent litigation, are discussed in detail elsewhere in this volume, under the heading *Work Authorized by Legislature*.

Chapters 207 and 224, laws of 1961, amended respectively sections 11-2-56 and 4-4-2.1, New Mexico Statutes Annotated, 1957 supplement to 1953 compilation, to exclude irrigation districts organized under sections 75-23-1 through 75-23-45 from the definition "local public body," for purposes of chapter 4 (State Affairs and Government) and chapter 11 (Public Finances), New Mexico Statutes Annotated, 1957 supplement to 1953 compilation.

Chapter 231, laws of 1961, amended section 75-32-8, New Mexico Statutes Annotated, 1953 compilation, which pertains to assessments of water users in conservancy districts, penalties to be assessed delinquents, and appeals therefrom.

Chapter 250, laws of 1961, amended section 75-1-2.1, New Mexico Statutes Annotated, 1959 supplement to 1953 compilation, which makes statutory provision for declaration of water rights claimed established prior to 1907. The amendment provides that water-rights records on file with the State Engineer or with the clerk of the county within which the diversion works are located shall constitute prima facie evidence of the truth of their contents.

WATER-RIGHTS ADMINISTRATION

The climate of New Mexico is semiarid. Annual precipitation over its 78 million acres averages less than 14 inches and aggregates about 100 million acre-feet a year. Of this quantity, some 4 million acre-feet a year becomes available for development of the land and related resources, and for filling other needs of about a million people. The remainder returns to the atmosphere through evaporation and use by native vegetation.

New Mexico statutes provide that the surface and underground waters of the State belong to the public and are subject to appropriation for beneficial use. Such use is the basis, the measure, and the limit to the right to use water, and priority in time gives the better right. The underlying principle is known as the appropriative doctrine of water rights. Where it applies, one has no right to the use of water simply because it flows past, through, or under his land; rather, the right is established through actual use, and rights established first must be served first. In New Mexico the doctrine was followed by custom and by court declaration for many years before statehood was attained. It was enunciated in the surface-water codes of 1905 and 1907, in the State Constitution in 1911, and in the ground-water statutes of 1927 and 1931.

In a climate such as New Mexico's, it would be difficult to manage water under any other system. Development of any nature would be discouraged if latecomers could interfere with the water supplies upon which earlier investments had been based.

Water rights in New Mexico are administered by the State Engineer — in accordance with provisions of the Constitution and the statutes, rulings of the courts, interstate water compacts, and international treaties. The seven interstate compacts to which the State is signatory profoundly affect development, control, and use of water in New Mexico. Situations in which there is intimate relationship between ground water and the flow of surface streams require coordinated administration of diversions by wells and surface works to protect rights within the State and to preserve the State's ability to meet interstate water-delivery obligations.

Irrigation is the principal user of water in New Mexico. Municipal and industrial demands are increasing sharply, but since more than 90 percent of present use is for irrigation on about 950,000 acres of land it is apparent that present municipal and industrial usage can be increased many times at small expense to irrigation. The fact that the value of water in municipal and industrial usage is generally many times that for agriculture makes irrigation an attractive source of water for municipal

and industrial uses, and State law provides procedures for changing ownership of water rights, point and method of diversion, and place and purpose of use.

Most surface water in the State has been appropriated, although much remains to be applied to beneficial use in the San Juan and Canadian River basins. Water-right activity in recent years, therefore, has been mostly concerned with ground water. Of a total of 18,663 water-rights instruments processed by the State Engineer during the 25th biennial period, 17,848 pertained to ground water.

Ground Water

When the State Engineer proclaims that certain underground streams, channels, artesian basins, reservoirs, or lakes have reasonably ascertainable boundaries, he assumes jurisdiction over the appropriation and use of ground water obtained from such sources. By the end of the 25th biennial period the State Engineer had assumed jurisdiction over ground-water uses in 19 such areas — to prevent impairment of existing water rights, to insure beneficial use of available water, to provide for orderly development of the resource, and in some instances as a safeguard against possible investment in wells the use of which might be prohibited by court decree (see Gila-San Francisco Underground Basin, below).

In declared underground-water basins no well may be drilled except by a driller licensed by the State Engineer, and no well may be drilled without a permit from the State Engineer. A person not licensed by the State Engineer may construct a driven well within a declared underground-water basin provided that the casing of the well does not exceed $2\frac{3}{8}$ inches outside diameter. However, a permit to construct such a well must be obtained from the State Engineer.

In areas not included in underground-water basins declared by the State Engineer, appropriation of the public water may be made without permit from the State Engineer and wells may be constructed by drillers not licensed by the State Engineer.

Procedures to be followed in appropriating ground water in areas which are within underground-water basins are described in detail in the Manual of Rules and Regulations Governing the Drilling of Wells and the Appropriation and Use of Ground Water in Declared Basins in the State of New Mexico, available without cost from the State Engineer Office in Santa Fe and from the Albuquerque, Deming, and Roswell suboffices.

UNDERGROUND-WATER BASINS

As of the end of the 25th biennium, 19 underground water basins covering almost 21,000 square miles, roughly a fifth of the State's area,

had been declared by the State Engineer. Five of the basins — Gila-San Francisco, San Simon, Lordsburg Valley, Nutt-Hockett, and Jal — were declared during the biennial period.

The 19 areas of ground-water control, shown in figure 1, are discussed below in sequence of their declaration.

1. *The Mimbres Valley Underground Water Basin* was declared on July 29, 1931, and extended on April 7, 1942; April 13, 1942; February 23, 1956; and June 3, 1960. With the exception of the Eastern Extension area, which was declared and closed on April 7, 1942, and reopened to appropriation on July 31, 1959, water in the basin is presently considered to be fully appropriated except for domestic and livestock uses.

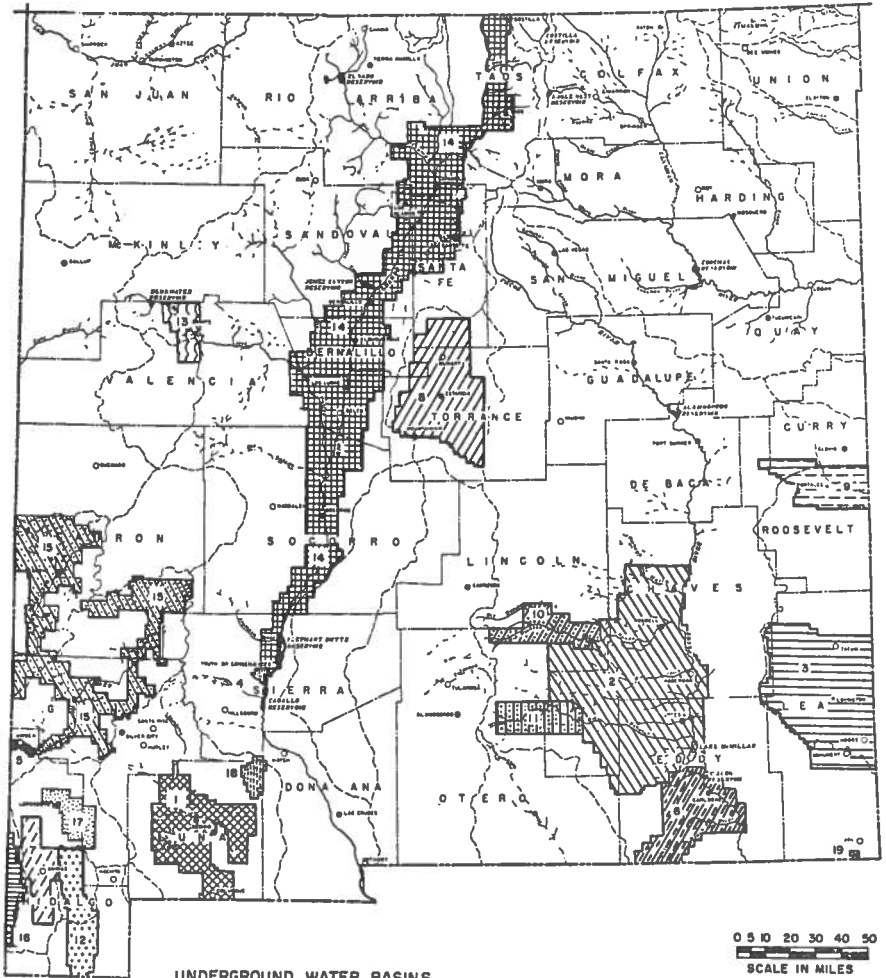
Water levels in the basin have continued to decline during the past 2 years.

2. *The Roswell Artesian Basin* was declared on August 21, 1931, and was extended on February 4, 1935; February 13, 1940; January 6, 1941; October 1, 1942; August 21, 1946; January 12, 1948; January 31, 1950; September 1, 1953; May 10, 1954; and July 20, 1959. The area in the extensions more than quadrupled the area within the original boundaries. New appropriations of artesian water for purposes other than domestic or livestock uses have not been permitted since August 1931; new appropriations of shallow ground water other than for domestic or livestock uses have not been permitted since August 1937.

Saline water encroachment has continued to be a problem in the artesian aquifer north and east of the city of Roswell, with the highest rate of encroachment occurring north of the city. Applications to transfer several hundred acres of water rights from this area to areas of fresher water for irrigation and municipal purposes are being held pending further study of the probable effects of such moves upon existing rights.

The legal determination of ground-water rights by adjudication continued during the biennial period — the adjudication having been initiated several years ago under a cooperative agreement of the State Engineer and the Pecos Valley Artesian Conservancy District. The adjudication is now almost complete and the legally defined rights, coupled with the hydrographic survey prepared for the adjudication, have facilitated administration of water rights and uses in the basin; however, numerous applications to adjust irrigated acreages to conform with final decrees have resulted in an increased workload in the Water Rights Division.

During the first half of the biennium personnel from the State Engineer Office witnessed the cementing, casing, and plugging of 82 oil wells in the southern and northern parts of the basin. This program, carried out to insure that the ground waters are adequately protected from leakage and contamination from oil wells, was transferred in June



UNDERGROUND WATER BASINS

BASIN	AREA IN SQUARE MI.
1. MIMBRES VALLEY	1,316
2. ROSWELL ARTESIAN	3,950
3. LEA COUNTY	2,180
4. HOT SPRINGS	38
5. VIRDEN VALLEY	19
6. CARLSBAD	962
7. ANIMAS VALLEY	426
8. ESTANCIA	1,498
9. PORTALES	628
10. HONDO	477
11. PENASCO	393
12. PLAYAS VALLEY	315
13. BLUEWATER	269
14. RIO GRANDE	5,009
15. GILA - SAN FRANCISCO	2,369
16. SAN SIMON	151
17. LORDSBURG VALLEY	329
18. NUTT - HOCKETT	104
19. JAL	15

FIGURE 1

**DECLARED UNDERGROUND
WATER BASINS
OF THE STATE ENGINEER
JUNE 30, 1962**

1961 to the Oil Conservation Commission, pursuant to statutes enacted by the 25th Legislature of New Mexico (chapter 61, laws of 1961).

On March 1, 1961, an aerial flight of the recharge area and the area east of the Pecos River was made to determine whether any new development or drilling activity had taken place. No such development or activity was noted.

An increased rate of transfer of irrigation rights to municipal and industrial uses occurred during the biennium. Water rights were transferred from irrigation for uses at missile sites, for construction of the Two Rivers Reservoir Project west of Roswell, for road-building purposes, for uses in trailer courts, and for many varied uses associated with rapid urban growth in the vicinity of Roswell.

Both shallow-water levels and the piezometric head in the artesian aquifer continued to decline during the biennium; in those shallow-ground-water areas where the accumulative declines have been greatest, well yields have decreased markedly.

Other activities during the biennium included 1) investigation and mapping of points of surface-water diversion on Berrendo River and on those parts of Rio Hondo and Rio Penasco that are within the boundaries of the Roswell Artesian Basin, 2) annual winter pressure tests in 337 wells, 3) witnessing of casing and cementing of 45 artesian wells, 4) leakage tests on 10 artesian wells, and 5) many smaller investigations including the preparation of maps and data for the processing of non-routine applications and for State Engineer hearings and district court cases.

The cooperation extended by the Pecos Valley Artesian Conservancy District facilitated administration of the basin.

3. *The Lea County Underground Water Basin* was declared on August 21, 1931, and extended on October 1, 1952. The original declared area was closed to further appropriations on December 29, 1948; parts of the basin were reopened to further development on December 31, 1952, and on February 2, 1953. New appropriations are permitted in those areas where unappropriated water, as determined by an inventory, is available.

A comprehensive investigation of irrigated lands and of commercial, industrial, and municipal uses of water was completed in November 1961 and a summary report of the investigation was prepared for administrative use. The field checks and much of the mapping were accomplished during the 23rd and 24th bienniums. Among other things, the investigation revealed that: 1) the total irrigation rights of record as of July 1, 1961, applied to 121,134 acres of cropland and 3,078 acres of irrigated native grass; 2) the commercial, industrial, and municipal rights of record as of July 1, 1961, totaled 109,928.8 acre-feet per annum; 3) in the year 1960, 95,395 acres of cropland and 2,070 acres of native grass were under irrigation from 1,340 wells. Most uses under commercial, industrial, and

municipal rights were for the purpose of secondary recovery of oil by water-flooding methods; the second largest usage was for milling (primarily potash), and the third largest usage was for municipal purposes. The estimated use of water during the year 1961 for municipal, commercial, and industrial purposes totaled 19,455 acre-feet, or approximately 18 percent of such rights permitted.

Water-flood pilot programs carried on by oil companies in fields located in and adjacent to the Lea County basin have demonstrated the feasibility of recovering oil by this method, and the use of shallow ground water for secondary recovery of oil has proceeded rapidly. Permits approved for this use during the 23rd and 24th bienniums are being developed at an accelerating rate.

Other work accomplished during the 25th biennium included the scheduling and measurement of water levels in 1,600 wells; the measurements will provide the basis for a new water-table map and new water-level-change map.

4. *The Hot Springs Underground Water Basin* was declared on April 15, 1935. Appropriation of thermal artesian (mineral) waters was closed on July 1, 1937. On August 26, 1947, and July 17, 1950, parts of the basin were reopened to appropriation of thermal artesian waters. Appropriation of fresh (cold) artesian waters was closed on August 26, 1947. Appropriation of shallow, nonthermal ground water currently is permitted along Palomas Creek, principally to supplement existing surface-water irrigation rights. The development of shallow thermal ground water is continuing.

5. *The Virden Valley Underground Water Basin* was declared on December 5, 1938. The boundary was revised on January 7, 1957, and extended on October 20, 1960. The principal source of water for irrigation is surface flow of the Gila River, diverted through the Sunset and New Model Canals. Supplemental ground water is used on all lands in the area and wells are the primary source of water on some lands. No new appropriations are being permitted at present. The basin, including the area added in 1960, is shown in figure 2. State Engineer Order 83, extending the declared area, is reproduced below.

STATE OF NEW MEXICO)

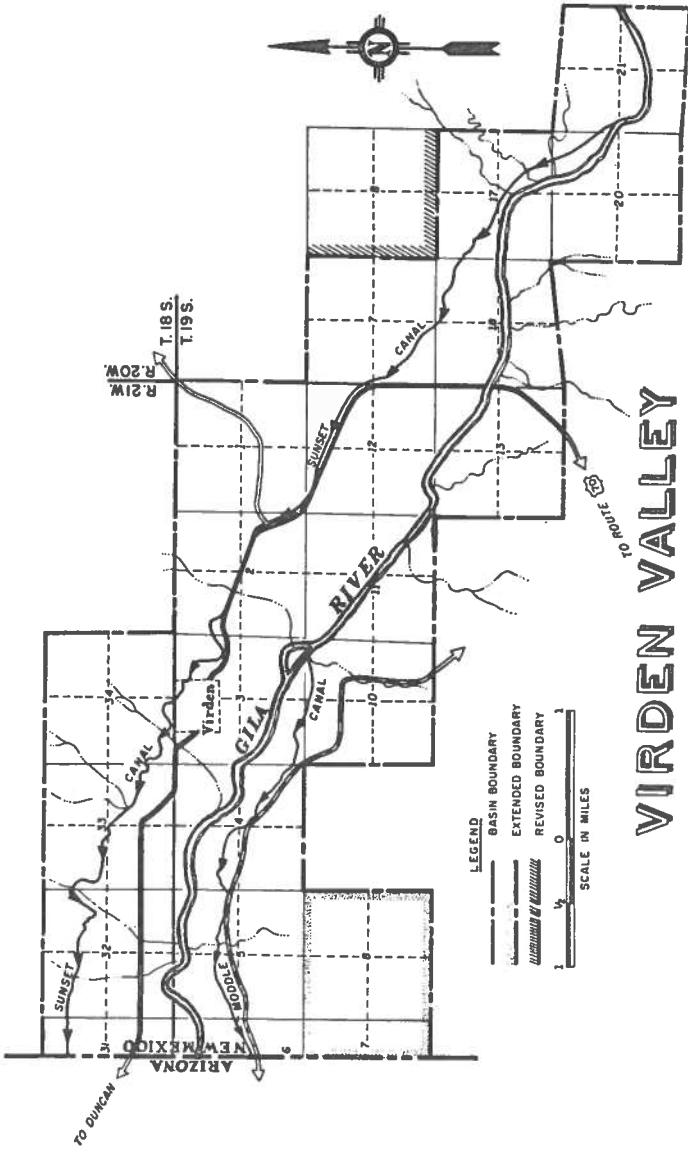
OFFICE OF STATE ENGINEER)

Order 83

DECLARATION OF EXTENSION OF THE VIRDEN VALLEY
UNDERGROUND WATER BASIN

WHEREAS, the waters of underground streams, channels, artesian basins, reservoirs, or lakes, having reasonably ascertainable boundaries, are public waters and are subject to appropriation for beneficial use; and

WHEREAS, the Virden Valley Underground Water Basin has been declared and bounded by order of the State Engineer dated December 5, 1938, and the boundary revised January 7, 1957, by Order No. 66; and



VIRDEN VALLEY UNDERGROUND WATER BASIN

FIGURE 2

DEC. 5, 1936, VIRDEN VALLEY UNDERGROUND WATER BASIN DECLARED.
JAN. 7, 1957, BASIN BOUNDARY REVISED.
OCT. 20, 1960, BASIN BOUNDARY EXTENDED.

WHEREAS, the Virden Valley Underground Water Basin boundaries, as presently defined, do not include certain adjacent areas which are a part of the underground water basin having reasonably ascertainable boundaries and in which new appropriations of water might impair existing rights;

NOW, THEREFORE, IT IS HEREBY DECLARED that the areas in Hidalgo County more fully described hereinafter are a part of the Virden Valley Underground Water Basin subject to the New Mexico statutes and the rules and regulations of the State Engineer:

TOWNSHIP	RANGE	SECTIONS
19 S.	21 W.	7 and 8

WITNESS my hand and the official seal of my office this 20th day of October, A. D. 1960.

/s/ S. E. Reynolds
S. E. Reynolds
 State Engineer

6. *The Carlsbad Underground Water Basin* was declared on October 16, 1947, and extended on October 21, 1952, and March 19, 1958. Appropriations have been granted for the application of shallow ground water to help serve existing surface-water rights and for domestic purposes and livestock watering.

On December 30, 1960, the State Engineer issued his decision, findings, and order in the matter of the applications of the city of Carlsbad to appropriate additional quantities of water from the Capitan Reef formation southwest of the city. These applications had been protested by other appropriators in the basin and hearings had been held in the latter part of the 24th biennium. The State Engineer concluded that new withdrawals from the Capitan limestone would decrease the discharge from that aquifer into Tansill Reservoir with a resultant diminution of supply for water users below the reservoir, and he further concluded that if such withdrawals were sufficiently increased the quality of water available to appropriators using wells tapping the limestone would deteriorate. He also found that some of the city applications as filed were defective in that they did not state the quantity of water to be appropriated. These applications were readvertised and were again protested; hearings were pending at the end of the biennial period. The State Engineer's decision, findings, and order were appealed to the district court.

In order to improve the quality of the city water supply until such time as it should be determined by the courts whether new appropriations could be made, the city of Carlsbad filed a separate set of applications for permits to use points of diversion in the Capitan limestone southwest of the city for the purpose of serving existing municipal rights. These applications also were protested, and on July 11, 1961, the State Engineer entered his decision, findings, and order, approving the use of the wells to help serve existing rights. The city appealed this decision

to the district court and further court action was pending at the close of the report period.

Before the program of oil-well inspection was assumed by the Oil Conservation Commission, personnel from the State Engineer Office witnessed the casing and cementing of 11 oil wells in the Carlsbad area. The casing and cementing of 25 water wells drilled in the limestone aquifer also were witnessed by office personnel.

7. *The Animas Valley Underground Water Basin* was declared on May 5, 1948, and closed to further appropriation on June 14, 1948. The basin was extended and the extension closed on February 23, 1956. Development of permitted acreage in this basin is continuing and licenses are being granted on perfected appropriations. Water levels continued to decline during the 25th biennium, necessitating the deepening of many existing wells and the drilling of supplemental wells. Except for livestock and domestic uses, the basin is closed to new appropriation.

8. *The Estancia Underground Water Basin* was declared on January 31, 1950. At the end of the biennial period, new development was still being permitted in the basin. Housing and recreational areas are being developed on the western fringe of the basin and between Moriarty and Estancia. The introduction of housing and recreation may result in increased demands for water in the future.

9. *The Portales Underground Water Basin* was declared by the State Engineer on May 1, 1950, and extended on July 18, 1955; the boundaries again were modified on November 3, 1955. Appropriations of ground water have been permitted in limited areas where supplies are still available and can be used without impairment to the rights of prior appropriators.

Lowering of the water table in some areas has become critical and the drilling of supplemental wells has greatly increased. In some sectors appropriators are now using four or five wells to irrigate 100-acre tracts, and other appropriators are moving their wells around on the same farm in an attempt to locate a "red-bed low" and consequent increased thickness of the saturated sediments. The large number of wells being drilled in concentrated areas has necessitated increased diligence on the part of office personnel to insure that undue well interference does not occur. Several applications have been protested when it was felt that drilling an additional well would interfere with water production from a neighboring well.

In addition to the routine field checks that are necessary in the processing of applications, 118 field checks were made in conjunction with the preparation of maps for the Portales hydrographic survey.

10. *The Hondo Underground Water Basin* was declared on September 1, 1953, and is open to appropriation of ground water to help serve

existing surface-water rights and to serve domestic and livestock needs. The development of the Ruidoso area as a summer and winter resort has resulted in an increased use of water for municipal purposes and in conversion of irrigation rights to municipal and commercial rights.

11. *The Penasco Underground Water Basin* was declared on September 1, 1953, and appropriations of ground water for irrigation have been permitted to supplement surface waters of the Rio Penasco and tributaries, as have appropriations for domestic and livestock use.

A 1961 investigation of crop and pasture land and existing wells covered part of the Penasco drainage, as well as acreage in an extension of the Roswell Artesian Basin west of the main cultivated area. Within the boundaries of the Penasco Underground Water Basin it was found that there were 771 acres of fallow land previously irrigated from surface waters, 807 acres irrigated with surface water only, 196 acres irrigated from wells only, 440 acres irrigated with primary surface-water rights supplemented by wells, and 325 acres of dryfarm land. Within the basin boundaries there were 25 irrigation wells equipped for use and 1 irrigation well not equipped for use; of 7 commercial wells, 4 were equipped for pumping and 3 were unequipped.

One particular investigation involved considerable time and work on the part of office personnel. The investigation was initiated after a commercial fish hatchery was put into operation on the Bell Springs Ditch near Mayhill, N. Mex. Downstream appropriators felt that the operation of the fish hatchery would cause decrease in flow of Bell Springs, their main source of supply during the irrigation season. Several conferences were held during 1961 and early 1962 between the downstream appropriators, operators of the hatchery, and members of the State Engineer's staff. Early in 1962 the operators moved the fish hatchery into an adjacent pasture and filed application to change place and purpose of use of part of the surface waters of the Bell Springs Ditch. This application was protested by the downstream appropriators and the matter was pending hearing at the end of the biennial period.

12. *The Playas Valley Underground Water Basin* was declared on February 23, 1956, and appropriation of ground water is still permitted. Thirty-one irrigation wells were drilled during the 25th biennial period and considerable irrigated acreage was developed under the new wells. Water levels in this basin have remained relatively unchanged.

13. *The Bluewater Underground Water Basin* was declared on May 21, 1956. Surface and underground waters within its boundaries are interrelated parts of a single supply. Appropriation of ground water to help serve existing surface-water rights to irrigate is permitted to the extent of the historical surface-water supply.

During 1961, an annual appropriation of approximately 2,500 acre-

feet of water per year that previously had been transferred from agricultural use to industrial use was returned to agriculture.

Water levels in the basin continued to decline during the 25th biennium.

14. *The Rio Grande Underground Water Basin* was declared on November 29, 1956. Surface and ground waters within its boundaries are interrelated parts of a single supply. Appropriation of ground water to help serve existing surface-water rights to irrigate is permitted to the extent of the historical surface-water supply. Appropriation of ground water for other purposes is permitted, provided that the immediate and potential effect on the flow of the Rio Grande is offset by the retirement of usage under existing rights.

During the 25th biennium, the State Engineer received from water users within the basin applications to change point of diversion (from surface water to ground water), to change partial point of diversion (drill a supplemental well), and to change place and/or purpose of use (from agricultural to municipal, industrial, and road-construction purposes).

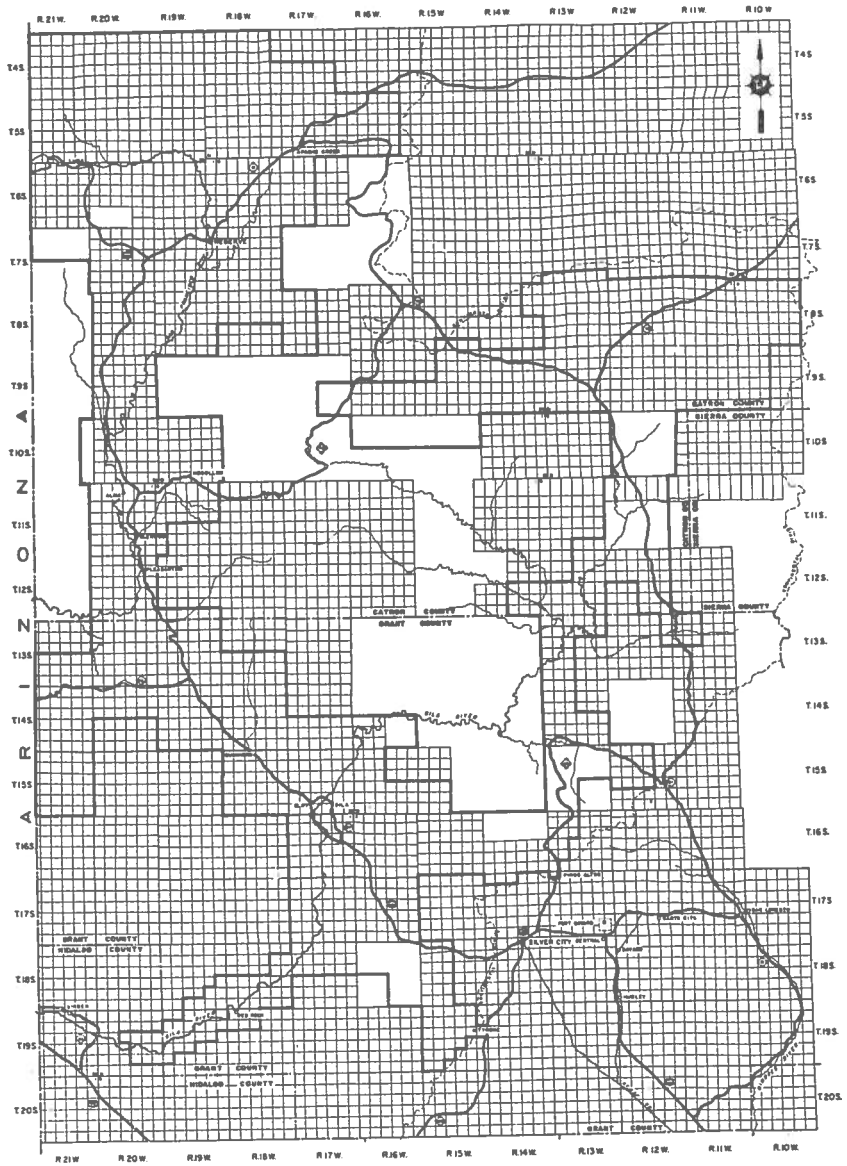
During the 2-year period plane-table surveys of irrigated lands were made at several locations throughout the basin and several investigations were made to determine rates of consumptive use for various types of municipal and industrial purposes.

15. *The Gila-San Francisco Underground Water Basin* was declared on October 20, 1960. The basin is shown in figure 3. Included in the area are drainage areas of the San Francisco River and its principal tributaries from Spur Lake to the Arizona-New Mexico boundary and of most of the main stem of the Gila River and its principal tributaries from the head of Railroad Canyon to the boundary of the declared Virden Valley Underground Water Basin.

The need for bringing appropriation of ground water in this area under the jurisdiction of the State Engineer arose out of litigation (*Arizona v. California*) in the U. S. Supreme Court over division of the waters of the Lower Colorado River Basin. New Mexico became a party to the suit because of her interest in the waters of tributaries of the lower Colorado River below Lees Ferry which originate within her borders. The decree to be entered in this suit is expected to make it mandatory that New Mexico account annually for waters used in the Gila-San Francisco drainage area.

The draft report of the court-appointed Special Master makes it appear likely that the upper limit for development of surface and ground waters in these areas will be the amount developed for uses established prior to 1958. The underground water basin was declared by the State Engineer to avoid the possibility that persons unaware of the pending

GILA-SAN FRANCISCO UNDERGROUND WATER BASIN



- LEGEND**
- BASHN BOUNDARY
 - - - - STATE LINE
 - COUNTY LINE
 - FEDERAL OR STATE ROAD
 - - - - CONTINENTAL DIVIDE
 - CITY OR TOWN
 - ⊙ COUNTY SEAT



FIGURE 3

Supreme Court decision might undertake costly development of new uses which they could within a few years be enjoined from enjoying.

The proposed decree recommended by the Special Master had not been adopted by the Supreme Court by the end of the biennial period; however, in anticipation of its adoption, the State Engineer is proceeding with preparing for the adjudication of the water rights throughout this large area.

Applications submitted for new appropriations of ground water within the Gila-San Francisco Underground Water Basin are still being received by the State Engineer Office, but action on such applications is being withheld pending promulgation of the final decision in *Arizona v. California*. In the meantime, applications to appropriate ground water to serve existing water rights and applications to change point or method of diversion and place or purpose of use are still being acted upon.

State Engineer Order 81 declaring the Gila-San Francisco Underground Water Basin is printed below.

STATE OF NEW MEXICO)
)
OFFICE OF STATE ENGINEER) Order 81

ORDER DECLARING THE
GILA-SAN FRANCISCO UNDERGROUND WATER BASIN

WHEREAS, the waters of underground streams, channels, artesian basins, reservoirs, or lakes, having reasonably ascertainable boundaries, are public waters and are subject to appropriation for beneficial use; and

WHEREAS, all natural waters flowing in streams and water-courses, whether such be perennial or torrential, within the State of New Mexico, belong to the public and are subject to appropriation for beneficial use; and

WHEREAS, there is known to exist an underground water basin in Catron, Grant and Hidalgo Counties in the State of New Mexico, the boundaries of which are reasonably ascertainable; and

WHEREAS, the surface and underground waters within the boundaries of this basin are interrelated;

NOW, THEREFORE, IT IS HEREBY DECLARED that the lands described hereinafter comprise an underground water basin, to be known as the GILA-SAN FRANCISCO UNDERGROUND WATER BASIN, subject to the New Mexico statutes and the rules and regulations of the State Engineer:

TOWNSHIP	RANGE	SECTIONS
4 S.	17 W.	19 thru 36
4 S.	18 W.	All
4 S.	19 W.	All
4 S.	20 W.	All
4 S.	21 W.	All
5 S.	16 W.	All
5 S.	17 W.	All
5 S.	18 W.	All
5 S.	19 W.	All
5 S.	20 W.	All

TOWNSHIP	RANGE	SECTIONS
5 S.	21 W.	All
6 S.	17 W.	4 thru 9, 16 thru 21, 28 thru 33
6 S.	18 W.	All
6 S.	19 W.	All
6 S.	20 W.	All
6 S.	21 W.	All
7 S.	13 W.	31 thru 36
7 S.	18 W.	All
7 S.	19 W.	All
7 S.	20 W.	All
7 S.	21 W.	* 1 thru 18 (projected)
8 S.	10 W.	All
8 S.	11 W.	All
8 S.	12 W.	All
8 S.	13 W.	All
8 S.	14 W.	1, 2, 11 thru 14
8 S.	15 W.	33 thru 36
8 S.	17 W.	4 thru 9, 16 thru 21, 28 thru 33
8 S.	18 W.	1 thru 18
8 S.	19 W.	All
8 S.	20 W.	All
9 S.	10 W.	4 thru 9, 16 thru 21, 28 thru 33
9 S.	11 W.	All
9 S.	12 W.	All
9 S.	13 W.	All
9 S.	14 W.	All
9 S.	15 W.	1 thru 4, 9 thru 16, 19 thru 36
9 S.	16 W.	19 thru 36
9 S.	17 W.	* 22 thru 27, 34 thru 36 (projected)
9 S.	20 W.	All
10 S.	12 W.	All
10 S.	15 W.	* 1 thru 18 (projected)
10 S.	16 W.	* 1 thru 18 (projected)
10 S.	19 W.	All
10 S.	20 W.	All
10 S.	21 W.	* 1, 12, 13, 24, 25, 36 (projected)
11 S.	12 W.	All
11 S.	13 W.	34 thru 36
11 S.	19 W.	1 thru 19, 30, 31
11 S.	20 W.	All
12 S.	12 W.	1 thru 18, 22 thru 27, 34 thru 36
12 S.	13 W.	1 thru 3, 10 thru 15, 19 thru 36
12 S.	14 W.	22 thru 27, 34 thru 36
12 S.	19 W.	31 thru 36
12 S.	20 W.	All
13 S.	11 W.	4 thru 9, 16 thru 18
13 S.	12 W.	1, 12, 13
13 S.	13 W.	1 thru 12, 16 thru 21, 28 thru 33
13 S.	18 W.	19 thru 36
13 S.	19 W.	All
13 S.	20 W.	All
13 S.	21 W.	19 thru 36
14 S.	13 W.	4 thru 9, 16 thru 36
14 S.	16 W.	* 19 thru 36 (projected)
14 S.	17 W.	19 thru 36

TOWNSHIP	RANGE	SECTIONS
14 S.	18 W.	All
14 S.	19 W.	All
14 S.	20 W.	1 thru 18
14 S.	21 W.	All
15 S.	12 W.	3 thru 10, 15 thru 22
15 S.	13 W.	* 1 thru 21, 28 thru 33 (projected)
15 S.	15 W.	19 thru 21, 28 thru 33
15 S.	16 W.	4 thru 9, 16 thru 36
15 S.	17 W.	All
15 S.	18 W.	All
15 S.	21 W.	All
16 S.	13 W.	4 thru 9, 16 thru 20, 29 thru 31
16 S.	14 W.	All
16 S.	15 W.	All
16 S.	16 W.	All
16 S.	17 W.	All
17 S.	13 W.	N½ Section 6
17 S.	14 W.	4 thru 6
17 S.	16 W.	All
17 S.	17 W.	All
18 S.	15 W.	4 thru 9, 16 thru 21, 28 thru 33
18 S.	16 W.	* 1 thru 18, 22 thru 27, 34 thru 36 (projected)
18 S.	17 W.	1 thru 18
18 S.	18 W.	11 thru 14, 19 thru 36
18 S.	19 W.	24 thru 26, 33 thru 36
19 S.	15 W.	2 thru 11, 13 thru 22, 28 thru 32
19 S.	18 W.	4 thru 9
19 S.	19 W.	1 thru 4, 7 thru 12, 14 thru 21, 30
19 S.	20 W.	13 thru 16, 22 thru 27

* Projected sections are based on meridian and parallel projections of surveyed townships.

WITNESS my hand and the official seal of my office this 20th day of October, A. D. 1960.

/s/ S. E. Reynolds

S. E. Reynolds
State Engineer

16. *The San Simon Underground Water Basin* was declared on October 20, 1960. Its area approximates that portion of the San Simon Creek drainage that is in New Mexico. The basin is shown in figure 4.

The need for bringing this area under the jurisdiction of the State Engineer is the same as that for creating the Gila-San Francisco Underground Water Basin. As in the Gila-San Francisco basin, action on applications for new appropriations of ground water in the San Simon basin is deferred pending final decision in the *Arizona v. California* litigation.

State Engineer Order 82 declaring the San Simon Underground Water Basin is printed below.

STATE OF NEW MEXICO)
)
 OFFICE OF STATE ENGINEER)

Order 82

ORDER DECLARING THE
 SAN SIMON UNDERGROUND WATER BASIN

WHEREAS, the waters of underground streams, channels, artesian basins, reservoirs, or lakes, having reasonably ascertainable boundaries, are public waters and are subject to appropriation for beneficial use; and

WHEREAS, all natural waters flowing in streams and water-courses, whether such be perennial or torrential, within the State of New Mexico, belong to the public and are subject to appropriation for beneficial use; and

WHEREAS, there is known to exist an underground water basin in Hidalgo County in the State of New Mexico, the boundaries of which are reasonably ascertainable; and

WHEREAS, the surface and underground waters within the boundaries of this basin are interrelated;

NOW, THEREFORE, IT IS HEREBY DECLARED that the lands described hereinafter comprise an underground water basin, to be known as the SAN SIMON UNDERGROUND WATER BASIN, subject to the New Mexico statutes and the rules and regulations of the State Engineer:

TOWNSHIP	RANGE	SECTIONS
24 S.	21 W.	5 thru 8, 17 thru 20, 29 thru 32
25 S.	21 W.	4 thru 9, 16 thru 21, 28 thru 33
26 S.	21 W.	3 thru 10, 15 thru 22, 27 thru 34
26 S.	22 W.	1, 12, 13, 24, 25, 36
27 S.	21 W.	3 thru 10, 14 thru 36
27 S.	22 W.	1, 12, 13, 24, 25, 36
28 S.	21 W.	2 thru 11, 14 thru 21, 28 thru 33
28 S.	22 W.	1, 12, 13, 24, 25, 36
29 S.	21 W.	6, 7, 18, 19, 30, 31
29 S.	22 W.	1, 2, 11 thru 14, 23 thru 26, 35, 36
30 S.	22 W.	1, 2, 11 thru 14, 23 thru 26, 35, 36
31 S.	22 W.	1, 2, 11, 12

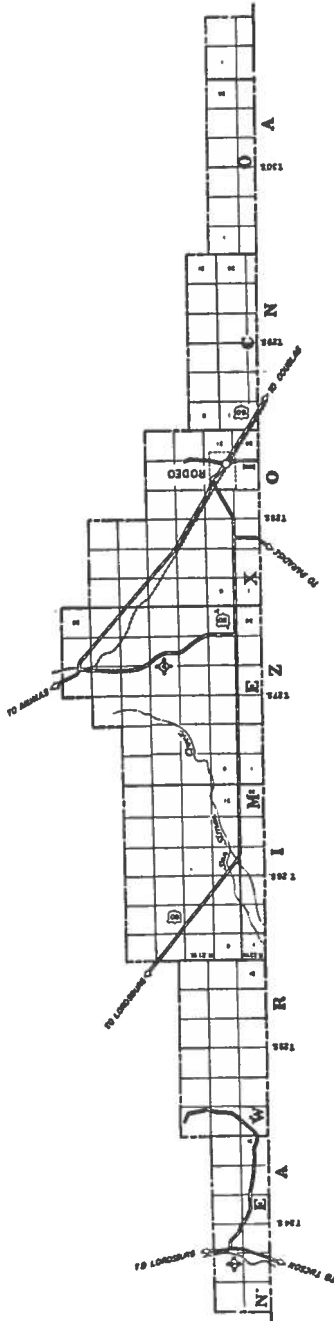
WITNESS my hand and the official seal of my office this 20th day of October, A. D. 1960.

/s/ S. E. Reynolds

S. E. Reynolds
 State Engineer

17. *The Lordsburg Valley Underground Water Basin* (fig. 5) was declared on November 18, 1960. Although the area had not previously been in an existing ground-water basin, approximately 160 applications had been filed in the State Engineer Office by the date of declaration. Many of the applications had been protested by the city of Lordsburg and individual water users who believed that the granting of a number of the applications would impair existing rights. After making a preliminary inventory of the ground-water supply, the State Engineer declared the basin in order to provide for orderly development of the water. Action on all applications was withheld until after the protest hearing on January 4 and 5, 1961. On March 10, 1961, the State Engineer

SAN SIMON UNDERGROUND WATER BASIN



COURTESY OF THE SAN SIMON UNDERGROUND WATER BASIN DISTRICT

FIGURE 4



issued a memorandum decision in the matter and subsequently all applications were acted on. Six appeals from the State Engineer's decision were taken to district court and a court hearing on the consolidated appeals is pending.

Portions of the basin presently are open to new appropriations. Twelve irrigation wells were drilled during the 25th biennial period and the development of irrigated acreage is progressing. Water levels in this basin have shown declines.

State Engineer Order 84, declaring the Lordsburg Valley Underground Water Basin, appears below.

STATE OF NEW MEXICO)
)
 OFFICE OF STATE ENGINEER) Order 84

ORDER DECLARING THE
 LORDSBURG VALLEY UNDERGROUND WATER BASIN

WHEREAS, the waters of underground streams, channels, artesian basins, reservoirs, or lakes, having reasonably ascertainable boundaries, are public waters and are subject to appropriation for beneficial use; and

WHEREAS, there is known to exist an underground water basin in Grant and Hidalgo Counties in the State of New Mexico, the boundaries of which are reasonably ascertainable;

NOW, THEREFORE, IT IS HEREBY DECLARED that the lands described hereinafter comprise an underground water basin, to be known as the LORDSBURG VALLEY UNDERGROUND WATER BASIN, subject to the New Mexico statutes and the rules and regulations of the State Engineer:

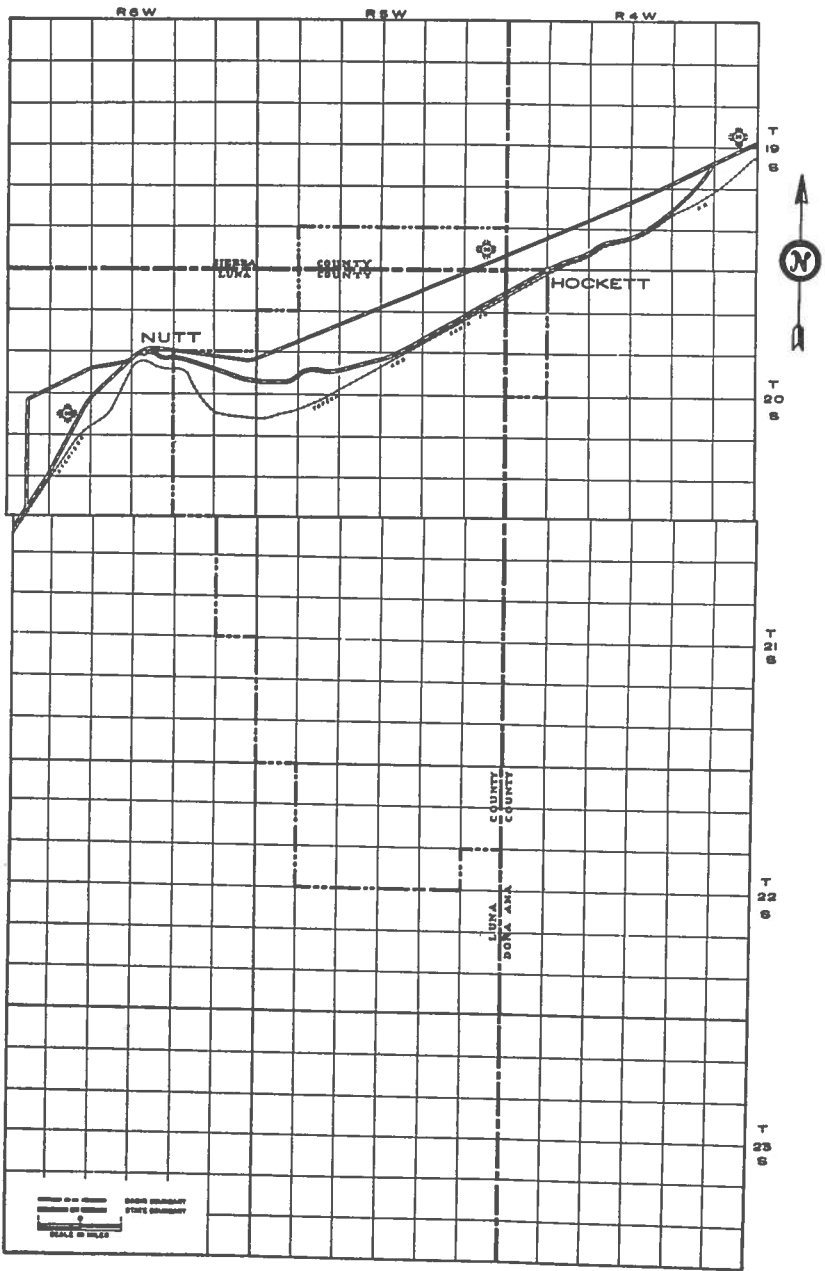
TOWNSHIP	RANGE	SECTIONS
22 S.	17 W.	19 thru 36
22 S.	18 W.	All
22 S.	19 W.	All
23 S.	16 W.	All
23 S.	17 W.	All
23 S.	18 W.	1 thru 6, 9 thru 16, 22 thru 27, 34 thru 36
24 S.	16 W.	All
24 S.	17 W.	All
24 S.	18 W.	1 thru 3, 10 thru 15, 22 thru 27, 34 thru 36
25 S.	16 W.	All
25 S.	17 W.	1 thru 18

WITNESS my hand and official seal of my office this 18th day of November, A. D. 1960.

/s/ S. E. Reynolds

 S. E. Reynolds
 State Engineer

18. The Nutt-Hockett Underground Water Basin (fig. 6) was declared on August 11, 1961. Although development of ground water in the area had not previously been subject to the rules and regulations of the State Engineer, 36 applications to appropriate had been filed in the State Engineer Office by the date of the basin's declaration. Some of



NUTT - HOCKETT UNDERGROUND WATER BASIN

DECLARED AUGUST 11, 1961

FIGURE 6

The basin was declared by the State Engineer in order to provide for orderly development of water and to protect existing rights in the area. A study and inventory of the ground-water supply of the basin was made and appropriations are permitted within the amount found available for the reasonable economic life of the ground-water resource.

State Engineer Order 88, declaring the Jal Underground Water Basin, and Corrective Order 88 follow.

STATE OF NEW MEXICO)
OFFICE OF STATE ENGINEER) Order 88

ORDER DECLARING THE
JAL UNDERGROUND WATER BASIN

WHEREAS, the waters of underground streams, channels, artesian basins, reservoirs, or lakes, having reasonably ascertainable boundaries, are public waters and are subject to appropriation for beneficial use; and

WHEREAS, there is known to exist an underground water basin in Lea County in the State of New Mexico, the boundaries of which are reasonably ascertainable;

NOW, THEREFORE, IT IS HEREBY DECLARED that the lands described hereinafter comprise an underground water basin, to be known as the JAL UNDERGROUND WATER BASIN, subject to the New Mexico statutes and the rules and regulations of the State Engineer:

TOWNSHIP	RANGE	SECTIONS
26 S.	35 E.	SE¼ 12, E½ 13, E½ 24,
26 S.	36 E.	S½ 7, S½ 8, S½ 9, SW¼ 10, W½ 15
		All 16 thru 21, W½ 22, W½ 27
		All 28 & 29, N½ & SE¼ 30
		NE¼ 31, N½ 32, N½ 33, NW¼ 34

WITNESS my hand and official seal of my office this 24th day of November, A. D. 1961.

/s/ S. E. Reynolds
S. E. Reynolds
State Engineer

STATE OF NEW MEXICO)
OFFICE OF STATE ENGINEER) Corrective Order 88

CORRECTIVE ORDER 88
DECLARING THE JAL UNDERGROUND WATER BASIN

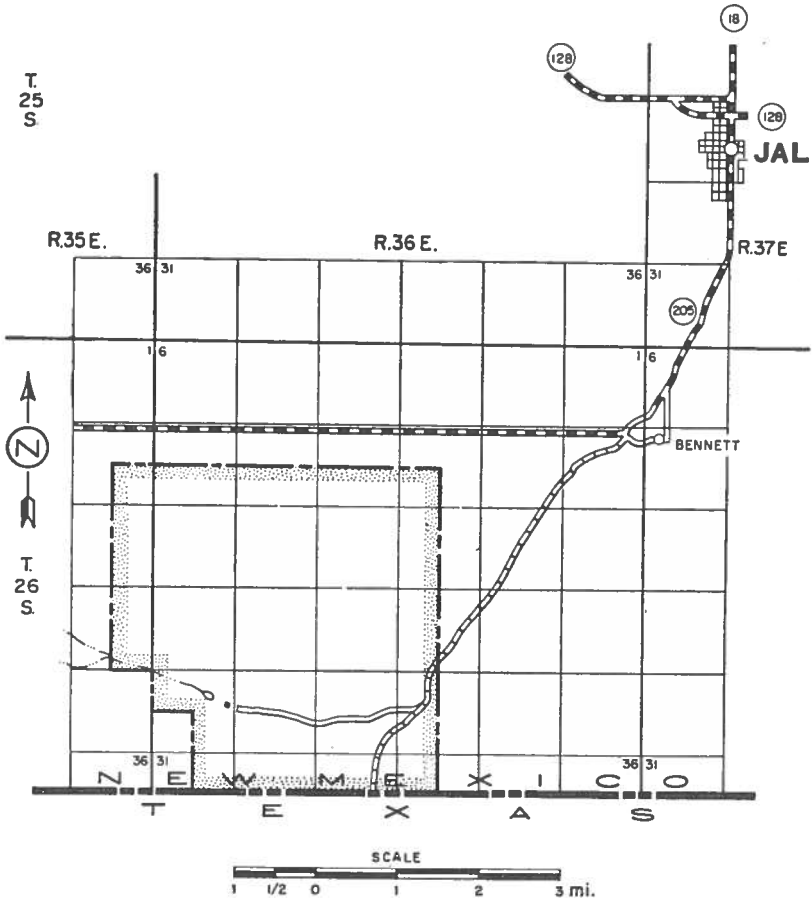
WHEREAS, the waters of underground streams, channels, artesian basins, reservoirs, or lakes, having reasonably ascertainable boundaries, are public waters and are subject to appropriation for beneficial use; and

WHEREAS, there is known to exist an underground water basin in Lea County in the State of New Mexico, the boundaries of which are reasonably ascertainable; and

WHEREAS, on the 24th day of November, A. D. 1961, Order 88 declaring the JAL UNDERGROUND WATER BASIN was promulgated by the State Engineer; and

WHEREAS, certain descriptions of lands to be included within the said basin were perhaps ambiguous;

NOW, THEREFORE, IT IS HEREBY DECLARED that aforementioned



JAL UNDERGROUND WATER BASIN
DECLARED NOVEMBER 24, 1961

FIGURE 7

Order 88 is to be corrected to include the lands described hereinafter, the same comprising an underground water basin to be known as the JAL UNDERGROUND WATER BASIN, subject to the New Mexico statutes and the rules and regulations of the State Engineer:

TOWNSHIP	RANGE	SECTIONS
26 S.	35 E.	SE $\frac{1}{4}$ 12, E $\frac{1}{2}$ 13, E $\frac{1}{2}$ 24
26 S.	36 E.	S $\frac{1}{2}$ 7, S $\frac{1}{2}$ 8, S $\frac{1}{2}$ 9, SW $\frac{1}{4}$ 10, W $\frac{1}{2}$ 15
		All 16 thru 21, W $\frac{1}{2}$ 22, W $\frac{1}{2}$ 27
		All 28 & 29, N $\frac{1}{2}$ & SE $\frac{1}{4}$ 30
		N $\frac{1}{2}$ NE $\frac{1}{4}$ & Lots 4 & 5 of 31
		N $\frac{1}{2}$ N $\frac{1}{2}$ & Lots 1 thru 4 of 32
		N $\frac{1}{2}$ N $\frac{1}{2}$ & Lots 1 thru 4 of 33
		N $\frac{1}{2}$ NW $\frac{1}{4}$ & Lots 3 & 4 of 34

WITNESS my hand and official seal of my office this 1st day of December, A. D. 1961.

/s/ S. E. Reynolds
 S. E. Reynolds
 State Engineer

AMENDMENTS OF RULES AND REGULATIONS

In addition to the orders pertaining to declaration of areas of ground-water control, the State Engineer during the 25th biennium issued two orders (86 and 87) amending the Manual of Rules and Regulations Governing the Drilling of Wells and the Appropriation and Use of Underground Waters in Declared Basins of the State of New Mexico. A brief discussion of the two amending orders follows.

Order 86, issued on August 22, 1961, rescinded Order 79 and concerns appropriation of water from a well within a declared basin from which no water had been applied to beneficial use prior to April 2, 1959. The order was issued to bring the water users' attention to statutes enacted by the 1959 Legislature, specifically to sections 75-11-26 through 75-11-36, New Mexico Statutes Annotated, 1953, and supplements thereto, being chapter 251, laws of 1959. This statute requires the owner of an existing well who has not applied water to beneficial use at the time a basin is declared or extended to file an application with the State Engineer before using the well.

Order 87, issued October 27, 1961, relates to forfeiture of water rights and implements section 75-11-8, New Mexico Statutes Annotated, as it was amended by the Legislature in 1957 and 1959. The legislation liberalized the previous statute relating to forfeiture of ground-water rights by providing that a person who has not used his water for a period of more than 3 years may, before the end of the 4th year, apply to the State Engineer for an extension of time for application of water to beneficial use. If an applicant shows reasonable cause for delay in using

the water beneficially, the law gives the State Engineer authority to grant the requested extension of time for a period not to exceed 1 year. If the requested extension is granted, the applicant avoids the forfeiture otherwise imposed by the statute.

INSTRUMENTS PROCESSED

During the biennial period a total of 17,848 instruments pertaining to appropriation and development of ground water in New Mexico were processed in the State Engineer Office. A breakdown is shown in Table 1. Additional instruments pertaining to exploratory and de-watering operations were processed.

In connection with the processing of these instruments, 80 water wells were inspected to insure that casing, cementing, and plugging specifications were carried out in accordance with the statutes and the rules and regulations of the State Engineer, and 337 artesian wells were measured to determine piezometric surface. Leakage tests were made on 17 artesian wells. Water-level measurements were made in more than 3,000 shallow wells. Field inspections and land surveys were made in connection with the processing of applications. Technical investigations were made for reports prepared in connection with litigation involving ground water. Several hundred notarized letters of certification were issued attesting to the status of records pertaining to water rights.

A total of 185 protests were filed with the State Engineer against 80 water-right applications; 29 of the protests subsequently were withdrawn. Several protests were combined for hearing by agreement of the interested parties as they were similar in nature and legal aspect. Eleven hearings were held on 197 protests which included several protests filed during the 24th biennium. Seventy-seven protested applications, 57 from previous bienniums and 20 from the period of this report, were still pending at the end of the report period because the principal parties had not expressed their readiness for hearing.

WATER-WELL DRILLERS

State law requires that any person who drills for water within the boundaries of a declared underground-water basin shall be licensed by the State Engineer. Such licenses are not required for construction of a driven well, provided the casing does not exceed 2 $\frac{3}{8}$ inches, outside diameter. Applications for licenses and renewals of licenses for well drillers within the 19 declared underground-water basins are processed in the District 2 Office at Roswell. A total of 56 new applications were approved during the 25th biennium, and 34 licenses were cancelled. In all, 191 applications for drillers' licenses and renewal of licenses were processed. At the end of the biennial period, 162 licensed well drillers were doing business in New Mexico.

TABLE 1
GROUND-WATER INSTRUMENTS PROCESSED DURING 25TH BIENNIUM

INSTRUMENT	DISTRICT NO. 1										DISTRICT NO. 2										DISTRICT NO. 3										GRAND TOTAL
	Bluewater Basin	Estancia Basin	Rio Grande Basin	Misc. (Outside Basins)	District Total	Carlsbad Basin	Hondo Basin	Jalisco Basin	Lea County Basin	Penasco Basin	Portales Basin	Roswell Basin	Misc. (Outside Basins) & Well Drillers Lic.	District Total	Animas Basin	Gila-San Francisco Basin	Hot Springs Basin	Lordsburg Basin	Mimbres Basin	Nutri-Hockett Basin	Platas Basin	San Simon Basin	Virden Basin	Misc. (Outside Basins)	District Total						
Declaration of Right	20	5	107	13	145	6	9	2	15	0	49	24	11	116	0	211	8	15	22	13	1	23	0	45	338	599					
Appl. to Appropriate, Irrig., M & I	1	31	6	5	43	6	0	5	317	0	18	0	0	346	0	10	8	53	25	92	8	9	1	8	214	603					
Appl. to Appropriate, Domestic & Stock	40	109	2,657	0	2,806	139	74	0	255	8	159	357	1	993	19	45	37	6	49	0	5	3	1	2	167	3,966					
Appl. to Appropriate, Oil Well Drilling	0	0	0	0	0	0	0	0	140	0	0	4	0	144	0	0	0	0	0	0	2	0	0	0	2	146					
Appl. for Supplemental Well	0	15	5	0	20	5	6	0	24	5	72	57	0	169	10	3	1	1	16	0	1	1	2	0	35	224					
Appl. to Repair or Deepen Well	6	10	31	0	47	6	3	0	43	0	40	74	0	166	30	6	2	3	55	0	7	1	0	0	104	317					
Appl. to Change Loc. of Well	0	4	22	0	26	8	3	0	107	0	77	81	0	276	19	2	2	1	32	0	5	1	0	0	62	364					
Appl. to Change Place of Use	4	0	1	0	5	4	0	0	44	0	3	87	0	138	3	0	1	0	46	1	2	2	0	0	55	198					
Appl. to Change Loc. of Well & Place and/ or Method of Use	5	0	91	0	96	1	6	0	40	0	4	105	0	156	1	0	0	2	11	0	16	2	0	0	32	284					
Appl. to Combine	0	3	3	0	6	0	0	0	57	0	7	8	0	72	1	0	0	2	10	0	0	0	0	0	13	91					
Appl. for Extension	21	46	90	0	157	21	8	0	951	1	150	219	0	1,350	28	1	0	23	163	0	126	1	5	5	352	1,859					
Appl. for Drill for Oil (artesian basins)	0	0	0	0	0	11	0	0	0	0	0	0	127	0	0	0	0	0	0	0	0	0	0	0	127						
Appl. for Drillers License	0	0	0	0	0	0	0	0	0	0	0	0	170	0	0	0	0	0	0	0	0	0	0	0	170						
Notice of Publication	11	43	117	0	171	33	12	1	476	0	190	343	0	1,055	34	6	12	59	140	102	32	6	3	8	402	1,628					
Change of Ownership	11	5	65	6	103	28	11	0	208	0	205	258	2	713	11	18	5	2	65	19	22	0	2	0	144	960					
Well Logging Record	47	73	2,491	1	2,612	110	57	0	525	6	277	434	9	1,418	49	28	32	9	147	0	34	3	2	17	321	4,351					
Proof of Completion	3	8	87	0	98	4	2	0	173	0	129	254	0	552	27	0	0	0	88	0	9	2	2	0	130	790					
Proof of Beneficial Use	5	10	2	0	17	6	2	0	142	0	47	156	0	353	7	0	0	0	61	0	5	2	1	0	79	449					
Certificate of Construction	0	5	0	0	5	0	0	0	12	0	29	182	0	45	13	0	0	0	0	0	0	0	0	0	0	50					
Engineer's authorization	0	12	10	0	25	4	2	0	71	0	39	182	0	300	7	0	6	0	59	0	6	0	0	0	81	406					
Certificate & License	0	12	1	0	13	4	0	0	143	0	16	14	0	177	7	0	6	0	61	0	2	0	0	0	76	266					
TOTALS	184	400	5,786	25	6,395	398	195	8	3,743	20	1,512	2,777	193	8,846	259	332	121	177	1,050	227	283	54	19	85	2,607	17,848					

Surface Water

New Mexico contains portions of the headwaters of three of the principal drainage systems of the United States: the Colorado River, Mississippi River, and western Gulf of Mexico tributaries. In addition, there are 12 areas from which surface water does not normally discharge to through-drainage systems. All of New Mexico's important surface streams are subject to regulation under the seven interstate water compacts to which the State is a party, and intrastate administration of water rights must be within the framework of New Mexico's interstate water commitments.

In general, procedures for appropriating surface water (or for changing point of diversion and place or purpose of use) closely parallel those for appropriating ground water.

AMENDMENT OF RULES AND REGULATIONS

On February 12, 1962, the State Engineer issued order 89 amending a section of Article VI-A (HIGH WATER LINE TRAVERSE) of the Manual of Rules and Regulations Governing the Appropriation and Use of the Surface Waters of the State of New Mexico, revised August 1953, to provide that a high-water-line contour obtained from actual field survey or by stereoplotting methods may be substituted for the high-water-line traverse on ungated flood-retention projects where reservoir basins will be drained within specified times after each filling.

DECLARATION OF STOCK TANKS

Although the existing statutes provide that applications to the State Engineer are not necessary from owners of livestock who, for the purpose of watering stock, build or construct water tanks or ponds which have a storage capacity of 10 acre-feet or less, owners may and are urged to record such structures with the State Engineer in order to establish priority of the use. Declaration of Ownership forms for stock tanks or ponds are available upon request.

SURFACE-WATER DISTRICTS

Generally speaking, surface-water rights throughout the State are administered from the central office of the State Engineer in Santa Fe. However, the statutes provide that, when necessary for the economical and satisfactory apportionment of water or upon application of a majority of the water users within a drainage area, the State Engineer may create surface-water districts and appoint watermasters to assume immediate charge of apportionment of water therein, in accordance with licenses issued by the State Engineer and adjudications of the courts. Watermasters so appointed are under supervision of the State Engineer.

The statutes also provide that in all instances where water rights established on interstate streams in New Mexico have been the subject of litigation in the state or Federal courts of an adjoining state, it is the duty of the State Engineer to assume control of the diversion and distribution of water from all or any part of the New Mexico reach of such interstate streams.

To date the State Engineer has created six surface-water districts and placed apportionment of irrigation water within each in the hands of an appointed watermaster. The streams affected are Cimarron Creek, Rayado Creek, Costilla Creek, Gila River, La Plata River, and Pecos River. A brief discussion of each district follows.

Cimarron and Rayado Water Districts, Colfax County. — Rights to the use of the waters within the Cimarron stream system were adjudicated by the district court on December 20, 1929. The administration of these rights and distribution of water in accordance with terms of the court decree were under the direction of the court until June 1, 1932, when the court relinquished its jurisdiction in the matter to the State Engineer.

The rights to the use of the waters within the Rayado stream system were adjudicated by the district court on May 11, 1918. Upon receipt of a petition signed by a majority of the water users within the Rayado stream system the State Engineer created the Rayado Water District by order dated April 15, 1940. The Cimarron and Rayado Water Districts are administered by the same watermaster.

Flows within the Rayado and Cimarron stream systems were low during July, August, and September of 1960. Beginning in October and continuing throughout the remainder of the season the water supply increased sufficiently to complete the irrigation season and provide carry-over storage in the major reservoirs. The Springer Ditch Company did not receive its full allocation until the middle of October, after which water was made available to the Antelope Valley Irrigation District. The Springer Ditch Company had 1,450 acre-feet of water in storage at the end of the season and the Antelope Valley Irrigation District had 3,500 acre-feet in storage.

Eagle Nest Reservoir water users received a full allocation during the 1960 season, relying upon water in storage. Storage in Eagle Nest Lake dropped from 17,400 acre-feet at the beginning of the season to 10,180 acre-feet at the end of the season.

Extreme water shortages were experienced by the Farmers Development Company on the Rayado River until the middle of October. Increased flows at that time enabled the company to have 1,450 acre-feet in storage in Miami Reservoir by the end of the season.

Water users in both the Cimarron and Rayado Water Districts experienced a good water year in 1961. A prolonged spring runoff and numerous summer and fall showers furnished a plentiful water supply

for crops and storage units. The Springer Ditch Company's storage capacity of 4,045.5 acre-feet was reached on March 15, 1961, at which time water was made available for storage in the Eagle Nest and Antelope Valley Irrigation District storage units. Antelope Valley Irrigation District storage units were full by April 15th. The Farmers Development Company Reservoir was filled by May 1. Storage units located below Eagle Nest Lake remained full or nearly full throughout the remainder of the year. At the end of the irrigation season Eagle Nest Lake contained 21,730 acre-feet of water. Antelope Valley Irrigation District had 4,100 acre-feet in storage. Springer Ditch Company had 2,050 acre-feet in storage and Farmers Development Company had 2,500 acre-feet in storage.

The spring runoff in 1962 continued until the middle of May. Storage in Eagle Nest Lake increased to 39,790 acre-feet by May 15, 1962. During the latter part of May streamflow declined. By the end of June, with water from the various reservoirs being utilized for irrigation, storage in Eagle Nest Lake had been reduced to 36,530 acre-feet.

Costilla Creek Water District, Taos County. — Costilla Creek heads in the Sangre de Cristo Mountains in Colorado, flows into New Mexico and — in seeking outlet to the Rio Grande — reenters Colorado and again returns to New Mexico near its confluence with the master stream. Allocation of the waters of Costilla Creek and Costilla Reservoir between irrigators in Colorado and New Mexico is in accordance with terms of the Costilla Creek Compact, ratified in 1945. The State Engineer of New Mexico created the Costilla Creek Water District in 1947 and appointed a watermaster to administer distribution and use of water in New Mexico and to make deliveries to the State line in accordance with compact allocations.

During the period July through September, 1960, direct flow in Costilla Creek was insufficient to meet the demands of the Amalia and Costilla-Garcia areas. Water in storage in Costilla Reservoir at the beginning of the 1960 irrigation season was 7,710 acre-feet and was reduced to 1,398 acre-feet by the end of the season. Storage releases began early in the season and continued until the middle of September.

After the irrigation season, flow in Costilla Creek originating below Costilla Reservoir was inadequate to supply stock and domestic water in the Costilla-Garcia and Jaroso areas. Therefore, the Costilla Creek Compact Commission authorized the bypass of 7 cubic feet per second of the inflow into Costilla Reservoir. This bypass was discontinued on October 18.

Costilla Creek water users experienced a good water year in 1961. Storage in Costilla Reservoir increased from 7,793 acre-feet at the beginning of the irrigation season to 11,711 acre-feet by June 20. Storage was depleted to 8,018 acre-feet by September 1, but increased again to 8,747 acre-feet by September 26. Because of excessive moisture in the

reservoir embankment, the State Engineer ordered evacuation of stored water to a level below elevation 9,490 feet. The subsequent release of all but 6,977 acre-feet of stored water was accomplished between September 27 and October 6. Another release from storage was made between November 1 and November 3 to make room for winter inflow. The second release reduced the water in storage to 6,460 acre-feet. Much of the evacuated water became available for storage in Eastdale Reservoir No. 1, located in Colorado.

Heavy snowfall during the winter of 1961-62 promised an exceedingly good supply of water for the 1962 irrigation season. By April 2, 1962, storage in Costilla Reservoir had increased to 9,357 acre-feet. Peak storage of 12,317 acre-feet was reached on May 20. From that date through June 30, runoff diminished rapidly and storage water from Costilla Reservoir was utilized. On June 30, 1962, 10,283 acre-feet of water was in storage.

Lower Gila River Water District, Hidalgo County. — On June 29, 1935, the U. S. District Court for Arizona adjudicated in the decree Globe Equity No. 59 the water rights and priorities in an interstate reach of the Gila River which included the Virden Valley in New Mexico and extended to the lower end of the San Carlos Irrigation Project in Arizona.

On December 31, 1939, the State Engineer created the Lower Gila River Water District, comprising the Virden Valley in New Mexico, and appointed a watermaster to supervise apportionment of water to New Mexico irrigators. Distribution is made through the Sunset Canal (2,433.6 acres) and the New Model Canal (426.2 acres).

Diversions from the Gila River into the Sunset Canal averaged 10 cubic feet per second during the period from July 1, 1960, through December 30, 1960. The maximum diversion was 25.6 cubic feet per second on July 11, 1960. The surface water available to the Sunset Canal was 3.14 acre-feet per acre, whereas the decreed duty in the reach of the river was established at 6 acre-feet per acre per annum. River-water shortages were somewhat relieved by the use of underground water.

Diversions from the Gila River in the New Model Canal after July 1, 1960, were made only during the period from August 12 through 17. This diversion averaged 9 cubic feet per second during the 6-day run. Surface water available to the New Model Canal was 1.42 acre-feet per acre in 1960. The remainder of water used under the ditch was from underground sources.

Riverflows were short and erratic throughout 1961. Water diverted from the Gila River amounted to 2.09 acre-feet per acre under the Sunset Canal and 0.65 acre-foot per acre under the New Model Canal. Irrigation under both ditches was dependent upon the continued use of underground water.

Early runoff in the Gila River from snowmelt indicated that the 1962 surface-water supply would be much improved over that of 1960

and 1961. However, deficient summer precipitation caused an increased demand for water during the growing season, and unless conditions improve irrigators must again depend on underground water to finish the 1962 season.

La Plata River Water District, San Juan County. — La Plata River rises in the La Plata Mountains in southwestern Colorado and flows into the San Juan River at Farmington, N. Mex. The river is a stream of uncertain and varying seasonal flow with frequent shortages occurring after the runoff from snowmelt.

The flows of La Plata River are apportioned among users in Colorado and New Mexico in accordance with the La Plata River Compact, ratified in 1923. In order to administer the compact and to supervise the apportionment of New Mexico's share of the waters, the State Engineer has appointed a watermaster to observe the river conditions, to work with the Colorado Compact representative, and to keep the State Engineer fully advised on the apportionment of the waters between the two states. After New Mexico's apportionment of available flows in La Plata River has passed the State line, distribution of the water is in accordance with the San Juan Court Decree of 1948 (No. 01690, First Judicial District Court of New Mexico in and for San Juan County).

In 1960 rotation of the available flows of La Plata River between Colorado and New Mexico under terms of the compact began in May and continued through July 5, 1960. After the latter date the waters were divided between the two states. After the middle of July the flow of La Plata at Hesperus, Colo., was not sufficient to reach the State line and New Mexico's apportionment was made up of tributary inflow only.

In 1961 the flows of La Plata were used by both states as desired until April 28. The flows of the river dropped during the early part of June and rotation of the use of the river's entire flow began with Colorado taking all water for a 10-day period, after which the entire flow was passed downstream to New Mexico for a like period. At the end of Colorado's second 10-day rotation period, which ended on July 9, 1961, the flow of the river at Hesperus amounted to only 24 cubic feet per second, all of which was passed on to New Mexico.

On July 13, 1961, Colorado again diverted the flow of La Plata River in the Hesperus area on the assumption that it was being lost in transit to the New Mexico line. Available flow at the State line was made up of tributary inflow only during the remainder of July and August and the early part of September. On September 24 all flows of La Plata River were released by Colorado for New Mexico use.

Owing to cool temperatures during the spring of 1962 the flows of La Plata River were fairly uniform until the latter part of June and no rotation of available flows was authorized by the compact commissioners. The lack of precipitation caused some junior-water-right users in New Mexico to be short of water after the first part of June.

Pecos Valley Surface Water District — Guadalupe, De Baca, Chaves, and Eddy Counties. — Upon request of a majority of the water users in the area, the Pecos River Surface Water District was declared on July 1, 1952, encompassing the main stem of the river from the mouth of Buffalo Creek south of Fort Sumner to the Texas line and including varying reaches of tributaries in the section. Again at the request of the water users, the district on January 20, 1956, was extended upstream from Buffalo Creek to the mouth of Cow Creek (sec. 24, T. 14 N., R. 13 E.) near San Jose. The reach of the river between Cow Creek and the southern boundary of the Jose Perea Grant (sec. 20, T. 9 N., R. 21 E.) near Santa Rosa was removed from the district, renamed Pecos Valley Surface Water District, on May 11, 1959.

Water rights in the Pecos Valley district have been adjudicated by the courts in the following cases:

United States v. Hope Community Ditch et al., No. 712 Equity, United States District Court for the District of New Mexico (1933).

Livingston v. Neeson et al., No. 5144, Fifth Judicial District in and for Eddy County, New Mexico (1931).

United States v. Harkey et al., No. 1610 Equity, United States District Court for the District of New Mexico (1930).

Harkey v. Parkhurst et al., No. 3258, District Court for Eddy County, New Mexico (1921).

United States v. Judkins et al., No. 112, Fifth Judicial District for the Territory of New Mexico (1912).

Extensive rainfall occurred in July 1960 within the Pecos River drainage system and produced sufficient runoff to relieve the then existing shortage and to meet the diversion requirements of the irrigators for the remainder of the season. Water in Alamogordo Reservoir, Lake McMillan, and Lake Avalon was at or near maximum capacity on December 31, 1960.

Riverflow for the year 1961 was not as high as for 1960 and some shortages occurred on the Pecos River and its tributaries between Roswell and Artesia and on Black River near Carlsbad. Storage water in the three reservoirs of the Carlsbad Irrigation District was depleted by approximately 36,000 acre-feet during the year.

In the early part of 1962, runoff was very good and water for irrigation was adequate. Rainfall in the upper part of the district, north of Roswell and including the Fort Sumner Irrigation District, was sporadic but sufficient to help relieve the water shortage in the southern part of the district where rainfall was below average.

The State Engineer directed that frequent investigations be made by the watermaster during the 1962 irrigation season for the purpose of preventing waste of water. Progress in such prevention was evident, particularly within the Fort Sumner Irrigation District.

INSTRUMENTS PROCESSED

The 1907 water code provided a mandatory procedure for obtaining and perfecting rights after March 19, 1907. Uses developed prior to that date are recognized and confirmed by the State Constitution. The individual definition of each right thus claimed to be established prior to March 19, 1907, is a judicial function; however, the claim may be recorded in the State Engineer Office as provided by section 75-1-2.1, New Mexico Statutes Annotated 1953, 1959 supplement. Such filing records the claim in the proper public office and such records are prima facie evidence of the truth of their contents.

The number and nature of instruments pertaining to surface water which were processed during the 25th biennium are shown in table 2.

TABLE 2
SURFACE-WATER INSTRUMENTS PROCESSED
DURING 25TH BIENNIUM

<i>Instruments</i>	<i>Number</i>
Declaration	198
Notice of Intention to Appropriate	32
Application to Appropriate	70
Application to Change Point of Diversion	29
Application to Change Place and/or Purpose of Use	37
Extension of Time	51
Change of Ownership	149
Notice of Publication	58
License to Appropriate	38
License to Change Place and/or Purpose of Use	26
Certificate of Construction	61
Certificate of Construction to Change Point of Diversion	24
Engineer's Authorization	42
	<hr/>
Total	815

It is necessary for the Water Rights Division to field check all water-right declarations and applications received. During the biennial period more than 400 such field checks were made by office personnel. Additional field checks and investigations are made in conjunction with protested applications, verification of proofs of completion of works and application of water to beneficial use, and reported violations in cases where more detailed information is required. Some 35 such investigations were conducted during the 25th biennial period.

Protests to the granting of four applications were received in the biennial period; protests against two applications subsequently were withdrawn. Two hearings were held and findings and orders were issued; both orders subsequently were appealed to the district court. Some five undeveloped permits were withdrawn or cancelled during the biennial period.

Litigation

During the 25th biennium, the adjudication of water rights in the Roswell Artesian Basin, which commenced on April 19, 1956, was continued as expeditiously as possible. The adjudication is being handled in two separate suits: *State of New Mexico and Pecos Valley Artesian Conservancy District v. L. T. Lewis and others*, Chaves County Cause No. 20294; and *State of New Mexico and Pecos Valley Artesian Conservancy District v. Hagerman Irrigation Company and the individual users of waters from the Hagerman Canal*, Chaves County Cause No. 22600.

As of June 30, 1962, these suits had resulted in the adjudication of water rights for the irrigation of 110,872.9 acres of land of the 129,510.5 acres found in irrigation by the 1952-60 resurvey of the Roswell Artesian Basin. The court by June 30, 1962, had enjoined as illegal the irrigation of 11,388.7 acres. A total of 28,540.6 acres were adjudicated after July 1, 1960.

Also during the biennial period, the court in adjudication ruled upon the water rights of the cities of Roswell and Artesia. The court held that the cities in question are entitled to use their wells which were originally drilled for municipal purposes to the full capacity of the wells, regardless of whether the wells were drilled before or after the declaration of the Roswell Artesian Basin.

The district court rulings were appealed to the State of New Mexico Supreme Court. If the decisions are affirmed, the city of Roswell will be entitled to pump from its present wells water sufficient to supply the needs of 100,000 people even though the city at present has a population of less than 50,000 — and, in 1931, the year the basin was declared, had a population of less than 12,000. If the city actually should pump such an amount of water without acquiring any additional water rights or without retiring other pumping in the basin, depletion and salt-water encroachment would be proportionately increased.

During the biennial period the Supreme Court of New Mexico made a determination on two cases arising out of the adjudication: *State v. Mendenhall*, 68 NM 467, 362 P2d 998; and *State v. Fanning*, 68 NM 313, 361 P2d 721.

The Mendenhall case is probably one of the most important ground-water cases in the history of New Mexico. The defendant had drilled wells outside the administrative boundaries of the Roswell Artesian Basin. Prior to the application of water from the wells to beneficial use upon the lands, the State Engineer by order extended the administrative boundaries of the basin and closed the area to further appropriation. The defendant, with knowledge of the State Engineer, applied the water from the wells to beneficial use on a large number of acres of land within a period of less than 2 years after the basin was extended.

The trial court held that, since the waters from the wells had not

been applied to beneficial use prior to the closing of the basin, the defendant had no right to irrigate the lands in question. The Supreme Court reversed the trial court and held that, since the Mendenhalls had legally commenced drilling their wells prior to the extension and closing of the basin to include the lands on which the wells were located, and since they had subsequently applied water to beneficial use in a diligent manner, they thereby had acquired a good and valid water right; and that the intervening order extending the Roswell Artesian Basin in no way affected the legality or validity of the appropriation. This case is especially significant since it was determinative of the adjudication of more than 10,000 acres of water rights belonging to other water users within the extended area of the basin.

In *State v. Fanning*, the Supreme Court affirmed the trial court's findings that Fanning had illegally irrigated 120 acres of land from a well since 1943. The court held that the use and irrigation from the illegal well for more than 4 consecutive years constituted a forfeiture of the water right, if any such right existed, reaffirming the doctrine in *State v. Mitchell*, 66 NM 212, 345 P2d 744.

One other important case arising out of the Roswell Artesian Basin adjudication during the 25th biennium was not appealed to the Supreme Court. The Flying H Ranch is located along the upper reaches of the Rio Felix and its surface-water rights for irrigation were adjudicated in 1931 in the Hope Community Decree; however, the owners of the ranch have also drilled numerous irrigation wells. The issue in the case as raised by the answer of the defendant was whether the ranch land was hydrologically a part of the Roswell Artesian Basin — and, therefore, whether the ground-water rights were subject to the jurisdiction of the court in the adjudication suit. The Special Master found that the lands were within the recharge area of the basin and that the court had jurisdiction in the suit. The decision was affirmed by the court.

In *State ex rel. Reynolds v. Board of County Commissioners of Guadalupe County*, New Mexico Supreme Court Cause No. 6618, the Supreme Court reversed the trial court. This was a mandamus action filed by the State Engineer wherein the commissioners of Guadalupe County had refused to place the Pecos River watermaster's budget upon the county tax rolls. The Supreme Court in reversing the district court held that the duty of the county commissioners to place the assessment on the tax rolls is a ministerial duty for the performance of which mandamus will lie, and that the trial court is required to order the county commissioners to place said assessments on the tax rolls. Even though this opinion was rendered on February 28, 1962, a mandate had not been entered by the Supreme Court by the end of the biennial period, inasmuch as the county commissioners had filed a motion for rehearing which had not been determined by the court.

Another case somewhat similar to *State v. Guadalupe County Com-*

missioners presently is pending in District Court of Chaves County Cause No. 25272, *Hagerman Irrigation Company v. New Mexico State Engineer*. In this case the Hagerman Irrigation Company paid its watermaster's assessment under protest and then filed suit for recovery of the payment on the basis that the assessment was not made in compliance with the law, inasmuch as the company's share of the watermaster's budget was based upon an adjudicated water right of 3 acre-feet per acre per year for 9,026 acres, instead of upon the smaller amount of water actually delivered to the lands during each of the growing seasons in question.

Also during the 25th biennium the State Engineer completed a survey of water rights in the Rio Puerco de Chama; the survey came out of the suit *Horacio Chacon et al., v. Remigio Chacon et al., and State of New Mexico (plaintiff in intervention) v. Horacio Chacon et al., Cause No. 4922* in the District Court of and for Rio Arriba County. The suit resulted from a controversy between water users on this stream system and the court required that the State Engineer survey and put on record the water rights of all users on the stream system.

Another adjudication suit has been instituted on the Rio Chama: *State ex rel. S. E. Reynolds v. Ramon Aragon*, Rio Arriba County Cause No. 8294. This suit was instituted to determine the water rights of the entire Rio Chama stream system in contemplation of construction of the San Juan-Chama Transmountain Diversion Project. During the biennium, 293 persons were made parties to the suit.

HYDROGRAPHIC SURVEYS

The New Mexico statutes direct the State Engineer to make hydrographic surveys and investigations of each stream system and source of water in the State, beginning with those most used for irrigation, and obtaining and recording all available data for the determination, development, and adjudication of the water supply and water rights in the State.

Since 1907, 27 hydrographic surveys have been conducted by the Territorial and State Engineers. Of these, 21 cover areas of surface-water use and 6 cover areas of ground-water use. All ground-water surveys and all but three of the surface-water surveys undertaken to date have been completed. Of the areas of surface-water use surveyed, rights in 11 have been adjudicated and rights in 3 — the Rio Puerco de Chama, Rio Grande de Ranchos, and Rio Chama systems — are presently before State courts. The ground-water rights within the Roswell Artesian Basin also are presently before a State court.

Hydrographic surveys on which work was accomplished during the report period are discussed briefly hereinafter.

COLORADO RIVER

Gila River System. — The hydrographic survey of the Gila River system in New Mexico was initiated in June 1960. Buce and Gunn, Inc., of Dallas, Tex., under contract with the State Engineer, photographed 315 flight-line miles of the irrigated areas on the river system. The 1960 photography was found to be unsuitable for stereocompilation, and Buce and Gunn, at their own expense, rephotographed the area in June 1962.

Field work to establish geodetic control for stereocompilation was initiated in December 1960 and was approximately 70 percent complete at the end of the biennium. Cost of the survey to June 30, 1962, was \$40,864.20, of which \$38,633.31 was spent in the report period.

RIO GRANDE

Rio Chama. — The hydrographic survey of the Rio Chama and its tributaries was initiated in September 1957. Because of the large area involved and differing climatic conditions, this survey has been divided into six sections. The survey of the first section, Espanola to Abiquiu, was completed during the 25th biennium.

On August 25, 1961, a suit to adjudicate the water rights of the Rio Chama stream system was filed in the First Judicial District, Rio Arriba

County. (See *Litigation*.) Hydrographic Survey personnel assisted the attorneys in the adjudication proceedings and will continue this work until the adjudication is completed.

Cost of the survey to June 30, 1962, was \$45,564.63, of which \$18,353.54 was expended during the 25th biennium.

Upper Rio Grande. — The hydrographic survey of the Rio Grande and its tributaries except the Rio Chama above San Ildefonso was initiated in March 1959. Field checks to determine the distribution of crops were completed in the 49th fiscal year.

Field work to establish geodetic control of the areas covered by aerial photography was initiated in August 1960. As of June 30, 1962, geodetic control has been established on approximately 80 percent of the area to be mapped. Stereocompilation of maps was started in January 1962, and as of June 30, 1962, preliminary maps had been prepared of the Pojoaque, Nambe, Tesuque, and Santa Cruz systems.

Cost of the survey to June 30, 1962, totaled \$62,591.06; of that amount, \$56,103.10 was expended during the 25th biennium.

PECOS RIVER

Roswell Artesian Basin. — The hydrographic survey of the Roswell Artesian Basin, conducted cooperatively by the State Engineer and the Pecos Valley Artesian Conservancy District, was completed during the 24th biennium. A summary of the findings of the survey is contained in the 24th biennial report of the State Engineer.

Expenditures for engineering assistance in adjudication proceedings during the 25th biennium amounted to \$5,976.30. (See *Litigation*.) These costs were financed equally by the State Engineer and the Pecos Valley Artesian Conservancy District.

HIGH PLAINS

Roosevelt and Curry Counties. — This survey is described in detail in the 24th biennial report of the State Engineer. Final map drafting was completed during the 25th biennium.

Cost of the survey as of June 30, 1962, was \$40,556.64; of the total, \$282.52 was spent in the 25th biennial period.

WORK AUTHORIZED BY LEGISLATURE

Chapter 18, laws of 1959 (uncodified), appropriated to the State Engineer from the New Mexico Irrigation Works Construction Fund the sum of \$100,000 to finance rehabilitation of flood-damaged diversion works and ditches in small direct-diversion irrigation projects on the Pecos River in San Miguel and Guadalupe Counties. The legislation authorized the State Engineer to enter into cooperative agreements with the owners or commissioners of the ditches to assure that the work would be accomplished in an efficient and economical manner.

Before proceeding with construction, the State Engineer solicited from the Attorney General of New Mexico an opinion on the question "Does the State constitutional provision against pledging the credit of the State or making any donation to or in aid of any person, association, or public or private corporation prohibit the legislature from appropriating funds for such purposes arising from trusts created by the Federal government in aid of irrigation purposes?"

On May 5, 1959, the Attorney General rendered a formal opinion which concluded as follows: "In view of . . . expressions of the Supreme Court and further in keeping with the purposes for which the fund was created, I, therefore, advise you that it is my opinion that House Bill 112, [chapter 18, laws of 1959] adopted by the Twenty-fourth Legislature and approved by the Governor, does not violate the provisions of Art. IX, Sec. 14 of the Constitution of New Mexico so long as the funds expended arise from 'trust funds', and that the expenditure of said funds for the purposes outlined in the legislation will not be unlawful."

Subsequent to promulgation of the Attorney General Opinion, restoration work on a number of small irrigation projects was initiated. Out of funds appropriated to him by the 24th Legislature, the State Engineer purchased materials, provided heavy equipment and equipment operators, performed engineering services, and supervised construction. Under cooperative agreement, local water users furnished rock and labor.

During the summer of 1959 and the winter of 1959-60, improvements described in the 24th biennial report of the State Engineer were made on nine ditch systems supplying water to some 41,100 acres of land. Work was continued into the 25th biennial period, and was essentially completed by the beginning of the 1961 irrigation season.

By chapters 181, 182, and 183, laws of 1961 (uncodified), the 25th State Legislature appropriated to the State Engineer from the Irrigation

Works Construction Fund an additional \$115,000 and directed that the sum be expended for rehabilitation of other small irrigation systems in Guadalupe, San Miguel, and Taos Counties. The statute allocated the funds among the counties as follows: Guadalupe \$35,000 for restoration of diversion and distribution works at East Anton Chico, Dilia, East Puerto de Luna, West Puerto de Luna, and Santa Rosa; San Miguel \$50,000 for repair of the East Ditch System at Pecos, West Ditch System at Pecos, El Molino Ditch System, South San Ysidro Community Irrigation System, San Juan Community Ditch System, San Jose Dam and Ditches, El Llano de la Presa East, Acequia del Agua Caliente West, El Garambullo Community Irrigation System, Villanueva Dam and Ditches, South Villanueva East and North Villanueva West; Taos \$30,000 for restoration of dams and ditch systems near the communities of Arroyo Hondo, San Cristobal, Talpa, Penasco, Costilla, and elsewhere.

As in the 1959 legislation, the statutes enacted in 1961 authorized the State Engineer to enter into cooperative agreements to repair the ditch systems as a joint enterprise of his office and the local water users. On August 17, 1961, the New Mexico Interstate Stream Commission brought action in the District Court in and for Santa Fe County, seeking to enjoin the State Engineer from spending any money appropriated to him from the Irrigation Works Construction Fund by the 25th Legislature.

The Interstate Stream Commission is delegated, by statute, joint responsibility with the Governor for budgeting and directing expenditure of moneys from the Irrigation Works Construction Fund, which derives its revenue from the Permanent Reservoirs for Irrigation Purposes Income Fund, a trust fund created by Congress in 1898 with the stipulation that the income therefrom be used for the establishment of permanent water reservoirs for irrigation purposes. In seeking the injunction, the Commission contended 1) that the appropriations violated the terms of the act of Congress which created the Permanent Reservoirs for Irrigation Purposes Income Fund in that the appropriated moneys were to be expended not for establishment of water-storage reservoirs but, rather, for deferred maintenance of direct-diversion and distribution works; 2) that the appropriations were not sufficient to permit construction of permanent works; and 3) that the appropriations constituted a donation of public funds in violation of the State Constitution.

On January 31, 1962, the court ruled that the appropriations were constitutional and did not violate State or Federal law. The Commission appealed the district court decision to the New Mexico Supreme Court. By the end of the 25th biennial period, the high court had not ruled in the matter and no funds from the 1961 appropriations had been expended.

Work financed by moneys from the 1959 appropriations and accom-

plished during the 25th biennium is described below. In all instances, the local water users provided labor and rock used in the various structures; the State Engineer provided other materials, heavy equipment as needed, and engineering and supervisory services.

SAN MIGUEL COUNTY

San Jose. — During the spring of 1961 repairs were made to the Acequia de la Agua Caliente on the east side of the Pecos River and to the El Llano de la Presa Acequia on the west side of the river. Both ditches head at the San Jose Diversion Dam.

Work on the east ditch consisted of stabilizing an arroyo crossing by reinforcing the downstream side of the ditch channel as a safeguard against washouts during floods. Steel rails (sections of railroad track) were driven in two rows that reached from one bank of the arroyo to the other. The rails in each row were placed at 10-foot intervals and tied together with $\frac{7}{8}$ -inch steel cable. The two rows were placed 10 feet apart. Heavy V-mesh wire was laid flat athwart the space between the rows and extending for several feet beyond the piling on both sides. The space between the rows then was filled with rock to a height of about 3 feet and the extensions of mesh wire were raised on either side and tied across the rock — forming a continuous rock-wire basket across the arroyo. The rails in one row were then tied to those in the other across the rock basket by means of $\frac{5}{8}$ -inch steel cable.

On the west side of the river for a distance of about half a mile immediately below the dam the stream channel had cut in close to the ditchbank and danger of washouts was imminent. Many large boulders which had slid down the hillside were blasted and moved with a power shovel to the edge of the river, there forming a rock groin to prevent further bank erosion. About 1,500 feet of ditch was then moved several feet away from the river bank. State funds expended at San Jose during the biennium totaled \$2,190.74.

El Ancon. — Repairs to El Ancon Dam consisted of leveling the top of the existing dam with a bulldozer and reinforcing the structure with piling and a continuous rock-and-wire basket similar to the arroyo-crossing installation on the Acequia de las Agua Caliente near San Jose. A concrete ditch heading was installed with a metal screw-lift headgate and a metal screw-lift sluicagate. State expenditures during the 25th biennial period totaled \$2,646.42.

Los Trigos. — Reconstruction of Los Trigos Dam was begun in September 1960. The top of the dam was leveled and the structure was reinforced with steel piling and rock-wire baskets as at San Jose. The dam diverts to ditches on both sides of the river, and concrete headworks with metal screw-lifts were installed at both ends of the dam.

A 1,000-foot section of badly choked canal just below the diversion dam was cleaned with a dragline. Total cost to the State was \$4,276.71.

Ribera. — Major repairs to Ribera Dam were undertaken in September 1960. The top was leveled and rail piling and rock baskets were installed. Concrete headworks and a sluiceway, both equipped with metal screw-lift gates, were installed on the north bank. A 52-foot, 22-by 36-inch pipe-arch flume was rebuilt on the ditch below the town of Ribera. Cost to the State was \$6,421.09.

El Pueblo. — Rehabilitation of El Pueblo Dam was accomplished through leveling and reinforcing in the manner described above. Concrete headworks and a sluiceway with metal screw-lift gates were installed. Expenditures by the State totaled \$3,512.86.

La Fragua. — Work on rehabilitation of La Fragua Dam began in October 1960. It consisted of widening the river channel where it crosses a rock outcrop and installing a new concrete weir section and concrete headworks and sluiceways with metal screw-lift gates. Approximately 80 cubic yards of concrete were used in the structure. Widening of the river channel involved the blasting and removal of approximately 1,300 cubic yards of rock from the north bank. Most of the rock thus removed was used to strengthen a brush wing dike which extends from the newly constructed channel to the south bank of the river and which was reinforced by the piling-rock basket method. Work was spread through parts of the 49th and 50th fiscal years. Total cost to the State was \$8,345.08.

Gonzales. — The top of Gonzales Dam was leveled and the structure was reinforced throughout its length with steel-rail piling and rock-wire baskets. A concrete headwall and a metal headgate already were in place. State expenditures totaled \$1,768.18.

Villanueva. — Villanueva Dam was reinforced by excavating a trench some 15 feet wide down to bedrock along the downstream toe of the existing structure and filling the excavation back to the level of the top of the present dam with rock-wire baskets — whereupon, with cement furnished cooperatively by the State Engineer and the U. S. Agricultural Stabilization and Conservation Service, the rock-wire basket structure was grouted with concrete. A wing dike also was constructed, utilizing steel-rail piling and rock-wire baskets. State funds in amount of \$4,603.91 were expended during the period of this report.

El Cerrito. — El Cerrito Diversion Dam is located in a canyon difficult of access, and it was necessary to improve about 3 miles of access road in order to move a pile driver and construction materials to the site. The top of the dam was leveled and the structure was rein-

forced with steel-rail piling and rock-wire baskets. Expenditures by the State during the 49th and 50th fiscal years totaled \$2,360.31.

GUADALUPE COUNTY

East Anton Chico-Dilia. — Work on the East Anton Chico-Dilia Ditch consisted of installation of nine sluiceways. Most gates for the installations had been purchased during the 24th biennial period. State funds expended during the report period totaled \$411.39.

Upper Anton Chico. — The Upper Anton Chico or Tecolotito Ditch was rehabilitated during the spring of 1961. A sluiceway was installed in the ditch about 500 feet below the diversion dam, and near Tecolotito the ditch was deepened and widened for about a quarter of a mile through a reach which consisted mostly of rock. Several metal screw-lift gates were installed at waste and sluiceway structures, and a mile of ditch near Anton Chico was widened. State funds in amount of \$8,214.53 were expended.

West Puerto de Luna. — In addition to work performed in the Puerto de Luna area during the 24th biennium and described in the 24th biennial report, it was decided to replace a leaky flume on the ditch just above the project area. The new structure — 240 feet long and 16 feet high, supporting a 27- by 42-inch corrugated-metal pipe-arch — was constructed on a cooperative basis by the community, the State, and the Agricultural Stabilization and Conservation Service. State funds expended during the 25th biennium totaled \$3,756.72.

SUMMARY

Total expenditures from moneys appropriated by the 24th Legislature of New Mexico in chapter 18, laws of 1959, as of the end of the 25th biennial period, were as follows:

County	24th Biennium	25th Biennium
Guadalupe	\$35,952.74	\$12,382.64
San Miguel	13,874.70	36,125.30

COOPERATION WITH STATE AGENCIES

During the 25th biennial period the State Engineer cooperated in various programs of water research and development sponsored by a number of other State agencies — including the New Mexico Interstate Stream Commission, New Mexico Institute of Mining and Technology, New Mexico Department of Public Health, and New Mexico Planning Office. The projects and the nature and extent of the State Engineer's participation in each are discussed hereinafter.

Interstate Stream Commission

By the so-called Ferguson Act of 1898, Congress created a trust fund, the income from which was to be used for establishing permanent reservoirs for irrigation purposes in New Mexico. In 1935, the Legislature of New Mexico created the New Mexico Interstate Stream Commission and placed expenditures from the Permanent Reservoirs for Irrigation Purposes Income Fund under joint control of the Commission and the Governor. In 1955, in an effort to promote conservation and more efficient use of water, the Legislature created the New Mexico Irrigation Works Construction Fund and provided that it would receive, among other revenues, money creditable to the Permanent Reservoirs for Irrigation Purposes Income Fund. Known as the "Small Projects Act," the 1955 statute authorized the Commission to issue revenue bonds against the fund to finance construction of projects of water conservation and development for irrigation. In addition, it gave the Commission authority to pay from the fund the costs of making feasibility investigations and other preliminary studies of irrigation projects. If preliminary reconnaissance investigation of a project indicates feasibility, and if the local interests form an acceptable contracting repayment agency, the Commission may authorize and finance a more detailed study of economic and engineering feasibility. If a project is found to be feasible and is constructed, all costs of the reconnaissance and feasibility investigations are reimbursable. If the project is found to be infeasible, costs of the investigations are nonreimbursable.

Projects upon which work was accomplished with moneys from the Irrigation Works Construction Fund during the 25th biennium are described hereinafter.

UTE DAM INVESTIGATIONS

The Canadian River Compact, signed in 1950 with the States of New Mexico, Oklahoma, and Texas as parties, allots to New Mexico free and unrestricted use of all water originating in the Canadian River and its tributaries within the State's boundaries below Conchas Dam, with the provision that conservation storage of such waters within New Mexico may not exceed 200,000 acre-feet.

In an attempt to devise feasible means of controlling and applying to beneficial use New Mexico's share of Canadian River waters which now flow out of the State unused, reconnaissance-type investigations of potential dam and reservoir sites in the area were initiated cooperatively by the State Engineer Office and the Interstate Stream Commission during the 22nd biennium of statehood. The investigations were continued throughout the 23rd, 24th, and 25th biennial periods.

In 1957 the 23rd State Legislature authorized the New Mexico Interstate Stream Commission to issue special revenue bonds in the amount of \$2 million to finance construction, operation, and maintenance of dams on the river and its tributaries below Conchas Reservoir. On the basis of more realistic cost estimates developed by the State Engineer, the 24th Legislature in 1959 amended the 1957 legislation, authorizing the Commission to issue bonds in the amount of \$5 million to finance project construction. As in the previous legislation, certain revenues which derive from severance taxes on natural resources were authorized to be pledged in the event that revenues from sale of water impounded by the dams should not be sufficient to meet repayment commitments, once the development had been accomplished.

Early investigations of potential Canadian River dam sites are discussed in the 22nd, 23rd, and 24th biennial reports of the State Engineer. During the 25th biennium, studies and investigations of Canadian River water storage were directed toward developing a feasible plan for constructing, at a cost not to exceed \$5 million, a single storage project at the Ute site near Logan, a few miles below the confluence of Canadian River and Ute Creek. Reconnaissance-type geological investigations were made of the foundation of the proposed dam site and of ground-water conditions throughout the area. Field surveys for mapping the reservoir area were completed in the fall of 1960, and mapping was accomplished by the photogrammetric method at a scale of 400 feet to the inch, with a contour interval of 10 feet. Reconnaissance plans and cost estimates for a compacted earth-fill dam at the Ute site were completed. Reports covering the engineering, geology, water supply, construction materials, flood hydrology, and sedimentation were compiled and printed for use in developing the basic project design.

Early cost analyses demonstrated that it would not be possible to construct a project to provide 200,000 acre-feet of conservation storage within the authorized bond issue. Consequently, preliminary planning

concentrated on developing a design of a low dam which could be built at a cost within the authorized expenditure and which could be enlarged at some future time.

In June 1961 a contract was negotiated with the Bechtel Corporation of San Francisco to prepare an investigation and design report, perform engineering design, and supervise construction of a dam. In addition to reviewing the reconnaissance plan prepared in the State Engineer Office, Bechtel Corporation investigated alternate possible arrangements of the dam features and made preliminary cost estimates on each.

In October 1961, additional information concerning subsurface conditions was obtained, during the course of which 33 test holes totaling 1,731.5 feet in depth were drilled. The field investigation indicated that foundation conditions were adequate for the type of dam proposed and also that, with the exception of riprap, sufficient quantities of suitable materials for construction of a zoned-earth dam of the size contemplated were available at or near the site. In the absence of rock suitable for riprap it was decided to use soil cement for slope protection.

In January 1962 Bechtel Corporation delivered to the Interstate Stream Commission a basic-design report setting forth the findings of their more detailed investigations, along with preliminary cost estimates for construction of the project. Also in January 1962 the State Engineer Office completed reconnaissance studies of the possibilities of applying Ute Reservoir water to irrigation. These studies indicated that irrigation would not be a feasible use of Ute Reservoir water at the present time and under the criteria used in project analysis.

After reviewing the Bechtel basic-design report and analyzing the estimated project costs, the Interstate Stream Commission on February 6, 1962, directed the corporation to proceed with final engineering design for a dam to be located in Quay County about 2 miles upstream from the U. S. Highway bridge across the Canadian River near Logan, N. Mex. — the costs of these services to be paid out of receipts from sale of bonds. Plans and specifications were completed and invitations for bids were issued on June 1, 1962. Bidders were requested to submit cost quotations on three alternate structures: Alternate A to be 121.5 feet high and 2,050 feet long, with an ungated chute-type spillway 840 feet wide and 41 feet deep; Alternates B and C to be 116 feet high and 2,010 feet long, with 700-foot ungated spillways (the difference in plans B and C resting in design and arrangement of features). A prominent feature of all three plans was a dike section extending from the spillway to high ground.

Personnel of the State Engineer Office worked in close association with representatives of the Bechtel Corporation in planning and preparing designs and specifications and in providing guidance with reference to relevant policies and laws of the State of New Mexico. Engineer

Albert T. Watson of the State Engineer Office coordinated the work of the State and the engineering firm.

Bids for construction of the dam were opened on July 24, 1962. On August 7, 1962, a notice of contract award was issued to William A. Smith Contracting Company, Inc., of Kansas City, Kans., to construct Alternate Dam A. The successful bid was \$3,812,694.35 — \$223,135 below the engineer's estimate and \$184,248 below the next low bid.

In addition to features described above, the dam spillway will have a wide approach channel, a concrete lining extending 250 feet downstream of the crest structure, and an unlined chute extending to the top of a cliff which forms the north bank of the river channel, some 1,000 feet downstream from the dam. The dike north of the spillway will be 2,860 feet long with a maximum height of 25 feet above natural ground surface. Low-level outlet works will consist of 1) an intake structure, 2) a 60-inch-diameter concrete conduit with a steel-lined section extending through the impervious core of the dam to a valve chamber in which will be located a 42-inch butterfly valve, and 3) a 36-inch steel pipe in a 7-foot by 7-foot horseshoe-shaped concrete tunnel extending to the downstream toe. Access to the gate is up the horseshoe tunnel from the downstream toe of the dam.

Construction of the project is scheduled to be completed by May 1, 1963. Reservoir capacity, to the spillway crest, will be 108,190 acre-feet. The reservoir surface area at this elevation will be 4,078 acres. The dam is so designed that spillway gates may be installed at any time in the future to increase reservoir capacity.

Although not the first contracted, Ute will be the first major dam in the nation on which soil-cement slope protection will be completed. The facing will be built in 6-inch layers, 7 feet wide, stair-stepped up the 3:1 slope, giving a thickness of 2 feet, normal to the slope. As a facing material, soil cement has proved itself in test sections to be resistant to wave action and extremes of heat and cold, increasing in strength with age. Its use on Ute Dam will be much less costly than rock riprap which would have to be hauled in from distant quarry sites.

The general arrangement of the dam is shown in the frontispiece and in figure 8. The principal features are summarized below.

- Type of dam: Compacted earth-fill.
- Maximum height above foundation: 121.5 feet.
- Length of dam: 2,050 feet.
- Length of dike: 2,860 feet.
- Maximum width, base of dam: 745 feet.
- Width of crest, dam and dike: 30 feet.
- Average slope of upstream face: 3.2 horizontal to 1 vertical.
- Slope of downstream face: 2 horizontal to 1 vertical.
- Elevation, crest of dam and dike: 3,801.0 feet above mean sea level.
- Elevation, spillway crest: 3,760.0 feet above mean sea level.
- Freeboard (above high water line as maximum spill): 10.0 feet.
- Elevation flow line of outlet conduit: 3,725.0 feet above mean sea level.

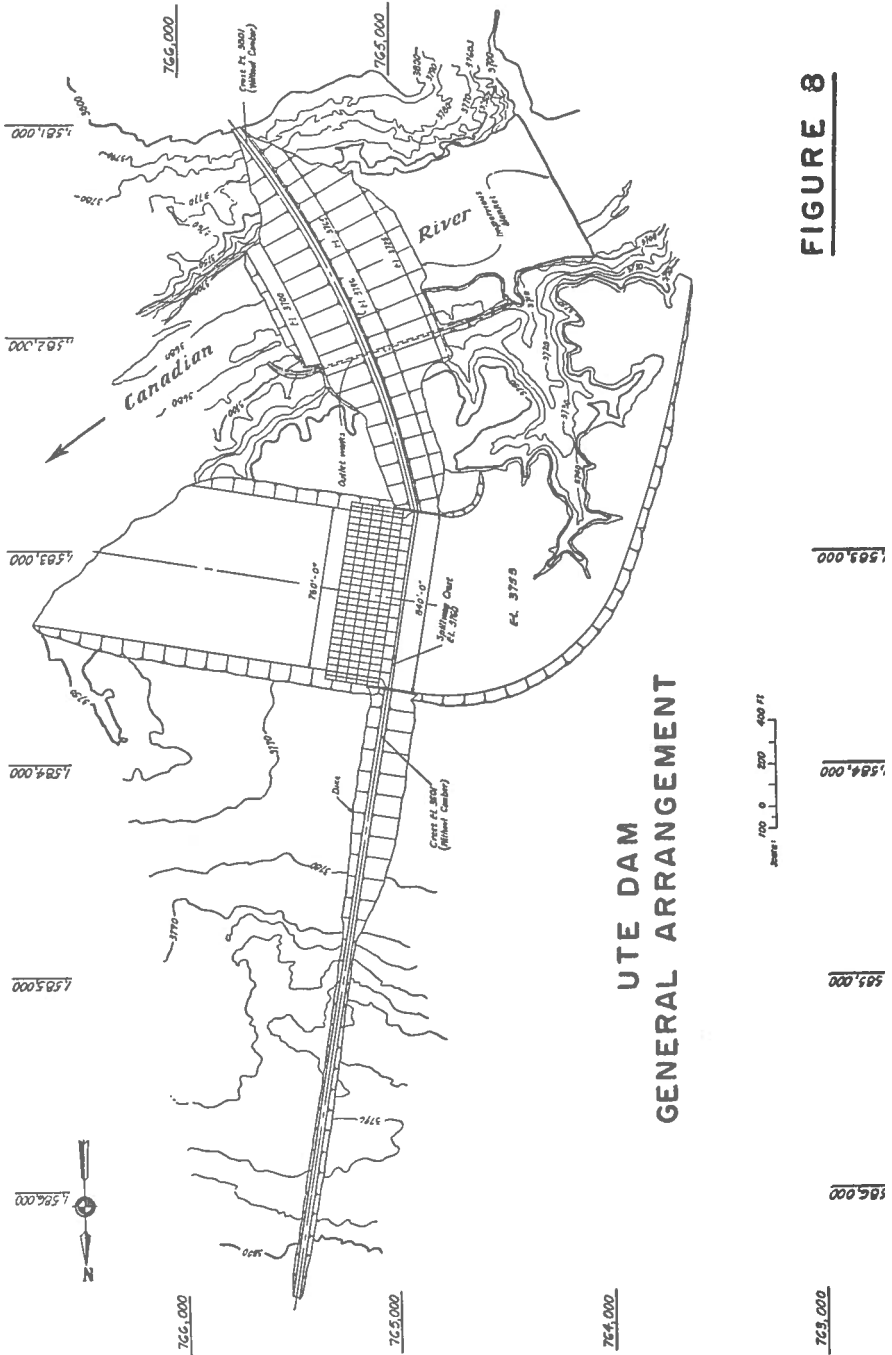


FIGURE 8

Width of spillway: 840.0 feet.

Discharge capacity of spillway: 566,000 cubic feet per second.

Character and size of outlet conduit: Conduit is of concrete and steel with a manually controlled gate. Discharge capacity of outlet under full head is 275 cubic feet per second.

Expenditures on investigations of storage sites on the Canadian River since December 1955 total \$282,984.36, of which amount \$158,102.84 was expended in the 25th biennium. In addition, \$56,232.72 of bond funds was expended during the 25th biennium in preparation of project plans and specifications for Ute Dam.

The project is discussed further in the Interstate Stream Commission section of this report.

OTHER INVESTIGATIONS

Reconnaissance-type investigations of the feasibility of constructing or rehabilitating small irrigation projects near Dixon and El Rito in Rio Arriba County, Monticello and Palomas in Sierra County, and Mountainair in Torrance County were completed during the biennial period. All studies were initiated prior to the 25th biennium and are reported in the 23rd and 24th biennial reports of the State Engineer.

The Dixon study indicates a feasible project under which approximately 700 acres of land presently irrigated with short supplies of water can be adequately served with direct surface-water diversions from Embudo Creek, provided the diversion and distribution works are renovated. Costs of renovation are estimated at \$267,000, with a benefit-cost ratio 7.60:1. A 33-page report, issued by the Interstate Stream Commission, was distributed to residents of the area.

As in the Dixon area, farms in the vicinity of El Rito suffer chronic shortages of water during the June-September growing season. Investigation of conditions early indicated that the cost of installing storage facilities would be beyond the ability of the water users to repay; hence, the investigation in its latter stages was limited to consideration of the potentiality of rehabilitating diversion and distribution systems and constructing wells to supply supplemental ground water. The study failed to establish full engineering and economic feasibility of the latter plan.

Farms in the Monticello and Cuchillo areas diverting surface water for irrigation suffer water shortages in summer. Farmers in both areas are commencing to construct wells to pump supplemental ground water, and a reconnaissance investigation of geologic conditions indicated that ground water is present in sufficient quantities to make up current surface-water deficiencies. However, only marginal economic feasibility for installation of wells on a project basis could be established.

The Mountainair investigation considered the potentialities of developing facilities to store surface water on the east slope of the Manzano

Mountains to serve both irrigation and recreational uses. A final report of the investigation transmitted by the Commission to the town of Mountainair and the New Mexico Department of Game and Fish concludes that construction of reservoirs to serve irrigation is economically infeasible and that costs of constructing such impoundments for recreational purposes would be high.

New Mexico Institute of Mining and Technology

In connection with studies by the U. S. Geological Survey of water-salvage potentialities in the Pecos River valley (see p. 77), the Interstate Stream Commission since 1958 has authorized expenditures from the Irrigation Works Construction Fund to be used by the New Mexico Institute of Mining and Technology, under cooperative agreement, to determine the "tritium content of the surface water, artesian ground water, and shallow ground water" of the Roswell artesian basin, and to prepare reports of the work and findings.

Water samples collected during the 47th and 48th fiscal years by the U. S. Geological Survey had been stored for analysis until detecting apparatus could be put in working order. Because of this backlog of analytical work, an expenditure of \$3,000 by the Institute during the 49th fiscal year was authorized. The authorized amount was expended.

The results of the analyses were somewhat surprising in that all samples analyzed showed a relatively high tritium content, suggesting that, in general, the water in the formations sampled is of meteoric origin subsequent at least to the March 1954 hydrogen bomb test, and perhaps subsequent to the 1956 tests. Because of the results obtained and attendant implications, \$8,000 was authorized for expenditure by the Institute during the 50th fiscal year so that a reasonably large number of samples could be analyzed. Of the amount authorized, \$4,600 was spent by the Institute.

At the end of the 50th fiscal year, 63 analyses had been made of waters from 40 wells and 9 springs.

Only tentative generalized conclusions and inferences can be drawn from the analyses available. The relatively high tritium content of the samples analyzed suggests 1) that the travel time for water to move from the recharge area to the vicinity of the Pecos River in the artesian aquifer may be only 3 to 5 years, 2) that because of the short time of travel, the porosity of the artesian aquifer is low (of the order of 1 percent), 3) that the amount of ground water in storage per unit volume of the artesian aquifer in the intake area is small and probably does not exceed 2,000 acre-feet per square mile, and 4) that recharge must very nearly equal pumpage and natural discharge from the artesian aquifer over

relatively short time intervals or declines in water levels in the artesian system would have been greater than recorded.

It is likely that additional analyses, together with an analytical appraisal of the results, would furnish good evidence of the direction and velocity of movement of major recharge to the Roswell basin. This information would be useful in combating the salt-encroachment problem near Roswell and in assessing the feasibility of artificial recharge. The Geological Survey is continuing to collect water samples. The samples will be stored until it is determined whether funds can be made available to perform the necessary analyses.

New Mexico Department of Public Health

Cooperation with the New Mexico Department of Public Health during the biennium consisted of brief investigations and conferences carried out on an informal basis and some work done by the U. S. Geological Survey under the State Engineer cooperative program.

A very brief reconnaissance investigation was made of ground-water conditions in the vicinity of Tres Piedras and a memorandum containing findings and suggestions for action by the community was prepared. A problem of nitrate in drinking water at the Mountain View (Albuquerque) school was discovered and a conference to discuss this problem was attended by personnel of the State Engineer Office, Geological Survey, New Mexico Department of Public Health, and Albuquerque and Bernalillo County health officials. The Geological Survey, under the State Engineer cooperative program, initiated an investigation of the occurrence and quality of ground water in the area in an attempt to discover the source of the nitrate. The problem had not been solved by the end of the period of this report.

Personnel of the State Engineer Office, Geological Survey, and Department of Public Health attended several conferences with officials of the Homestake-New Mexico Partners and the Homestake-Sapin Partners uranium mills north of Grants in connection with ground-water monitoring programs. State Engineer Office personnel also made several field trips to the Ambrosia Lake area, in company with Department of Public Health personnel, to witness conditions incidental to uranium-mill-waste disposal and mine-waste-water disposal in that area (see p. 49-51, 24th biennial report of the State Engineer).

The U. S. Geological Survey, Ground Water Branch, under the State Engineer cooperative program, has taken special interest in the uranium-mill-waste-disposal operations of the Anaconda Company Blue-water Mill, about 9 miles northwest of Grants. Disposal of uranium-mill effluent at the Anaconda plant became a problem in a relatively short time after the installation commenced operations in 1952. The company

did much research into feasible methods of surface disposal of the effluent, including discharge into a pond, from which the water was expected to evaporate. When the surface method of disposal showed signs of contaminating ground water, the company investigated the possibility of injecting the waste fluids into an unused aquifer, below and isolated from the principal sources of ground water in the area.

Early in 1959 a test well was drilled to experiment with deep-well disposal. S. W. West and Sidney R. Ash of the Geological Survey and Glen Hammock and E. A. Chavez of the State Engineer Office cooperatively observed the drilling, logged cores, and observed drillstem tests, well-completion work, and initial withdrawal and injection tests. Personnel of the Geological Survey also observed additional injection after the company received from the Department of Public Health approval for using the disposal well.

The well was drilled to a depth of 2,511 feet and was cored continuously below 445 feet. Several drillstem pressure tests and swabbing tests were made as the hole was cored. Samples of water from various intervals were collected for chemical analyses. The Meseta Blanca (sandstone) member of the Yeso formation and other thin zones of sandstone between 950 and 1,423 feet were selected as the injection intervals. Beds of dense mudstone, limestone, anhydrite, and gypsum between the base of the Glorieta sandstone, at a depth of 577 feet, and the highest injection zone (950 feet) were expected to prevent the movement of water upward into the Glorieta sandstone and the San Andres limestone, the principal fresh-water aquifers. The annular spaces between the casing and the wall of the hole were cemented and tested by using air pressure. The pressure test indicated a tight seal. The casing was gun-perforated adjacent to permeable zones in the interval from 950 to 1,423 feet. Several zones below 1,423 feet also were perforated and tested but none took water. A monitoring well was drilled to the base of the Glorieta sandstone 300 feet southeast of the disposal well.

Because of the many faults in the region, it was thought that fractures in the fault zones might be conduits through which water could move from one formation to another. The possibility also existed that permeable beds might be offset against impermeable beds, forming barriers to lateral movement of water away from the injection well, causing excessive buildup of hydraulic pressure at the disposal well. The initial injection test indicated that vertical leakage was negligible.

Experiments were made with various rates of injection, ranging from 380 to 1,400 gallons per minute (gpm). Projection of the pressure-buildup curves indicated that the well would not take as much as 1,000 gpm by gravity injection but that it would take more than 380 gpm. The results of the injection tests indicated that the mill effluent can be disposed of favorably by injection into the lower part of the Yeso forma-

tion and that vertical leakage in significant amounts into the potable water aquifer is unlikely.

Routine disposal of 400 gpm of effluent by injection was started in December 1960. Accurate records of discharge and pressure changes in the well have been kept since injection began. Also, samples of water have been collected periodically from several monitoring wells in the area for chemical analyses. The Anaconda Company sends reports on the amount of water injected, the changes in hydraulic pressure in the injection well, and chemical and radiological analyses to the New Mexico Department of Public Health and the U. S. Geological Survey. The Geological Survey will prepare a report on the disposal well and its operation for publication by the State Engineer Office.

New Mexico Planning Office

UPLANDS WATERSHED STUDY

Active participation by the State Engineer Office in the program of the New Mexico Interagency Council for Area Development Planning, initiated during the 24th biennium under general sponsorship of the State Planning Office, was continued through the period of this report. Activities of the council during the period were concentrated on development of a preliminary economic study of the Embudo watershed in north-central New Mexico, a 300-square-mile economically depressed uplands area characterized by sub-alpine, timbered mountains and small farming communities in scattered valleys — the latter depending for the most part on old community acequia systems for diversion and distribution of irrigation water.

State Engineer Office participation in the study was concerned primarily with economic investigation of farming operations within the cultivated portions of the watershed. Data were gathered on such subjects as crops most suited to production in the area, yields of crops presently grown, farm sizes, climatic conditions, and condition and rehabilitation potential of existing irrigation systems.

In May 1962 a report titled "Embudo — A Pilot Planning Project for the Embudo Watershed of New Mexico" was published by the interagency council and the State Planning Office. The illustrated volume summarized the findings of the study and suggested some methods where-by the area might improve its economic productivity. Methods suggested included improvement and expansion of irrigation systems, orderly exploitation of forest resources, and development of light industry and recreational facilities.

On June 21, 1962, the published report was presented to residents of the area of study by members of the interagency council. At that time it was pointed out that implementation of any plan of economic

development would require active participation on the part of local residents.

State Engineer expenditures on the project during the biennial period totaled \$2,270.76.

It is contemplated that during the 26th biennium the State Engineer will continue to participate in the program, with primary interest in the economic feasibility of improving irrigation facilities.

WATER-RESOURCES LIBRARY

Pursuant to chapter 237, laws of 1961, the State Planning Office has requested the State Engineer to prepare a library and bibliography of water resources of the State. In cooperation with the State Planning Office the body of a bibliography of water resources was completed in the 25th biennial period and only editing of the index remained uncompleted at the end of the period.

Preparation of a divided card catalog has been undertaken. This catalog, prepared to recommended library standards, will replace the various indexes and listings now used and will provide better access to library materials in the State Engineer and Interstate Stream Commission offices.

COOPERATION WITH FEDERAL AGENCIES

For several decades prior to creation of what is now the office of the State Engineer, various Federal agencies were active in programs of water research and development in New Mexico. Since establishment of the office in 1907, the Territorial and State Engineers have cooperated with such agencies in collecting and interpreting basic hydrologic data and in developing water for application to beneficial use. An increasingly important function of the office in recent years has been to coordinate with the work of State and local agencies the various Federal programs of water research, development, and conservation that are carried on in the State. During the 25th biennial period, the State Engineer cooperated actively in programs of the U. S. Geological Survey, U. S. Bureau of Reclamation, U. S. Soil Conservation Service, U. S. Bureau of Land Management, U. S. Corps of Engineers, and U. S. Office of Saline Water. Descriptions of these programs and of State Engineer Office participation appear hereinafter.

U. S. Geological Survey

The United States Geological Survey was created by Congress in 1879 as a fact-finding agency of the Department of the Interior charged with responsibility for gathering basic data pertaining to the nation's mineral resources. The State Engineer has cooperated with the agency in obtaining streamflow and reservoir-content data since 1907 (with a period of interruption between 1915 and 1932), in ground-water investigations since 1925, and in quality-of-water studies since 1937. These programs are conducted, respectively, by the Surface Water, Ground Water, and Quality of Water Branches of the Water Resources Division of the agency.

The programs of the Surface Water and Quality of Water Branches are essentially statewide and of a continuing nature. The work of the Ground Water Branch consists primarily of 1) a continuing, essentially statewide program of obtaining data upon which to base estimates of ground-water pumpage and annual fluctuations of water levels, particularly in areas that are heavily pumped; and 2) various noncontinuing, project-type investigations of geology and ground-water conditions in specific areas of use. During the 25th biennium the agency initiated a

statewide inventory of principal municipal and industrial water uses in the State.

The various programs and projects are discussed hereinafter.

STREAM AND RESERVOIR GAGING

If the water resources of New Mexico are to be properly developed and administered, it is essential that basic data of streamflows and reservoir contents be obtained and recorded on a continuing basis. Such data are taken, generally on a daily schedule, at numerous stream-gaging stations located throughout the State, and at most major reservoirs. Data for specific studies also are obtained, usually for much shorter periods of time.

Measurement of streamflow in New Mexico dates from 1888, when the Geological Survey established at Embudo on the Rio Grande its first experimental gaging station and camp of instruction in techniques of measuring runoff in streams. In 1907, the Territorial Engineer began to cooperate in the program, and by 1912 a total of 60 stations were in operation. The cooperative arrangement was continued until 1915, at which time the State assumed full charge of the program and met its entire cost, with the exception of a few stations which were maintained and operated by the U. S. Bureau of Reclamation and the International Boundary Commission. The program was continued under State auspices until 1932, when cooperation with the Geological Survey was resumed. Since 1932, the program has been on a cooperative basis. Numerous stations are operated for the administration of the several interstate water-apportionment compacts to which the State is a party, and since its creation in 1935 the Interstate Stream Commission has borne New Mexico's share of the cost of such stations.

During the period 1907-15, streamflow records of New Mexico were published both in the water-supply papers of the Geological Survey and in reports of the State Engineer. During the period 1916-31, the Geological Survey published only those records which were obtained and processed by agencies of the Department of the Interior, other New Mexico records being published by the State Engineer in a series of annual publications titled "Surface-Water Supply of New Mexico." From 1932 through September 30, 1960, the records of discharge and stage of streams and contents and stage of lakes or reservoirs were published in an annual series of water-supply papers titled "Surface-Water Supply of the United States," issued in various parts according to major drainage basins. Beginning with the 1961 water year, streamflow records and related data are being released by the Federal agency in annual reports on a state-boundary basis. Distribution of these basic-data reports is limited and intended primarily to serve local needs. Summaries of

records will be published later in Geological Survey water-supply papers, at 5-year intervals. The 5-year summaries will show daily discharge and will be compiled by the same geographical areas previously used for the annual series; however, some of the 14 parts will be further subdivided. The agency also makes data available in advance of publication.

The State Engineer Office and Interstate Stream Commission were cooperating with the Geological Survey in maintaining 127 stations in and adjacent to New Mexico at the end of the 25th biennial period. Sixteen additional stations were maintained by the State Engineer Office and other agencies and municipalities in cooperation with the Geological Survey. Still another 51 stations were maintained either entirely by the Geological Survey or by the Survey in cooperation with agencies other than the State Engineer and Interstate Stream Commission. Temporary and seasonal stations, records from which are not published, are not included in the above enumerations.

Financing of stations operated jointly by the State Engineer Office or Interstate Stream Commission and the Geological Survey is on a 50-50 basis.

Delineation of the flow characteristics of streams is helpful in rational evaluation of streamflow and efficient design of works for the development of surface-water supplies. In cooperation with the State Engineer, Interstate Stream Commission, U. S. Soil Conservation Service, and U. S. Bureau of Reclamation, the Surface Water Branch of the Geological Survey during the 49th fiscal year began compilation of statistical summaries of streamflow records taken at 122 gaging stations in New Mexico and 15 stations in Colorado. Statistical tabulations were produced by electronic computers which summarized the flow-duration, high-flow, and low-flow data from basic streamflow records, and a report was prepared by L. J. Reiland and G. L. Haynes of the Survey for publication by the State Engineer. The report is limited to presentation and explanation of the data, and to descriptions of procedures for preparing duration curves and frequency curves from the data summaries.

Each of the characteristics included in the report has particular uses in the investigation of water problems. Curves prepared from flow-duration summaries indicate the availability and variability of streamflow and have specific applications in power and pollution problems. High-flow-frequency curves, prepared from the high-flow summaries, may be used to compute required storage for flood control. Low-flow-frequency curves, similarly prepared from the low-flow tables, indicate the probability of occurrence of annual minimum flows of various magnitudes and provide a means of determining storage required to maintain flows of greater magnitudes.

The streamflow records that form the basis for the data presented were selected by the agencies which financed the project. In general, the

criteria used for selection were related to immediate project-investigation requirements of the agencies concerned, and this accounts for the inclusion of records from the 15 stations in Colorado, important in the hydrology of the San Juan River and Rio Grande valleys in New Mexico. Records have been published for more than 220 sites on natural channels in New Mexico, as compared with 122 New Mexico stations for which data are included in the summary. However, almost all New Mexico records that reasonably represent natural-flow conditions are included. Some records included are appreciably affected by regulation and diversion, but were included at specific request.

Titled "Flow Characteristics of New Mexico Streams," the report was in press at the end of the biennial period.

Table 3 lists all gaging stations in operation in and adjacent to New Mexico at the close of the 25th biennial period. Temporary or seasonal stations whose records are not published are not included in the tabulation. Stations are listed in downstream order by drainage basins. With the main-stem station at the left margin, one indentation denotes a tributary which enters the main stream, two indentions denote a subtributary, and so on. All stations on a tributary entering a stream above a main-stem station are listed ahead of the main-stem station. A similar order is followed in listing stations on first, second, and other orders of tributaries. Names in italics do not indicate stations but are inserted in the table to maintain the tributary sequence.

State Engineer Office funds expended in the streamflow-gaging program during the 25th biennium totaled \$108,798.39.

TABLE 3

STREAM AND RESERVOIR GAGING STATIONS

Explanation of symbols:

Without symbol: State Engineer Office, Interstate Stream Commission, and compact commissions in cooperation with U. S. Geological Survey.

* *U. S. Geological Survey, or agencies other than State Engineer Office, Interstate Stream Commission, and compact commissions in cooperation with U. S. Geological Survey.*

† *State Engineer Office and other agencies in cooperation with U. S. Geological Survey.*

LOWER MISSISSIPPI RIVER BASIN

ARKANSAS RIVER BASIN

Cimarron River near Guy

Canadian River near Hebron

Vermejo River near Dawson

Cimarron Creek

Six Mile Creek near Eagle Nest

TABLE 3 (continued)

Lower Mississippi River Basin (continued)

ARKANSAS RIVER BASIN (continued)

Canadian River (continued)

- Eagle Nest Reservoir
- Cimarron Creek below Eagle Nest Dam
 - McEvoy Creek near Eagle Nest†
 - Tolby Creek near Eagle Nest†
 - Clear Creek near Ute Park†
- Cimarron Creek near Cimarron
 - Ponil Creek near Cimarron
 - Rayado Creek at Sauble Ranch, near Cimarron
- Cimarron Creek at Springer
- Canadian River near Roy*
- Rio Agua Negra (head of Mora River) near Holman*
 - Vigil Canyon at Holman
 - Agua Fria Creek near Holman
 - Rio de la Casa near Cleveland*
 - La Cueva Canal below waste, at La Cueva*
- Mora River at La Cueva
 - Cebolla River near Golondrinas
- Mora River near Golondrinas
 - Coyote Creek below Black Lake*
 - Coyote Creek above Guadalupita
 - Coyote Creek near Golondrinas
- Mora River near Watrous
 - Sapello River
 - Sapello Canal at Sapello
 - Manuelitas Creek near Rociada*
 - Sapello River at Sapello
 - Lake Isabel Feeder Canal near Sapello
 - Sapello River near Watrous
- Mora River near Shoemaker
- Canadian River near Sanchez
 - Conchas River at Variadero*
- Conchas Reservoir*
 - Bell Ranch Canal near Conchas Dam*
 - Conchas Canal below Conchas Dam
- Canadian River below Conchas Dam*
 - Ute Creek near Logan
- Canadian River at Logan*
 - Revuelto Creek near Logan

WESTERN GULF OF MEXICO BASINS

BRAZOS RIVER BASIN

Salt Fork Brazos River

- Running Water Draw near Clovist†

RIO GRANDE BASIN

- Rio Grande at Colorado-New Mexico state line*

TABLE 3 (continued)

Western Gulf of Mexico Basins (continued)

RIO GRANDE BASIN (continued)

Rio Grande (continued)

Costilla Creek above Costilla Dam
 Casias Creek near Costilla
 Santistevan Creek near Costilla
 Costilla Reservoir
 Costilla Creek below Costilla Dam
 Costilla Creek near Amalia
 Costilla Creek near Costilla
 Acequia Madre at Costilla
 Mesa Ditch near Garcia, Colo.
 Cordillera Ditch at Garcia, Colo.
 Cerro Canal at Costilla
 Association Ditch at Costilla
 Cerro Canal near Jaroso, Colo.
 New Mexico Branch Cerro Canal near Jaroso, Colo.
 Costilla Creek below diversion dam, at Costilla
 Costilla Creek at Garcia, Colo.
 Eastdale No. 1 Intake Canal near Jaroso, Colo.
 Latir Creek near Cerro

Rio Grande near Cerro*

Red River near Questa
 Cabresto Creek
 Llano Ditch near Questa
 Cabresto Creek near Questa
 Red River at mouth, near Questa
 Rio Hondo near Valdez
 Rio Hondo at Arroyo Hondo
 Rio Pueblo de Taos near Ranchito
 Rio Grande de Ranchos near Talpa*
 Rio Chiquito near Talpa
 Rio Pueblo de Taos at Los Cordovas
 Rio Pueblo de Taos below Los Cordovas

Rio Grande below Taos Junction Bridge near Taos

Rio Grande at Embudo*

Rio Chama near La Puente
 Willow Creek near Park View
 El Vado Reservoir
 Rio Chama below El Vado Dam
 Rio Chama above Abiquiu Reservoir*
 Rio Chama below Abiquiu Dam*
 Rio Chama near Abiquiu
 Rio Ojo Caliente at La Madera
 Rio Chama near Chamita
 Santa Cluz River at Cundiyo
 Pojoaque River
 Rio Tesuque
 Tesuque Creek
 Middle Fork Tesuque Creek near Santa Fe†
 Little Tesuque Creek near Santa Fe†
 Little Tesuque Creek Tributary No. 2 near Santa Fe†

TABLE 3 (continued)

Western Gulf of Mexico Basins (continued)

RIO GRANDE BASIN (continued)

- Rio Grande at Otowi Bridge, near San Ildefonso
Rito de los Frijoles near Los Alamos*
- Rio Grande at Cochiti (and Cochiti East Side Main Canal and Sili Main Canal)
McClure Reservoir
Santa Fe River near Santa Fe
Nichols Reservoir
Galisteo Creek at Domingo
- Rio Grande at San Felipe
Jemez River below East Fork, near Jemez Springs*
Rio Guadalupe at Box Canyon, near Jemez†
Jemez River near Jemez†
Jemez Canyon Reservoir*
Jemez River below Jemez Canyon Dam*
Bernalillo Floodwater Retarding Reservoir No. 1 (Piedra Lisa Arroyo)*
- Rio Grande near Bernalillo
- Rio Grande at Albuquerque*
- Rio Grande near Bernardo
Rio Puerco above Chico Arroyo, near Guadalupe
Chico Arroyo near Guadalupe*
Bluewater Lake (head of Rio San Jose) *
Bluewater Creek below Bluewater Dam*
Bluewater Creek near Bluewater
Bluewater Creek at Grants*
Grants Canyon at Grants*
Rio San Jose near Grants*
Rio San Jose at Correo*
- Rio Puerco at Rio Puerco
Rio Puerco near Bernardo
Rio Salado near San Acacia
Socorro Main Canal North at San Acacia
- Rio Grande at San Acacia
Socorro Main Canal South near San Antonio†
San Antonio Riverside Drain near San Antonio†
Elmendorf Interior Drain near San Antonio†
San Antonio Riverside Drain near San Marcial†
- Rio Grande at San Marcial
Alamosa River near Monticello
- Elephant Butte Reservoir
- Rio Grande below Elephant Butte Dam*
- Caballo Reservoir
- Rio Grande below Caballo Dam (and Bonita Ditch)
Las Cruces Arroyo near Las Cruces*

PECOS RIVER BASIN

- Pecos River near Pecos
Tecolote Creek near San Pablo

TABLE 3 (continued)

Western Gulf of Mexico Basins (continued)

PECOS RIVER BASIN (continued)

- Pecos River near Anton Chico
 - Gallinas River near Montezuma
 - Gallinas River at Montezuma
 - Gallinas River near Lourdes*
 - Gallinas River near Colonias*
- Pecos River at Santa Rosa
- Pecos River near Puerto de Luna
- Alamogordo Reservoir
- Pecos River below Alamogordo Dam
 - Fort Sumner Main Canal near Fort Sumner
- Pecos River below Fort Sumner
- Pecos River near Acme
 - Rio Ruidoso (head of Rio Hondo) at Hollywood (and F. Herrera Ditch S)†
 - Rio Hondo at Pichacho* (discontinued June 30, 1962)
 - Rio Hondo at Diamond A Ranch, near Roswell*
 - North Spring River at Roswell*
 - Rio Felix at old highway bridge, near Hagerman
- Pecos River near Lake Arthur
 - Cottonwood Creek near Lake Arthur
- Pecos River near Artesia
 - Rio Penasco near Dunken* (discontinued June 30, 1962)
 - Rio Penasco at Dayton*
- Pecos River (Kaiser Channel) near Lakewood
 - Four Mile Draw near Lakewood*
- Lake McMillan
- Pecos River below McMillan Dam
- Pecos River at Dam Site 3, near Carlsbad
- Lake Avalon*
 - Carlsbad Main Canal at head, near Carlsbad*
- Pecos River below Avalon Dam*
- Pecos River at Carlsbad
 - Black River above Malaga
- Pecos River near Malaga
- Pecos River at Pierce Canyon Crossing, near Malaga
- Pecos River at Red Bluff
 - Delaware River near Red Bluff
- Pecos River near Orla, Tex.
- Pecos River near Girvin, Tex.

MIMBRES RIVER BASIN

- Mimbres River near Mimbres
 - San Vicente Arroyo at Silver City†

TULAROSA VALLEY

- Rio Tularosa near Bent

TABLE 3 (continued)
 COLORADO RIVER BASIN

SAN JUAN RIVER BASIN

- San Juan River near Carracas, Colo.*
- San Juan River at Rosa*
 - Los Pinos River at La Boca, Colo.*
 - Spring Creek at La Boca, Colo.*
- Navajo Reservoir*
- San Juan River near Archuleta
- San Juan River at Bloomfield
 - Animas River near Cedar Hill
 - Animas River at Farmington
- San Juan River at Farmington
 - La Plata River at Colorado-New Mexico state line*
 - La Plata River near Farmington
- San Juan River at Shiprock*

LITTLE COLORADO RIVER BASIN

- Largo Creek near Mangas† (noncontributing drainage)

GILA RIVER BASIN

- Gila River near Gila
- Gila River below Blue Creek, near Virden*
 - Sunset Canal near Virden
 - New Model Canal near Virden
 - San Francisco River near Reserve
 - San Francisco River near Glenwood

QUALITY-OF-WATER SAMPLING

The quality-of-water program in cooperation with the U. S. Geological Survey in New Mexico is concerned with chemical and physical characteristics of the surface-water supplies. Data supplied by chemical analyses are used in determining suitability of water for domestic, industrial, irrigation, and other uses. Suspended-sediment data are used in determining sediment movement through stream channels, and in computing reservoir capacity necessary to allow for sediment deposition in important surface-water impoundments.

The data are collected and published by the Quality of Water Branch of the Geological Survey's Water Resources Division. The information is published in a series of annual publications titled "Quality of Surface Waters of the United States," and "Quality of Surface Waters for Irrigation, Western United States," issued in various parts according to major drainage units. In addition, the agency makes the information available in advance of publication and makes special analyses and determinations upon request.

During the 25th biennium the Geological Survey maintained 46 chemical-quality and suspended-sediment stations in and adjacent to New Mexico — each chemical-quality and suspended-sediment sampling point being considered a separate station, even though both kinds of samples may be taken at one place. The Interstate Stream Commission and the Pecos River Commission cooperated in maintaining 25 of these stations. Financing of stations operated jointly by the Geological Survey and the Interstate Stream Commission or the Pecos River Commission is on a 50-50 basis. Money for New Mexico's share of the Pecos River Commission fund is included in the Interstate Stream Commission budget.

Table 4 lists all chemical-quality and suspended-sediment stations which were in operation at the close of the biennial period. Stations are listed in downstream order by drainage basins; tributaries are indicated and listed by the method employed in table 3. The method is described on page 62.

TABLE 4

CHEMICAL-QUALITY AND SUSPENDED-SEDIMENT STATIONS

Explanation of symbols:

(CQ) Chemical quality.

(S) Suspended sediment.

* U. S. Geological Survey, or agencies other than State Engineer Office, Interstate Stream Commission, and compact commissions in cooperation with U. S. Geological Survey.

† U. S. Geological Survey in cooperation with the Interstate Stream Commission or Pecos River Commission.

Daily sample collections unless noted as follows: (w) weekly; (m) monthly; (i) intermittent.

LOWER MISSISSIPPI RIVER BASIN

ARKANSAS RIVER BASIN

Canadian River at Logan (CQ)†

Revelto Creek near Logan (CQ)†

WESTERN GULF OF MEXICO BASINS

RIO GRANDE BASIN

Rio Grande above Culebra Creek near Lobatos, Colo. (CQ)†

Red River near Red River (S)* (m)

Rio Hondo near Valdez (S)* (m)

Rio Grande de Ranchos near Talpa (S)* (m)

Willow Creek near Parkview (S)* (m)

Rio Chama near Chamita (S)*

Rio Nambe near Nambe (S)* (m)

TABLE 4 (continued)

Western Gulf of Mexico Basins (continued)

RIO GRANDE BASIN (continued)

- Rio Grande at Otowi Bridge near San Ildefonso (CQ)† (S)*
- Galisteo Creek at Domingo (S)*
- Bernalillo Floodwater Retarding Reservoir No. 1 (Piedra Lisa Arroyo) near Bernalillo (S)*
- Rio Grande near Bernalillo (S)*
- Rio Grande near Bernardo (CQ)† (S)†
- Rio Puerco near Bernardo (CQ)† (m) (S)*
- Rio Salado near San Acacia (S)† (i)
- Rio Grande Floodway at San Acacia (S)†
- Rio Grande Conveyance Channel at San Acacia (S)†
- Rio Grande Floodway at San Marcial (CQ)* (S)†
- Rio Grande Conveyance Channel at San Marcial (CQ)* (S)†

PECOS RIVER BASIN

- Pecos River at Santa Rosa (S)*
- Pecos River below Alamogordo Dam (CQ)†
- Pecos River near Acme (CQ)†
- Rio Hondo at Diamond A Ranch, near Roswell (CQ)† (m) (S)*†
(discontinued June 30, 1962)
- Pecos River near Artesia (CQ)† (S)*
- Rio Penasco at Dayton (S)†
- Pecos River at Dam Site 3, near Carlsbad (CQ)† (w)
- Pecos River at Carlsbad (CQ)†
- Pecos River east of Malaga (CQ)†
- Pecos River at Pierce Canyon Crossing near Malaga (CQ)†
- Pecos River at Red Bluff (CQ)*

COLORADO RIVER BASIN

SAN JUAN RIVER BASIN

- San Juan River near Archuleta (CQ)* (S)*
- San Juan River at Bloomfield (S)†
- Animas River at Farmington (CQ)* (S)*
- San Juan River at Shiprock (CQ)† (S)*

GILA RIVER BASIN

- Gila River near Gila (S)†

PUMPAGE AND WATER-LEVEL MEASUREMENTS

Obtaining water-level measurements and related data from which to estimate annual pumpage of ground water, particularly in the heavily pumped areas of the State, constitutes one of the major programs of the

State Engineer in cooperation with the Geological Survey. Cost of the program accounts for roughly half of State Engineer funds which are spent on cooperative programs with that agency.

Pumping of ground water causes changes in water level in an aquifer and these changes provide an index to relative changes in ground water in storage. Correlative data on water-level changes and pumping are, therefore, important criteria in evaluating ground-water resources and in formulating administrative decisions concerning control of ground-water development and the granting of ground-water rights.

At the end of the 25th biennium water-level measurements were being obtained on a continuing basis in 27 areas of the State (see fig. 9). Measurements were being made annually in more than 1,600 wells, of which more than 500 also were measured seasonally, and 32 were equipped with recording gages to give continuous records. Estimates of annual pumpage are being obtained in most of the areas in which measurement programs are being carried on.

Because of its basic importance in evaluating the State's water resources, the program of measuring water levels is being expanded, as financial conditions permit, to include all areas of significant ground-water use. Data gathered are made available as compiled and are subsequently published on an annual basis — formerly in the water-supply papers of the Geological Survey, presently in reports of the State Engineer (see *Public Information Program*).

USE OF WATER BY MUNICIPALITIES IN NEW MEXICO

Under the impact of expanding populations and growing per capita requirements, water uses in most New Mexico communities have been increasing steadily through the years. If future demands for water for municipal requirements are to be met in an orderly fashion, civic planners and all persons and agencies concerned with development and administration of municipal supplies require access to data concerning quantities of present use, types of use, per capita requirements, quality of available supplies, probable future requirements, sources of present and potential future supplies, present and potential salvage of water from sewage, and various other related subjects.

Accordingly, in 1961 the State Engineer in cooperation with the Geological Survey initiated a program to inventory municipal water systems, supplies, and uses throughout the State. For purposes of the investigation, the State was divided roughly into four quarters — southeastern, northeastern, southwestern, and northwestern — with each quarter to be treated as a unit. Data will be gathered from all communities whose populations number 100 or more. In communities possessing public water systems, data are being extracted from the system

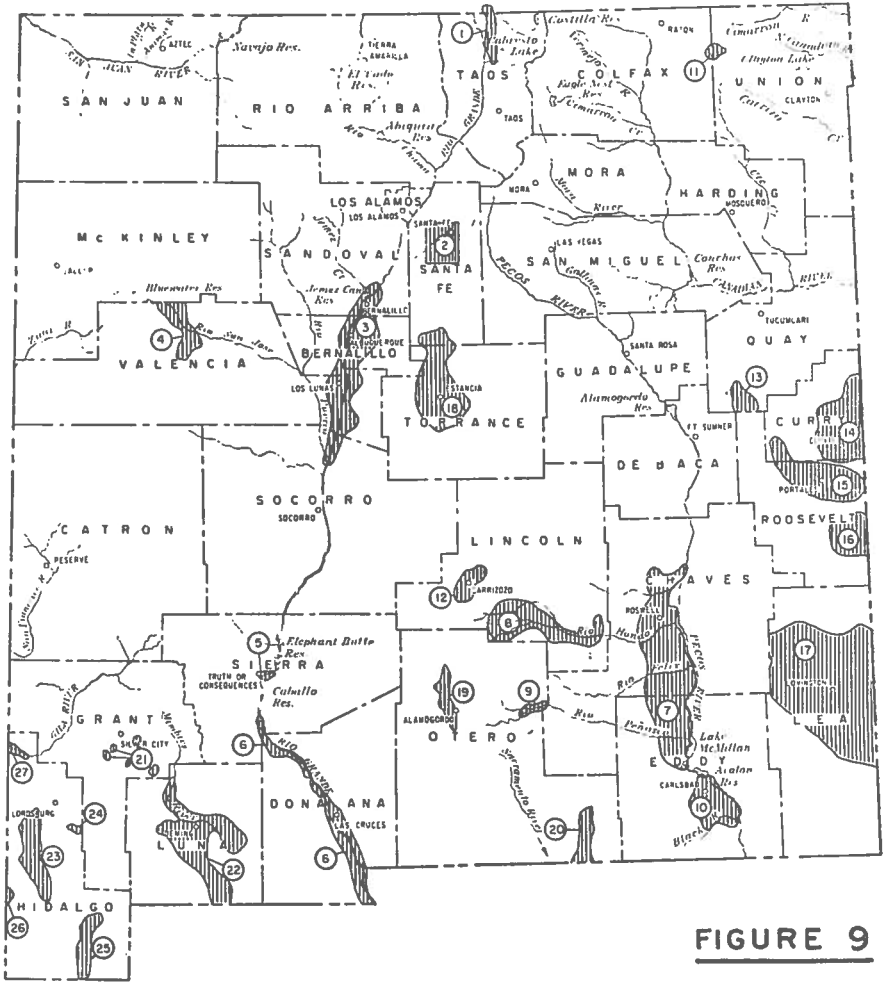


FIGURE 9

AREAS OF OBSERVATION OF WATER LEVELS

BY THE
U. S. GEOLOGICAL SURVEY
UNDER COOPERATIVE AGREEMENT
WITH THE STATE ENGINEER

1960 - 62

STATE ENGINEER OFFICE



- | | |
|---|--|
| <ol style="list-style-type: none"> 1. SUNSHINE VALLEY, TAOS COUNTY (1956) 2. SANTA FE AREA, SANTA FE COUNTY (1959) 3. ALBUQUERQUE - BELEN AREA, BERNALILLO, VALENCIA, AND SOCORRO COUNTIES (1956) 4. GRANTS - BLUEWATER AREA, VALENCIA COUNTY (1946) 5. HOT SPRINGS AREA, SIERRA COUNTY (1939) 6. RINCON - MESILLA VALLEY, DOÑA ANA AND SIERRA COUNTIES (1957) 7. ROSWELL BASIN, CHAVES AND EDDY COUNTIES (1925) 8. HONDO VALLEY, LINCOLN COUNTY (1956) 9. PEÑASCO VALLEY, OTERO AND CHAVES COUNTIES (1955) 10. CARLSBAD AREA, EDDY COUNTY (1942) 11. CAPULIH AREA, UNION COUNTY (1957) 12. CARRIZOZO AREA, LINCOLN COUNTY (1957) 13. HOUSE AREA, QUAY COUNTY (1940) | <ol style="list-style-type: none"> 14. CLOVIS AREA, CURRY COUNTY (1954) 15. PORTALES VALLEY, ROOSEVELT COUNTY (1931) 16. CAUSEY-LINGO AREA, ROOSEVELT COUNTY (1957) 17. TATUM-LOVINGTON-HOBBS AREA, LEA COUNTY (1929) 18. ESTANCIA VALLEY, TORRANCE AND SANTA FE COUNTIES (1941) 19. TULAROSA-ALAMOGORDO AREA, OTERO COUNTY (1952) 20. CROW FLATS AREA, OTERO COUNTY (1956) 21. AREAS IN GRANT COUNTY (1943) 22. MIMBRES VALLEY, LUNA COUNTY (1927) 23. ANIMAS VALLEY, HIDALGO COUNTY (1948) 24. LORDSBURG VALLEY, HIDALGO COUNTY (1956) 25. PLAYAS VALLEY, HIDALGO COUNTY (1948) 26. SAN SIMON VALLEY, HIDALGO COUNTY (1958) 27. VIRGEN VALLEY, HIDALGO COUNTY (1939) |
|---|--|

NUMBERS IN PARENTHESES REFER TO YEAR OBSERVATION PROGRAM WAS STARTED

records and allowances are being made for uses served by private sources of supply. In communities which have no central distribution systems, methods have been worked out for estimating quantities of use.

Present sources of water for the various communities are being identified and appraised for dependability and quality of the supply. Samples for chemical analysis are being taken in areas for which no records exist; but, where available, existing records are being utilized. Similarly, existing water-level and streamflow records are being used, and some new data concerning water levels are being gathered as required. Per capita uses are being computed, and efforts are being made to differentiate household, industrial, commercial, recreational, and other types of use.

Data are being compiled for presentation in the form of charts, graphs, tables, maps, etc., for publication along with interpretative text in four reports, each of which will deal with one-quarter of the State. The project schedule calls for the preparation of one report during each year of the investigation. At the end of the 25th biennium field work had been completed in the southeastern quarter and was proceeding in the northeastern quarter. A report on the southeastern quarter had been completed and was receiving critical review.

Scheduled for publication in 1963, the report on the southeastern sector will present data for 10 counties: Otero, Lincoln, Torrance, Guadalupe, De Baca, Curry, Roosevelt, Lea, Chaves, and Eddy. The second report in the series will present data from northeastern New Mexico, with reports of the southwestern and northwestern sections following in that order.

The investigation is being carried out by George A. Dinwiddie of the Geological Survey.

AREAL GROUND-WATER INVESTIGATIONS

COLORADO RIVER BASIN

Gallup area, McKinley County: Availability of ground water. — Located in an area where there are no perennial streams, the town of Gallup (1960 population: 14,089) has experienced recurring shortages of water for municipal use. Its population has more than doubled since 1940. Present average water use is more than a million gallons a day. Owing to increasing demands resulting from continued population growth and industrial expansion, the community soon will require more water than presently is developed.

The Gallup hydrologic investigation is a cooperative effort of the town, the State Engineer, and the U. S. Geological Survey to determine the availability of ground water for municipal use. The study area includes approximately 1,000 square miles extending about 10 miles north,

20 miles west, 30 miles east, and 15 miles south of the community (area 1, fig. 10).

Field work for the investigation was begun in August 1955 by S. W. West of the Geological Survey and was essentially concluded in December 1957. Interim reports of the study were prepared in 1957 and 1959, and the 1959 report was published in 1961 as Geological Survey Circular 443. Basic data, excluded in the main from the circular, are available from the district office, Ground Water Branch, in Albuquerque. A final report containing basic data, expanded text, and a geologic map will be published by the State Engineer.

Grant County: Geology and ground-water conditions. — Grant County, in the southwestern part of New Mexico, has an area of approximately 4,000 square miles (area 2, fig. 10). About 10,000 acres are being irrigated along the Gila and Mimbres Rivers, in part by means of wells. Considerable water is utilized by several communities and a number of large mining enterprises, and many of the municipalities and mining areas are short of water. Diminished surface-water supplies during the drought of the 1950's aggravated the situation.

The present investigation, initiated by agreement between the Grant County commissioners and the State Engineer, is being made by F. D. Trauger of the Geological Survey to determine general availability of ground water, particularly in the valleys near the municipalities and mining areas. A geologic map of the county and a map showing the water-table contours is in preparation. A map showing the general quality of the ground water throughout the county, based on 215 chemical analyses, has been prepared and released to the public. Preparation of the study report has been delayed by intervention of work of higher priority. Pending completion and publication of the report, access to the compiled basic data may be had in the Albuquerque office of the Geological Survey.

RIO GRANDE BASIN

Albuquerque area, Bernalillo and Sandoval Counties: Quantitative analysis of water resources. — The Albuquerque area includes about 1,400 square miles in Bernalillo and Sandoval Counties, extending from Algodones on the north to Isleta on the south and from the Sandia and Manzano Mountains on the east to the Rio Puerco on the west (area 3, fig. 10). It lies mostly within the Rio Grande depression, which is a series of grabens having a general north-south alignment. The grabens have been partly filled with Tertiary and Quaternary deposits of sands, gravels, silts and clays, and volcanic rocks. In places, the valley-fill sediments are more than 6,000 feet thick. All water wells of large capacity are finished in these rocks. Rocks older than Tertiary are exposed in the Sandia and Manzano Mountains, in the Rio Puerco valley, and on

the highlands west of the Zia Pueblo. The older rocks yield relatively small quantities of water to wells.

The rapid growth of Albuquerque in recent years (population: 96,815 in 1950; 201,189 in 1960) and an attendant increase in demand for water for municipal and industrial uses created problems pertaining to water supply and the extent to which increasing use of water for municipal and industrial purposes might infringe upon the rights of prior appropriators — especially downstream of the growing city.

A study of the ground-water resources of the area was initiated in 1955 as a cooperative effort of the city of Albuquerque, the State Engineer, and the U. S. Geological Survey. A qualitative report of investigation findings, prepared during the 24th biennium, was published in 1961 (see p. 99). A quantitative investigation, utilizing many basic data, maps, illustrations and concepts set forth in the report of qualitative investigation, was continued through the 25th biennial period to determine the relation of present and future ground-water use to present and future flow in the Rio Grande.

Streamflow data collected by the Surface Water Branch of the Geological Survey were analyzed, as were data from 20 aquifer tests. Hydraulic values and anticipated pumping rates (scaled to increasing population and industrialization) were applied to various wells to determine how pumping of all wells will affect ground-water levels and surface flows in the river and drains for the period 1960-2000.

The investigation was begun by L. J. Bjorklund and is being completed by H. O. Reeder, both of the Geological Survey. A report of findings will be published by the State Engineer.

Sandia and Manzano Mountains, Bernalillo and Sandoval Counties: Geology and ground-water resources. — The area of investigation consists roughly of 540 square miles along the eastern slope of the Sandia and Manzano Mountains east of Albuquerque (area 4, fig. 10). Until recently the area was unpopulated, except for Tijeras Canyon, points along State Highway 10 between Tijeras and Sandia Park, and a few small, scattered agricultural villages. Beginning in the late 1950's considerable interest began to develop in the area as a convenient location for mountain homes and summer cabins. Many homes have been built, both in subdivisions and at isolated sites. Surface-water supplies are inadequate and undeveloped, and the number of small domestic wells in the area has increased.

An investigation of the area's geology and ground-water supplies was undertaken in 1961 and continued throughout the remainder of the biennium. Cooperating in the project are the State Engineer, New Mexico Bureau of Mines and Mineral Resources, and the Geological Survey. The investigation is being made by F. B. Titus of the latter agency.

The hydrology of the area and the availability of ground water are controlled by the moderately complex geologic setting. Rocks ranging in age from Precambrian to Recent crop out in the region and where they contain permeable zones these rocks constitute aquifers. Structural complexities, particularly in the Sandia Mountains, result locally in numerous different stratigraphic units serving as small, shallow aquifers.

The Madera limestone of Pennsylvania age crops out over about two-thirds of the project area and, because of its extent and great thickness (1,000 feet), constitutes the most widely used aquifer. Ground water in the Madera occurs in joints, fractures, and solution channels in the limestone beds. High on the slopes of the Manzano Mountains the Madera is a fairly reliable aquifer, although not a prolific one. Low on the eastern slope of the mountains, however, many dry holes have been drilled.

Prior to the beginning of the investigation, virtually no water-level or streamflow measurements had been made in the area. Existing wells are being inventoried and representative water samples are being collected for chemical analysis. The geology is mapped in sufficient detail to allow description of the stratigraphic, lithologic, and structural control over the hydrology. Water levels in selected wells will be measured periodically during the period of the investigation. A report of the project will be published by the Bureau of Mines and Mineral Resources.

Southeastern McKinley County: Geology and ground-water occurrence. — This study (area 5, fig. 10) by James B. Cooper was begun in 1958 to obtain information regarding ground-water resources in an area which has considerable growth potential, as regards both industry and population, resulting from uranium mining and processing and allied industrial developments.

Objectives of the study are: 1) to determine the general availability and quality of ground water, with particular emphasis on those areas where water occurs in strata which contain large bodies of uranium ores; and 2) to determine the principal aquifers, their areal extent, and their areas of recharge and discharge. Problems involving de-watering of strata in the vicinity of ore bodies also are being studied. Field work was continued in the 25th biennium, and a geologic map was prepared. A report of the study eventually will be published by the State Engineer.

PECOS RIVER BASIN

Guadalupe County: Geology and water resources. — The investigation in Guadalupe County (area 6, fig. 10) is one of the first reconnaissance-type countywide hydrologic studies wherein financial cooperation is between the Geological Survey and the State Engineer only. It re-

sulted from efforts to hasten the collection of basic information concerning occurrence of ground water on a county basis. Special problems of the investigation have been discussed in earlier biennial reports of the State Engineer.

The study is being conducted by Alfred Clebsch, Jr., of the Geological Survey, and a report of its findings was essentially completed at the end of the biennial period. In keeping with the practice that reports of countywide subsurface hydrological investigations are published by the New Mexico Bureau of Mines and Mineral Resources, it is contemplated that findings of the Guadalupe County investigation will be published as a ground-water report of that agency.

Roswell basin, Chaves and Eddy Counties: An appraisal of potential ground-water salvage along the Pecos River between Acme and Artesia. — Phreatophytes such as saltcedar, grasses (saltgrass and sacaton), and mesquite growing in the bottomland of the Acme-Artesia reach of the Pecos River in Chaves and Eddy Counties (area 7, fig. 10) consume tens of thousands of acre-feet of water each year. The spread and increase in growth density of this vegetation — particularly of saltcedar — are continuing uncontrolled, and the amount of water thus wasted increases yearly.

Phreatophytes draw water directly from the Quaternary alluvium, but the major source of recharge to the alluvium is artesian water from the San Andres limestone and the Grayburg formation, either as seepage from artesian water pumped for irrigation or as upward leakage from the artesian system. The rate of discharge to the alluvium as upward leakage per unit area of alluvium is largest south of the vicinity of Roswell and becomes progressively smaller southward, as the thickness of the confining bed separating the artesian and nonartesian water increases.

The general movement of ground water in both aquifers is eastward toward the Pecos River. The river and the adjacent bottomland are the principal areas of natural discharge of ground water in the Acme-Artesia reach. In general, water moving eastward toward the river and not intercepted by wells will reach the bottomland. Ground water not pumped from wells and not discharged by evapotranspiration will discharge to the river or its tributaries.

Water levels in the artesian and nonartesian wells in the Acme-Artesia reach of the river have trended downward since 1942, because of drought, heavy pumping for irrigation, and discharge of water in the bottomland by evapotranspiration. The decline in nonartesian water levels by 1958 had not been sufficient to cause a shortage of ground water to the phreatophytes; thus conditions still were favorable for additional phreatophytic growth. In time, pumping in the cultivated area may reverse the movement of ground water between the bottomland and the cul-

tivated area. If this occurs, the nonartesian water levels in parts of the infested area should decline to a point that would cause a shortage of water to the phreatophytes. However, it is not anticipated that this will occur in the immediate future.

Ground water in the bottomland is, in general, suitable for irrigation. Use of water by phreatophytes causes some deterioration in the chemical quality of the water in the bottomland, as evapotranspiration discharges chemically pure water, leaving the mineral salts in the soil. The rejected salts eventually are leached downward to the water table and increase the dissolved-salts content of the water. Reducing the amount of evapotranspiration in the bottomland thus would impede the chemical deterioration of ground water reaching the river.

Phreatophytes in the area were mapped in 1956 and 1958, according to species, areal density, and vertical density. About 41,000 acres were infested in 1956, and there was no appreciable increase in acres infested by 1958; however, during the period saltcedar increased in areal and vertical density and encroached on about 5,000 acres that formerly had been occupied by saltgrass. Results of the 1958 survey indicated that if each species were reduced to an area of 100-percent volume density, saltcedar would cover about 8,700 acres, saltgrass about 17,000 acres, and mesquite about 170 acres. Total magnitude of water wasted to phreatophytic vegetation was estimated to be between 70,000 and 80,000 acre-feet a year.

It is concluded that if the saltcedar were to be eradicated and replaced by saltgrass, and if nonartesian water levels were to be lowered and controlled, the nonbeneficial use of water in the area would be reduced to about 45,000 acre-feet a year.

Means of eradicating the phreatophytes were not investigated during the study. Information from other sources indicate that control is possible through clearing, spraying with chemicals, and burning.

A report of the phreatophyte study, by R. W. Mower, J. W. Hood, R. L. Cushman, and others, all of the Geological Survey, was released to the public in May 1961. It will be published as Water-Supply Paper 1659 of the Survey.

The engineering feasibility of initiating a phreatophyte and water-level-control program is being studied by the State Engineer Office with assistance from the Geological Survey.

Roswell Basin, Chaves, Eddy, Lincoln, and Otero Counties: An appraisal of artificial recharge to ground-water supplies. — The persistent downward trend of water levels in wells tapping the deep (artesian) and shallow (alluvial) aquifers of the Roswell basin indicates that discharge of water from these aquifers has exceeded recharge since 1942. Although

the supply of water in storage is not nearly exhausted, the decline in pressure in the artesian part of the limestone aquifer has disturbed the equilibrium of a fresh water-saline water interface in the main aquifer, and saline water is gradually encroaching westward to the heavily pumped irrigated sector of the basin.

The lowering of water levels and the encroachment of saline water can be halted or retarded by reducing discharge or increasing recharge, or both. The amount of recharge possibly could be increased substantially by inducing additional infiltration of surface water through sinkholes and permeable sections of stream channels.

The recharge potential was studied in an area that extends from the vicinity of Vaughn, N. Mex., southward to the Seven Rivers Hills and the Guadalupe Mountains, and westward from the Pecos River to the crest of the Jicarilla and Sacramento Mountains (area 8, fig. 10). The Yeso formation, San Andres limestone, and the Artesia group, all of Permian age, crop out extensively or have been tapped by wells in the basin west of the Pecos River. Unconsolidated and some consolidated gravel, sand, and silt of Tertiary and Quaternary age compose the alluvium of the lowland area. Major structural zones — Border Hill, Sixmile Hill, Y-O, Fourmile, Vandewart-Cornucopia, and Huapache — are characterized in the study area by modified surface drainages and generally higher permeability.

Sinkholes and closed depressions, common in the study area, were formed by ground water moving upward under pressure in zones of weakness and dissolving the soluble rock; by surface water infiltrating the surface rocks, dissolving the soluble rocks and carrying the dissolved materials to the water table; and by a combination of the two processes.

The San Andres limestone, principal aquifer of the basin, is within the Permian rocks. Water in most of the main aquifer west of the Pecos River is under water-table conditions. From 10 to 20 miles west of the river the water table in the main aquifer intersects the base of semi-confining beds in the Artesia formation, and from that point eastward the water in the main aquifer is under artesian pressure.

Artificial-recharge potentials of the main aquifer are far more favorable where the aquifer is highly permeable. Areas of highest permeability in the recharge area are along the major drainages, along structural zones, and in the vicinity of carbonate-*evaporite* facies boundaries.

The secondary aquifer of the basin is the alluvium along the Pecos River. Water here is under water-table conditions. Recharge to the alluvium is inhibited in places by a layer of caliche.

The study area was divided into seven recharge areas: the western limestone area, the eastern limestone area, the northern *evaporite* area, the southern *evaporite* area, the northern limestone area, the eastern

evaporite alluvial area, and the alluvial lowland area. The recharge potential of the western limestone area is poor because much of the water put underground there would reappear as surface flow within that area. The potential of the eastern limestone area is moderate to good. Dams could be constructed to impound water over the more permeable areas of stream channels to increase length of time the water would remain in contact with these channel areas. In the northern part of the northern limestone area the surface drainage is internal to sinkholes. Inducing additional recharge in that area would involve increasing the infiltration rate in sinkholes to reduce evaporation losses. Drainage is well integrated in the southern half of the northern limestone area, and small dams could be constructed to retard streamflow over the more permeable sections of the streambeds.

The alluvial lowland is not a natural recharge area for the main aquifer; however, it has some potential for artificial recharge to the main and alluvial aquifers. Recharge water to the main aquifer in most places would have to be injected through wells 400 to 1,000 feet deep. The alluvial lowland probably is more favorable for artificial recharge to the alluvium than to the artesian aquifer. Wells injecting water to the alluvial aquifer could be less than 200 feet deep.

Waters in the Roswell basin that probably could be made available for artificial recharge are: 1) floodwaters in tributaries that debouch onto lands at the terminus of well-defined channels and thereupon are lost to evapotranspiration, 2) water that would be saved by controlling saltcedar growth in the basin, and 3) water that at present evaporates from ponds in sinkholes. The right to use of these waters would have to be established before they could be utilized in artificial recharge. The amount of water that might become available for such use was not computed.

The recharge-potential study was initiated in 1957 by the Geological Survey in cooperation with the Pecos Valley Artesian Conservancy District. Final phases of the investigation were carried out in financial cooperation with the State Engineer. A report of the study, by Ward S. Motts of the Federal agency, was released to the open file in 1962. It will be published as a water-supply paper of the Geological Survey.

Roswell basin, Chaves, Eddy, Lincoln, and Otero Counties: Tritium study. — This study (area 9, fig. 10) is being conducted by New Mexico Institute of Mining and Technology and the State Engineer in cooperation with the Geological Survey. Its purpose is to provide data leading to a better understanding of the processes which affect recharge to the principal aquifers of the Roswell basin. The major part of the technical work is being done by the Institute. The program is discussed in detail elsewhere in this report (see p. 54).

Hondo Valley, Chaves, Lincoln, and Otero Counties: Water resources and geology. — Rio Hondo, a major tributary of the Pecos River in southeastern New Mexico, is formed in its upper valley by union of Rio Bonito and Rio Ruidoso; in all, it drains an area of about 1,400 square miles (area 10, fig. 10). Except for the city of Roswell (1960 population: 39,593), the economy of the valley is based primarily on agriculture which is dependent on irrigation. Irrigated farms on the alluvial plain near Roswell produce cotton, alfalfa, and small-grain crops. Apples and alfalfa are the principal crops in the higher mountain valleys along Rio Bonito and Rio Ruidoso. The upland slopes and semiarid plains are grazed by cattle and sheep.

Surface water has been diverted from Rio Bonito and Rio Ruidoso for use in irrigation for more than a hundred years. Surface-water irrigation in the eastern part of the valley along the Pecos River was initiated about 1880. About 3,650 acres in the drainage area presently are irrigated under surface-water rights, but ground water is used extensively as a supplemental supply during periods of low streamflow. Surface water also is used to supply a number of municipalities in the higher valleys. About a thousand acre-feet of surface water annually is piped to the city of Alamogordo which is outside the drainage basin.

Geologic formations in the valley range from Permian to Recent. The San Andres limestone of Permian age and alluvium of Quaternary age are the only formations that yield large supplies of water to wells. All formations yield supplies adequate for domestic and stock uses. The city of Roswell pumps its water from the San Andres limestone.

The supply of water in the alluvial aquifers in the valleys of Rio Bonito and Rio Ruidoso and along the upper Rio Hondo seems to be adequate to serve present demands for an indefinite period of time. Little irrigable land remains undeveloped. The amount of water in storage in the aquifers is fairly constant. On the other hand, levels in the San Andres limestone in the eastern part of the basin are declining and probably will continue to decline at a rate of 1½ to 2 feet a year, if present rates of pumpage and recharge are continued — resulting in greater pumping lifts and accelerated westward encroachment of saline water. In this part of the basin, water supply limits the acreage of land that can be irrigated.

Concentrations of sulfate in both ground and surface water range from 29 to 2,130 parts per million, and 72 percent of the water samples analyzed contained more than 250 parts per million of sulfate, the recommended upper limit for water used on interstate carriers. Ground water in the extreme eastern part of the valley is highly saline, and the saline water is encroaching westward because of reduced artesian pressure in the San Andres limestone.

Ground water in the upper Hondo Valley has not been affected

measurably by pumpage in the Roswell artesian basin, of which area the valley is hydrologically a part. Ground water in the upper valley moves eastward and recharges the artesian aquifer near Roswell. Any additional use of water in the upper two-thirds of the Hondo Valley would reduce recharge to the Roswell basin. Since 1953, when the basin was declared, the State Engineer has permitted the use of ground water to help serve existing surface-water rights, but not to irrigate new lands.

Successful wells have been drilled in all townships in the Hondo Valley. The very few wells that have been abandoned either were not drilled to the regional water table or the yield was insufficient for the intended use. The regional water table is more than 500 feet below the land surface at many places in the valley.

The Hondo Valley investigation was begun in April 1955. A final report, by W. A. Mourant of the Geological Survey, was released to the public in 1962. It will be published as a technical report of the State Engineer.

Carlsbad area, Eddy County: Geology and water resources. — An investigation of water resources in the vicinity of Carlsbad (area 11, fig. 10) was begun in July 1953 by the Geological Survey in cooperation with the State Engineer, the city of Carlsbad, and the Carlsbad Irrigation District. A report of the study, by L. J. Bjorklund and W. S. Motts, was released to the public in December 1959. The manuscript report was duplicated for administrative use by the State Engineer. It originally was contemplated that formal publication would be by the Geological Survey as a water-supply paper. However, the backlog of work in the U. S. Government Printing Office indicated that publication by the Federal government would be long delayed, and it now is planned that the study will be published as a technical report of the State Engineer.

The investigation and report are described in detail in the 24th biennial report of the State Engineer.

Rattlesnake Springs, Eddy County: Effects of three irrigation wells on flow of the springs. — Water from Rattlesnake Springs in the upper Black River valley in southwestern Eddy County (area 12, fig. 10) is used by the U. S. National Park Service and the New Mexico Department of Game and Fish for irrigation, public supply, domestic supply, and propagation of fish and other types of wildlife.

Three privately owned irrigation wells are pumped in the general vicinity of the springs. In July 1959, when it appeared that the flow of the springs was declining as a result of pumping from the farm wells, the National Park Service brought suit in the United States District Court for the District of New Mexico to enjoin the well owners from pumping. (*United States v. H. F. Ballard et al.*)

An earlier reconnaissance investigation of the flow of the springs (W. E. Hale, 1955, *Ground-Water Conditions in the Vicinity of Rattlesnake Springs, Eddy County, New Mexico: State Engineer Technical Report 3*) had indicated that the pumping in question did influence the flow of the springs but left some question as to the magnitude of the influence. In *United States v. Ballard*, the court did not find for the plaintiff but directed the Geological Survey to measure the flow from the springs and pumpage from the wells concerned for a period of 1 year, beginning on February 1, 1961.

The investigation was instituted as ordered. Data have been tabulated and submitted to the United States Attorney and to counsel for the defendants. A report describing the relationship between well pumpage and flow of the springs is being prepared for publication by the State Engineer, a cooperator in preparation of the report.

CANADIAN RIVER BASIN

Quay County: Ground-water conditions in the structural basins west and south of Tucumcari. — Because water levels and yields of wells in its new well field (developed since 1938) declined markedly in recent years, the city of Tucumcari became concerned about the permanence of its water supply. Consideration was given to developing a surface-water supply from Conchas Reservoir, but because of the cost and other considerations it was decided that a thorough investigation of available ground-water supplies in the area should precede consideration of converting to a surface-water system. Subsequently, the city in cooperation with the State Engineer, the New Mexico Bureau of Mines and Mineral Resources, and the Geological Survey initiated an investigation in the structural basins west of Tucumcari to determine the adequacy of the ground-water supply.

The region of investigation (area 13, fig. 10) includes about 280 square miles south and west of Tucumcari. The study found that ground water for domestic and stock use is available nearly everywhere in the Tucumcari area and is available in moderate quantities for industrial and irrigation purposes from parts of some of the formations, particularly the alluvium and the Entrada sandstone. The Chinle formation and the lower member of the Morrison formation consist essentially of shale and clay and are, at best, poor aquifers; however, small quantities of water generally can be obtained from these rocks where they occur below the regional water table.

More than a casual familiarity with the sequence of rocks in the Tucumcari area is essential for consistently successful results in the drilling of wells because of the pronounced similarity of the lower beds of the Morrison formation and the beds of the lower-lying Redonda

formation. Although both sets of beds are relatively barren of water, the principal aquifer of the region, the Entrada sandstone, lies between them, and drilling should not be halted in the red beds of the lower Morrison formation in the mistaken belief that the well has passed through the Entrada and entered the Redonda formation.

The Entrada sandstone is capable of yielding moderate amounts of water to properly constructed wells. The fineness of the particles forming the sandstone and the lack of effective cementation create problems in well development and use. Careful construction of the wells can alleviate the problem of pumping sand with possible subsequent collapse of wells. Wells must be used properly to gain optimum efficiency. The fineness of the sandstone accounts for a relatively low permeability. Therefore, wells should be carefully spaced and pumping held to a rate consistent with the ability of the well to yield steadily without excessive drawdown.

The spacing of wells (from 1,000 to 1,500 feet apart) on lines normal to the direction of movement of ground water through the basin areas and close to the areas of natural discharge would, from a hydrologic point of view, be the best method of developing water supplies from the Entrada sandstone. Advantage should be taken of structural depressions or troughs because it is probable that the Entrada sandstone is thickest and most fully saturated in such structures.

The study suggests that heavy and continuous pumping of large-capacity wells in the alluvium in the immediate vicinity of Tucumcari, and elsewhere in the irrigated areas, be limited in such a manner that water levels will not be lowered excessively and individual well capacities diminished to the point where pumping will no longer be economically feasible. There also is the possibility that continuous or heavy seasonal pumping in the town field will induce greater recharge by sulfate-rich irrigation waters and render the aquifer unfit for municipal use.

Some adulteration of the natural ground water by sulfate-laden irrigation water already has taken place. Additional adulteration is certain to occur locally, and it is possible that the present sources of ground water serving both the city and rural areas could deteriorate to a degree sufficient to cause concern. Periodic sampling and laboratory analysis would indicate changes in the quality of the municipal supply. Lining of canals and ditches in the irrigation project also would help to reduce the danger.

The Tucumcari investigation was conducted by F. D. Trauger of the Geological Survey and F. X. Bushman of the Bureau of Mines and Mineral Resources. A report will be released to the open file early in 1963. It will be published as a technical report of the State Engineer.

Quay County: Geology and ground-water conditions. — Quay County, in east-central New Mexico, has an area of approximately 3,000 square

miles (area 14, fig. 10). Much of the region is typified by exposures of red clay and red, brown, and yellow sandstones. Buttes and other remnants of a higher upland surface are numerous.

The investigation, a cooperative project of the New Mexico Bureau of Mines and Mineral Resources, State Engineer, and U. S. Geological Survey, is part of a program to obtain basic ground-water information on the various counties in the State. Quay County was chosen for investigation as an outgrowth of the study of the Tucumcari area. In general, water supplies in the county are meager except in the structural basins west of Tucumcari and in that part of the area which is on the High Plains. Data obtained during the investigation should help residents of the area to develop firm water supplies.

Field work has consisted of general reconnaissance mapping of the geology and collection of well data and water samples for chemical analysis. The investigation was begun by C. F. Berkstresser in July 1953, but was interrupted in 1957. Work on this project was resumed in 1962 by W. E. Mourant. A map showing the general quality of ground water in the county, based on approximately 240 chemical analyses, has been prepared and released to the public. A report, now in preparation, will be published in the ground-water reports series of the Bureau of Mines and Mineral Resources.

HIGH PLAINS

Northern Lea County, Hydrologic atlas. — The hydrologic atlas of northern Lea County contains information relative to the Lea County Underground Water Basin and the region northward to the Roosevelt County line — a region of about 2,500 square miles (area 15, fig. 10). It includes maps which show the general physiographic features of the area, the bedrock topography (by means of contours), the saturated thickness of the Ogallala formation, and contours on the water table. Additional maps show important water-level changes that have occurred.

Preparation of the atlas was by Alex Nicholson and Sidney Ash. It was released to the open file in May 1961 and will be published as a hydrologic atlas of the Geological Survey.

Northern Lea County: Recharge study. — A program to study the feasibility of increasing recharge to the Ogallala formation in northern Lea County (area 16, fig. 10) by inducing floodwaters impounded in natural depressions into the aquifer by means of recharge wells was initiated in 1956 by the commissioners of Lea County and continued by the Geological Survey in 1958 in cooperation with the State Engineer, Lea County, and the Lea Soil and Water Conservation District.

Work accomplished during the first phase of the investigation is dis-

cussed in the 24th biennial report of the State Engineer. The investigational work by the Geological Survey was scheduled as a 3- to 5-year program. Aside from maintaining the observations in the original project area, efforts were made to determine the amount of water that can be expected to collect in undrained depressions, the amount of water that is recharged to the aquifer under natural conditions, and the extent to which recharge can be increased by artificial means. Topographic maps of a number of the natural depressions and their drainage areas were prepared, staff gages were installed in the depressions to determine the quantity of water collected and its rate of dissipation, and rain gages were installed to obtain correlative precipitation data. Test holes were drilled in order to obtain information pertaining to subsurface conditions in and adjacent to a number of the depressions.

Work since 1958 has been under the direction of John S. Havens of the Geological Survey. A report has been prepared and is receiving critical review.

Southern Lea County: Geology and ground-water conditions. — Southern Lea County in the southeast corner of New Mexico (area 17, fig. 10) is a semiarid region where water deficiencies have been intensified by recent economic development. Prior to development of the oil and gas industry and its stimulus to population growth, water demands in the area were for livestock, domestic, and small public-supply uses only. Development of the oil and gas industry has brought about a six-fold increase in population since 1930. Population growth and the establishment of gasoline plants, which use large quantities of water, have increased the area's water requirements to well over 6,000 acre-feet a year.

There are no perennial streams in southern Lea County. Ground water is obtained from Triassic rocks of the Dockum group, the Ogallala formation, and the Quaternary alluvium. A very small quantity of impounded runoff is used for watering livestock. Of the three principal water-bearing formations, the Triassic formations contain only a small part of the water supply. On the eastern side of southern Lea County, most of the supply comes from the Ogallala formation and the Quaternary alluvium which form a continuous water-table aquifer. This single ground-water body provides about 80 percent of the entire area's water needs.

Development of water is rendered difficult by variable and generally low transmissibility of the sediments and an apparently low recharge rate. A large part of the water used is being removed from storage.

The chemical quality of water from the principal aquifers is generally fair to good, but production of large quantities of oil-field brine

(3,700 acre-feet in 1955) has created a waste-disposal problem of major importance. Prior to 1958, most of the brine was discharged into pits. Leakage from the pits caused contamination of the shallow-water aquifers in some areas and since 1958 the New Mexico Oil Conservation Commission has prohibited surface disposal of brines in unlined pits in specific areas where danger of contamination is imminent. As a result of a program of investigation in which the State Engineer participated, brines in those areas now are injected into formations which are well below the known fresh-water aquifers.

It is anticipated that the water needs of southern Lea County will continue to increase as it is assumed that the oil and gas industry will continue to expand. To date its development has been restricted almost entirely to the shallower oil-bearing structures of the Central basin platform and the Back Reef or Shelf area of the Delaware basin. The Delaware basin proper probably will provide a field for expansion for a long time to come.

With continued economic development and depletion of water through pumpage from storage and possible contamination, the area's water-supply problems promise to become more and more acute. There is little hope that additional supplies can be found in the region. Water-bearing horizons below the top of the Permian formations will not yield water of suitable quality, and there appear to be no highly productive water-bearing horizons within the Triassic formations. Recourse thus must be to conservation methods that will yield the most value from available supplies.

The southern Lea County investigation was conducted by Alex Nicholson and Alfred Clebsch, Jr., of the Geological Survey. It was part of a long-range program of ground-water investigations in which the State Engineer and the New Mexico Bureau of Mines and Mineral Resources are cooperators. Work was initiated in 1953 and in 1961 a report of the study findings was published as Ground-Water Report 6 of the Bureau of Mines and Mineral Resources.

CLOSED DRAINAGE BASINS

Southern Luna County: Progress report on ground-water investigation. — This investigation, begun in January 1953 by John Willett and assumed by Gene C. Doty in July 1955, covers about 860 square miles of southern Luna County (area 18, fig. 10). Considerable ground-water development has occurred in this area in recent years. The report of the investigation will present data and conclusions of primary importance to the State Engineer with respect to administration of the water resources of the area. Field work for the investigation has been completed and a report is being prepared for publication by the State Engineer.

U. S. Bureau of Reclamation

WATER SALVAGE

Middle Rio Grande valley. — In 1953 the Interstate Stream Commission authorized the State Engineer to cooperate with the U. S. Bureau of Reclamation in a program designed to salvage water in the Middle Rio Grande valley, utilizing moneys from the Commission-administered Improvement of the Rio Grande Income Fund. The program was continued through the 25th biennial period. Its objective is to increase available flow of the Rio Grande above Elephant Butte Reservoir through 1) eradication and control of phreatophytes; 2) increasing the efficiency of existing drains by clearing, cleaning, and enlarging channels; 3) constructing additional drains; 4) channelizing side inflow from arroyos directly into the river; 5) strengthening and improving the river-levee system; and 6) maintaining a floodway free of vegetation.

Work during the report period consisted primarily of construction and rehabilitation of drains, repairs to the river channel, and eradication of phreatophytic vegetation.

It has been found, in the Middle Rio Grande valley and elsewhere, that the most successful means of mechanical eradication of saltcedar is to cut off the tree roots from 12 to 18 inches beneath the surface (using a root plow) and to grub out the crowns with rock rakes. The felled trees and extracted roots then are stacked and burned (see Caballo Reservoir area, below).

In addition to equipment purchased during the 24th biennium, valued at about \$150,000 and listed in the 24th biennial report of the State Engineer, the State during the 50th fiscal year purchased one Holt root-plow attachment for an International TD-24 tractor at a cost of \$3,908, and two Holt root-plow attachments and one Fleco rock rake for Caterpillar D-8 tractors at a cost of \$8,770.60. The Commission also advanced from the Improvement of the Rio Grande Income Fund the sums of \$100,000 during the 49th fiscal year and \$140,000 during the 50th fiscal year to meet the State's portion of operation and maintenance costs of the project. The contribution of the Bureau of Reclamation approximated \$68,000 in each fiscal year.

Caballo Reservoir area, Sierra County. — In 1957 a cooperative agreement between the Bureau of Reclamation and the State Engineer provided for the clearing of approximately 5,600 acres of water-wasting vegetation in the delta area of Caballo Reservoir. Most of the work of clearing was done during the 23rd biennial period. It was recognized, however, that in order to realize continued benefits, regrowth would have to be carefully controlled. As a result, a cooperative maintenance

program was carried out through the 24th and 25th bienniums. Under terms of the agreement, the Bureau of Reclamation continued to use State equipment as listed in the 23rd biennial report of the State Engineer and during the 25th biennial period the State contributed \$22,105 for employment of personnel and for meeting expenses of service, repair, and general operation. During the same period the Bureau of Reclamation contributed a total value of \$24,600 in use of equipment, shop facilities, labor, engineering services, and field supervision.

Results of the program to date have been gratifying. Efforts to control the phreatophytic vegetation have been successful and most of the project area now supports a healthy growth of several beneficial varieties of grasses, including Bermuda.

Saltcedar, with its ability to continue sprouting from the same roots year after year, has continued to pose the principal problem in maintaining the area, and during the 50th fiscal year several hundred acres were recleared with a root plow. Drawn by a large, crawler-type tractor, this apparatus consists of a knife blade that cuts through the ground some 12 to 18 inches below the surface, severing the vegetation below the crown. The crowns then are rooted up with rock rakes and burned. It has been found that this process practically eliminates the old growth and thereafter maintenance consists mostly of controlling seedlings.

Recently a question arose as to whether drainage works to supplement the phreatophyte-control program would increase salvage of water or decrease maintenance expenses. An investigation of ground-water conditions in the area indicated that installation of an effective drainage system would not be economically feasible. This study is discussed in more detail on page 101.

It is currently estimated that about 15,000 acre-feet of water annually is being salvaged as a result of the phreatophyte-control program in the Caballo Reservoir area. It is expected that the maintenance work will be continued through the 26th biennium.

U. S. Soil Conservation Service

PUBLIC LAW 566 PROGRAM

Public Law 566, 83rd Congress, is known as the Watershed Protection and Flood Prevention Act. Primary purpose of the legislation was to help local organizations control erosion, floods, and deposition of sediment. A secondary purpose was to further conservation, development, utilization, and disposal of water throughout the nation. The program is administered by the U. S. Soil Conservation Service.

Under authority delegated by the Governor, as provided in the

Federal act, the State Engineer is the approving officer for all projects undertaken in the program in New Mexico. In this capacity, he reviews and approves or disapproves all applications for projects, and in cooperation with the Soil Conservation Service he recommends priorities of approved applications for receiving planning assistance from the Federal agency. When planning has been completed, he reviews and comments on work plans. If a project calls for construction of irrigation or flood-control works, the State Engineer approves plans and specifications before construction may begin.

By June 30, 1962, the State Engineer had approved 64 applications for projects, of which 56 were acceptable to the Soil Conservation Service for consideration for construction. Also as of June 30, 1962, seven projects had been completed: Hatch Valley Arroyos, Sierra and Dona Ana Counties; Upper Rio Penasco, Otero County; Dona Ana Arroyos, Dona Ana County; Zuber Draw, Chaves County; Tramperos Creek, Union and Harding Counties; Prop Canyon and Tributaries, Valencia County; and Caballo Arroyos, Sierra and Dona Ana Counties.

During the 25th biennial period four projects were approved for planning, two work plans were reviewed, four projects were approved for construction by the Soil Conservation Service, and five projects were constructed by soil conservation districts.

SNOW SURVEYS

The Snow Survey Program, initiated in 1937 by the U. S. Soil Conservation Service, provides predictions of spring runoff from snowmelt throughout the western United States, where snowfall varies greatly from area to area and from year to year. Streamflow regulation and water management in general depend upon these forecasts for successful operation, and the State Engineer has contributed financially to the program since 1950.

During the 25th biennial period 26 snow courses were operated in New Mexico. They were located strategically in headwater areas of four of the State's major river basins: Canadian River (1 station), Gila-San Francisco system (10 stations), Pecos River (1 station), and Rio Grande (14 stations). Runoff in the San Juan River is forecast from snow courses operated in Colorado.

Measurements of the depth and the water content of snow are taken monthly or semimonthly at the various stations, beginning in January and continuing until April or May. Data are consolidated by Snow Survey supervisors, and reports are published periodically — usually within 10 days after each survey has been completed. Data pertaining to the Gila River appear in a publication titled "Water Supply Outlook for Arizona," issued at intervals (in season) by the Soil Conservation Service in Phoenix, Ariz. Data pertaining to the Canadian River, Pecos

River, Rio Chama, Rio Grande, and San Juan River appear periodically in "Water Supply Outlook for Colorado and New Mexico," issued as a general series paper by the Colorado Agricultural Experiment Station in Fort Collins, Colo.

State Engineer expenditures under the program during the biennial period totaled \$1800.

U. S. Bureau of Land Management

DAM-FOUNDATIONS INVESTIGATIONS

The cooperative agreement with the U. S. Bureau of Land Management for dam-site drilling and laboratory testing of embankment material, entered into on October 31, 1957, and described in the 23rd biennial report of the State Engineer, was continued through the 25th biennial period. Under the program, the State Engineer drill rig was sent to potential sites of small dams in Bureau of Land Management districts throughout the State where, under the direction of Bureau engineers, dam-foundation conditions were investigated and samples of embankment materials were taken from potential borrow areas for testing in the State Engineer soils laboratory in Santa Fe. During the 25th biennium the drill crew visited 53 dam sites and 177 soil samples were analyzed. Cost of the work in the 2-year period was \$11,643.50, all of which was reimbursed by the Federal agency.

The program was completed during the 50th fiscal year, and it is not anticipated that it will be continued in the future.

U. S. Office of Saline Water

About three-quarters of the ground water in the State ranges in quality from brackish to brine and is not suitable without treatment for most present uses. As processes of desalinization become feasible, this very large volume of saline water will become available for use in areas where fresh water is inadequate to meet increasing demands and to insure a continuing water supply in areas where fresh water supplies may have been exhausted.

New Mexico thus has a considerable stake in experimentation with various desalinization processes currently being carried on by industry and government and has expressed her interest in a variety of ways. Following an announcement by the Department of the Interior that the U. S. Office of Saline Water planned to construct a water-desalinization demonstration plant somewhere in the Southwest, pursuant to

Public Law 85-883, the 24th Legislature of New Mexico authorized the State Engineer to enter into a cooperative agreement with the agency whereby the State would agree to pay 10 percent of the cost of constructing such a plant, up to a limit of \$100,000, provided it be located in New Mexico. Thereafter the State Engineer encouraged several New Mexico communities to submit information to the Office of Saline Water for its consideration in selecting the site of the southwestern plant. He also entered into a cooperative agreement with the agency to exchange technical assistance and information in the field of brackish-water conversion.

Specific events leading to selection of the city of Roswell, N. Mex., as the site of the Southwest's desalinization plant are discussed in the 24th biennial report of the State Engineer. Active cooperation with the Office of Saline Water and the city of Roswell was continued throughout the 25th biennium.

Under contractual agreement with the Office of Saline Water, the city of Roswell provided a site for the desalinization plant (about 7 acres, some 5 miles east of the city limits) and will deliver raw water to the plant (containing about 25,000 parts per million total dissolved solids) in quantities of about 4 acre-feet per day. Once the plant is in operation, the city will purchase the product water, amounting to about 1 million gallons per day, and will dispose of the brine effluent, amounting to from 1 acre-foot to 1½ acre-feet per day of water whose dissolved salts contents will total approximately 100,000 parts per million (three times the salinity of sea water, four times the salinity of the raw water feed).

On April 6, 1962, the Department of the Interior announced the award of a \$1,794,000 plant-construction contract to the Chicago Bridge and Iron Company of Oak Brook, Ill. The installation will utilize a forced-circulation vapor-compression process of conversion. Specifications call for completion of construction within 1 year from the date the contract was awarded and for an acceptance test period not to exceed 75 additional days. The facility will produce nearly pure water containing about 50 parts per million dissolved solids. The feed water will be produced from wells near the plant site. The effluent brine will be disposed of in a manner mutually satisfactory to the city of Roswell, the State, and the Office of Saline Water.

During the 25th biennium the city constructed an experimental evaporation pond about half a mile from the plant site, and as his contribution to the program the State Engineer established and operated a weather station near the disposal site to determine evaporation rates. The weather installation includes facilities for recording temperatures, precipitation, wind movement, and relative humidity — also for determining pan-evaporation rates for fresh water and for water containing 25,000 parts

per million and 100,000 parts per million dissolved solids. In addition, the State Engineer operated three observation wells near the pond to determine rates of leakage of brine to the water table.

The Roswell plant will be the fourth of five water-desalination plants to be constructed by the Office of Saline Water pursuant to the terms of Public Law 85-883. Three plants already are in operation — at Freeport, Tex., Webster, S. Dak., and San Diego, Calif. The fifth plant will be constructed at Wrightsville Beach, N. C. Each facility uses a different process, and each is intended primarily for demonstration of the conversion method used. Each plant will be operated by the Office of Saline Water until such time as the demonstration has been effected, and each then will be sold at auction.

U. S. Army Corps of Engineers

FLOOD-PLAIN-INFORMATION STUDIES

Section 206a, Public Law 86-645, approved July 14, 1960, states that “in recognition of the increasing use and development of the flood plains of the rivers of the United States and of the need for information on flood hazards to serve as a guide to such development, and as a basis for avoiding future flood hazards by regulation of use by States and municipalities, the Secretary of the Army, through the Chief of Engineers, Department of the Army, is hereby authorized to compile and disseminate information on floods and flood damages, including identification of areas subject to inundation by floods of various magnitudes and frequencies, and general criteria for guidance in the use of flood plain areas; and to provide engineering advice to local interests for their use in planning to ameliorate the flood hazard: Provided, That the necessary surveys and studies will be made and such information and advice will be provided for specific localities only upon the request of a State or a responsible local governmental agency and upon approval by the Chief of Engineers.”

Applications for flood-plain studies may be submitted by a state or any of its subdivisions or by local agencies. The application should be by letter addressed to the District Engineer, U. S. Army Corps of Engineers, and applications originating in New Mexico should be submitted through the State Engineer, State Capitol, Santa Fe. (The law authorizes the Governor of each state to designate a coordinating agency to receive and comment on each application for flood-plain studies prior to its consideration by the Corps and, where more than one study in a state is pending, to determine state priority. The designated coordinator in New Mexico is the State Engineer.) The State Engineer in July 1961

advised local and State agencies of the provisions of Public Law 86-645 and furnished instructions for submission of applications.

The investigations are not intended to be substitutes for regular flood-control studies, but rather to complement such studies. The services of the State Engineer and the District Engineer, Corps of Engineers, are available to any agency to assist with preparation of applications for studies.

At the close of the 25th biennium, applications for flood studies had been received from the Vermejo Conservancy District and the Rio Costilla Cooperative Livestock Association. The applications had been reviewed and processed and forwarded to the Corps of Engineers.

PUBLIC INFORMATION PROGRAM

An important function of the State Engineer Office is to gather, interpret, and disseminate information concerning the State's water resources. Much of the information is collected and processed in cooperation with other public agencies. Dissemination is by means of publications, published papers and maps, correspondence, press conferences, testimony before State and Federal legislative committees, and personal appearances of the State Engineer and members of his staff before learned societies and professional and civic groups. In addition, the office maintains a library which contains published works in hydrology and engineering as well as rare unpublished documents and compilations of basic hydrologic data to which the public has access on an open-file basis. Upon request, the office provides at cost copies of maps and documents pertaining to water rights in New Mexico.

Publications

Formal publications of the State Engineer include 1) annotated compilations of New Mexico statutes pertaining to water and water rights,* 2) manuals of rules and regulations governing the appropriation of water and its application to beneficial use, 3) biennial activity reports, 4) reports of findings of geologic, hydrologic, and engineering investigations carried out by personnel of his office and by other agencies in cooperation with his office, 5) miscellaneous publications, and 6) engineering and economic feasibility reports of proposed water-development projects considered for construction by the Interstate Stream Commission. As a general rule, distribution of the feasibility reports is limited

*The most recent such compilation, *Water Laws of New Mexico, New Mexico Statutes Annotated*, 1953, was published in 1954, and is still in print. In 1955, 1957, and 1959, the State Engineer also published cumulative summaries of water legislation enacted since 1953 and made the supplementary compilations available without charge to purchasers of the parent volume (cost \$10). By 1961, the bulk of the supplementary compilation and the cost of publication had increased to the point where the office found itself unable to continue the practice of supplying the supplements free of charge. Annotated compilations of statutes enacted since 1953 now are available from the Allen Smith Company of Indianapolis, publishers (under the supervision of the New Mexico Compilation Commission) of *New Mexico Statutes, Annotated*.

to agencies and individuals having direct interest in the project under consideration, but copies may be consulted in the State Engineer Office. All other publications of the office are available for general distribution.

In the interest of economy, most publications of the State Engineer — other than the statute compilations, the manuals of rules and regulations governing water use, and the biennial reports — are printed by the photolithographic process from typescript prepared by stenographers. Prior to July 7, 1961, the office in cooperation with the Interstate Stream Commission maintained a departmental reproduction shop where all routine printing was done and most reports were printed and bound. On the above date the Governor of New Mexico issued a directive which consolidated reproduction facilities and personnel of all agencies operating under direct authority of his office, and which established a central State printing operation under administration of a new State agency: Inter-Agency Services. The transfer of State Engineer facilities and personnel was effected at once, although the shop personnel was carried on the State Engineer Office payroll until December 31, 1961. Since July 1961, reports and publications of the State Engineer and Interstate Stream Commission have been printed by Inter-Agency Services or by commercial printing plants.

Major publications issued for general distribution during the biennial period are discussed below. All were in print at the biennium's end.

BIENNIAL REPORTS

Until 1938, most reports of hydrologic investigations conducted by the State Engineer, either independently or in cooperation with other State and Federal agencies, were published in the biennial reports of his office. During the period 1938-52 (14th through 20th biennial periods of New Mexico's statehood), the publications program of the State Engineer was suspended because of disruptions attendant upon the wartime and early postwar years. In order to make available to the public reports of investigations completed during the period when no publications were issued, the State Engineer in 1952 initiated on a low-priority basis a program of publishing biennial reports covering the period of suspension. A report treating the 14th and 15th bienniums (1938-42) was published in 1954, and a second volume covering the 16th and 17th bienniums (1942-46) was issued in 1962. Reports of the 18th, 19th, and 20th biennial periods (1946-52) currently are being processed for early publication.

Since 1952, the biennial reports have been published on schedule and have not included reports of hydrologic investigations — the latter being published separately, many of them in the technical reports series of the office.

Sixteenth and Seventeenth Biennial Reports of the State Engineer of New Mexico (1942-46). — In addition to a brief summary of the activities of the State Engineer Office and the Interstate Stream Commission during the period July 1, 1942, through June 30, 1946, this volume contains reports of 20 hydrologic investigations which were conducted during the two biennial periods. Seventeen of the investigations were conducted and reported cooperatively by personnel of the U. S. Geological Survey. The volume contains 462 pages and 50 illustrations.

Twenty-fourth Biennial Report of the State Engineer of New Mexico. — This report summarizes activities of the State Engineer Office and the Interstate Stream Commission during the 47th and 48th fiscal years (July 1, 1958, through June 30, 1960) and sets forth programs of work proposed for accomplishment during the 50th and 51st fiscal years (July 1, 1961, through June 30, 1963). The volume contains 190 pages and 6 illustrations.

TECHNICAL REPORTS

During the 25th biennial period, 10 reports were published in the State Engineer technical reports series — bringing the total number of publications in the series to 27. Reports issued during the 25th biennium are described below.

Technical Report 18: *Availability of Ground Water at Proposed Well Sites in Gila National Forest, Sierra and Catron Counties, New Mexico*, by F. D. Trauger, U. S. Geological Survey. — As part of its program to develop potable water on range lands and at recreational facilities in the Gila National Forest, the U. S. Forest Service requested that the U. S. Geological Survey investigate five proposed sites for wells. The sites were in high mountainous country in Catron County and western Sierra County. A reconnaissance investigation was made of the area's geology and of existing wells. The report, published in 1960, concludes that ground water in quantities sufficient to supply stock wells and camp facilities can be developed where needed. In general, wells should be drilled to depths of more than 500 feet, and water levels in all will probably be deep. Water in some of the areas may be under artesian pressure. The chemical quality of ground water throughout the area probably is suitable for livestock and human use. The report contains 20 pages and 5 illustrations.

In order to make the report of the investigation available in the literature of geohydrology, the State Engineer financed costs of editing by the Geological Survey and costs of publication.

Technical Report 19: *Ground-Water Levels in New Mexico, 1956*, by H. O. Reeder and others, U. S. Geological Survey. — Since 1925, water-level fluctuations in wells in areas of extensive ground-water

development in New Mexico have been measured and reported by the U. S. Geological Survey in cooperation with the State Engineer. Included have been annual measurements in an ever-increasing number of wells and seasonal and daily measurements in a lesser number of selected "key" wells.

Beginning in 1938, the well measurements together with interpretive text were published annually in the water-supply papers of the Geological Survey. After publication of data for 1950, the Federal agency suspended publication of annual measurements, while continuing to publish compilations of seasonal and daily measurements. After publication of the 1955 seasonal and daily measurements, the agency also suspended publication of these data for general distribution, limiting itself to issuance of brief data summaries at 5-year intervals. The cooperative program of taking all three types of measurements was continued, however, and in order that all findings might again become available to the general public the State Engineer in 1960 inaugurated a program of publishing detailed water-level data.

State Engineer Technical Reports 13 and 16, issued during the 24th biennial period, contain previously unpublished data collected during the period 1951-55. Technical Report 19, third in the series of State Engineer water-level papers, was published late in 1960. It contains annual (1956) water-level measurements from 1,600 wells, seasonal and daily measurements from a lesser number of selected wells, and interpretive text pertaining to the State at large and to 19 specific areas of investigation — in most instances areas where large quantities of ground water are being diverted for irrigation. Interpretive text includes summaries of climatology, irrigated acreage, and total diversions of ground water for irrigation and municipal and industrial uses. The report contains 251 pages and 20 illustrations.

Technical Report 20: *Geology and Ground-Water Resources of the Grants-Bluewater Area, Valencia County, New Mexico*, by Ellis D. Gordon (with a section on aquifer characteristics by H. O. Reeder and a section on chemical quality of the ground water by J. L. Kunkler), U. S. Geological Survey. — The Grants-Bluewater area in north-central Valencia County contains fertile farmlands and the principal known uranium reserves in the United States. Prior to completion of a successful irrigation well in 1944, surface water was used exclusively in irrigation, and ground-water development was limited to domestic, livestock, and small municipal wells. Construction of the larger well in 1944 started a boom in ground-water irrigation which reached a peak in 1954 when 12,600 acre-feet of well water was pumped to irrigate some 5,000 acres of cropland.

Industrial use of ground water became significant after 1950, the amount pumped for industry increasing from 300 acre-feet in 1952 to

4,500 acre-feet in 1956. The aquifer being threatened with over-appropriation, the State Engineer on May 21, 1956, declared the Bluewater Underground Water Basin and brought appropriation and use of ground water in the area under control of his office. Municipal use of water also has increased to accommodate a growing population. The increase in industrial and municipal use of ground water has been counterbalanced by a comparable decrease in irrigation, so that total diversion has been stabilized at about 13,000 acre-feet a year.

The largest average yields to wells are obtained in a narrow strip between the villages of Bluewater and Milan, where the wells produce 500 to 2,200 gallons a minute. Most wells are 100 to 300 feet deep, and the depth to water ranges from 20 to 250 feet. The concentration of dissolved solids in this strip ranges from 350 to 750 parts per million.

Large quantities of ground water of slightly inferior quality are believed to be available in the San Andres limestone, north, east, and south of the areas of present pumping. However, the water in these areas may not be chemically acceptable for domestic use and for many types of industrial use without treatment. Despite these adverse features, a large supply of water seems assured for the future.

Published in 1961, the report contains 109 pages and 16 illustrations.

Technical Report 21: *Availability of Ground Water in the Albuquerque Area, Bernalillo and Sandoval Counties, New Mexico*, by Louis J. Bjorklund and Bruce W. Maxwell, U. S. Geological Survey. — The Albuquerque area is underlain by 6,000 or more feet of saturated water-bearing valley fill — gravel, sand, silt, and clay deposited by streams and lakes during the last several million years between the Sandia and Manzano Mountains on the east and the Rio Puerco highlands on the west. The underground reservoir is hydraulically connected with surface water in the Rio Grande and its tributaries; thus, pumping from wells affects streamflow.

The ground water in the valley fill is generally unconfined (not artesian) and is used for public, industrial, irrigation, domestic, and stock purposes. Wells yield as much as 3,000 gallons per minute. Total pumpage of ground water in the area during 1959 was about 63,000 acre-feet, and pumpage will increase as the city of Albuquerque continues to grow. Depths to water range from 5 or 10 feet below the floor of the inner valley to as deep as 1,000 feet below the land level of the bounding mesas. Chemical quality of the ground water is suitable for most purposes, but surface water in the Rio Grande is high in suspended sediment which must be filtered or settled out prior to most uses other than for irrigation.

The investigation upon which the report is based was spread over a period of several years and was financed jointly by the State Engineer, the Geological Survey, and the city of Albuquerque. Its preliminary

findings, along with the prospect of continued increase in pumping throughout the area, were instrumental in creation of the Rio Grande Underground Water Basin, largest area of ground-water control in the State (5,009 sq. mi.), declared by the State Engineer on November 29, 1956.

The report contains 117 pages and 20 illustrations. It was published in 1961.

Technical Reports 22 and 23: *Ground-Water Levels in New Mexico, 1957 and 1958*, by H. O. Reeder and others, U. S. Geological Survey. — Fourth and fifth publications, respectively, in the series of State Engineer water-level papers (see Technical Report 19, above), Technical Reports 22 and 23 contain annual water-level measurements from about 1,700 wells, plus seasonal and daily measurements from a lesser number of selected wells in various localities. Measurements were taken and reported by Geological Survey personnel in cooperation with the State Engineer in 22 specific areas of investigation in 1957 and in 23 areas in 1958. Both reports contain interpretive text pertaining to the study areas and to the State at large. Both also include data from 10 observation wells constructed in 1956-57 in the intake area of the Roswell artesian basin by the Pecos Valley Artesian Conservancy District and operated since by that agency. Technical Report 22, published in 1961, contains 306 pages and 20 illustrations. Technical Report 23, published in 1962, contains 288 pages and 21 illustrations.

Technical Report 24: *Ground-Water Levels in New Mexico, 1959*, by H. O. Reeder and others, U. S. Geological Survey. — Changes in levels of the ground-water table from year to year and even from season to season and from day to day, particularly in areas of intensive use, have much significance for hydrologists, geologists, agriculturalists, conservationists, home builders, investors in land, and all individuals and agencies concerned with present and future supplies of water in a semi-arid environment. Because of this widespread need for ready access to information concerning the State's supply of underground water, detailed basic data of water levels (depth to water in various aquifers and representative yearly, seasonal, and daily fluctuations in levels) will continue to be published annually as a public service. However, interpretive text pertaining to ground-water use and resulting fluctuations in water levels tends to become repetitive when reported on a yearly basis. For this reason, and in the interest of economy, the State Engineer, since publication of the 1958 data, publishes detailed basic water-level data on an annual basis but includes interpretive text only 1 year out of 2 or 3. This sixth in the series of State Engineer water-level papers thus contains basic data only, preceded by brief introductory text. Presented

in its 125 pages and 22 illustrations are data from 23 areas of investigation, including records from gages maintained on 10 Pecos Valley Artesian Conservancy District observation wells in the intake area of the Roswell artesian basin.

Technical Report 25: *Ground-Water Conditions in the Rio Grande Valley between Truth or Consequences and Las Palomas, Sierra County, New Mexico*, by H. O. Reeder and others, U. S. Geological Survey. — In 1957 the State Engineer and the Bureau of Reclamation initiated a program of phreatophyte eradication along the flood plain of the Rio Grande between Williamsburg and Caballo Reservoir in central Sierra County. The phreatophytes, mostly saltcedar, were removed by mechanical methods and through application of chemical sprays. Regrowth likewise has been controlled by mechanical and chemical methods. The question then was posed whether construction of drainage works to supplement the phreatophyte program would be effective in increasing salvage or in lessening program-maintenance costs. In an effort to answer this question, the State Engineer and the Geological Survey undertook a cooperative investigation of ground-water conditions beneath the flood plain and of the probable effects that lowering of the shallow water table would have on water levels and artesian heads in wells in thermal and nonthermal aquifers.

A network of shallow observation wells, including two wells equipped with recording gages, was established by the State Engineer Office late in 1957 and operated through November 1960. Two sets of river-discharge measurements were made at 11 sites on the Rio Grande and tributaries between Elephant Butte Dam and Caballo Reservoir. Long-term water-level and streamflow data were used to determine relationships between flow of the river and head in the thermal artesian aquifer.

The report of the study (47 pages, 10 illustrations, published in 1962) concludes that, during periods of high flow, water moves from the river to the shallow aquifer throughout most of the area of study. During periods of low flow, water moves from the shallow aquifer to the river. It was also found that water levels in the shallow aquifer fluctuate with the level of Caballo Reservoir, which is controlled by releases from Elephant Butte Reservoir. Further study of the problem, based on the subject report, indicates that construction of drainage works in the area would not be economically feasible.

Technical Report 26: *Ground Water in Central Hachita Valley Northeast of the Big Hatchet Mountains, Hidalgo County, New Mexico*, by F. D. Trauger and E. H. Herrick, U. S. Geological Survey. — In 1955, a reconnaissance survey of a part of the Big Hatchet Mountains and the adjacent part of Hachita Valley was made by the Geological Survey in cooperation with the State Engineer at the request of the U. S. Army

Corps of Engineers. Purpose of the survey was to determine whether a supply of 36,000 gallons of potable water a day could be developed for use at a small military installation planned in Thompson Canyon in the Big Hatchet Mountains. The topography and geology were examined briefly, existing wells in the area were inventoried, samples of water were collected for chemical analysis, and approximate specific capacities of a number of the wells were determined. It was concluded, on the basis of these data, that a water supply adequate for the anticipated needs of the proposed installation could be developed from one or two wells on the slope of an alluvial fan extending northeastward from Thompson Canyon. Five locations for wells were suggested.

The report (21 pages, 4 illustrations, published in 1962) was prepared in cooperation with the State Engineer to make available the data collected in the 1955 investigation, along with information contained in earlier reports, and to summarize all that is known of the occurrence of ground water in the area.

Technical Report 27: *Ground-Water Levels in New Mexico, 1960*, by W. C. Ballance and others, U. S. Geological Survey. — Basic data only of water levels measured in 1959 were published by the State Engineer in Technical Report 24. Basic data for 1960 are accompanied by a full interpretive text which treats the State at large and 27 specific areas of water-level investigation. In the future, basic data of water levels will be published annually, and interpretive text will be published at 2- or 3-year intervals.

In addition to information compiled by personnel of the Geological Survey, Technical Report 27 contains data of 10 observation wells maintained in the intake area of the Roswell artesian basin by the Pecos Valley Artesian Conservancy District. It also contains records of monthly measurements made in wells in the Rincon and Mesilla Valleys in south-central New Mexico by the U. S. Bureau of Reclamation for the periods of record through 1960. Records in Rincon Valley date from 1952, in Mesilla Valley from 1946.

This seventh in the series of State Engineer water-level papers contains 215 pages and 34 illustrations.

MISCELLANEOUS REPORTS

New Mexico Statement to the U. S. Senate Select Committee on National Water Resources. — Under provisions of U. S. Senate Resolution 48, 86th Congress, adopted April 20, 1959, the Senate Select Committee on National Water Resources was created for the purpose of obtaining basic data pertaining to the national water supply and information concerning proposed Federal and state plans and programs for solving the water problems. The committee subsequently requested

that the State of New Mexico prepare a brief statement pertaining to its water problems, as existing in 1959 and as anticipated by 1980, and containing a statement of New Mexico's views of how the problems might be solved.

In response to the request, the State Engineer and his staff prepared a 13-page statement to the committee, setting forth the State's water problems as anticipated to 1980 along with suggested solutions thereto. Supporting data appended to the statement covered some 30 pages and included 3 illustrations, 8 tables, and 2 exhibits presenting data of water use, economic growth, and prospective increases in the State's population. Also appended were letters setting forth views of other State agencies and educational institutions.

In January 1960 the New Mexico statement, dated September 30, 1959, and complete with supporting data, was published in Print 6 of the Senate Select Committee, titled *Water Resources Activities in the United States — Views and Comments of the States* (U. S. Government Printing Office, Washington, p. 228-254). In September 1960, pursuant to a request of the Water Resources Subcommittee of the New Mexico Advisory Committee on Long Range State Development Objectives, the statement was revised to reflect the status of the projects and problems as of that date and was published for general distribution. The revised statement covers 17 pages and is accompanied by the original supporting data.

Availability of Ground Water in New Mexico, 1961, by W. E. Hale, U. S. Geological Survey. — This paper was presented at the Sixth Annual New Mexico Water Conference at New Mexico State University, University Park, on November 1, 1961, and subsequently was published for limited distribution in the conference proceedings. Because of widespread interest in its contents, the State Engineer in 1962 obtained permission to reprint the paper for wider distribution. As the title implies, the work discusses in nontechnical terms the general availability of ground water in the State, the nature and location of principal aquifers, depths to water in each, quality of the water in each, and so on. It contains 18 pages and 6 illustrations.

Papers, Lectures, and Statements

In the course of the 25th biennial period, the State Engineer and his staff presented a number of formal papers and informal talks before scientific and civic groups, and appeared before various legislative and Congressional committees to offer information and recommendations in regard to proposed legislation. A list of typical presentations appears hereinafter.

Speaker	Group	Title	Date
J. R. Williams	North Valley Lions Club Albuquerque, N. Mex.	Water-rights administration by State Engineer and effects upon Albuquerque area	7-28-60
S. E. Reynolds	Western Resources Conference Boulder, Colo.	Comments on "Some Economic Effects of Alternative Water-Use Patterns in New Mexico"	8-25-60
J. R. Williams	Multiple Listing Service Albuquerque, N. Mex.	Water-rights administration by State Engineer and effects on commercial, industrial, and municipal development in Albuquerque area	8-31-60
S. E. Reynolds	Association of Western State Engineers Santa Barbara, Calif.	New Mexico report	9- 1-60
S. E. Reynolds	Four-State Conference on Water Resources Phoenix, Ariz.	Statement concerning New Mexico water resources problems	9-20-60
S. E. Reynolds	Fifth Annual New Mexico Water Conference University Park, N. Mex.	State Water program	11- 2-60
D. G. Myer	County Committees, Agricultural Stabilization and Conservation Service and Soil Conservation Service Reserve, N. Mex.	Water-rights administration by State Engineer in Gila-San Francisco Underground Water Basin	11- 7-60
L. T. Putnam, and D. G. Myer	Cliff-Gila Farm and Livestock Bureau Cliff, N. Mex.	Water-rights administration by State Engineer in Gila-San Francisco Underground Water Basin and preliminary report of Special Master in <i>Arizona v. California</i>	11-25-60
J. C. Yates	Pacific Southwest Inter-Agency Committee Las Vegas, Nev.	Constructed tanks for range livestock watering in New Mexico	11-30-60
S. E. Reynolds	New Mexico Association of Soil Conservation Districts Farmington, N. Mex.	Competition for water uses in New Mexico	12- 2-60
S. E. Reynolds, and C. S. Mann	The Irrigation and Reclamation Subcommittee of the Senate Interior and Insular Affairs Committee Washington, D. C.	Statement in support of S. 107 to authorize the Navajo Irrigation Project, and San-Juan Chama Diversion Project	3-15-61

<i>Speaker</i>	<i>Group</i>	<i>Title</i>	<i>Date</i>
S. E. Reynolds, and D. P. Hale	The Irrigation and Reclamation Subcommittee of the House Interior and Insular Affairs Committee Washington, D. C.	Statement concerning the San Juan-Chama Diversion Project and Navajo Irrigation Project	4-25-61
D. P. Hale	Hooker Dam Association Silver City, N. Mex.	Gila River water in New Mexico	6-19-61
P. B. Mutz	Hooker Dam Association Silver City, N. Mex.	Potential uses of Gila River water in New Mexico	6-19-61
S. E. Reynolds	Sixth Annual New Mexico Water Conference University Park, N. Mex.	An outline of the statutes governing the appropriation and use of ground water in New Mexico	11- 2-61
J. C. Yates	Sixth Annual New Mexico Water Conference University Park, N. Mex.	Changes in quantity of ground water	11- 2-61
L. T. Putnam	Southwestern Chapter, New Mexico Water and Sewerage Operators Las Cruces, N. Mex.	Regulations governing appropriation and use of ground water by municipalities in declared underground water basins	11-27-61
S. E. Reynolds	New Mexico Farm and Livestock Bureau Albuquerque, N. Mex.	An outline of the statutes governing the appropriation and use of ground water in New Mexico	11-27-61
J. C. Yates	New Mexico Farm and Livestock Bureau Albuquerque, N. Mex.	How much irrigation water does New Mexico have and how long will it last?	11-27-61
J. G. Koogler	Pacific Southwest Inter-Agency Committee Las Vegas, Nev.	New Mexico phreato-phyte action program	11-29-61
S. E. Reynolds	Santa Rosa Chamber of Commerce Santa Rosa, N. Mex.	Corps of Engineers' Los Esteros-Alamogordo Reservoir project	12- 4-61
F. E. Irby	Annual meeting of the Springer Ditch Company Springer, N. Mex.	Notes on the evolution of the doctrine of prior appropriation relating to surface waters	2- 7-62
S. E. Reynolds	Albuquerque Council of Garden Clubs Albuquerque, N. Mex.	Introduction to water problems in New Mexico	3-13-62
P. B. Mutz	Public Meeting Liberal, Kansas	Survey on flood control, Cimarron River	5-10-62

SPECIAL ACTIVITIES

Association of Western State Engineers

The Association of Western State Engineers is an organization of officials charged with responsibility for administering water resources in the 17 western states. The association was formed in 1928 1) to formulate a series of broad principles applying to the utilization, control, and regulation of water resources; 2) to assist in the solution of problems through shared experience and exchange of ideas; 3) to cooperate in making cause for the preservation to the states of their inherent right to use, control, and distribute the waters thereof; 4) to facilitate the adjustment of interstate water problems; and 5) to stabilize commercial uses of water by encouraging the perfection of laws relating thereto.

Conventions are held annually, during which routine business is transacted and annual reports outlining problems and achievements are presented by members. Addresses are delivered by outstanding authorities in various phases of water conservation and use, and proceedings of each meeting are published.

The association's 33rd annual convention was held in Santa Barbara, Calif., from August 31 to September 2, 1960. The 34th convention was in Bismarck, N. Dak., August 15-17, 1961. S. E. Reynolds, State Engineer of New Mexico and a past president of the association, was a member of the executive committee and chairman of the constitution committee throughout the period of this report.

New Mexico Mapping Advisory Committee

The New Mexico Mapping Advisory Committee is composed of representatives of State agencies, private industry, and professional engineering organizations. The group was organized on August 19, 1953, to investigate the status of mapping in New Mexico and to correlate State, local, and private requests for mapping. In order to evaluate requests, priorities are assigned in accordance with actual need and the degree to which the public interest would be served by filling the requests. Status of mapping in the State and priorities assigned to mapping requests are published in the committee's annual reports.

During the 25th biennial period the committee held two general

meetings and published the sixth and seventh annual reports. At the time the seventh report was published, 35 percent of the State's 121,666-square-mile area had been mapped and published on 7½- or 15-minute quadrangle sheets, and similar mapping of an additional 17 percent of the State's area was in progress.

Officers of the committee during 1960-61 were F. R. Allen, State Engineer Office, chairman; and Dr. R. H. Weber, New Mexico Institute of Mining and Technology, secretary. Officers during 1961-1962 were Carl L. Slingerland, New Mexico Interstate Stream Commission, chairman; and F. R. Allen, State Engineer Office, secretary. Participating agencies during the biennium were:

Albuquerque Chamber of Commerce	New Mexico Oil Conservation
Albuquerque Planning Department	Commission
American Society of Civil Engineers	Standard Oil Company of Texas
New Mexico Department of Development	New Mexico State Engineer Office
Department of Geography	New Mexico State Forester
University of New Mexico	New Mexico State Highway Department
New Mexico Interstate Stream Commission	New Mexico State Park Commission
New Mexico Institute of Mining	New Mexico State Planning Office
and Technology	Town of Farmington
New Mexico Society of Professional	El Paso Natural Gas Company
Engineers	Navajo Tribe

New Mexico Water Conference

In 1956 New Mexico State University of Agriculture, Engineering, and Science organized at University Park an annual water conference wherein problems of statewide interest might be presented and discussed. The conference is sponsored by the University in cooperation with the Water Conference Advisory Committee and the New Mexico Department of Development. Dr. H. R. Stucky, head, Department of Agricultural Economics, NMSU, is general conference chairman. S. E. Reynolds is a member of the advisory committee.

The fifth annual water conference was held at University Park on November 1 and 2, 1960. Theme of the conference was "Watershed Management." The sixth conference, held on November 1 and 2, 1961, discussed the theme "Ground Water — its Availability, Quantity, Quality, and Use." Mr. Reynolds presented papers at both conventions. The sixth conference also was addressed by J. C. Yates, chief, Technical Division, State Engineer Office.

PERSONNEL

Chapter 240, laws of 1961, known as the State Personnel Act, states at section 2 that "The purpose of the Personnel Act is to establish for New Mexico a system of personnel administration based solely on qualification and ability, which will provide greater economy and efficiency in the management of state affairs."

Pursuant to authority granted to it by the statute, the State Personnel Board late in the 25th biennial period adopted a uniform employment classification and compensation plan governing employment in all State agencies which are subject to the terms of the act. Under the plan, a number of new job classifications were created for State Engineer Office employees of professional and subprofessional status.

Personnel of the office during the biennial period are listed hereunder. The roster includes persons who were employed by and directly concerned with work of the office during the report period. Temporary employees are not included. Also omitted are a small number of employees of cooperating Federal agencies whose salaries were paid out of State Engineer Office funds. Personnel of the Interstate Stream Commission are listed elsewhere in this volume.

In the following presentation, employees are listed alphabetically by division and section, following supervisors. If employment was initiated and/or terminated during the report period, the dates of such initiation and/or termination are given. In instances where an employee served in more than one position during the period, his or her name appears more than once. Where no date appears following a name and position title, employment was initiated prior to July 1, 1960, and was continued through June 30, 1962.

STATE ENGINEER

S. E. Reynolds

LEGAL STAFF

J. L. Cathey, special assistant attorney general

C. D. Harris, special assistant attorney general

Wilma Harris, secretary, empl. 12-16-60, term. 3-31-61

Gertrude Larson, secretary, empl. 9-5-61

Carol Lyon, secretary, empl. 3-16-62

Eula (Coker) Vanderveer, secretary, term. 3-15-62

Elynor Welton, secretary, term. 12-15-60

ADMINISTRATIVE DIVISION

A. A. Najjar, administrative officer, chief
Rose Baca, accountant
Dolores Gonzales, bookkeeping machine operator
J. O. Leyba, accounting clerk, term. 7-1-61
J. E. Lopez, clerk, term. 6-30-61
Presiliana (Trujillo) Schafer, clerk-typist
Mary Stone, accountant

TECHNICAL DIVISION

J. C. Yates, engineer, chief
Mildred McFarland, secretary

DESIGN AND CONSTRUCTION SECTION

J. G. Koogler, engineer, chief
Ormonde Earp, engineer, term. 1-15-61
E. A. Gonzales, engineering assistant, transf. to Hydrographic Surv. Sec.
9-30-61
M. J. Gonzales, aide, term. 2-23-62
Frances (Templeton) Morriss, secretary, empl. 8-21-61
La Verna Pendleton, clerk-typist, term. 8-28-61
G. C. Shaw, equipment operator, term. 4-30-62
E. F. Sorensen, engineer
A. T. Watson, engineer
J. L. Whiteman, engineer, transf. to Interstate Stream Comm. 3-31-61

DRAFTING SECTION

Harlan Lizer, drafting supervisor, chief
Andrea Bacigalupa, draftsman
Mary Boyce, draftsman
E. L. Gonzales, draftsman, transf. to Hydrographic Surv. Sec. 6-30-61

HYDROGRAPHIC SURVEY SECTION

F. R. Allen, engineer, chief
F. F. Barron, surveyor
E. C. Cooper, surveyor, empl. 2-19-62 (see also Water Rights Div.)
Gene Dallas, technician
E. A. Gonzales, engineering assistant, transf. from Design & Const. Sec.
10-1-61, term. 12-31-61
E. L. Gonzales, technician, transf. from Drafting Sec. 7-1-61
Jerry Lowance, technician, empl. 6-1-62
A. D. Moore, aide, mil. leave 3-5-62
L. P. Ortega, technician, transf. from Reports Sec. 7-1-61
Ernesto Ruiz, aide, empl. 5-1-62
Rupert Sanchez, aide

Kenneth Sandlin, surveyor
 Charles Skelton, aide, empl. 3-1-62
 Phillip Smith, aide, empl. 5-1-62
 Jack Thomas, technician
 Helen Wood, clerk, transf. from Reports Sec. 7-1-61

REPORTS AND ENGINEERING DATA SECTION

Dee Linford, editor, chief
 Lawrence Barrone, photographer, term. 12-31-61
 Peter Duran, multilith operator, term. 12-31-61
 Andrew Flores, photostat operator, term. 3-15-61
 L. P. Otega, photostat operator, transf. to Hydrographic Surv. Sec. 6-30-61
 M. S. Ortiz, reproduction supervisor, term. 12-31-61
 Florence van Dresser, secretary
 Helen Wood, composing mach., opr., transf. to Hydrographic Surv. Sec. 6-30-61

WATER RESOURCES AND DEVELOPMENT SECTION

P. D. Akin, engineer, chief
 R. L. Borton, geohydrologist
 E. A. Chavez, geohydrologic assistant
 E. G. De Wilde, engineering assistant, empl. 1-30-61, term. 4-30-62
 E. A. Elevatorski, geohydrologist, empl. 7-3-61, term. 2-1-62
 W. C. Fowler, geohydrologist, empl. 6-7-62
 S. E. Galloway, geohydrologist
 Lena Trujillo, clerk-typist, term. 7-21-60
 F. G. West, geohydrologist
 Iva Zeigler, clerk, term. 6-15-62

WATER RIGHTS DIVISION

F. E. Irby, engineer, chief
 Martha M. Armijo, secretary

SURFACE WATER SECTION

M. B. Compton, engineer, chief and assistant to division chief
 E. H. Banta, Pecos River watermaster
 E. C. Cooper, technician, term. 1-15-62 (see also Hydrographic Surv. Sec.)
 J. C. Emmett, engineering assistant, transf. from Ground Water Sec. 1-22-62
 R. H. Hutson, Cimarron Creek-Rayado Creek watermaster
 Price Nelson, La Plata River watermaster, term. 7-27-60
 G. R. Pace, Gila River watermaster, empl. 4-1-61
 H. M. Pace, Gila River watermaster, term. 3-31-61
 Frances N. Richey, stenographer

W. R. Stocking, La Plata River watermaster, empl. 7-28-60, term. 12-31-61
E. M. Thomas, La Plata River watermaster, empl. 3-9-62
J. H. Yaple, Costilla Creek watermaster

GROUND WATER SECTION

D. E. Gray, engineer, chief and assistant to division chief
Marie Downum, stenographer, term. 10-15-60
Charlotte Gallegos, clerk, empl. 11-15-61, term. 5-31-62
J. B. Nixon, engineering assistant, empl. 3-20-61
Bernila Sandoval, typist, term. 10-31-61
Helen Vigil, stenographer, empl. 9-29-60

District I—Albuquerque

J. L. Williams, geohydrologist, supervisor
Ruth G. Churchill, secretary
E. A. Enyart, geohydrologic assistant, empl. 10-23-61
J. T. Everheart, engineering assistant, empl. 2-2-61
W. L. Garner, engineer, term. 7-19-60
W. A. Godby, engineering assistant, term. 11-30-60
H. F. Metzler, engineer, empl. 8-10-60, term. 9-15-61
Mary E. Thomas, clerk

District II—Roswell

Fred H. Hennighausen, engineer, supervisor
E. C. Barry, technician
Freda F. Clark, stenographer
R. B. Collins, Jr., engineering assistant, empl. 2-1-62
F. L. Covert, custodian
Z. L. Dean, geohydrologic assistant
Jackie Douglas, stenographer
Tommie Sue Dunnahoo, secretary
J. C. Emmett, engineering assistant, transf. to Surface Water Sec. 1-21-62
R. J. Garvey, technician
Wanda Harper, stenographer, empl. 12-12-61
Ruby Hayes, typist
Patricia Horton, stenographer, term. 8-18-61
Kathryn (Lary) Kendall, clerk
Jackie (Locke) Le Roy, stenographer
H. E. Loble, technician, term. 5-31-61
L. J. Malone, draftsman, term. 8-31-61
C. H. Marson, draftsman, empl. 10-11-61
Delbert W. Nelson, geohydrologist
Laurence Nowak, technician
B. M. Pulley, draftsman, term. 3-24-61
J. L. Romero, technician, term. 1-16-61
Nettie L. Roper, stenographer, term. 7-29-60
Winnie Mae Scitern, stenographer, term. 2-15-61

Opal Teague, stenographer, empl. 3-1-61, term. 4-30-62
J. I. Wright, geohydrologist
Bonnie Wyatt, stenographer, empl. 4-5-61, term. 12-6-61
La Moyne Zuern, stenographer, term. 12-31-60

District III—Deming

L. T. Putnam, engineer, supervisor
R. E. Babcock, aide, empl. 9-18-61
Ada Kerr, clerk
Jewel L. Landrum, stenographer, empl. 2-21-62
D. G. Myer, engineering assistant
Virginia (Garcia) Peacock, stenographer, term. 2-15-62
Victor Trujillo, technician
J. R. Wilbanks, technician, empl. 1-23-61, term. 8-18-61

FINANCIAL STATEMENTS, 1960-62

Funds which financed State Engineer Office activity during the 49th and 50th fiscal years were the State Engineer Administrative Fund, the Hydrographic Survey Fund, the Underground Water Fund, and the Irrigation Fees Suspense Fund. In addition, the 24th Legislature of New Mexico in 1959 appropriated to the State Engineer from the General Fund the sum of \$100,000 to finance State cooperation with the U. S. Office of Saline Water in establishing in New Mexico a saline-water-conversion plant for demonstration purposes. Under authority vested in him by the act, the State Engineer entered into contract with the United States to assist in construction of such a plant, paying 10 percent of construction costs, up to the amount of the appropriation. No money was disbursed from the Desalinization Plant Construction Fund during the 24th or 25th biennial periods. It is anticipated that all money in the fund will be expended during the 26th biennium.

Following are descriptions of funds and financial statements of receipts and disbursements during the 25th biennial period.

State Engineer Administrative Fund

The State Engineer Administrative Fund is used to 1) supervise and administer the waters of the State and the measurement, appropriation, and distribution thereof; 2) obtain basic hydrologic data; 3) conduct studies of water supply and methods of use; 4) formulate orderly plans of development of the water resources of the State; 5) approve plans and specifications of proposed water-development works and make final inspection of such works; and 6) coordinate the work of various Federal agencies concerned with water resources in New Mexico. Statements of cash receipts and disbursements follow.

FORTY-NINTH FISCAL YEAR *July 1, 1960, to June 30, 1961*

Balance July 1, 1960		\$ 0.00
Receipts:		
General fund appropriation	\$696,000.00	
Sale of publications	50.00	
Use of property	1,803.96	

Refunds and transfers

Hydrographic Survey, prior year	\$	961.21	
Less Hydrographic Survey, aerial photography		(75.00)	
Less Bureau of Land Management		(636.19)	
Irrigation Works Construction Fund, prior year		11,916.61	
Insurance and other, prior year		27.19	
Insurance and other, current year		743.38	
Hagerman Irrigation Co., prior year		173.01	
Hagerman Irrigation Co., current year		324.56	13,434.77

Contractual services and
cooperative agreements

Bureau of Land Management, prior year		1,234.50	
Bureau of Land Management, current year		1,975.36	
Village of Ruidoso		400.00	
Carlsbad Irrigation District		125.00	
Town of Silver City		500.00	
City of Albuquerque		5,300.00	
New Mexico Game and Fish Department, prior year		184.36	
New Mexico Game and Fish Department, current year		1,809.38	11,528.60

Total receipts

\$722,817.33

Disbursements:

Personal services

Salaries and wages	\$405,543.95	
Temporary	(1,650.22)	
Terminal leave	1,198.90	\$405,092.63

Employee benefits

Group insurance	1,156.96	
Retirement, State share	20,254.59	
Social security, State share	9,794.63	31,206.18

Travel and automotive

In-State mileage and fares	677.78	
In-State meals and lodging	11,340.94	
Out-State mileage and fares	284.45	
Out-State meals and lodging	305.00	
Oil and gas, transportation	7,284.37	
Maintenance and repairs, transportation	6,119.81	
Insurance, transportation	1,597.31	
Rental, transportation	(.13)	
Other travel	342.00	27,951.53

Maintenance and repairs		
Office furniture and fixtures	2,796.95	
Buildings and structures	390.79	
Maintenance assessments, State's share	9,511.41	
Maintenance, supplies and small parts	1,272.58	
Small tools	95.97	
Maintenance services	698.40	14,766.10
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Supplies and materials		
Office supplies	8,258.59	
Engineering supplies	2,134.58	10,393.17
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Professional services		
Photographic services	689.58	
Printing services	345.10	
Audit	3,750.00	
Litigation	671.49	5,456.17
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Communications		
Postage	2,446.15	
Telephone	8,681.12	11,127.27
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Utilities	2,415.26	2,415.26
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Rentals		
Equipment	925.20	
Buildings	17,366.00	18,291.20
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Insurance and bonds		
Property insurance	112.80	
Workmen's compensation	1,719.18	
Bond premiums	48.00	1,879.98
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Capital outlay		
Furniture and fixtures	475.60	
Equipment	771.44	
Automotive	8,363.41	9,610.45
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Other expenditures		
Freight and express out	6.20	
Subscriptions, dues and licenses	633.66	
Advertising and publications	274.24	914.10
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Cooperative agreements		
USGS surface water	50,099.91	
USGS underground water	90,743.81	
Snow survey	900.00	
New Mexico Institute of Mining and Technology	3,000.00	144,743.72
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Transfer to General Fund		38,969.57
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Total disbursements		\$722,817.33
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Balance June 30, 1961		<u>\$ 0.00</u>

FIFTIETH FISCAL YEAR
July 1, 1961, to June 30, 1962

Balance July 1, 1961

\$ 0.00

Receipts:

General Fund appropriation		\$696,000.00
Sale of publications		242.50
Use of property		1,803.96
Refunds and transfers		
Hagerman Irrigation Company		
prior year	\$ 160.20	
Hagerman Irrigation Company	79.20	
Irrigation Works Construction		
prior year	11,661.57	
Insurance and other		
prior year	854.60	
Insurance and other		
current year	206.24	12,961.81
Contractual services and		
cooperative agreements		
U. S. Bur. of Land Management	4,869.80	
Village of Ruidoso	400.00	
Carlsbad Irrigation District	125.00	
Town of Silver City	500.00	
N. Mex. Dept. of Game and Fish	9,100.00	14,994.80
Total receipts		\$726,003.07

Disbursements:

Personal services		
Regular	\$383,920.50	
Temporary	2,070.00	
Terminal	2,260.77	\$388,251.27
Employee benefits		
Group insurance	1,039.37	
Retirement, State share	20,054.87	
Social Security, State share	9,226.75	30,320.99
Travel and automotive		
In-State mileage and fares	1,003.65	
In-State meals and lodging	9,065.35	
Out-State mileage and fares	437.81	
Out-State meals and lodging	285.00	
Gas and oil, auto	6,318.53	
Maintenance and repairs, auto	4,414.48	
Insurance, transportation	1,468.90	
Rental, transportation	282.90	
Other travel	60.32	23,336.94

Maintenance and repairs		
Office furniture, fixtures, and equipment	3,432.89	
Buildings and structures	1,844.59	
Maintenance assessment, State share	10,671.00	
Maintenance, supplies and small parts	627.15	
Small tools	54.46	
Maintenance services	602.03	17,232.12
	<hr/>	
Supplies and materials		
Office supplies	5,919.45	
Engineering supplies	1,608.44	7,527.89
	<hr/>	
Professional services		
Photographic services	2.05	
Printing services	6,461.94	
Audit	4,250.00	
Engineering fees	1,762.41	
Litigation and legal fees	1,474.71	13,951.11
	<hr/>	
Communications		
Postage	2,800.65	
Telephone and telegraph	10,597.01	13,397.66
	<hr/>	
Utilities	2,318.96	2,318.96
	<hr/>	
Rentals		
Buildings	17,813.50	
Equipment	279.87	18,093.37
	<hr/>	
Insurance and bonds		
Property insurance	99.26	
Workmen's compensation	1,392.09	
Bond premiums	394.27	1,885.62
	<hr/>	
Capital outlay		
Furniture and fixtures	3,654.26	
Equipment	9,208.26	
Fencing	245.40	
Aircraft	7,500.00	
Automotive	15,663.08	36,271.00
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Other expenditures		
Freight and express	134.36	
Subscriptions, dues, and licenses	580.21	
Advertising and publications	17.08	
Services to other agencies	497.00	
Cooperative agreements		
USGS, surface water	58,698.48	
USGS, ground water	82,999.26	
Snow survey	900.00	
Canadian River investigation	678.92	
Colorado University	6,296.51	

New Mexico Institute of Mining and Technology Test well repairs	4,600.00 204.00	155,605.82
	<hr/>	
Transfer to General Fund		17,810.32
		<hr/>
Total disbursements		\$726,003.07
		<hr/>
Balance, June 30, 1962		<u>\$ 0.00</u>

Hydrographic Survey Fund

The Hydrographic Survey Fund was established in 1907 for the purpose of financing surveys and water studies necessary in the adjudication of water rights. The statutes provide that "The state engineer shall make hydrographic surveys and investigations of each stream system and source of water supply in the state, beginning with those most used for irrigation, and obtaining and recording all available data for the determination, development, and adjudication of water supply of the state." The statutes provide further that if counties are temporarily unable to pay the expenses of a watermaster, the State Engineer may pay such expenses out of money available in the Hydrographic Survey Fund, provided that the fund shall be reimbursed in the amounts so expended. Statements of cash receipts and disbursements follow.

FORTY-NINTH FISCAL YEAR July 1, 1960, to June 30, 1961

Balance, July 1, 1960 \$90,409.64

Receipts:

General Fund appropriation	\$63,000.00
Irrigation fees	2,330.00
Fees from publications	801.35
Refunds and reimbursements	
State Engineer Administrative prior year	\$ 75.00
State Engineer Administrative U. S. Bur. of Land Management, prior year	636.19
Interstate Stream Commission	417.50
Irrigation Works Construction	6,220.49
Transfer to State Engineer Administrative	(961.21)
Watermaster, prior year	10.79
Surveys, prior year	211.53
Watermaster, current year	12,209.47
Surveys, current year	8,635.34

Inspection of dams and plans	4,638.00	32,093.10	
Services per contract or agreement			
U. S. Bureau of Land Management		702.39	
Total receipts			\$98,926.84
<i>Disbursements:</i>			
Personal services			
Regular	\$60,449.75		
Temporary	5,996.30	\$66,446.05	
Employee benefits			
Group insurance	220.56		
Retirement, State share	3,322.22		
Social Security, State share	1,589.30	5,132.08	
Travel and automotive			
In-State mileage and fares	111.72		
In-State meals and lodging	7,617.00		
Gas and oil, auto	2,563.11		
Maintenance and repairs, auto	1,422.00		
Insurance, auto	200.00	11,913.83	
Maintenance and repairs			
Furniture, fixtures, and equipment	\$ 219.90		
Buildings and structures	72.45		
Maintenance, supplies	167.06	459.41	
Supplies and materials			
Office supplies	668.69		
Engineering supplies	742.88	1,411.57	
Professional services			
Attorney fees	485.74	485.74	
Communications			
Telephone and telegraph	925.21	925.21	
Other expenditures			
Rental, buildings	1,440.00		
Freight and express	11.31		
Cooperative agreements	500.00	1,951.31	
Capital outlay			
Equipment	826.16	826.16	
Total disbursements			\$89,551.36
Excess revenues over disbursements			\$ 9,375.48
Balance, June 30, 1961			\$99,785.12

FIFTIETH FISCAL YEAR
July 1, 1961, to June 30, 1962

Balance, July 1, 1961

\$99,785.12

Receipts:

General Fund appropriation	\$127,460.00	
Irrigation fees	2,022.93	
Fees for publications	461.25	
Use of money and property (auto)	1,003.80	
Refunds and reimbursements		
Pecos Valley Artesian		
Conservancy District survey		
prior year	\$ 735.99	
Pecos Valley Artesian		
Conservancy District survey		
current year	5,145.56	
Pecos River watermaster		
prior year	123.53	
Pecos River watermaster		
current year	10,521.48	
Irrigation Works Construction	535.40	
Interstate Stream Commission	3,405.31	
U. S. Bureau of		
Land Management	3,889.45	24,356.72
Total receipts		\$155,304.70

Disbursements:

Personal services		
Regular	\$75,471.09	
Temporary	14,888.87	
Terminal	800.26	\$ 91,160.22
Employee benefits		
Group insurance	283.10	
Retirement, State share	4,539.83	
Social Security, State share	2,420.15	7,243.08
Travel and automotive		
In-State mileage and fares	153.20	
In-State meals and lodging	16,272.50	
Gas and oil, transportation	3,070.22	
Maintenance and repairs,		
transportation	2,262.07	21,757.99
Maintenance and repairs		
Furniture, fixtures and		
equipment	297.45	
Maintenance, supplies and		
small parts	114.31	

Small tools	50.54	
Maintenance services	3.00	465.30
		<hr/>
Supplies and materials		
Office supplies	435.88	
Engineering supplies	1,341.38	1,777.26
		<hr/>
Professional services		
Legal fees	155.20	155.20
		<hr/>
Communications		
Postage	249.60	
Telephone and telegraph	896.45	1,146.05
		<hr/>
Rentals		
Buildings	360.00	360.00
		<hr/>
Insurance and bonds		
Workmen's compensation	132.72	132.72
		<hr/>
Capital outlay		
Equipment	6,173.60	
Automotive	3,140.03	9,313.63
		<hr/>
Other expenditures		
Freight and express	11.42	
Subscriptions, dues, and licenses	4.75	
USGS, surface water	500.00	516.17
		<hr/>
Total disbursements		\$134,027.62
		<hr/>
Net receipts		\$ 21,277.08
		<hr/>
Balance, June 30, 1962		<u>\$121,062.20</u>

Underground Water Fund

Authority for this fund is section 75-11-19, New Mexico statutes, 1953 annotated, which provides that all fees collected under provisions of the so-called Underground Water Act shall be deposited with the State Treasurer and may be withdrawn by the State Engineer for the purpose of administering the said act. Statements of cash receipts and disbursements follow.

FORTY-NINTH FISCAL YEAR July 1, 1960, to June 30, 1961

Balance, July 1, 1960

\$22,975.11

Receipts:

Irrigation fees		\$20,640.16	
Total receipts			\$20,640.16

Disbursements:

<i>Personal services</i>			
Regular	\$ 9,920.00		
Temporary	1,850.00	11,770.00	
<hr/>			
<i>Employee benefits</i>			
Group insurance	25.92		
Retirement, State share	588.50		
Social Security, State share	200.70	815.12	
<hr/>			
<i>Travel and automotive</i>			
In-State meals and lodging	252.50		
Gas and oil, auto	163.06		
Maintenance and repairs, auto	48.45	464.01	
<hr/>			
Total disbursements			\$13,049.13
<hr/>			
Excess receipts over disbursements			\$ 7,591.03
<hr/>			
Balance, June 30, 1961			\$30,566.14
<hr/> <hr/>			

FIFTIETH FISCAL YEAR
July 1, 1961, to June 30, 1962

Balance, July 1, 1961 \$30,566.14

Receipts:

Irrigation fees		\$ 9,251.86	
<hr/>			
Total receipts			\$ 9,251.86

Disbursements:

<i>Personal services</i>			
Regular	\$10,440.00	10,440.00	
<hr/>			
<i>Employee benefits</i>			
Group insurance	25.92		
Retirement, State share	522.00		
Social Security, State share	150.03	697.95	
<hr/>			
<i>Travel and automotive</i>			
In-State meals and lodging	260.00		

Oil and gas, auto	71.40	
Maintenance and repairs, auto	12.01	343.41
	<hr/>	
Communications		
Telephone and telegraph	25.23	25.23
	<hr/>	<hr/>
Total disbursements		\$11,506.59
Excess disbursements over receipts		<hr/> (\$2,254.73)
Balance, June 30, 1962		<hr/> <hr/> \$28,311.41

Irrigation Fees Suspense Fund

The Irrigation Fees Suspense Fund was created by administrative action to receive all filing fees paid to the State Engineer Office. Money in the fund subsequently is transferred to the Hydrographic Survey and Underground Water Funds, from which it is expended. Statements of cash receipts and disbursements follow.

FORTY-NINTH FISCAL YEAR

July 1, 1960, to June 30, 1961

Balance, June 30, 1960		\$29,030.74
Receipts:		
Irrigation fees and licenses	\$25,487.05	
Returned checks redeposited	10.00	
	<hr/>	
Total receipts		\$25,497.05
Disbursements:		
Refunds	\$13,036.97	
Transcripts	2,130.14	
Earned fees	\$22,955.16	
Adjustment overdraft	(1.00)	22,954.16
	<hr/>	
Returned checks		11.00
	<hr/>	
Total disbursements		<hr/> \$38,132.27
Net receipts		<hr/> (\$12,635.22)
Balance, June 30, 1961		<hr/> <hr/> \$16,395.52

FIFTIETH FISCAL YEAR

July 1, 1961, to June 30, 1962

Balance, June 30, 1961		\$16,395.52
<i>Receipts:</i>		
Irrigation fees and licenses	\$17,500.81	
Returned checks redeposited	263.00	
	<hr/>	
Total receipts		\$17,763.81
<i>Disbursements:</i>		
Refunds	\$ 5,001.25	
Transcripts	735.40	
Earned fees	11,259.79	
Returned checks	263.00	
	<hr/>	
Total disbursements		\$17,259.44
Net receipts		<hr/> \$ 504.37
Balance, June 30, 1962		<hr/> <hr/> \$16,899.89

PROPOSED PROGRAM, 1963-65

The objectives of the State Engineer Office are to perform effectively the specific duties delegated to it by the Legislature and to strive diligently and wisely to administer the water laws of the State within the framework of the doctrine pronounced in the State Constitution, detailed in the statutes, and interpreted by the courts. The proposed budgets are believed minimal to finance efficient administration of water rights and to finance continuing investigative programs at the level of need for such administration and for providing basic knowledge for planning increased and improved utilization of the State's water resources.

Careful consideration has been given to the 1960 report of the Water Resources Advisory Subcommittee on Long-Range Planning regarding the conservation, development, and use of water resources, contained in the Report of Coordinating Committee of Governor's Advisory Committee on Long-Range State Development Objectives. To the extent made possible by the proposed budgets and the necessity of properly performing the basic functions of the office, emphasis has been placed upon many of the recommendations contained in that report.

The programs proposed to be financed from the State Engineer Administrative Fund during the 52nd and 53rd fiscal years contemplate an increase of about 15 percent for the biennium in services performed directly by office personnel and annual increases of about 13 percent in the 52nd fiscal year and 8 percent in the 53rd fiscal year in basic-data collection and investigative programs in cooperation with Federal agencies. To provide for these increases in level of activity, to meet growing competition for qualified personnel, to provide better equipment for investigative work, and to cooperate with the State Planning Office, it is necessary to increase the total budget requests for the 52nd fiscal year by 23 percent over the budget of the 51st fiscal year, and the request for the 53rd fiscal year by 4 percent over the budget requested for the 52nd fiscal year.

The proposed programs for the Hydrographic Survey Fund would continue the same level of activity in the 52nd and 53rd fiscal years as was maintained in the 50th fiscal year and is expected to be maintained in the 51st fiscal year. Budgetary requests for the 52nd and 53rd fiscal years have been increased by about 5 percent over the 51st fiscal year budget.

The proposed budgets for the Underground Water Fund are \$22,000 for the 52nd fiscal year and \$22,520 for the 53rd fiscal year. The proposed

programs would continue the employment of a senior ground-water engineer and would provide additional funds for temporary employment of highly qualified hydrologists.

WATER-RIGHTS ADMINISTRATION

In the 25th biennium the number of instruments processed by the Water Rights Division and the number of protests filed were approximately the same as during the 24th biennium. However, as the amount of unappropriated water in the State decreases, the hydrologic problems involved become more complex and the time required for investigation and study in the processing of each water-right application increases.

Routine field inspection to police illegal well drilling and water use has been curtailed as a result of the additional work load created by processing complex applications. Two additional subprofessional employees, one in Roswell and one in Albuquerque, are required in order to increase the number of field inspections to reduce violations in critical areas under the administration of those district offices.

The number of underground water basins increased from 14 to 19 during the biennium. New basins declared were the Gila-San Francisco, San Simon, Lordsburg Valley, Nutt-Hockett, and Jal. The need to bring the Gila-San Francisco area and the San Simon Valley under the jurisdiction of the State Engineer arose out of litigation in the U. S. Supreme Court over the waters of the Lower Colorado River system; increased development and concern that the underground water would become overappropriated prompted declaration of the other three basins. The services of two additional employees in Deming, one professional and one subprofessional, are required to administer the four new basins in southwestern New Mexico.

Budget limitations in the past several years have required the Roswell office to operate with three fewer employees than formerly. The proposed budget provides for replacement of the three, two of subprofessional technical status and one clerk; replacement is considered necessary in order that the district may keep abreast of the work of the processing of water-right applications.

HYDROGRAPHIC SURVEYS AND ADJUDICATIONS

Hydrographic surveying in the 52nd and 53rd fiscal years will be directed toward completion of surveys now in progress in the Rio Chama basin, in areas in the Rio Grande basin above San Ildefonso in which participating units of the San Juan-Chama Project are planned, and in the Gila River basin in New Mexico.

The San Juan-Chama Project has been authorized by the Congress and it is imperative that adjudication of water rights of the Rio Chama and of the participating-unit areas be accomplished as soon as possible to insure proper operation of the project.

The hydrographic survey of the Gila River system in New Mexico is under way and completion is expected in the first half of the 53rd fiscal year. Adjudication proceedings will be started in the 51st fiscal year, beginning in the San Simon Valley and extending to other areas as the survey progresses.

Budget requests for the Hydrographic Survey fund for the 52nd and 53rd fiscal years amount to \$160,856 and \$163,150, respectively.

BASIC-DATA COLLECTION AND HYDROLOGIC INVESTIGATIONS

Basic-data collection and hydrologic investigations by the State Engineer are financed 1) with moneys from the General Fund and with matching funds provided by cooperating agencies, 2) with moneys from the New Mexico Irrigation Works Construction Fund and the Improvement of the Rio Grande Income Fund authorized by the Interstate Stream Commission for expenditure for specific purposes, and 3) with moneys contributed to the State Engineer for work performed by Federal agencies in cooperation with the State Engineer.

Continuing basic-data compilation and investigations directed toward inventorying the State's water resources are largely financed by General Fund appropriation for expenditure in cooperative programs with Federal agencies. Stream and reservoir gaging and water-level measurements and estimates of annual pumpage by the U. S. Geological Survey are basic-data-collection programs which must be continued and constantly expanded to keep pace with the needs for successful operation of existing irrigation developments and interstate stream compacts; such programs also provide basic data for the proper administration of water rights and for planning future development and utilization of the State's water resources. The ground-water investigations carried on by the Geological Survey in cooperation with the State Engineer and other agencies urgently need to be extended to areas of the State in which the hydrology is not known or is inadequately described. Such areal investigations are generally qualitative in nature but provide a delineation of the limitations and potentialities of water resources for future development. Effects of some of the older irrigation developments on the hydrology of the areas concerned are becoming apparent, and special investigation to determine the nature and extent of these effects and the most practical methods of dealing with them are needed. Information concerning the quantitative relationship between the ground-water and surface-water regimens is required for proper administration of water rights where ground-water development has been long established contiguous to streams and springs and in areas where there is demand for new ground-water development. Areas in stream basins where ground-water appropriations have not yet been sought may afford potential sources for increased water use that cannot be appraised until the relationship of the ground-water reservoir to the stream is known in some detail.

Since 1955, the cooperative program with the Geological Survey has remained at about the same level of activity. Increased annual allocations have approximately offset increased costs of doing business, including Federal pay raises to Civil Service employees. Additional allocations to the stream-gaging program would permit reconstruction of several stations to obtain better records and to reactivate several stations that have been discontinued because of lack of funds. The water-level-measurement program would be only slightly enlarged. Studies under way are reappraising this program and it is anticipated that some expanded coverage can be attained by rearrangements within the program at its present level. An expanded ground-water investigative program would 1) provide for earlier completion of studies now under way, including the statewide inventory of uses and hydrologic descriptions of municipal supplies; 2) make possible more pumping tests and well surveys in the Roswell artesian basin, in the study to develop plans and schedules of remedial measures which could be undertaken to combat saline-water encroachment; 3) commence a reconnaissance study of the hydrology of the San Juan basin; and 4) increase contributions to the costs of countywide ground-water studies in cooperation with the New Mexico Bureau of Mines and Mineral Resources and the Geological Survey.

The proposed budget provides for the addition of a geohydrologist to the staff of the Santa Fe office and a technician to the Roswell office. This addition of personnel will extend present capabilities for conducting studies and investigations necessary for the solution of water-right problems which are increasing in number and complexity. Also, an increased staff working on ground-water problems would allow better collaboration with the Geological Survey to supplement and expedite cooperative investigations so that project findings would become available earlier and in form better suited to the needs of the State Engineer.

The proposed budget also provides for the purchase of tools to extend the capabilities of a basic well logger proposed for purchase in the 51st fiscal year. This logger, to be stationed at Roswell, will provide the Geological Survey and the State Engineer with an instrument which will allow application of techniques long used in the petroleum industry for correlating subsurface geologic formations and for obtaining indications of well and aquifer characteristics.

PUBLIC INFORMATION PROGRAM

The dissemination of hydrologic knowledge of the State's water resources, particularly in the form of factual geologic and engineering data and interpretation inferred therefrom, is a most important function of the State Engineer Office. Many data obtained in cooperation with Federal agencies are published by the Government Printing Office, but the trend is for the states to assume an increasing share of the burden

of publication. Water-level data and interpretation as well as reports on areal investigations of ground-water resources are published in the technical reports series of the State Engineer. Beginning in the 51st fiscal year the technical reports series will be augmented by unnumbered miscellaneous reports and basic-data reports presenting information of local interest and which will not be subject to the distribution demand that is made upon serial publications. In many instances the publication of basic data, preceding by several years the publication of formal interpretive reports, will be of much help to engineers and hydrologists concerned with the State's water problems.

It is anticipated that publication of the technical reports series will continue at about the same level as during the 25th biennium. The publication of unnumbered miscellaneous reports and basic-data reports will represent increased printing costs. The proposed budget provides \$15,500 for all printing costs in the 52nd fiscal year, and \$13,500 in the 53rd fiscal year.

STATE RESOURCES-DEVELOPMENT PLAN

The proposed budgets contain a special line item request, \$18,450 in the 52nd fiscal year and \$12,590 in the 53rd fiscal year, to finance State Engineer participation in the development of a statewide resources-planning program proposed by the State Planning Office. State Engineer personnel for this project would be in addition to the staff required and proposed for normal activity. Funds requested, together with matching Federal funds, would finance approximately 5 man-years of professional service by engineers and geohydrologists — 3½ man-years by professional employees of the State Engineer, and 1½ man-years by professional personnel of the U. S. Geological Survey working cooperatively with the State Engineer.

Proposed Budgets, 1963-65

Budgets proposed for the State Engineer Office for the 52nd and 53rd fiscal years are shown below.

STATE ENGINEER ADMINISTRATIVE FUND

<i>Item</i>	<i>52nd Fiscal year</i>	<i>53rd Fiscal year</i>
Personal services	\$482,945	\$503,425
Employee benefit plans	40,100	41,250
Travel	35,800	35,800
Maintenance and repairs	5,900	5,900
Supplies and materials	11,000	11,000
Contractual services	76,550	74,550

Cooperative services:		
U. S. Geological Survey—surface water	54,125	59,125
U. S. Geological Survey—ground water	104,600	120,900
U. S. Soil Conservation Service—Snow survey	1,200	1,400
N. Mex. State Planning Office	18,450	12,590
Capital outlay	31,905	27,065
	<hr/>	<hr/>
Totals	\$862,575	\$893,005

HYDROGRAPHIC SURVEY FUND

Personal services	\$111,976	\$116,440
Employee benefit plans	9,500	10,100
Travel	24,800	24,800
Maintenance and repairs	1,650	1,600
Supplies and materials	2,000	2,000
Contractual services	6,120	4,620
Cooperative services:		
U. S. Geological Survey—surface water	500	500
Capital outlay	4,310	3,090
	<hr/>	<hr/>
Totals	\$160,856	\$163,150

UNDERGROUND WATER FUND

Personal services	\$ 19,340	\$ 19,835
Employee benefit plans	1,510	1,535
Travel	750	750
Maintenance and repairs	50	50
Supplies and materials	150	150
Contractual services	200	200
	<hr/>	<hr/>
Totals	\$ 22,000	\$ 22,520

INTERSTATE STREAM
COMMISSION

The statutes also provide that the Commission may employ such attorneys, engineers, and clerical help as may be necessary to discharge its duties. The commission membership and personnel employed on the staff during the 25th biennial period are listed below.

COMMISSION MEMBERS:

I. J. Coury, Farmington, Chairman
 S. E. Reynolds, Santa Fe, Secretary
 W. H. Gary, Rincon, Member
 L. C. Strawn, Tucumcari, Member
 Jack T. Cargill, Carlsbad, Member
 Peter Gallagher, Albuquerque, Member
 William C. Schauer, Roswell, Member from May 1961
 T. T. Sanders, Jr., Roswell, Member to May 1961

COMMISSION STAFF:

ADMINISTRATIVE OFFICIAL

S. E. Reynolds
 Catherine Canavan, Secretary

INTERSTATE STREAM ENGINEER

David P. Hale
 Ruth R. Smith, Secretary

GENERAL COUNSEL

Thomas O. Olson from July 1, 1961

LEGAL ADVISERS

Claud S. Mann
 Dudley Cornell
 Thomas O. Olson to June 30, 1961

CONSULTANT

John H. Bliss

ENGINEERS

Philip B. Mutz
 Carl L. Slingerland
 James L. Whiteman from April 1, 1961

ENGINEERING AIDE

Bertha M. Martinez

ACTIVITIES DURING THE BIENNIAL PERIOD

Administration

The Interstate Stream Commission held 10 meetings during the 25th biennial period. Major items considered and acted upon by the Commission were:

1. Preparation of programs and budgets for the general funds of the Interstate Stream Commission, the Improvement of the Rio Grande Income Fund, and the New Mexico Irrigation Works Construction Fund.

2. Consideration of and recommendations to the State Land Commissioner relative to the sale of certain State lands, the income from which is administered by the Interstate Stream Commission.

3. Processing of loans and loan contracts from the New Mexico Irrigation Works Construction Fund for water-development projects in New Mexico.

4. Continued support of Federal legislation for authorization of the Navajo Indian Project and the San Juan-Chama Transmountain Diversion Project together with consideration of amendments offered by other states.

5. Approval of contract for the purchase of rights-of-way for the Malaga Bend Salinity Alleviation Program with money appropriated for this purpose by the State Legislature.

6. United States Supreme Court litigation concerning waters of the Lower Colorado River system.

7. Litigation to test the validity of appropriations made from the New Mexico Irrigation Works Construction Fund by the New Mexico Legislature in 1961.

8. Review of reports of Federal agencies on proposed water-development projects, both interstate and intrastate.

9. Review of reports on State water-development projects financed from the New Mexico Irrigation Works Construction Fund and the Improvement of the Rio Grande Income Fund.

10. Consideration of cooperative programs with Federal and State agencies for collection of basic and special data for water-development programs and administration of interstate water compacts.

11. a) Direction of studies of the Canadian River looking toward construction of a dam and reservoir near Logan, N. Mex.; b) negotiation of a contract with a consulting engineering firm to design the structure; c) selection of the size of the dam and capacity of the reservoir; d) negotiation of a contract for operation and maintenance of the structure; e) acquisition of lands for the dam and reservoir; and f) award of contract for construction of the project.

12. Consideration of the problems involved in the filling of the Colorado River Storage Project reservoirs, the construction of Storage Project electric transmission lines, and the operation of the Navajo Reservoir.

13. Approval of a contract with the Bureau of Reclamation for studies of the Gila River in which the Commission made available \$30,000 from the Irrigation Works Construction Fund.

14. Authorization for the Secretary to negotiate with representatives of the State of Colorado on proposed amendments to the Costilla Creek Compact and to report back to the Commission on results of the negotiations.

New Mexico is a party to seven interstate compacts pertaining to the waters of the stream systems of the State. These are the Colorado River Compact, La Plata River Compact, Rio Grande Compact, Costilla Creek Compact, Upper Colorado River Basin Compact, Pecos River Compact, and Canadian River Compact.

The Colorado River Compact is considered to be self-operative and there is no provision in its terms for an administrative commission.

Administration of the La Plata River Compact is carried out by the State Engineers of Colorado and New Mexico.

The other five compacts provide for and are administered by compact commissions. The activities of these commissions during the biennium are discussed in appropriate sections of this report.

The Commission engineering staff made studies and computations for use in administration of the various compacts. Staff members also act as advisers to the compact commissioners. The staff reviewed reports of various proposed water-development projects both in New Mexico and in adjacent states, and assisted in preparing New Mexico's official comments on such projects for submission in accordance with the provisions of the Flood Control Act of 1944. In addition, the staff made several detailed independent investigations of specific problems of State water-resource development.

Members of the legal staff provided advice to the Commission and to the compact commissioners for the various compacts, and participated in litigation in which the Interstate Stream Commission was involved.

During the report period the Commission maintained its program of

financial cooperation with the various branches of the Water Resources Division of the U. S. Geological Survey to obtain basic hydrologic data, and continued its program of associated activities with national, State, and local water groups having mutual interests.

Colorado River

COLORADO RIVER COMPACT

The Colorado River Compact, with the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming as parties, was signed on November 24, 1922.

After much controversy concerning ratification of the compact it was finally approved by the Congress on December 21, 1928. With the exception of Arizona all parties had completed ratification of the compact by March 1929 and the President of the United States proclaimed the compact effective on June 25, 1929. Arizona did not ratify the agreement until 1944.

The Colorado River Compact apportions the use of waters of the Colorado River system between the upper and lower basins. Parts of Arizona, Colorado, New Mexico, Utah, and Wyoming constitute the upper basin, and parts of Arizona, California, Nevada, New Mexico, and Utah make up the lower basin.

The compact makes no specific provision for an administrative commission. However, the instrument provides, in Article V, that the party states shall: 1) promote the systematic determination and coordination of the facts as to flow, appropriation, consumption, and use of water in the Colorado River basin and the exchange of available information in such matters; 2) ascertain and publish the annual flow of the Colorado River at Lee Ferry; and 3) perform such other duties as may be assigned by mutual consent of the signatory states from time to time.

Certain sections of the compact have occasioned considerable controversy over interpretation, chiefly between Arizona and California, and several lawsuits have resulted. The most recent is in the Supreme Court of the United States: *Arizona v. California et al., No. 8 Original*. New Mexico became a party in this litigation by order of the Supreme Court on December 12, 1955, in her capacity as a lower basin state only. The State's participation in this litigation during the biennial period is discussed below.

ARIZONA-CALIFORNIA LITIGATION

The Interstate Stream Commission sections of the 22nd, 23rd, and 24th biennial reports of the State Engineer contain discussions of New

Mexico's participation in the Arizona-California litigation during those periods.

On June 9, 1960, New Mexico filed "New Mexico's Comments on the Special Master's Report, May 5, 1960." Following submittal of these comments, the Special Master contacted New Mexico and Arizona and suggested that, in view of the comments of New Mexico on the Special Master's report of May 5, 1960, the two states should attempt to arrive at a stipulation to define New Mexico's present use of water in the Gila River drainage basin in New Mexico.

Representatives of New Mexico, Arizona, and the United States met with the Special Master in New York on July 11, 1960, to discuss the question of the extent of New Mexico's present use of waters of the Gila River system. Subsequently, representatives of the two states held a series of meetings and conferences in an attempt to arrive at a stipulation of New Mexico's uses.

As a result of the conferences, representatives of the two states were able to agree on a stipulation as to New Mexico's present use of waters of the Gila River basin. The stipulation was submitted to the Special Master in New York on August 17, 1960, at which time oral arguments were scheduled for all parties on the entire case. The United States submitted objections and suggested certain modifications to the stipulation agreed to by representatives of New Mexico and Arizona. In particular the United States opposed the stipulation regarding use of water in the Virden Valley not covered by the Gila River Decree of June 29, 1935 (Globe Equity No. 59, in the District Court of the United States in and for the District of Arizona).

On September 6, 1960, New Mexico filed "New Mexico's Memorandum in Response to the Memorandum of the United States Objecting to Suggested Modifications of the Draft Report Proposed by New Mexico and Arizona." In this memorandum New Mexico reiterated her contentions that the Special Master should adopt the proposed amendments agreed upon by representatives of Arizona and New Mexico.

The Special Master filed with the United States Supreme Court his final report in December 1960. The Special Master's report contained a recommended decree which would, if entered by the Court, limit the amount of acreage irrigated in New Mexico and the use of water from the Gila River and its tributaries in accordance with the terms of the recommended decree. Included in the recommended decree was the stipulation agreed to by representatives of New Mexico and Arizona without the modifications suggested by the United States.

The stipulation by representatives of New Mexico and Arizona, as compared with the Special Master's report of May 5, 1960, substantially increased the acreage determined as presently irrigated from the Gila and San Francisco Rivers and substantially increased the quantity of water that would be allocated to New Mexico from these streams.

The Special Master's recommended decree would allow, in addition to the water allocated to New Mexico, the use of water in quantities reasonably necessary to fulfill the purposes of the Gila National Forest.

Following receipt of the Special Master's report the Supreme Court allowed time to file exceptions to the report and briefs in support of exceptions by all parties.

New Mexico filed with the Supreme Court "New Mexico's Exceptions to the Report and Recommended Decree of the Special Master dated December 5, 1960." This brief was short and not detailed in view of the stipulation by Arizona and New Mexico. New Mexico did not agree in principle with the Special Master's application of the Winters case [207 U. S. 564 (1908)] to the Indian Reservations nor to the extension thereof to include all Federal reservations. New Mexico noted in her exceptions that continued unrestricted development of the underground waters in the San Simon basin in Arizona immediately across the State line would, if not controlled, interfere with New Mexico uses, making it necessary for New Mexico to apply to the Court for relief to protect her uses.

The United States Supreme Court set the week of January 8, 1962, for oral argument. A brief statement regarding New Mexico's exceptions to the report of the Special Master was presented by Attorney General Earl Hartley and Special Assistant Attorney General Claud S. Mann.

The Supreme Court, on June 4, 1962, ordered re-argument to be heard in November 1962.

The recommended decree of the Special Master, if adopted by the Supreme Court, would not apportion water for future uses from the Gila River system in New Mexico; however, Sec. IX of the proposed decree gives opportunity for amendment to provide for future uses.

On June 19, 1961, a meeting arranged by local interests was held in Silver City to acquaint people of the area with the results of the case to that date. The Governor, State Engineer, Attorney General, and staff members of the Interstate Stream Commission explained to persons present the effects of the Special Master's final report and the possibilities for additional use of water under the provisions for amendment of the decree.

GILA RIVER STUDIES

The United States Bureau of Reclamation, through its Region III office, in Boulder City, Nev., has embarked upon a reappraisal study of the Central Arizona Project which was reported on by that Bureau in 1947. Funds for the reappraisal report were made available by the Arizona Interstate Stream Commission and the New Mexico Interstate Stream Commission. The latter entered a contract with the Bureau of Reclamation on August 2, 1961. Under this contract the Commission

provided \$30,000 for use by the Bureau to expedite the Central Arizona Project Reappraisal Report and also to provide a reconnaissance report on other potential water-development projects in New Mexico. The reappraisal report was completed and copies furnished New Mexico in February 1962. Under this contract the Bureau was able to accelerate its program of investigations of potential water-development projects in New Mexico and a report on that phase of the study is expected to be made available during the early part of the next biennial period. Such studies will greatly aid the State in making plans for future use of waters of the Gila River basin in New Mexico that can be developed by exchange arrangements under the Central Arizona Project and amendment of the Special Master's recommended decree in *Arizona v. California et al.*

SALINITY PROBLEMS ON DELIVERIES TO MEXICO

Early in 1962 the government of the United Mexican States complained to the government of the United States of America that Colorado River water then being delivered to Mexico contained such a large proportion of salts that use of the water was injurious to crops being grown in Mexico. As a result of the complaint the United States, acting through the International Boundary Commission, has made a detailed study of the problem of salinity of the Colorado River water for deliveries to Mexico and ways in which the total salts in the water could be reduced without adverse effects on the quantity of water specified for delivery under the Mexican Treaty. The problem is most acute in the winter months when return flows from irrigation constitute a large portion of the total amount of water being delivered at the international boundary under the schedule of deliveries in the treaty.

S. E. Reynolds, State Engineer, was retained without fee by the International Boundary Commission as chairman of a study panel made up of several experts having knowledge of problems encountered in this study and he devoted a considerable amount of time to this problem during the early part of 1962.

In order to keep advised and informed on the salinity problem, the states of the Colorado River basin have activated a committee, known as "The Committee of Fourteen," composed of two representatives from each state. David P. Hale and Thomas O. Olson were designated by the Governor to represent New Mexico on this committee. The committee has held several meetings and will continue to function during the coming biennium to keep abreast of the problem.

LA PLATA RIVER COMPACT

The La Plata River Compact governing division of the waters of the La Plata River between Colorado and New Mexico was signed in Santa

Fe on November 27, 1922. The compact was ratified by the legislatures of the states involved and approved by Congress on January 29, 1929.

The compact provides that the State Engineers of the signatory states shall administer the waters of the La Plata River in their respective states in accordance with the terms of the compact. Provisions of the compact also call for cooperative collection, exchange, and publication of streamflow data and agreement on details of operation of the river.

To administer La Plata River water in New Mexico the State Engineer appoints a watermaster, in recent years an employee of the La Plata Conservancy District, to supervise delivery of water to users in New Mexico and to cooperate with Colorado water officials in distributing the water between the two states. This watermaster is under the direct supervision of the Water Rights Division of the State Engineer Office and his activities are reported in that section of this report.

UPPER COLORADO RIVER BASIN COMPACT

The Upper Colorado River Basin Compact was signed in Santa Fe on October 11, 1948, with the States of Arizona, Colorado, New Mexico, Utah, and Wyoming as parties. The United States was represented in all negotiations. The compact was ratified by the legislatures of the respective states and consented to by the Congress. The President approved the agreement on April 6, 1949.

Article VIII of the compact creates a commission to administer its provisions. Membership of the Upper Colorado River Commission during the 25th biennial period was composed of: Robert J. Newell, commissioner for the United States and chairman; George D. Clyde, commissioner for Utah and vice-chairman; Edwin C. Johnson, commissioner for Colorado; John H. Bliss, commissioner for New Mexico; and Earl Lloyd, commissioner for Wyoming. The New Mexico commissioner was assisted in his administration during the biennial period by members of the engineering and legal staffs of the Interstate Stream Commission and by I. J. Coury, chairman of the Interstate Stream Commission. Mr. Coury was elected treasurer of the Upper Colorado River Commission on November 30, 1960, and has served in that position to date.

The Upper Colorado River Commission maintains an office in Salt Lake City, Utah. The commission staff consists of an executive director, an attorney, engineers, and clerical help.

Principal activities of the commission and members of its staff during the 25th biennial period have been directed toward 1) assisting in obtaining authorization for new projects listed for priority of planning in Public Law 485, 84th Congress; 2) securing the necessary appropriations from Congress to provide an orderly construction schedule for projects authorized by Public Law 485 and for other projects subsequently

authorized; 3) research and study of engineering and hydrologic problems posed by the construction of new projects in the Upper Colorado River basin; 4) collection and compilation of legal documents for a library on utilization and development of waters of the Colorado River system; 5) collection and compilation of briefs and other matters in the *Arizona v. California* Supreme Court litigation; 6) study of plans for transmission lines to be built for the distribution of energy to be generated by the units of the Colorado River Storage Project; 7) collection of basic water-resource data in the Upper Colorado River basin; 8) study and analysis of the Mexican Treaty and legislative history leading up to the adoption of the treaty; 9) study of the Secretary of the Interior's general principles for filling Colorado River Storage Project reservoirs; 10) construction of an office building; and 11) study of the problems that would be created by the construction of Bridge and Marble Canyon Dams for power production, as proposed by the Arizona Power Authority and the city of Los Angeles.

The Upper Colorado River Commission has a standing Engineering Advisory Committee composed of representatives from the compact-party states and the Executive Director. This committee has been actively engaged in reviewing numerous water-supply and power-generation studies prepared by the Upper Colorado Commission's engineering staff and other interests to acquaint and inform the compact commission regarding the generation and sale of power and the filling of upper basin reservoirs. Numerous studies were also made by lower basin interests and the Bureau of Reclamation.

The commission also has a standing Legal Advisory Committee made up of representatives of the various states. The legal committee and the commission's staff attorney have advised the commission on the legal aspects of problems such as the filling of Colorado River Storage Project reservoirs and the quality of water delivered to Mexico.

Additional information regarding the activities of the Upper Colorado River Commission during the biennial period may be found in the commission's 11th, 12th, and 13th annual reports.

Article VIII of the compact provides that the salary and personal expenditures of each commissioner are to be paid by the agency he represents. The compact also provides that other expenses which are incurred incident to administration and which are not paid by the United States are to be borne by the four states according to the percentage of consumptive use of water apportioned to each. The commission's budget for the 49th fiscal year was \$97,000. New Mexico was assessed \$8,437.50 or 11.25% of \$75,000. The remainder of the \$97,000 was furnished from surplus commission funds. For the 50th fiscal year the budget was \$100,000, of which New Mexico's contribution was \$11,250. The budget adopted for the 51st fiscal year was \$103,000, of which New Mexico's share was \$11,587.50.

SAN JUAN RIVER DEVELOPMENT

The Corps of Engineers, Los Angeles District, in 1959 instituted a review survey for flood control on the Animas River and tributaries in Colorado and New Mexico. Purpose of the survey was to inventory existing improvements on the flood plain, estimate potential damage from floods, establish flood-frequency studies, and report on the feasibility of constructing works to alleviate flood damages. The Corps continued this investigation during the 25th biennial period.

New Mexico, over the past decade, has been actively engaged in studies of potential projects that would utilize her share of the waters allocated by the Upper Colorado River Basin Compact. Five major projects have been planned in the State for use of waters of the San Juan River system.

Construction of Navajo Dam — one of the four storage units authorized by the Colorado River Storage Project and the regulatory unit to supply water for diversion to several projects in New Mexico — was initiated in 1958. Construction progressed rapidly until December 1961 when severe weather halted all work until March 1962. Because of this delay it was not possible to store water during the 1962 runoff season. At the end of the biennial period work remaining consisted of construction of a valve house, placement of a steel liner in the outlet tunnel, installation of valves and control works, and completion of the embankment section. Initial storage of water in the reservoir began in June 1962 with closure of the diversion tunnel. At the end of the biennial period only a small amount of water had been stored and water was being by-passed through the auxiliary outlet works for use downstream. It is expected that the dam and reservoir will be completed during the winter of 1962-63. The reservoir will control runoff of the San Juan River and will provide water for the Hammond Irrigation Project, for the authorized Navajo Indian Irrigation Project, and for future municipal and industrial uses in the basin. The lake created by Navajo Dam will provide a large area for recreation purposes.

The Hammond Project was authorized as a participating project by the Colorado River Storage Project Act. Construction was started with award of the first contract in June 1960. A large portion of the project is completed; priming of the canal and initial delivery of water to lands formerly supplied by the Kutz Canyon Association was initiated in 1962.

The Bureau of Reclamation, in cooperation with the States of Colorado and New Mexico, has continued studies looking toward a feasible plan for construction of the proposed Animas-La Plata Project. This project includes lands in both Colorado and New Mexico. During the biennial period the Bureau completed and circulated its initial report of the project to the States of Colorado and New Mexico and to the appropriate Federal agencies for informal comment. Water would be

imported into the La Plata River basin from the Animas River to supplement the La Plata River flows. New Mexico lands under the project, as envisioned by the report, would constitute a total of about 20,600 acres, of which about 15,000 acres would be new lands generally located to the northeast and southwest of La Plata, N. Mex. New Mexico lands presently irrigated from La Plata River would receive supplemental water from this project.

The first session of the 87th Congress did not provide, in the Bureau of Reclamation budget, the entire amount of money requested for planning purposes. Consequently, the agency felt it could not complete a draft of its Animas-La Plata feasibility report by June 30, 1961, as had originally been scheduled. In order to expedite completion of the report, New Mexico made available to the Bureau of Reclamation the sum of \$10,000. Colorado also contributed \$10,000, as well as some staff services. As a result of these contributions by the two states, the Bureau of Reclamation was able to complete a draft of the report on schedule.

The principal features of the project in New Mexico, according to the Bureau report, would consist of an off-stream storage reservoir, supply canals and laterals, and drainage systems to serve the new lands, as well as enlargement of some of the existing canals. It is expected that the Bureau of Reclamation's proposed feasibility report on this project will be released early in the 26th biennium.

The Navajo Indian Irrigation Project and the initial stage of the San Juan-Chama Project were authorized by the 87th Congress. The Navajo Indian Project will furnish water to about 110,000 acres of new land lying south of the San Juan River. The initial stage of the San Juan-Chama Project will divert an average of about 110,000 acre-feet of water annually from the San Juan River basin to the Rio Grande basin. In accordance with the expressed policy of the State of New Mexico, these two projects were authorized simultaneously under the same legislation.

Legislation to authorize the two projects previously had been introduced into both the 85th and 86th Congresses, and in each Congress the Senate approved the legislation. However, neither the 85th nor the 86th Congress considered the legislation on the floor of the House.

Following introduction of legislation to authorize the projects in the 87th Congress, the Senate Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs held hearings on the projects on March 15, 1961. Testimony was presented to this committee by staff members of the Interstate Stream Commission.

In April and June 1961, the House Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs held hearings on the legislation. These hearings were lengthy and considerable testimony was submitted for the record by the Governor of New Mexico, by the members and the staff of the Interstate Stream Commission, and

by others. Also, testimony opposing the legislation was entered on behalf of California interests and other parties. No action was taken on the floor by the House during the first session of the 87th Congress. After the legislation to authorize the projects had received favorable reports from the subcommittee and the full committee, and after it had received a rule to bring it to debate on the floor of the House, the Governor, members and staff of the Interstate Stream Commission, members of the Navajo Tribal Council, and other interested New Mexico parties made a concerted effort to inform Congressmen from all parts of the United States regarding the merits of the two proposed projects; the New Mexico delegation also attended House sessions in Washington during the week when the projects were considered. During the second session of the 87th Congress, the House approved legislation authorizing the two projects, including amendments to the version approved by the Senate. Conferees of the two legislative bodies reached agreement on the legislation and the statute was signed by the President on June 13, 1962, as Public Law 87-483. The enacted legislation follows:

AN ACT

To authorize the Secretary of the Interior to construct, operate, and maintain the Navajo Indian Irrigation project and the initial stage of the San Juan-Chama project as participating projects of the Colorado River storage project, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, for the purposes of furnishing water for the irrigation of irrigable and arable lands and for municipal, domestic, and industrial uses, providing recreation and fish and wildlife benefits, and controlling silt, and for other beneficial purposes, the Congress approves as participating projects of the Colorado River storage project (Act of April 11, 1956, 70 Stat. 105, as amended, 43 U. S. C. 620-620o) the Navajo Indian irrigation project, New Mexico, and the initial stage of the San Juan-Chama project, Colorado-New Mexico. The Navajo Indian irrigation project and the initial stage of the San Juan-Chama project herein approved are substantially those described in the proposed coordinated report of the Acting Commissioner of Reclamation and the Commissioner of Indian Affairs, approved and adopted by the Secretary of the Interior on October 16, 1957, as conditioned, modified, and limited herein.

NAVAJO INDIAN IRRIGATION PROJECT

Sec. 2. Pursuant to the provisions of the Act of April 11, 1956, as amended, the Secretary of the Interior is authorized to construct, operate, and maintain the Navajo Indian irrigation project for the principal purpose of furnishing irrigation water to approximately one hundred and ten thousand six hundred and thirty acres of land, said project to have an average annual diversion of five hundred and eight thousand acre-feet of water and the repayment of the costs of construction thereof to be in accordance with the provisions of said Act of April 11, 1956, as amended, including, but not limited to, section 4(d) thereof.

Sec. 3. (a) In order to provide for the most economical development of the Navajo Indian irrigation project, the Secretary shall declare by publication in the Federal Register that the United States of America holds in trust for the Navajo Tribe

of Indians any legal subdivisions or unsurveyed tracts of federally owned land outside the present boundary of the Navajo Indian Reservation in New Mexico in townships 28 and 29 north, ranges 10 and 11 west, and townships 27 and 28 north, ranges 12 and 13 west, New Mexico principal meridian, susceptible to irrigation as part of the project or necessary for location of any of the works or canals of such project: *Provided, however,* That no such legal subdivision or unsurveyed tract shall be so declared to be held in trust by the United States for the Navajo Tribe until the Navajo Tribe shall have paid the United States the full appraised value thereof: *And provided further,* That in making appraisals of such lands the Secretary shall consider their values as of the date of approval of this Act, excluding therefrom the value of minerals subject to leasing under the Act of February 25, 1920, as amended (30 U. S. C. 181-286), and such leasable minerals shall not be held in trust for the Navajo Tribe but shall continue to be subject to leasing under the Act of February 25, 1920, as amended, after the lands containing them have been declared to be held in trust by the United States for the Navajo Tribe.

(b) The Navajo Tribe is authorized to convey to the United States, and the Secretary shall accept on behalf of the United States, title to any land or interest in land within the above-described townships, susceptible to irrigation as part of the Navajo Indian irrigation project or necessary for location of any of the works or canals of such project, acquired in fee simple by the Navajo Tribe, and after such conveyance said land or interest in land shall be held in trust by the United States for the Navajo Tribe as a part of the project.

(c) The Secretary is authorized to acquire by purchase, exchange, or condemnation any other land or interest in land within the townships above described susceptible to irrigation as part of the Navajo Indian irrigation project or necessary for location of any of the works or canals of such project. After such acquisition, said lands or interest in lands shall be held by the United States in trust for the Navajo Tribe of Indians.

Sec. 4. In developing the Navajo Indian irrigation project, the Secretary is authorized to provide capacity for municipal and industrial water supplies or miscellaneous purposes over and above the diversion requirements for irrigation stated in section 2 of this Act, but such additional capacity shall not be constructed and no appropriation of funds for such construction shall be made until contracts have been executed which, in the judgment of the Secretary, provide satisfactory assurance of repayment of all costs properly allocated to the purposes aforesaid with interest as provided by law.

Sec. 5. Payment of operation and maintenance charges of the irrigation features of the Navajo Indian irrigation project shall be in accordance with the provisions of the Act of August 1, 1914 (38 Stat. 582, 583), as amended (25 U. S. C. 385): *Provided,* That the Secretary may transfer to the Navajo Tribe of Indians the care, operation, and maintenance of all or any part of the project works, subject to such rules and regulations as he may prescribe and, in such event, the Secretary may transfer to the Navajo Tribe title to movable property necessary to the operation and maintenance of those works.

Sec. 6. For the period ending ten years after completion of construction of the Navajo Indian irrigation project no water from the project shall be delivered to any water user for the production on newly irrigated lands of any basic agricultural commodity, as defined in section 408(c) of the Agricultural Act of 1949 (63 Stat. 1056, 7 U. S. C. 1428), or any amendment thereof, if the total supply of such commodity for the marketing year in which the bulk of the crop would normally be marketed is in excess of the normal supply as defined in section 301(b)(10) of the Agricultural Adjustment Act of 1938 (52 Stat. 41), as amended (7 U. S. C. 1281), unless the Secretary of Agriculture calls for an increase in production of such commodity in the interest of national security.

Sec. 7. There are hereby authorized to be appropriated to the Bureau of Indian Affairs such sums as may be required to construct the Navajo Indian irrigation project, including the purchase of lands under section 3, subsection (c), of this Act, but not more than \$135,000,000 (June 1961 prices) plus or minus such amounts, if any, as may be required by reason of changes in construction costs as indicated by engineering cost indices applicable to the types of construction involved therein.

SAN JUAN-CHAMA RECLAMATION PROJECT (INITIAL STAGE)

Sec. 8. Pursuant to the provisions of the Act of April 11, 1956, as amended, the Secretary is authorized to construct, operate, and maintain the initial stage of the San Juan-Chama project, Colorado-New Mexico, for the principal purposes of furnishing water supplies to approximately thirty-nine thousand three hundred acres of land in the Cerro, Taos, Llano, and Pojoaque tributary irrigation units in the Rio Grande Basin and approximately eighty-one thousand six hundred acres of land in the existing Middle Rio Grande Conservancy District and for municipal, domestic, and industrial uses, and providing recreation and fish and wildlife benefits. The diversion facilities of the initial stage authorized herein shall be so constructed and operated as to divert only natural flow of the Navajo, Little Navajo, and Blanco Rivers in Colorado as set forth in the supplemental project report dated May 1957. The principal engineering works of the initial stage development, involving three major elements, shall include diversion dams and conduits, storage and regulation facilities at the Heron Numbered 4 Reservoir site, enlarged outlet works of the existing El Vado Dam, and water use facilities consisting of reservoirs, dams, canals, lateral and drainage systems, and associated works and appurtenances. The construction of recreation facilities at the Nambe Reservoir shall be contingent upon the Secretary's making appropriate arrangements with the governing body of the Nambe Pueblo for the operation and maintenance of such facilities, and the construction of recreation facilities at the Heron Numbered 4, Valdez, and Indian Camp Reservoirs shall be contingent upon his making appropriate arrangements with a State or local agency or organization for the operation and maintenance of those facilities: *Provided, That—*

(a) the Secretary shall so operate the initial stage of the project authorized herein that diversions to the Rio Grande Valley shall not exceed one million three hundred and fifty thousand acre-feet of water in any period of ten consecutive years, reckoned in continuing progressive series starting with the first day of October after the project shall have commenced operation: *Provided, however, That not more than two hundred and seventy thousand acre-feet shall be delivered in any one year;*

(b) the Secretary shall operate the project so that there shall be no injury, impairment, or depletion of existing or future beneficial uses of water within the State of Colorado, the use of which is within the apportionment made to the State of Colorado by article III of the Upper Colorado River Basin compact, as provided by article IX of the Upper Colorado River Basin compact and article IX of the Rio Grande compact;

(c) all works of the project shall be constructed so as to permit compliance physically with all provisions of the Rio Grande compact, and all such works shall be operated at all times in conformity with said compact;

(d) the amount of water diverted in the Rio Grande Basin for uses served by the San Juan-Chama project shall be limited in any calendar year to the amount of imported water available to such uses from importation to and storage in the Rio Grande Basin in that year;

(e) details of project operation essential to accounting for diverted San Juan and Rio Grande flows shall be developed through the joint efforts of the Rio Grande Compact Commission, the Upper Colorado River Commission, the

appropriate agencies of the United States and of the States of Colorado, New Mexico, and Texas, and the various project entities. In this connection the States of Texas and New Mexico shall agree, within a reasonable time, on a system of gaging devices and measurements to secure data necessary to determine the present effects of tributary irrigation, as well as present river channel losses: *Provided*, That if the State of Texas shall require, as a condition precedent to such agreement, gaging devices and measurements in addition to or different from those considered by the Department of the Interior and the State of New Mexico to be necessary to this determination, the State of Texas shall pay one-half of all costs of constructing and operating such additional or different devices and making such additional or different measurements which are not borne by the United States. The results of the action required by this subsection shall be incorporated in a written report transmitted to the States of Colorado, Texas, and New Mexico for comment in the manner provided in the Flood Control Act of 1944 before any appropriation shall be made for project construction;

(f) the Secretary shall operate the project so that for the preservation of fish and aquatic life the flow of the Navajo River and the flow of the Blanco River shall not be depleted at the project diversion points below the values set forth at page D2-7 of appendix D of the United States Bureau of Reclamation report entitled "San Juan-Chama Project, Colorado-New Mexico", dated November 1955;

(g) the Secretary is hereby authorized to construct the tunnel and conduit works of the initial stage of the San Juan-Chama project with sufficient capacity for future diversion of an average of two hundred and thirty-five thousand acre-feet per annum: *Provided, however*, That nothing contained in this Act shall be construed as committing the Congress of the United States to future authorization of any additional stage of the San Juan-Chama project.

Sec. 9. For the period ending ten years after completion of construction of the initial stage of the San Juan-Chama project no water from the project shall be delivered to any water user for the production on newly irrigated lands of any basic agricultural commodity, as defined in section 408(c) of the Agricultural Act of 1949 (63 Stat. 1056, 7 U. S. C. 1428), or any amendment thereof, if the total supply of such commodity for the marketing year in which the bulk of the crop would normally be marketed is in excess of the normal supply as defined in section 301(b)(10) of the Agricultural Adjustment Act of 1938 (52 Stat. 41), as amended (7 U. S. C. 1281), unless the Secretary of Agriculture calls for an increase in production of such commodity in the interest of national security.

Sec. 10. The amount which section 12 of the Act of April 11, 1956, authorizes to be appropriated is hereby increased by \$85,828,000 (June 1961 prices) plus or minus such amounts, if any, as may be required by reason of changes in construction costs as indicated by engineering cost indices applicable to the types of construction involved, which increase shall be available solely for construction of the San Juan-Chama project and shall not be used for any other purpose.

GENERAL

Sec. 11. (a) No person shall have or be entitled to have the use for any purpose, including uses under the Navajo Indian irrigation project and the San Juan-Chama project authorized by sections 2 and 8 of this Act, of water stored in Navajo Reservoir or of any other waters of the San Juan River and its tributaries originating above Navajo Reservoir to the use of which the United States is entitled under these projects except under contract satisfactory to the Secretary and conforming to the provisions of this Act. Such contracts, which, in the case of water for Indian uses, shall be executed with the Navajo Tribe, shall make provision, in any year in which the

Secretary anticipates a shortage, taking into account both prospective runoff originating above Navajo Reservoir and the available water in storage in Navajo Reservoir, for a sharing of the available water in the following manner: The prospective runoff shall be apportioned between the contractors diverting above and those diverting at or below Navajo Reservoir in the proportion that the total normal diversion requirement of each group bears to the total of all normal diversion requirements. In the case of contractors diverting above Navajo Reservoir, each such contract shall provide for a sharing of the runoff apportioned to said group in the same proportion as the normal diversion requirement under said contract bears to the total normal diversion requirements of all such contracts that have been made hereunder: *Provided*, That for any year in which the foregoing sharing procedure either would apportion to any contractor diverting above Navajo Reservoir an amount in excess of the runoff anticipated to be physically available at the point of his diversion, or would result in no water being available to one or more such contractors, the runoff apportioned to said group shall be reapportioned, as near as may be, among the contractors diverting above Navajo Reservoir in the proportion that the normal diversion requirements of each bears to the total normal diversion requirements of the group. In the case of contractors diverting from or below Navajo Reservoir, each such contract shall provide for a sharing of the remaining runoff together with the available storage in the same proportion as the normal diversion requirement under said contract bears to the total normal diversion requirements under all such contracts that have been made hereunder.

The Secretary shall not enter into contracts for a total amount of water beyond that which, in his judgment, in the event of shortage, will result in a reasonable amount being available for the diversion requirements for the Navajo Indian irrigation project and the initial stage of the San Juan-Chama project as specified in sections 2 and 8 of this Act.

No long-term contract, except contracts for the benefit of the lands and for the purposes specified in sections 2 and 8 of this Act, shall be entered into for the delivery of water stored in Navajo Reservoir or of any other waters of the San Juan River and its tributaries, as aforesaid, until the Secretary has determined by hydrologic investigations that sufficient water to fulfill said contract is reasonably likely to be available for use in the State of New Mexico during the term thereof under the allocations made in articles III and XIV of the Upper Colorado River Basin compact, and has submitted such determination to the Congress of the United States and the Congress has approved such contracts: *Provided*, That nothing contained in the foregoing shall be construed to forbid the Secretary from entering into temporary water supply contracts in the San Juan River Basin for any year in which he determines that water legally available for use in the upper basin of the Colorado River system would otherwise not be used there and is not needed to fulfill the obligations of the upper division States with respect to delivery of water at Lee Ferry.

(b) If contracts are entered into for delivery from storage in Navajo Reservoir of water not covered by subsection (a) of this section, such contracts shall be subject to the same provision for sharing of available water supply in the event of shortage as in the case of contracts required to be made pursuant to subparagraph (a) of this section.

(c) This section shall not be applicable to the water requirements of the existing Fruitland, Hogback, Cudai, and Cambridge Indian irrigation projects, nor to the water required in connection with the extension of the irrigated acreages of the Fruitland and Hogback Indian irrigation projects in a total amount of approximately eleven thousand acres.

Sec. 12. (a) None of the project works or structures authorized by this Act shall be so operated as to create, implement, or satisfy any preferential right in the United States or any Indian tribe to the waters impounded, diverted, or used by means of

such project works or structures, other than contained in those rights to the uses of water granted to the States of New Mexico or Arizona pursuant to the provisions of the Upper Colorado River Basin compact.

(b) The projects authorized by this Act shall be so operated that no waters shall be diverted or used by means of the project works, which, together with all other waters used in or diverted from the San Juan River Basin in New Mexico, will exceed the water available to the States of New Mexico and Arizona under the allocation contained in article III of the Upper Colorado River Basin compact for any water year.

Sec. 13. (a) The use of water, including that diverted from the Colorado River system to the Rio Grande Basin, through works constructed under authority of this Act, shall be subject to and controlled by the Colorado River compact, the Upper Colorado River Basin compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, the Colorado River Storage Project Act, and the Mexican Water Treaty (Treaty Series 994), and shall be included within and shall in no way increase the total quantity of water to the use of which the State of New Mexico is entitled and limited under said compacts, statutes, and treaty, and every contract entered into under this Act for the storage, use, and delivery of such water shall so recite.

(b) All works constructed under authority of this Act, and all officers, employees, permittees, licensees, and contractees of the United States and of the State of New Mexico acting pursuant thereto and all users and appropriators of water of the Colorado River system diverted or delivered through the works constructed under authority of this Act and any enlargements or additions thereto shall observe and be subject to said compacts, statutes, and treaty, as hereinbefore provided, in the diversion, delivery, and use of water of the Colorado River system, and such condition and covenant shall attach as a matter of law whether or not set out or referred to in the instrument evidencing such permit, license, or contract and shall be deemed to be for the benefit of and be available to the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming and the users of water therein or thereunder by way of suit, defense or otherwise in any litigation respecting the waters of the Colorado River system.

(c) No right or claim of right to the use of the waters of the Colorado River system shall be aided or prejudiced by this Act, and Congress does not, by its enactment, construe or interpret any provision of the Colorado River compact, the Upper Colorado River Basin compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, the Colorado River Storage Project Act, or the Mexican Water Treaty or subject the United States to, or approve or disapprove any interpretation of, said compacts, statutes, or treaty, anything in this Act to the contrary notwithstanding.

Sec. 14. In the operation and maintenance of all facilities under the jurisdiction and supervision of the Secretary of the Interior authorized by this Act, the Secretary is directed to comply with the applicable provisions of the Colorado River compact, the Upper Colorado River Basin compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, the Colorado River Storage Project Act and the treaty with the United Mexican States in the storage and release of water from reservoirs in the Colorado River Basin. In the event of the failure of the Secretary of the Interior to so comply, any State of the Colorado River Basin may maintain an action in the Supreme Court of the United States to enforce the provisions of this section, and consent is given to the joinder of the United States as a party in such suit or suits, as a defendant or otherwise.

Sec. 15. The Secretary of the Interior is directed to continue his studies of the quality of water of the Colorado River system, to appraise its suitability for municipal, domestic, and industrial use and for irrigation in the various areas in the United States in which it is used or proposed to be used, to estimate the effect of additional developments involving its storage and use (whether heretofore authorized or contemplated for authorization) on the remaining water available for use in United States, to study all possible means of improving the quality of such water and of alleviating the ill effects of water of poor quality, and to report the results of his studies and estimates to the Eighty-seventh Congress and every two years thereafter.

Sec. 16. (a) The diversion of water for either or both of the projects authorized in this Act shall in no way impair or diminish the obligation of the "States of the upper division" as provided in article III(d) of the Colorado River compact "not to cause the flow of the river at Lee Ferry to be depleted below an aggregate of seventy-five million acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact".

(b) The diversion of water for either or both of the projects authorized in this Act shall in no way impair or diminish the obligation of the "States of the upper division" to meet their share of the Mexican Treaty burden as provided in article III(c) of the Colorado River compact.

Sec. 17. Section 12 of the Act of April 11, 1956, shall not apply to the works authorized by this Act except as otherwise provided by section 10 of this Act.

Sec. 18. The Act of April 11, 1956, as amended, is hereby further amended as follows: (i) In section 1, subsection (2), after the words "Central Utah (initial phase)" delete the colon and insert in lieu thereof a comma and the words "San Juan-Chama (initial stage)," and after the word "Lyman" insert the words "Navajo Indian,"; (ii) in section 2 delete the words "San Juan-Chama, Navajo," from the first sentence; (iii) in section 5, subsection (e), in the phrase "herein or hereinafter authorized" delete the word "hereinafter" and insert in lieu thereof the word "hereafter"; (iv) in section 7 in the phrase "and any contract lawfully entered unto under said compacts and Acts" delete the word "unto" and insert in lieu thereof the word "into".

Approved June 13, 1962, 11:15 a. m.

Following passage of the authorizing legislation, efforts were made to obtain funds from the 87th Congress to initiate final project planning.

Rio Grande

RIO GRANDE COMPACT

The Rio Grande Compact was signed in Santa Fe on March 18, 1939, with Colorado, New Mexico, and Texas as parties. Representatives of the United States participated in all negotiations. The compact was ratified by the respective state legislatures and was approved by Congress on May 11, 1939. Article XII provides that the compact will be admin-

istered by a commission consisting of the State Engineers of Colorado and New Mexico, a commissioner for Texas, and a representative of the United States. The commission was organized in 1939 and has functioned continuously to date.

Members of the commission during the biennium were Berkeley Johnson, Federal representative and chairman; J. E. Whitten, commissioner for Colorado; S. E. Reynolds, commissioner for New Mexico; and Louis A. Scott, commissioner for Texas. The New Mexico commissioner was assisted in his administration by engineers and attorneys of the Interstate Stream Commission staff.

Activities of the commission during the biennial period consisted of routine administration and two annual meetings to compute the scheduled and actual delivery of water by the respective states under provisions of the compact. Budgets for operation of the commission were approved at the annual meetings.

The commission, in cooperation with the Corps of Engineers and the Bureau of Reclamation, developed and agreed upon regulations for the operation of Platoro Reservoir in Colorado for flood-control purposes.

Members of the commission met during the biennial period to review and discuss the Bureau of Reclamation's plan for development of the Closed Basin Division of the San Luis Valley Project in Colorado. The plan proposed by the Bureau of Reclamation would recover water now being lost by nonbeneficial use in the closed basin and would convey the salvaged waters to the Rio Grande for delivery to New Mexico and Texas. Action by the Colorado Water Conservation Board on the report of the Bureau was held up pending resolution of differences of opinion in Colorado on the proposed plan of development.

As a result of Colorado's continued inability to meet her schedule of deliveries under the Rio Grande Compact, the Governors of New Mexico and Texas requested of the Governor of Colorado that he expedite that state's processing of the Bureau report and that he urge the Bureau to complete and forward the report to the affected states for comment. In February 1962, the State of Colorado requested the Bureau to proceed with completion of the report in accordance with expressed desires of that state. At the end of the biennial period the report had not been released.

In 1961, following a request made by the commissioner for New Mexico, the Rio Grande Compact Commission gave its consent to a release of 10,000 acre-feet of water being retained in El Vado Reservoir as debit water. About 8,600 acre-feet of the amount authorized was released for use on lands in the Middle Rio Grande Conservancy District.

Costs of operation for the Rio Grande Compact Commission for the 49th fiscal year totaled \$29,310, New Mexico's share being \$5,380. The commission's budget for the 50th fiscal year totaled \$28,969, New

Mexico's share being \$5,373. The budget adopted for the 51st fiscal year totaled \$29,550, of which New Mexico's share will be \$5,500.

FLOOD CONTROL, CHANNEL REHABILITATION, ETC.

During the biennial period, the Bureau of Reclamation and the Corps of Engineers engaged actively in planning and construction of works in the Rio Grande basin to provide flood and sediment control and channel rectification.

The Bureau of Reclamation has completed a rectified channel extending from the San Acacia Diversion Dam to Elephant Butte Reservoir. About 75 miles of rectified channel is now available in this reach to convey low flows of the river. Also in this reach a floodway has been cleared and will be maintained to convey large riverflows. Eradication and control of saltcedars in the area above and below Elephant Butte Reservoir has been carried on by the Bureau of Reclamation in cooperation with the New Mexico State Engineer. The Bureau also operated the irrigation works of the Middle Rio Grande Conservancy District, including El Vado Reservoir, under contract with the district.

During the biennial period the engineering staff of the Interstate Stream Commission made independent, detailed studies of several reaches of the Rio Grande in an attempt to evaluate the effect on the riverflow of the works constructed; the staff also studied other reaches of the river for information on river losses or gains.

Jemez Reservoir was operated as needed for flood and sediment control by the Corps of Engineers.

Construction work on Abiquiu Dam and Reservoir, located on the Chama River a short distance above the village of Abiquiu, was continued during the biennial period under the direction of the Corps of Engineers. The works under active construction during the biennial period consisted of an earth and rock embankment and a spillway. Roads and utility lines were relocated. The project is scheduled for completion late in 1962. The estimated total cost of the project will be \$20,000,000.

The Corps of Engineers has continued construction of the Cochiti-Rio Puerco reach of the Rio Grande Floodway in a cooperative program with the Bureau of Reclamation.

Under the authority of resolutions of the Committee on Public Works, U. S. Senate, on June 28, 1956, and May 18, 1961, the Corps has initiated investigations of flood and sediment control on the Rio Puerco and Rio Salado, tributaries of the Rio Grande.

In July 1960, the President approved Public Law 86-645, authorizing construction of Cochiti and Galisteo Reservoirs for flood control and allied purposes. Cochiti Reservoir will be located on the main stem of the Rio Grande a short distance above the pueblo of Cochiti. Galisteo

Reservoir will be located on Galisteo Creek between the village of Cerillos and the U. S. Highway 85 crossing. During the biennial period the Corps continued preconstruction planning activities on these two structures to establish a final design of Cochiti Reservoir that will include regulation of flood-flows of Santa Fe River in that structure, rather than in Galisteo Reservoir as previously planned. As a result of this change the Corps was able to move Galisteo Dam to a more favorable site upstream from the site originally proposed. Both changes in the authorized plan had been approved by the State of New Mexico.

Efforts continued during the biennial period to provide water for a permanent pool in Cochiti Reservoir for fish and wildlife propagation and recreation. The legislation authorizing the reservoir requires that water to establish and maintain a permanent pool must be obtained from sources outside the Rio Grande basin. The city of Albuquerque has agreed to allow a portion of its tentative allocation of San Juan-Chama water to be reallocated to the purpose of filling and maintaining such a permanent pool. Senator Clinton Anderson has asked the Secretary of the Interior to determine whether the Bureau of Reclamation can furnish water from the San Juan-Chama Project to establish and maintain the pool on a nonreimbursable basis under existing authority. At the end of the biennial period, the matter was still pending.

In the matter of the application by the Plains Electric Generation and Transmission Cooperative, Inc., for a license to construct a power plant on the Rio Grande just below the mouth of Red River, the State of New Mexico on behalf of the State Engineer, the State Game Commission, and the State Park Commission filed, in December 1960, a "Petition for Leave to Intervene" before the Federal Power Commission. The Plains Electric plan would involve 1) pump-diversion of flows of both the Rio Grande and Red River to a small regulatory reservoir, and 2) release of water to a power plant located just below the mouth of Red River. The plant would use off-peak thermal and hydroelectric energy to lift the water for release to meet peak demands. Concern of the State Engineer in the matter involved 1) the nature and type of facilities for the use of water, and 2) enforcement of water laws involving use and distribution of the flows of the Rio Grande. The Federal Power Commission, in February 1961, filed an order permitting intervention. At the end of the biennial period, no further action had been taken in the matter.

COSTILLA CREEK COMPACT

The Costilla Creek Compact was signed in Santa Fe, on September 30, 1944, with the States of Colorado and New Mexico as parties. The compact was ratified by the respective state legislatures in 1945 and was

approved by the United States in June 1946. Article VIII of the compact provides for a commission made up of the State Engineers of the two signatory states.

Members of the commission during the biennium were J. E. Whitten, commissioner for Colorado; S. E. Reynolds, commissioner for New Mexico; and David P. Hale, acting commissioner for New Mexico. The New Mexico commissioner was assisted in his administration by members of the staff of the Interstate Stream Commission and by personnel of the Water Rights Division of the State Engineer Office.

Administration of the waters of Costilla Creek as required by the compact, including direct diversion of river flow and reservoir releases, is under the immediate supervision of a watermaster responsible to the New Mexico State Engineer. Activities of this watermaster are described in the State Engineer Office section of this report.

During the biennial period, the commission held regular annual meetings to receive reports on the administration of the waters of Costilla Creek for the preceding year, adopt budgets, and transact other business. The engineering staff of the Interstate Stream Commission prepared, for consideration by the commission, annual computations of water deliveries under the compact.

As a result of purchase and transfer of water rights in Colorado, the Colorado commissioner requested that a portion of Colorado's compact allocation to the Acequia Madre be delivered to Colorado via the Cerro Canal. The proposed transfer involved, among other matters, loss of water between the point of diversion and the State line. New Mexico contended that the requested change in point of State line delivery involved a substantive change requiring amendment of the compact. The New Mexico Interstate Stream Commission authorized its Secretary to negotiate with officials of the State of Colorado concerning proposed amendments to the compact and report back to the Commission. Accordingly, conferences were held and correspondence exchanged with representatives of Colorado regarding proposed amendments. At the close of the biennial period, no definite agreement had been reached between the negotiators. It is expected that negotiations will be continued during the 26th biennium.

The Bureau of Reclamation initiated a study to investigate the possibility of constructing additional storage facilities on Costilla Creek and rehabilitating existing works. The Bureau's report had not been completed at the end of the biennial period.

Costs of operation of the Costilla Creek Compact Commission for calendar year 1960 totaled \$16,991.44, of which New Mexico's share was \$5,600.10. For calendar year 1961 the total cost of operation of the commission was \$18,595.67, with New Mexico's share being \$6,085.33. For calendar year 1962 the adopted budget of the commission totaled \$19,500, of which New Mexico's share would be \$6,500.

Litigation involving waters of Costilla Creek, *State of New Mexico v. W. S. Ranch Company*, was continued during the biennial period. The district court had previously dismissed the action, ruling that New Mexico water users below Costilla Reservoir were indispensable parties to the case. The State appealed this judgment to the New Mexico Supreme Court and the Court allowed the appeal. Following the filing of briefs, the Supreme Court, on May 10, 1961, ordered the judgment of the district court affirmed with instructions. The following language is quoted from the order of the Supreme Court: "We conclude that the New Mexico claimants of water rights below the Costilla Reservoir are necessary and indispensable parties to this action, and to that extent the judgment of the trial court is affirmed. However, the trial court is instructed to vacate and set aside its judgment and to enter a new judgment dismissing the action but with leave to reinstate the action upon making the New Mexico claimants to water rights of the Costilla Creek system below Costilla Reservoir parties thereto, and for such other proceedings as may be required not inconsistent with the view expressed herein." The State appealed for a rehearing and the Supreme Court, on October 11, 1961, denied the appeal. Since the order of the Supreme Court was entered the State has been exploring the possibilities of additional legal action in the case. The State was represented in the litigation by the Attorney General and the legal staff of the Interstate Stream Commission.

Pecos River

PECOS RIVER COMPACT

The Pecos River Compact was signed in Santa Fe on December 3, 1948, by commissioners for New Mexico and Texas and a representative of the United States. The compact was ratified by the respective state legislatures and was subsequently approved by the Congress, becoming effective on June 9, 1949.

Article V of the compact provides for the formation of a commission to administer its provisions. During the 25th biennium the commission was composed of Berkeley Johnson, representative of the United States and chairman; George L. Reese, commissioner for New Mexico to February 29, 1961; David P. Hale, commissioner for New Mexico from May 8, 1961; and J. C. Wilson, commissioner for Texas. The New Mexico commissioner was assisted in his administration by members of the staff of the Interstate Stream Commission.

Mr. C. J. Anderson, engineer adviser to the Texas commissioner, died

on June 26, 1962. Mr. Anderson had been closely associated for many years with the Pecos River Compact. He had been General Manager and Irrigation Engineer for the Red Bluff Water Power Control District since 1943 and had served as an engineer adviser to the Texas commissioner since 1949.

In addition to routine transaction of business during the biennium, the commission engaged in the following activities: 1) final planning of the Malaga Bend Division of the McMillan Delta Project; 2) support of Federal legislation to authorize the Agricultural Research Service to engage in a comprehensive program of research and experimentation to determine growth characteristics of saltcedar and other phreatophytes, the hydrological and climatological factors influencing their use of water, and various techniques for the eradication and control of such plants; 3) continuation of studies concerning the refinement of computations for the inflow-outflow method of determining deliveries as provided by the compact; and 4) coordinated action with the Bureau of Reclamation on a feasibility study of the proposed Brantley Dam and Reservoir.

The compact commission continued financial cooperation with the Surface Water, Ground Water, and Quality of Water Branches of the U. S. Geological Survey to obtain factual data relating to waters of the Pecos River.

The commission has a standing Engineering Advisory Committee which has continued to function during the biennial period and which reports to the commission on its assigned activities. A subcommittee of the Engineering Advisory Committee cooperated with the Ground Water Branch of the Geological Survey and the Bureau of Reclamation in final planning of the Malaga Bend Division of the McMillan Delta Project. Another subcommittee continued its review and up-dating of basic engineering data, and submitted to the Engineering Advisory Committee a report entitled "Report on Review of Basic Data," dated October 18, 1960.

Staff members of the Interstate Stream Commission represented the State on the Engineering Advisory Committee and its subcommittees.

Mr. Robert T. Lingle continued in the employ of the commission as Secretary-Manager during the biennium. Mr. Lingle spent considerable time on the legislation authorizing the phreatophyte research program, and directed completion of the Pecos River Commission report entitled "A Decade of Progress." Mr. Lingle also worked in cooperation with various Federal agencies on completion of reports and planning of additional commission projects.

The cost of operation of the Pecos River Commission for the 49th fiscal year was \$64,123.82. For the 50th fiscal year the commission budget was \$60,490.00, and for the 51st fiscal year the budget is \$55,550.00. New Mexico's share in each year is half the total budget.

McMILLAN DELTA PROJECT

The McMillan Delta Project was authorized by Public Law 85-333, approved February 20, 1958. The project has two features: 1) the McMillan Delta Channelization Division, and 2) the Malaga Bend Salinity Alleviation Division.

The channelization division was authorized for construction substantially in accordance with the plan described in the report of the Secretary of the Interior entitled "McMillan Delta Project, Pecos River Basin, New Mexico," House Document 489, 84th Congress. The authorizing legislation states that no money shall be appropriated for, and no work commenced on, clearing of the floodway unless provisions have been made to replace any Carlsbad Irrigation District terminal storage which might be lost as a result of clearing of the floodway. At the request of the Pecos River Commission, the Bureau of Reclamation prepared a reappraisal report which presented a modified plan that would accomplish the major purposes of the authorized project and include, insofar as possible, the existing channel rectification works constructed by the Carlsbad Irrigation District. Final planning and construction of the channelization division of the authorized project has been held in abeyance at the request of the Carlsbad Irrigation District and the Red Bluff Water and Power Control District.

The Salinity Alleviation Division of the project was authorized on a nonreimbursable basis to accomplish alleviation of salinity conditions in the Pecos River basin substantially in accordance with a plan set forth in a 1954 report of the Geological Survey entitled "Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine, Malaga Bend, Eddy County, New Mexico." The plan contemplates pumping from the brine aquifer to intercept flow of brine to the river and disposing of the pumped brine in a surface reservoir.

In a search for a suitable disposal method, four additional reports have been completed. Three of the reports were prepared by the Geological Survey: 1) "Evaluation of the Queen Lake Depression as a Storage Basin for Brine, Eddy County, New Mexico," 2) "Memorandum on Quality of Brines, Eddy County, New Mexico," dealing with possible deep-well disposal of the brines, and 3) "The Suitability of Northeast Depression near Queen Lake, Eddy County, New Mexico, for Storing Brine." The fourth report, prepared by the Bureau of Reclamation, is entitled "Reappraisal Report, Malaga Bend Division, McMillan Delta Project." The Bureau report contemplated use of privately owned Laguna Grande de la Sal as a disposal area.

Early in 1962 it was decided to use the so-called Northeast Depression near Queen Lake as a disposal area. Final planning was accomplished, a contract was awarded, and construction was commenced

during the 25th biennium. The Interstate Stream Commission acquired the necessary private lands and easements for construction of the project from money appropriated by the 1961 New Mexico Legislature for the purpose of acquiring rights-of-way for the projects authorized by P. L. 85-333. The cost of acquiring the lands and easements for the Salinity Alleviation Division of the authorized project totaled \$1,567.25. This amount is fully reimbursable to New Mexico as provided in a contract between the United States, the New Mexico Interstate Stream Commission, and the Red Bluff Water and Power Control District.

OTHER DEVELOPMENT

The State of New Mexico, commenting on the Bureau of Reclamation's "Reconnaissance Report — Pecos River Basin, New Mexico-Texas," recommended that a feasibility study of Brantley Dam and Reservoir be undertaken. The Bureau of Reclamation has been actively engaged in this feasibility study since July 1961.

The Corps of Engineers awarded a contract in May 1961 in the amount of \$3,749,000 for construction of Two Rivers Reservoir Project on Rio Hondo in Chaves County, a few miles west of Roswell. The project is being constructed as a joint enterprise of the M. T. Reed Construction Company and Boyd Construction Company, both of Jackson, Miss. Construction of the project was proceeding at the end of the biennial period. Completion was scheduled for the latter part of 1962. This project will provide much-needed flood control for the city of Roswell, Walker Air Force Base, and adjoining areas; it also will provide some incidental flood control in the Pecos River valley below the confluence of Rio Hondo with the Pecos River.

The Los Esteros-Alamogordo Reservoir Project was authorized in 1954 by Public Law 780, 83rd Congress. The project involves construction of a dam about 10 river miles above Santa Rosa; and, in order to create an effective flood-control project, it is necessary to use a part of the capacity of existing Alamogordo Reservoir to control floodflows originating between the Los Esteros site and Alamogordo Dam. For this reason the Corps of Engineers' plan includes conservation-storage capacity for the Carlsbad Irrigation District in the proposed Los Esteros Reservoir to compensate the district for 70,000 acre-feet of capacity in Alamogordo Reservoir that would be reserved for flood control.

The legislation authorizing the Los Esteros Project provides that no appropriations shall be made for construction of the project until satisfactory arrangements have been made by the State of New Mexico for transfer of part of the Carlsbad Irrigation District conservation storage from Alamogordo Reservoir to Los Esteros Reservoir. The Carlsbad Irrigation District requested that certain river-routing studies be made

so that possible effects of such a transfer on the district's water supply could be analyzed in detail.

Because of the complex nature of the studies, the Interstate Stream Commission contracted with Texas Research Associates of Austin, Tex., for the services of an electronic computer in making the river-routing studies.

Considerable time was spent by staff members of the Interstate Stream Commission in preparing the criteria, assembling the necessary basic data, and reviewing the studies. Results of the investigations were made available to the Carlsbad Irrigation District, the Bureau of Reclamation, and the Corps of Engineers.

At the close of the biennium the Carlsbad Irrigation District had not completed appraisal of the studies and had not reached a decision on the transfer of some of the conservation capacity from Alamogordo Reservoir to the proposed Los Esteros Reservoir.

Canadian River

CANADIAN RIVER COMPACT

The Canadian River Compact was signed in Santa Fe, N. Mex., on December 6, 1950, with the States of New Mexico, Oklahoma, and Texas as parties. A representative of the United States participated in the negotiations. The compact was duly ratified by the respective state legislatures; it was subsequently approved by Congress and became effective on May 19, 1952.

Article IX of the compact provides for a commission to administer its provisions. Members of the Canadian River Commission during the biennial period were: Clyde M. Reed, Jr., commissioner for the United States and chairman; S. E. Reynolds, commissioner for New Mexico and secretary; L. L. Males, commissioner for Oklahoma; and C. Everett Fulgham, commissioner for Texas. Frank J. Raab served as alternate commissioner for Oklahoma during the biennial period. The New Mexico commissioner was assisted in his administration by members of the staff of the Interstate Stream Commission.

The compact commission held two annual meetings during the biennial period to transact routine business.

To date the commission has not established an operating budget; the expenses of its respective commissioners and advisers are paid by the governments they represent.

UTE DAM AND RESERVOIR SITE INVESTIGATIONS

In 1959 the New Mexico Legislature enacted a law authorizing the

Interstate Stream Commission to issue bonds guaranteed by \$5 million of severance-tax revenues to finance the construction of dams on the Canadian River and/or its tributaries below Conchas Dam in New Mexico. Questions regarding the mechanism of pledging severance-tax revenues which might affect the salability of the bonds guaranteed under the 1959 legislation caused a delay in proceeding with the investigations during 1959 and 1960. The 1961 Legislature enacted amended legislation to correct deficiencies of the 1959 law.

Starting in 1955, reconnaissance investigations of potential reservoir sites below Conchas Dam have been carried out for the Commission by personnel of the State Engineer Office. The investigations indicated that a site, designated as the "Ute site," on the Canadian River about 1 mile west of Logan, N. Mex., offered the best potentialities for construction of a dam and reservoir within the available funds. Following passage of the 1961 legislation, the Interstate Stream Commission authorized its Secretary to enter into negotiations to contract with Bechtel Corporation (Professional Engineers) of San Francisco, Calif., to prepare for the Commission's consideration a report of feasibility of constructing a dam to be located at the Ute site. In July 1961, the Commission approved a contract with Bechtel Corporation for this work. Further details of Bechtel's investigation are presented in the State Engineer Office section of this report.

The legislation authorizing the severance-tax bonds for construction of dams on the Canadian River below Conchas Dam directed that the Interstate Stream Commission should not allow construction to commence until it had reasonable assurance that the project would produce sufficient income with which to pay the cost of operation and maintenance of the dams constructed. The Commission negotiated with the New Mexico Game and Fish Commission for funds to be used for operation and maintenance purposes. On September 19, 1961, the Interstate Stream Commission accepted in principle a State Game and Fish Commission proposal which assured operation and maintenance costs, subject to resolution of problems of land acquisition, design, construction, and operation related to the project.

On November 21, 1961, after reviewing studies made by Bechtel Corporation, the Commission directed Bechtel to proceed with a basic design report of a dam and reservoir at the Ute site with a storage capacity of about 107,000 acre-feet. Accordingly, in January 1962, Bechtel submitted to the Commission a basic design setting forth plans for construction at the Ute site which, it was estimated, could be paid for with the available funds. After review, the Commission directed Bechtel to proceed with the second phase of work under the contract between the Commission and Bechtel, consisting of preparing designs and specifications and advertising for bids. The Commission directed Bechtel to prepare invitations for bids on three alternative structures at the Ute site.

At this time the Commission also directed its Secretary to arrange with the State Board of Finance to issue the bonds authorized by the Legislature to secure funds for construction of Ute Dam and Reservoir. This action by the Interstate Stream Commission followed receipt of assurance from the State Game Commission that the Game Commission would assume operation and maintenance costs estimated to be \$20,000 a year.

In October 1961, the Commission retained Mr. Earl Lostetter, a professional appraiser, to make a reconnaissance appraisal of land and property which might be necessary for the construction of Ute Dam and Reservoir. The State Land Office cooperated by providing reconnaissance cost appraisal of State lands that would have to be acquired. Mr. Lostetter was also retained by the Commission to make final appraisals.

On June 11, 1962, the Commission entered an agreement with the Bureau of Land Management, Department of the Interior, for cadastral surveys of the reservoir area.

During the spring and summer of 1962 the Commission took action regarding 1) acquisition of rights-of-way for the construction of the dam, 2) acquisition of lands in the reservoir area, 3) surveying of the reservoir site to delineate the area to be acquired in fee and easement, and 4) consideration of specifications prepared by Bechtel for the invitation of bids to construct the project. The matter of acquiring lands for construction of the dam and for the reservoir area was complex in that lands in Federal, State, and private ownership were involved.

On July 24, 1962, the Commission met in Tucumcari to attend the opening of bids for the construction of the dam and spillway and appurtenant works. Upon consideration of the bids tendered and in view of the bid on Alternative Plan A (the large dam), the Commission made an effort to secure additional money for construction of the project. Funds were sought from 1) the use of interest accruing on the reinvestment of proceeds of the bond issue, 2) an assurance by the State Game Commission that the agency would contribute additional funds toward construction of the reservoir, if necessary, to cover contingencies, and 3) a commitment from the State Board of Finance for access to emergency funds if found necessary to cover contingencies. The efforts were successful.

On August 6, 1962, the Commission met in Tucumcari to attend the sale of the State lands needed for construction of the dam. Mr. L. C. Strawn, acting for the Commission, bid the appraised price of the lands as advertised and the Interstate Stream Commission was the successful bidder. At this meeting the Commission recommended to the State Purchasing Agent the award of a contract to the low bidder, W. A. Smith Contracting Company, Kansas City, Kans., for construction of Alternative Plan A for a dam, spillway, and appurtenant works, contingent upon formal action by the Board of Finance for approval of the use of interest

accruing to the severance bond issue fund and approval by the Board of Finance of setting aside of additional money for a contingency fund to be used only if needed to defray costs of the project. On August 7, 1962, the Commission issued a notice of contract award to W. A. Smith Contracting Company, and on August 27, 1962, signed a contract with the company for construction of Commission Alternative Plan A.

The Commission directed Bechtel to proceed under phase C of its contract with Bechtel for the supervision of construction of the Ute Dam and Reservoir Project.

The Commission also entered an agreement with the Museum of New Mexico to conduct an archaeological survey and archaeological salvage program on sites within the reservoir area, in the dam construction zone, and in other adjacent areas. Under terms of the contract, the Museum would conduct the survey and salvage of any artifacts found to be worthy of salvage.

Cimarron River

Early in 1962 the U. S. Army Corps of Engineers issued a notice of initiation of a Review Survey for Flood Control on the Cimarron River and its tributaries in Oklahoma, Kansas, Colorado, and New Mexico, and of a public hearing to be held to afford State and local interests an opportunity to present to the Corps flood-control problems, estimates of flood damages, and plans of desired improvements. Members of the staff of the State Engineer Office and the Interstate Stream Commission reviewed existing reports, made a field inspection of the Cimarron River in New Mexico, and attended a meeting with local interests at Folsom, N. Mex. A statement setting forth the State's interest in the flood-control investigation on the Cimarron River was presented in April 1962 at a public hearing in Liberal, Kans.

Review of Reports of Other Agencies

The Flood Control Act of 1944, together with other Federal legislation, provides for review by the affected states of reports prepared by Federal and certain other agencies on proposed water-development projects. The Governor has designated the State Engineer as reviewing official for the State of New Mexico. On proposed projects involving interstate problems or operation under interstate compacts, as well as on certain proposed projects involving intrastate problems, the State Engineer, as Secretary of the Interstate Stream Commission, delegates much of the work of review to the staff of the Interstate Stream Commission.

The review of many of these reports requires detailed engineering and economic analysis in order to determine the feasibility and potential effect of the proposed works on other existing or authorized projects, on individual water rights, and on operation of interstate compacts. The Federal agencies have cooperated fully with the State Engineer and the Interstate Stream Commission in supplying details and basic data as required by the staff to complete these reviews.

During the biennial period the staff of the Interstate Stream Commission reviewed and prepared comments on the following reports:

1. Proposed report of the Regional Director (Bureau of Reclamation) on Buttes Dam and Reservoir, Middle Gila Project, Arizona.
2. The Secretary of the Interior's feasibility report on the Waurika Project, Oklahoma.
3. Board of Engineers' (Corps of Engineers) report on Survey for Flood Control, Gila River, Arizona, with particular reference to a dam at or near the Camelsback site.
4. The Secretary of the Interior's feasibility report on the Arbuckle Project, Oklahoma.
5. Chief of Engineers' (Corps of Engineers) interim report on Survey for Flood Control, Gila River, Arizona, with particular reference to a dam at or near the Camelsback site.
6. Proposed report of the Regional Director (Bureau of Reclamation) on the Animas-La Plata Project, Colorado and New Mexico.
7. The Secretary of Interior's feasibility report on Buttes Dam and Reservoir, Middle Gila Project, Arizona.
8. District Engineer's (Corps of Engineers) proposed report on Review Survey for Flood Control, Rio Grande and Tributaries, at Las Cruces, New Mexico.
9. Proposed report of the Regional Director (Bureau of Reclamation) on the Mountain Park Project, Oklahoma.
10. The Secretary of the Interior's feasibility report on the Bostwick Park Project, Colorado.
11. District Engineer's (Corps of Engineers) proposed report on Review Survey for Flood Control of the streams at and in the vicinity of Alamogordo, New Mexico, Tularosa (closed) Basin.
12. Report for Small Projects Loan Application for Orchard City Irrigation District, Orchard City, Colorado.
13. Chief of Engineers' (Corps of Engineers) report on Review Survey for Flood Control of the streams at and in the vicinity of Alamogordo, New Mexico, Tularosa (closed) Basin.
14. The Regional Director's (Bureau of Reclamation) reconnaissance report on the Mimbres (closed) Basin, New Mexico.

15. Chief of Engineers' (Corps of Engineers) report on Review Survey for Flood Control, Rio Grande and Tributaries, at Las Cruces, New Mexico.
16. The Secretary of the Interior's feasibility report on the Dixie Project, Utah.
17. The Secretary of the Interior's feasibility report on Fruitland Mesa Project, Colorado.

Cooperation with the U. S. Geological Survey

During the biennial period the Interstate Stream Commission continued its program of cooperation with the Surface Water and Quality of Water Branches of the U. S. Geological Survey to obtain basic data for use in administration of interstate compacts and other water-resource investigations. Moneys provided by the Commission are matched by the Geological Survey to finance operation of stream-gaging, quality-of-water, and sediment-data stations, as well as for making miscellaneous measurements and conducting seepage runs and other investigations.

Under cooperative agreements with the Interstate Stream Commission, the State Engineer Office, and other interested agencies, the Surface Water Branch of the Geological Survey directs the measurement, computation, and publication of data on streamflow and reservoir contents in New Mexico. These records are essential for administration of the waters of the State, for determination of delivery obligations and water delivery under the compacts to which the State is a party, for the numerous hydrologic studies made by the Interstate Stream Commission in connection with administration of compacts, and for general water-resource investigations. These measurements, published and released by the Geological Survey, are used extensively by other State, Federal, and private agencies in their investigations and studies of water resources.

The Quality of Water Branch of the Geological Survey, under cooperative agreements with the Interstate Stream Commission and other agencies, directs the collection, computation, and publication of chemical-analysis and suspended-sediment data of waters in New Mexico. Records of chemical analysis and suspended sediment serve several useful purposes in the field of water-supply study. Chemical-quality data are used principally in determining suitability of water for various uses and in determining salt-balance conditions for irrigated areas. Sediment data are used chiefly in connection with designing reservoir capacities, planning diversion and distribution works, and in studies of sediment movement in and through stream channels. The program of the Quality of Water Branch during the biennium consisted of maintaining chemical-quality and sediment-discharge stations in the various river basins of the

State, together with taking and analyzing miscellaneous surface- and ground-water samples for specific investigations.

Lists of stream- and reservoir-gaging stations, quality-of-water stations, and suspended-sediment stations in operation in New Mexico during the biennial period appear in the State Engineer Office section of this report. Stations financed cooperatively by the Interstate Stream Commission and State Engineer with the Geological Survey are identified in the tabulation. During the 49th fiscal year \$51,453.43 was expended by the Interstate Stream Commission and an additional \$16,848.00 was disbursed through the Pecos River Commission in support of cooperative programs with the U. S. Geological Survey. In the 50th fiscal year the Commission spent \$57,973.77 and an additional \$16,172.00 through the Pecos River Commission in support of the cooperative programs. Funds for New Mexico's participation in the program of the Pecos River Commission were included in the appropriation to the Interstate Stream Commission.

Improvement of the Rio Grande Income Fund

In 1898, under terms of the so-called Ferguson Act, the Congress of the United States granted 100,000 acres of land to the Territory of New Mexico, the income from which is to be used for increasing the flow of water in the bed of the Rio Grande. By statute, the Interstate Stream Commission is delegated the responsibility for preparing budgets and submitting plans for use of the income from this fund.

During the biennium the major expenditures from this fund were for construction of water-salvage works, elimination and control of the growth of nonbeneficial water-consuming vegetation, operation of sediment-data stations, and operation of special stream-gaging stations. The program of water-salvage work to increase the flow of the Rio Grande was accomplished in cooperation with the Bureau of Reclamation. Activities of this program are described in the State Engineer Office section of this report.

New Mexico Irrigation Works Construction Fund

Under the terms of the Ferguson Act of 1898, New Mexico was also granted lands the income from which is creditable to the Permanent Reservoirs for Irrigation Purposes Income Fund (Water Reservoirs Income Fund). In 1955, the State Legislature created the New Mexico Irrigation Works Construction Fund and provided that it would receive, among other revenues, money previously credited to the Permanent

Reservoirs for Irrigation Purposes Income Fund. The act placed the fund under the administration of the Interstate Stream Commission and authorized expenditures to meet the costs of investigations, construction, and other expenses directly chargeable to a proposed water-development project. Such expenses properly chargeable to any feasible project are reimbursed to the fund. The legislature amended the 1955 act in 1957 and 1959 to authorize the Commission to make loans from the Irrigation Works Construction Fund for necessary engineering and design work, construction, and rehabilitation of irrigation projects.

The Commission has authorized expenditure of funds to finance preliminary reconnaissance investigations of irrigation projects which appear to offer promise. If such preliminary investigations indicate a feasible project and if local interests form an acceptable contracting agency, the Commission may contract for a feasibility study.

The Attorney General has held that the moneys credited to the Irrigation Works Construction Fund from the Permanent Reservoirs for Irrigation Purposes Income fund may not be used to finance investigations for the development of water supplies for municipal and industrial uses where no commercial irrigation is involved.

In the biennial period the Commission disbursed money under appropriate contracts to two organizations for use in rehabilitation of existing irrigation works, ditch lining, installation of drainage works, and land-leveling programs. The two organizations, the Pecos Valley Artesian Conservancy District and the Hagerman Irrigation Company, had previously entered contracts with the Commission for loans. During the biennial period the Commission entered additional agreements with both entities to modify the original contracts in the matter of repayment and other minor provisions. The programs of both the district and the company are designed to improve distribution and conservation of the water supplies of both organizations.

Under provisions of agreements and contracts previously entered with five organizations named below, the Commission has provided money from the New Mexico Irrigation Works Construction Fund and the organizations are making repayment to the fund. Under the program of the Pecos Valley Artesian Conservancy District, money borrowed from the Commission is loaned to individuals of the District. The Hagerman Irrigation Company is using the proceeds of its loan to repair works of the company. The Antelope Valley Irrigation District used the proceeds of its loan for repair and rehabilitation of a dam, reservoir, and other works. A feasibility study for the repair and rehabilitation of Cabresto Dam was financed under appropriate agreement with the Llano Irrigation Company and the Cabresto Lake Irrigation Company. Under appropriate agreement with the town of Santa Rosa, a feasibility study for improving the water supplies in that area was financed.

Studies during the biennium were authorized or continued on the following proposed projects, each of which is discussed in greater detail in the State Engineer Office section of this report.

1. Cuchillo Project. An investigation for rehabilitation of irrigation works and for developing a reliable water supply for irrigation of lands near the village of Cuchillo in Sierra County.
2. El Rito Project. An investigation of water supply and distribution problems affecting lands of the El Rito Watershed Development Association in Rio Arriba County.
3. Palomas Project. An investigation to determine methods for improving the water supply and distribution system for lands along the Palomas River near Palomas in Sierra County.
4. Pecos Basin Water Salvage. A study to define ground-water movement and use by nonbeneficial vegetation in the Pecos River basin in cooperation with U. S. Geological Survey and the New Mexico Institute of Mining and Technology.
5. Dixon Project. An investigation to determine feasible means of rehabilitating the irrigation works to improve distribution of available water supplies to lands irrigated from Embudo Creek in the vicinity of Dixon in Taos County. The reconnaissance report was completed and distributed to interested persons and agencies.
6. Monticello Project. An investigation for improving the water supply and distribution system serving the lands irrigated from the Alamosa River in the vicinity of Monticello in Sierra County.
7. Uplands Watershed Study. A cooperative investigation undertaken by Federal and State agencies and private groups under the direction of the State Planning Office to provide basic data pertaining to resources of the Embudo Creek watershed. These data would be used to develop a plan for improving the economy of the area and to rehabilitate three community ditch systems serving lands in the vicinity of Penasco. A report entitled "Embudo, a Pilot Planning Project for the Embudo Watershed of New Mexico" was completed and distributed to interested persons and agencies.
8. Manzano Mountains Project. An investigation to determine the possibility of developing a combination irrigation and recreation project along the eastern slope of the Manzano Mountains. A reconnaissance report was completed and delivered to the New Mexico Department of Game and Fish.

Staff engineers of the Interstate Stream Commission have participated in establishing criteria for studies of these projects and have reviewed completed reports.

The 1959 New Mexico Legislature appropriated \$100,000 from the

Irrigation Works Construction Fund to be expended under supervision of the State Engineer to provide assistance in meeting costs of the most urgently required rehabilitation of several small community ditches in Guadalupe and San Miguel Counties. A detailed discussion of the work accomplished during the biennial period is contained in the State Engineer Office section of this report.

From the New Mexico Irrigation Works Construction Fund, the 1961 New Mexico Legislature appropriated \$35,000 to finance repair and improvement of certain dams, reservoirs, and ditches located in Guadalupe County, and \$50,000 and \$30,000 to finance similar work in San Miguel and Taos Counties, respectively.

Both the 1959 and 1961 legislative appropriations were made as direct grants. Following the 1961 enactment, the Interstate Stream Commission instituted a suit in the District Court of Santa Fe County to restrain the State Engineer from spending Irrigation Works Construction funds from the appropriations made by the 1961 Legislature on the grounds that the legislation was in violation of the trust established by the Ferguson Act of 1898. During the remainder of the biennial period the matter was in the courts and no expenditures were made of the money appropriated in 1961.

Disbursements from the New Mexico Irrigation Works Construction Fund in the biennial period, including loans, totaled \$615,503.14. Repayment to the fund during the period totaled \$16,593.34.

Associated Activities

In addition to its regular work, the Interstate Stream Commission and its staff continued participation in activities of the Arkansas-White-Red River Basins Inter-Agency Committee, the Pacific Southwest Inter-Agency Committee, the National Reclamation Association, the National Rivers and Harbors Congress, the Southwest Water Council, the State Mapping Advisory Committee, and the Council of State Governments.

ARKANSAS-WHITE-RED RIVER BASINS INTER-AGENCY COMMITTEE

This interagency committee was established in 1950 to study a plan for comprehensive water development in the basins of the Arkansas, White, and Red Rivers. Included in the area are parts of the States of New Mexico, Colorado, Texas, Oklahoma, Kansas, Missouri, Arkansas, and Louisiana. The area of New Mexico involved in the study included all or parts of Colfax, Curry, Guadalupe, Harding, Mora, Quay, San

Miguel, and Union Counties. The greater portion of the area is in the drainage of the Cimarron and Canadian Rivers, both of which are tributary to the Arkansas River. After completion of the original study and publication of a report in 1955, a permanent committee was set up to coordinate activities and exchange information. The committee is composed of representatives of Federal agencies and of the states concerned.

During the biennial period the State Engineer served as the Governor's representative on the committee. Four to six meetings of the committee are scheduled each year and several subcommittees or *ad hoc* committees are appointed from time to time to study special technical problems as they arise.

PACIFIC SOUTHWEST INTER-AGENCY COMMITTEE

The Pacific Southwest Inter-Agency Committee has been active for several years in an area which includes the Colorado River basin, the Great Basin, and the State of California. The committee is composed of representatives of Federal agencies and of the states concerned. The New Mexico portion of the area includes all of the State west of the Continental Divide, comprising the drainage areas of the San Juan, Little Colorado, and Gila Rivers within New Mexico.

Four meetings of the committee are scheduled each year to exchange information and correlate technical activities. Six subcommittees (executive, hydrology, sedimentation, phreatophyte, recreation, and quality) have been established to study and report to the parent committee on the technical aspects of special problems. The Executive Subcommittee prepares agenda, sets up meetings, and coordinates activities of the technical subcommittees. During the biennial period the Governor's representative on this committee was the State Engineer. The State was also represented on the Phreatophyte and Sedimentation Subcommittee by J. G. Koogler of the State Engineer Office — on the Hydrology, Recreation, and Quality of Water Subcommittees by David P. Hale, Interstate Stream Engineer.

NATIONAL RECLAMATION ASSOCIATION

The National Reclamation Association is composed of representatives of state and local agencies interested in reclamation activities and water-development projects in the western United States. The association maintains an office and staff in Washington, D. C., and issues a weekly bulletin describing the progress of legislation concerning water-resources development and related matters which may affect the so-called Reclamation States. The association holds an annual meeting to transact business and adopt resolutions relative to national water policy. The association

has several standing committees that study and report on the various aspects of the nation's water problems.

S. E. Reynolds has served on the association's Water Policy Committee for several years. I. J. Coury, chairman of the Interstate Stream Commission, served as New Mexico State Director of the National Reclamation Association during the biennial period.

NATIONAL RIVERS AND HARBORS CONGRESS

The National Rivers and Harbors Congress reviews proposed projects pertaining to flood control and navigation, harbor improvements, and reclamation works. It considers the merits of proposed projects and, if deemed warranted, endorses them on the basis of engineering and economic justification. Endorsement of a project by this group is helpful in securing authorization of construction from the United States Congress. The organization has in the past given its full endorsement to plans for projects throughout New Mexico.

I. J. Coury and Phil Maestas attended the meetings of the congress during the biennium.

NEW MEXICO MAPPING ADVISORY COMMITTEE

The New Mexico Mapping Advisory Committee was organized in 1953 to study State mapping requirements, to coordinate mapping requests, and to transmit requests for mapping to the Topographic Branch of the U. S. Geological Survey.

The committee considers requests and recommends priorities in accordance with determined need and degree of interest in State mapping. It issues periodic reports containing information on the status of mapping, priorities of requests, lists of available maps, index sheets, etc. The reports of the committee have been very well received by the Topographic Branch. The efforts of the committee are reflected in the accelerated program of much-needed topographic mapping that was undertaken in the State by the Geological Survey during the biennium. Additional description of the activities of this committee is contained in the State Engineer Office section of this report.

Carl L. Slingerland served on the committee and as its chairman during the biennial period.

SOUTHWEST WATER COUNCIL

The Southwest Water Council was organized in 1960. Its membership is composed of representatives of the seven states of the Colorado

River basin and its objective is to promote the exchange of information on matters affecting the long-range water-resources-development program of the Colorado River basin. The Governor has designated S. E. Reynolds as his representative on the council and David P. Hale has acted as alternate representative. During the biennium the council organized, adopted by-laws, and held several meetings.

COUNCIL OF STATE GOVERNMENTS

The Council of State Governments is an organization of representatives of various states concerned with Federal-state relations and with problems of interstate agencies. Recently the Council has been actively concerned with several interstate problems concerning water resources and the function of interstate compacts dealing with water supply. S. E. Reynolds has attended several sessions of various committees established by the Council of State Governments to discuss Federal legislation and its effect on interstate compact commissions and on matters concerned with control of water pollution.

FINANCIAL STATEMENTS, 1960-62

Statements showing receipts and disbursements during the 49th and 50th fiscal years to and from the Interstate Stream Commission Fund, the Improvement of the Rio Grande Income Fund, the Water Reservoirs Income Fund, and the New Mexico Irrigation Works Construction Fund follow. The New Mexico Irrigation Works Construction Fund consists of income creditable to the Permanent Reservoirs for Irrigation Purposes Income Fund (Water Reservoirs Income Fund).

The 1961 State Legislature appropriated money to the Interstate Stream Commission for acquiring rights-of-way and for other purposes in connection with water-development projects on the Pecos River authorized by Public Law 85-333. The amount appropriated by the 1961 legislature was \$247,200. Expenditures from this fund during the biennial period for purchase of rights-of-way and easements for the Malaga Bend Salinity Alleviation Division of the authorized project amounted to \$1,567.25. The remainder is available for expenditure in the 51st fiscal year.

During the 50th fiscal year, the Interstate Stream Commission began disbursement of funds from proceeds of bonds issued to finance construction of Ute Dam on the Canadian River below Conchas Dam. Disbursements from the Ute Dam Fund during the biennial period are shown in the appropriate financial statement.

Interstate Stream Commission Fund

FORTY-NINTH FISCAL YEAR

July 1, 1960, to June 30, 1961

Balance, July 1, 1960 \$ 0.00

Receipts:

General Fund appropriation	\$267,650.00
Use of money and property	184.50
Refunds and reimbursements	
Colorado share, Costilla Creek	
Compact expense, prior year	\$ 2,832.41
Regular transfer, prior year	67.30
Transfer to Hydrographic Survey, prior year	(653.46)

Colorado share, Costilla Creek		
Compact expense, current year	2,767.68	
Regular transfer, current year	182.49	5,196.42
	<hr/>	<hr/>
Total receipts		\$273,030.97
Disbursements:		
Personal services		
Regular	\$62,082.34	
Temporary	2,935.00	
Terminal	1,149.08	
Professional retainers	5,000.00	\$ 71,166.42
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Employee benefits		
Group insurance	179.28	
Retirement, State share	3,558.27	
Social Security, State share	1,350.31	5,087.86
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Travel and automotive		
In-State mileage and fares	476.42	
In-State meals and lodging	491.50	
Out-State mileage and fares	8,119.06	
Out-State meals and lodging	2,097.50	
Gas and oil, auto	494.33	
Maintenance and repairs, auto	481.33	
Insurance, auto	200.00	
Rental, transportation	1,885.43	14,245.57
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Maintenance and repairs		
Furniture, fixtures, and equipment	63.39	
Maintenance supplies	40.39	103.78
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Supplies and materials		
Office supplies	493.41	493.41
	<hr/>	
Professional services		
Audit	2,000.00	
Attorney fees	3,087.50	
Engineering fees	13,226.94	
Litigation	19,156.78	37,471.22
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Communications		
Postage	300.00	
Telephone and telegraph	1,575.33	1,875.33
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Other expenditures		
Property insurance	11.16	
Workmen's compensation	200.00	
Freight and express	4.42	
Subscriptions, dues, and publications	209.26	

Board expense	1,137.69	
Cooperative agreements		
Pecos River Compact	30,452.65	
USGS, surface water	22,800.00	
USGS, quality of water	19,969.99	
Rio Grande Compact	1,473.44	
Upper Colorado River Compact	11,250.00	87,508.61
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Capital outlay		
Equipment	430.00	
Automotive	1,702.82	2,132.82
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Transfer to General Fund		52,945.90
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Total disbursements		\$273,030.92
		<hr/>
Balance, June 30, 1961		\$ 0.00
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FIFTIETH FISCAL YEAR
July 1, 1961, to June 30, 1962

Balance, July 1, 1962 \$ 0.00

Receipts:

General Fund appropriation		\$269,650.00
Use of money and property		184.50
Refunds and reimbursements		
Colorado share, Costilla Creek		
Compact expense, prior year	\$ 3,435.32	
Colorado share, Costilla Creek		
Compact expense, current year	2,650.01	
Airline and other, prior year	118.64	
Airline and other, current year	199.45	
Transfer to Hydrographic		
Survey, prior year	(3,405.31)	2,998.11
	<hr/>	<hr/>
Total receipts		\$272,832.61

Disbursements:

Personal services		
Regular	\$77,980.40	
Professional retainers	4,999.98	\$ 82,980.38
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Employee benefits		
Group insurance	196.56	
Retirement, State share	4,148.77	
Social Security, State share	1,357.90	5,703.23
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Travel and automotive		
In-State mileage and fares	535.15	

In-State meals and lodging	627.50	
Out-State mileage and fares	5,924.74	
Out-State meals and lodging	1,675.00	
Gas and oil, auto	469.70	
Maintenance and repairs, auto	338.52	
Insurance, auto	160.00	
Rental, transportation	1,698.79	11,429.40
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Maintenance and repairs		
Furniture, fixtures, and equipment	190.05	190.05
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Supplies and materials		
Office supplies	818.34	818.34
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Professional services		
Printing services	169.03	
Audit	1,500.00	
Attorney fees	1,462.25	
Engineering fees	13,072.67	
Litigation	7,209.81	23,413.76
	<hr/>	
Communications		
Postage	300.00	
Telephone and telegraph	1,870.41	2,170.41
	<hr/>	
Insurance and bonds		
Property insurance	11.16	
Workmen's compensation	100.00	111.16
	<hr/>	
Capital outlay		
Furniture and fixtures	244.30	
Equipment	340.00	
Automotive	1,769.14	2,353.44
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Other expenditures		
Freight and express	12.33	
Subscriptions, dues, and licenses	587.50	
Board expense	1,676.02	
Services to other agencies	48.00	
Cooperative agreements		
Pecos River Compact	30,245.00	
USGS, surface water	22,800.00	
USGS, quality of water	24,134.77	
Rio Grande Compact	1,374.00	
Upper Colorado River Compact	11,587.50	92,465.12
	<hr/>	
Transfer to General Fund		51,197.32
		<hr/>
Total disbursements		\$272,832.61
		<hr/>
Balance, June 30, 1962		\$ 0.00
		<hr/> <hr/>

Improvement of the Rio Grande Income Fund

FORTY-NINTH FISCAL YEAR

July 1, 1960, to June 30, 1961

Balance, July 1, 1960		\$196,415.45
<i>Receipts:</i>		
Use of money and property	\$ 93,152.15	
Refunds and reimbursements	36.00	
	<hr/>	
Total receipts		\$ 93,188.15
<i>Disbursements:</i>		
U. S. Bureau of Reclamation, Caballo Reservoir, phreatophytes	\$ 10,435.00	
Middle Rio Grande, water salvage	100,000.00	
Rio Grande Basin, water- salvage investigation	6,600.00	\$117,035.00
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USGS, quality of water	7,210.00	
Transfers to Investment Council	167.86	
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Total disbursements		\$124,412.86
Excess disbursements over receipts		(\$ 31,224.71)
Balance, June 30, 1961		<u>\$165,190.74*</u>
*Ending balance is made of the following:		
Cash	\$ 60,190.74	
Certificates of deposit	\$105,000.00	
	<hr/>	
	\$165,190.74	

FIFTIETH FISCAL YEAR

July 1, 1961, to June 30, 1962

Balance, July 1, 1961		\$165,190.74
<i>Receipts:</i>		
Use of money and property	\$ 62,779.81	
Refunds and reimbursements		
U. S. Bureau of Reclamation	2,140.00	
	<hr/>	
Total receipts		\$ 64,919.81
<i>Disbursements:</i>		
U. S. Bureau of Reclamation, Caballo Reservoir, phreatophytes	\$ 11,670.00	

Middle Rio Grande, water salvage	140,000.00	
Wm. K. Holt Machinery Co.	7,468.00	
Rust Tractor Co.	5,210.60	
Rio Grande Basin, water- salvage investigation	4,500.00	\$168,848.60
	<hr/>	
USGS, quality of water		3,665.00
USGS, surface water		6,000.00
Transfers to Investment Council		314.16
		<hr/>
Total disbursements		\$178,827.76
		<hr/>
Excess disbursements over receipts		(\$113,907.95)
		<hr/>
Balance, June 30, 1962		\$ 51,282.79

Water Reservoirs Income Fund

FORTY-NINTH FISCAL YEAR

July 1, 1960, to June 30, 1961

Balance, July 1, 1960		\$ 42,026.58
<i>Receipts:</i>		
Use of money and property	\$217,844.36	
	<hr/>	
Total receipts		\$217,844.36
<i>Disbursements:</i>		
Transfers to Irrigation Works Construction Fund	\$259,181.83	
Transfers to Investment Council	689.11	
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Total disbursements		\$259,870.94
		<hr/>
Excess disbursements over receipts		(\$ 42,026.58)
		<hr/>
Balance, June 30, 1961		\$ 0.00
		<hr/> <hr/>

FIFTIETH FISCAL YEAR

July 1, 1961, to June 30, 1962

Balance, July 1, 1961		\$ 0.00
<i>Receipts:</i>		
Use of money and property	\$222,415.73	
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Total receipts		\$222,415.73

Disbursements:

Transfers to Irrigation Works Construction Fund	\$221,981.76	
Transfers to Investment Council	433.97	
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Total disbursements		\$222,415.73
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Balance, June 30, 1962		\$ 0.00
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Irrigation Works Construction Fund

FORTY-NINTH FISCAL YEAR

July 1, 1960, to June 30, 1961

Balance, July 1, 1960	\$916,552.38
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Receipts:

Transfer from Water Reservoirs Income Fund	\$259,181.83	
Use of money and property	12,500.00	
Loans and contract work		
Town of Santa Rosa	2,000.00	
Antelope Valley Irrigation District	3,538.14	
Cabresto, Llano Irrigation District	401.75	
Hagerman Irrigation Company	3,891.33	
Pecos Valley Artesian Conservancy District, principal	\$15,000.00	
Pecos Valley Artesian Conservancy District, interest	2,314.57	17,314.57
	<hr/>	<hr/>
Total receipts		\$298,827.62

Disbursements:

Canadian River storage	\$ 22,553.64
Small projects	421.15
Guadalupe County (H. B. 112, 24th Legislature)	6,219.59
San Miguel County (H. B. 112, 24th Legislature)	36,111.23
Prior year projects	
Canadian River storage	12,529.53
Small projects	(85.03)
Guadalupe County (H. B. 112)	3,921.77
San Miguel County (H. B. 112)	1,602.17
Loans	
Hagerman Irrigation Company	110,196.95

Pecos Valley Artesian Conservancy District	55,275.00	
Total disbursements		<u>\$248,746.00</u>
Net receipts		\$ 50,081.62
Balance, June 30, 1961		<u>\$966,634.00*</u>
*Ending balance is made of the following:		
Cash	\$466,634.00	
Certificates of deposit	500,000.00	
	<u>\$966,634.00</u>	

FIFTIETH FISCAL YEAR
July 1, 1961, to June 30, 1962

Balance, July 1, 1962 \$966,634.00

Receipts:

Transfer from Water Reservoirs		
Income Fund	\$221,981.76	
Use of money and property	11,250.00	
Refunds, loans and contracts		
Preparation of		
Ute Dam plans	\$ 500.00	
Town of Santa Rosa	1,500.00	
Antelope Valley Irrigation District	2,358.76	
Cabresto-Llano Irrigation District	401.75	
Hagerman Irrigation Company	7,572.32	
Pecos Valley Artesian Conservancy District	4,890.43	17,223.26
Total receipts		<u>\$250,455.02</u>

Disbursements:

Canadian River storage	\$131,988.19	
Gila River investigation	30,000.00	
Natural discharge of		
Roswell Artesian Basin	1,168.92	
Small projects	1,097.71	
Guadalupe County (H. B. 112, 24th Legislature)	6,131.25	
San Miguel County (H. B. 112, 24th Legislature)	14.07	\$170,400.14
Loans		
Hagerman Irrigation Co.	\$ 83,282.00	
Pecos Valley Artesian Conservancy District	113,075.00	196,357.00
Total disbursements		<u>\$366,757.14</u>

Excess disbursements over receipts	(\$116,302.12)
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Balance, June 30, 1962	<u>\$850,331.88*</u>
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*Ending balance is made of the following:

Cash	\$350,331.88
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Certificates of deposit	<u>500,000.00</u>
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	<u>\$850,331.88</u>
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Pecos River and McMillan Delta Water Salvage Fund

FIFTIETH FISCAL YEAR

July 1, 1961, to June 30, 1962

Balance, July 1, 1961	\$247,200.00
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Receipts:	\$ 0.00
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Disbursements:

Valley Land Company, purchase of land and rights-of-way	\$1,500.00
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H. D. Higginson, purchase of easement of right-of-way	50.00
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Virginia K. Buckner, recording fees to Eddy Co. Clerk, deeds and easement	17.25
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Total disbursements	<u>\$1,567.25</u>
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Excess disbursements over receipts	(\$ 1,567.25)
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Balance, June 30, 1962	<u>\$245,632.75</u>
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Ute Dam and Reservoir Fund

FIFTIETH FISCAL YEAR

July 1, 1961, to June 30, 1962

Receipts:

Proceeds Severance Tax Bond Issue	\$80,000.00
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Disbursements:

Bureau of Land Management	\$25,000.00
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Bechtel Corporation	31,232.72
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Total Disbursements	<u>\$56,232.72</u>
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Balance, June 30, 1962	<u>\$23,767.28</u>
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PROPOSED PROGRAM, 1963-65

General Considerations

New Mexico's obligations under the various interstate water compacts to which the State is a party are of great importance. Administration of the provisions and the financial commitments created by these compacts require legislative appropriation to the Interstate Stream Commission.

The staff of the Interstate Stream Commission makes engineering investigations and various hydrologic studies directed toward conservation and development of waters of the State and protection of the rights of New Mexico to use waters of the various interstate streams that flow in and through the State. The future program of the Commission includes review and preparation of comments on reports of Federal and other agencies on proposed projects for water development; studies and preparation of statements to be presented to the Congress in support of authorization of proposed water-conservation projects and in support of appropriations for authorized projects; and studies as required to enable proper administration of the seven interstate water compacts to which the State is a party. In addition, the program will include independent studies of projects for conservation and development of water supplies, consideration and review of proposed projects that would be financed from the Irrigation Works Construction Fund and Improvement of the Rio Grande Income Fund, research and engineering studies in connection with water litigation, coordination of the program of collection of basic data required for administration of interstate compacts, studies and cooperative planning of proposed or future water-development projects, and independent study and evaluation of existing projects financed through the Improvement of the Rio Grande Income Fund.

During most of the past biennium the engineering staff of the Interstate Stream Commission has consisted of the Secretary, Interstate Stream Engineer, Engineer Consultant, and three engineers. The legal staff of the Commission has consisted of a full-time attorney and two legal advisers employed on a retainer basis.

In view of the continuing increase in effort that will be required for project reviews, hydrologic studies for compact administration, and development of water-accounting procedures for the San Juan-Chama Project and for administration of water uses in the Gila River basin in

New Mexico under the anticipated U. S. Supreme Court decree in *Arizona v. California et al.*, it is proposed to add one engineer to the present staff of the Interstate Stream Commission in the 52nd fiscal year. Should litigation activity increase during the coming biennium, additional legal and engineering assistance will be required.

Following is a brief description of specific items of the proposed program.

Colorado River

LOWER COLORADO RIVER BASIN

It is probable that during the 51st fiscal year a decree will be entered by the U. S. Supreme Court in *Arizona v. California et al.* Based on the proposed decree contained in the Court-appointed Special Master's Report, it is anticipated that New Mexico will be required to report annually on the amount of land being irrigated and the consumptive use of both surface and underground water in the San Simon Creek, San Francisco River, and Gila River drainage basins in the State. Determinations of these items will require collection and study of detailed engineering data. It is contemplated that the regular Commission staff will make these studies.

In the 50th fiscal year New Mexico made available to the Bureau of Reclamation \$30,000 for an up-dating of the Central Arizona Project Report and an inventory and reconnaissance investigation of potential water-development projects in the Gila River drainage basin in the State. The Bureau of Reclamation inventory report will be submitted during the 51st fiscal year. The Bureau has made budget requests for Federal funds in the 51st fiscal year to make additional studies of the Gila River drainage basin in New Mexico and Arizona. In order to evaluate the potential for future uses of waters of the Gila River drainage in New Mexico, the Interstate Stream Commission and its staff must give careful study to the reports of the Bureau of Reclamation and possibly make additional independent studies. It is anticipated that considerable time of the engineering staff will be required during the 52nd and 53rd fiscal years to evaluate potential water-conservation development in this portion of the State.

UPPER COLORADO RIVER BASIN

Construction of three of the main storage units of the Colorado River Storage Project and most of the initial participating projects is now well under way. Construction of a fourth storage unit as well as additional participating projects will begin shortly. Investigations and planning

directed toward authorization of additional participating projects are progressing.

The construction of the major storage units, particularly of Glen Canyon Dam and Reservoir, has presented several important and complex problems for consideration by the Upper Colorado River Basin States. Extensive water-supply and power-generation studies have been made by the Upper Colorado River Commission and other agencies to analyze the various problems associated with the accumulation of initial storage in these reservoirs. The engineering and legal staffs of the Interstate Stream Commission must continue to devote attention to these problems.

Throughout the Upper Colorado River Basin the Bureau of Reclamation has been investigating participating projects. Reports on several of these projects will soon be completed and must be reviewed by the Interstate Stream Commission staff during the next 2 years.

Authorization of the Navajo Indian Irrigation and San Juan-Chama Projects has been accomplished. The Interstate Stream Commission must be prepared to work for appropriations to complete definite planning reports and to initiate construction of these units. Also, the Commission staff must be prepared to cooperate with the Bureau of Reclamation in preparing the final planning reports. The Commission staff also must participate with the Bureau of Reclamation and the representatives of the States of Colorado and Texas in the preparation and review of a program for gaging stations and the establishment of a method of accounting for water imported from the San Juan into the Rio Grande.

Operations under the La Plata Compact will require study and assembly of data by staff engineers of the Interstate Stream Commission to assist the New Mexico State Engineer in the interstate administration of the waters of the La Plata River.

The operating budget adopted by the Upper Colorado River Commission for the 51st fiscal year is \$103,000 and New Mexico's share of this budget is \$11,590. It is estimated that New Mexico's share of the program for the work of the compact commission for the 52nd and 53rd fiscal years will be \$12,600 for each year.

Rio Grande

Operations of the Rio Grande Compact Commission during the 52nd and 53rd fiscal years will require computations and assembly of data by staff engineers of the Interstate Stream Commission for use in the annual meetings of the compact commission and special studies from time to time to deal with problems of administration. Administra-

tion of the compact requires that continued streamflow measurements be obtained, and financial cooperation with the Surface Water Branch of the Geological Survey will be required for this purpose as well as for providing secretarial services to the compact commission. The Rio Grande Compact Commission adopted a budget for the 51st fiscal year totaling \$29,550, of which New Mexico's share is \$5,500. It is estimated that the State's share of the commission's activities will be \$6,000 annually during both the 52nd and 53rd fiscal years. That portion of this amount which is for stream gaging is included in the general cooperative agreement between the Interstate Stream Commission and the Geological Survey. The balance of New Mexico's estimated share of costs of operation under this compact is budgeted in a separate line item in the proposed Interstate Stream Commission budget and is estimated to be \$1,600 in each year of the coming biennium.

The compact commission will also be active in establishment of procedures for accounting for water imported into the Rio Grande basin by the authorized San Juan-Chama Project.

Definite planning work for construction of the authorized Cochiti and Galisteo Reservoirs is being processed by the Albuquerque District of the Corps of Engineers. It is anticipated that some time of the engineering and legal staff of the Interstate Stream Commission will be required for coordination of effort with the Corps of Engineers in the final planning stages of these projects. Also, the Interstate Stream Commission must be prepared to work for appropriations to initiate and complete construction of these two authorized units of the Middle Rio Grande Project.

Continued cooperation with both the Corps of Engineers and Bureau of Reclamation and other agencies will be maintained on other features of the Middle Rio Grande Project and on other additional projects that are being studied or constructed in the Rio Grande basin.

COSTILLA CREEK

Administration of the Costilla Creek Compact during the 52nd and 53rd fiscal years will require continuing financial cooperation with the Geological Survey to obtain streamflow measurements. Also required are the services of the Costilla Creek watermaster to administer the flows of the creek and to make deliveries of water to Colorado in accordance with the compact. The program of water measurement required for administration of the compact will probably continue at about the same level as during the past biennium with minor cost increases. The watermaster's expenses will remain about the same as during the 51st fiscal year.

The Costilla Creek Compact Commission adopted a budget in the amount of \$19,500 for the 51st fiscal year. New Mexico's share of this

budget is \$6,500. It is estimated that New Mexico's share of the program for the work of the commission will be \$7,000 in each of the 52nd and 53rd fiscal years.

Operations under the compact require that the engineering staff of the Interstate Stream Commission perform studies for special problems of administration and make the annual computations required to determine delivery of water. Legal services also are required from time to time in connection with compact administration.

Colorado has made a request for certain changes in points of delivery of water allocated to her under the compact. New Mexico has maintained that such changes are substantive and require formal amendment of the compact. Negotiations have been carried on during the past biennium and it is anticipated that some work may remain on these amendments for both the engineering and legal staffs of the Interstate Stream Commission.

Pecos River

The Pecos River Commission program for the 52nd and 53rd fiscal years includes the following objectives:

1. Restudy and refine the inflow-outflow method for compact determination in the upper basin in New Mexico, i.e., Santa Rosa to headwaters.
2. Define the 1947 condition along the Pecos River in Texas for use in determining amount of unappropriated flood waters.
3. Continue compiling data and making necessary studies for use by the Pecos River Commission in making administrative determinations under the compact.
4. Complete and evaluate the Salinity Alleviation Project. Construction of this project is under way. Cooperation with the Bureau of Reclamation, Geological Survey, and Red Bluff Water and Power Control District of Texas will be required for completion and evaluation of the project.
5. Cooperate with Bureau of Reclamation on feasibility studies of proposed Brantley Dam and Reservoir. This project would provide much-needed flood control for Carlsbad and terminal storage for the Carlsbad Irrigation District. It also would permit construction of the authorized McMillan Delta Water Salvage Project.
6. Continue studies of potential water-salvage measures for other sections of the river.
7. Reexamine power potential near the mouth of the Pecos River in Texas in combination with possible water-salvage measures in Texas.

8. Cooperate with U. S. Department of Agriculture in a comprehensive program of research and experimentation for investigation of the growth, water use, and eradication and control of phreatophytes, and of the measurement of water salvage resulting from control of phreatophytes.

9. Complete studies for evaluation of the authorized Los Esteros-Alamogordo project.

10. Compile data for annual reports of the commission.

11. Cooperate with the Geological Survey in collecting basic water-resources data and conducting special studies.

The Pecos River Commission adopted a budget for the 51st fiscal year totaling \$55,550, New Mexico's share being \$27,775.

It is estimated that New Mexico's share of the program for work of the Commission will be \$39,500 in the 52nd fiscal year and \$40,500 in the 53rd fiscal year.

Canadian River

At the present time neither staff nor budget is required for operation of the Canadian River Commission. Salary and expenses of the commissioner for New Mexico together with his legal and engineering advisers are included in the proposed personal services and travel budgets of the Interstate Stream Commission. Expenses in connection with administration of the Canadian River Compact are not expected to increase materially over those experienced in the past biennium, and should represent a relatively small amount of money.

The Interstate Stream Commission staff will devote some time to review of proposed projects involving use of waters of the Canadian River basin.

Ute Dam and Reservoir are being constructed on the Canadian River just below the mouth of Ute Creek near Logan. The project will be completed during the 51st fiscal year and, following construction, numerous items in connection with operation and maintenance and use of the reservoir will require attention.

Litigation

By statute the Interstate Stream Commission is authorized to institute legal proceedings in the name of the State of New Mexico for the protection, conservation, and development of public waters of the State.

For the past several years New Mexico has been involved in U. S.

Supreme Court litigation, *Arizona v. California et al.*, on the Lower Colorado River. The Supreme Court held oral arguments during the 50th fiscal year and has ordered additional oral argument during the 51st fiscal year. Should the Supreme Court enter a decree during the 51st fiscal year, Commission activities in the future will consist chiefly of supervising administration of water uses in New Mexico under terms of the decree and reporting annually upon such administration to the Court.

The New Mexico Supreme Court has denied the State's request for a rehearing in the litigation instituted by the State against the W. S. Ranch Company over use of waters of Costilla Creek. The court has ruled that all necessary parties were not represented in the suit. The State presently is investigating the possibility of bringing in all parties deemed necessary in the action. If the State should reinstitute the case it is anticipated that considerable work will be required, especially on the part of the legal staff.

The litigation item included in the proposed Interstate Stream Commission budget is designed to provide money for current and potential litigation during the coming biennium. The amount budgeted should be included in the appropriation to the Commission to obviate appeals, as have been necessary in the past, to the State Board of Finance for emergency funds when New Mexico becomes involved in lawsuits instituted after budgets have been approved.

Cooperation with Federal, State, and Local Agencies

The various water-resources-development problems that must be solved throughout the river basins of the State should receive the attention, through cooperative effort, of all agencies concerned. In this respect, the Interstate Stream Commission will continue its work with the Bureau of Reclamation, Corps of Engineers, Geological Survey, Bureau of Indian Affairs, the Department of Agriculture, and other Federal agencies together with State agencies and local interests on both individual project development and in basinwide development.

The regular cooperative program with the Surface Water Branch of the Geological Survey for securing basic streamflow data throughout the State should be expanded beyond the level maintained during the past biennium. It is anticipated that the cost of maintaining the present program of the Geological Survey will require an increase in funds of about 10 percent because of increases in Federal salaries and other costs. The proposed budget provides sufficient funds to add several gaging stations to the State network in both the 52nd and 53rd fiscal years. Very few gaging stations were added to the network during the 25th biennium, and in certain areas there is a scarcity of streamflow data. In

order that sufficient knowledge of streamflow can be made available, not only to State agencies but to all interests concerned with water-resources development in New Mexico, the additional funds required to maintain and expand the stream-gaging network in the State should be provided. The cooperative program provides for stream-gaging records necessary for administration of the Rio Grande Compact and for statewide measurements of streamflow. In addition, money for stream gaging scheduled to be carried out jointly by the Geological Survey and the Pecos River Commission, and by the Geological Survey and the Costilla Creek Compact Commission, is included in the respective items of the proposed Interstate Stream Commission budget.

State participation in the regular chemical-quality and suspended-sediment program of the Quality of Water Branch of the Geological Survey should be continued at about the same level as was carried on during the 25th biennial period, with a slight increase in funds to compensate for higher operational costs.

Associated Activities

There are numerous interagency committees and associations and other groups with interests and problems similar to those of the Interstate Stream Commission. It is proposed that the Commission continue participation in activities of these groups. Major organizations in this category are the Arkansas-White-Red River Basins Inter-Agency Committee, the Pacific Southwest Inter-Agency Committee, the National Reclamation Association, the National Rivers and Harbors Congress, the Southwest Water Council, the Council of State Governments, and the State Mapping Advisory Committee.

The two interagency committees schedule about four meetings each year, and the State's designated representative on these committees is S. E. Reynolds. New Mexico is also represented on subcommittees of the PSIAC. Meetings of these committees and subcommittees have not been fully attended in the past because of a heavy Commission workload and the costs involved. It is anticipated that the Commission's activities in both the PSIAC and the AWRBIAC will continue at about the same level as in the past. Expenses of the State's designated representative and a subcommittee member are included in the proposed Interstate Stream Commission budget.

Money for travel expenses for New Mexico's representation at the annual meetings of the National Reclamation Association and the National Rivers and Harbors Congress are provided in the proposed Commission regular travel budget. NRA dues assessed to the State of New Mexico are also included in the proposed budgets.

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