1956 ANNUAL REPORT

SECRETARY OF THE Interior

FRED A. SEATON



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The Conservation of Natural Resources

FOR THE FISCAL YEAR ENDED JUNE 30, 1956

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The Conservation of Natural Resources

FOR THE FISCAL YEAR ENDED JUNE 30, 1956

UNITED STATES
DEPARTMENT OF THE INTERIOR

Fred A. Seaton, *Secretary*

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THE SECRETARY OF THE INTERIOR
WASHINGTON

My Dear Mr. President: Transmitted herewith is the annual report of the Department of the Interior for the fiscal year which ended June 30, 1956.

Activities of the Department's bureaus and offices, as reviewed in this report, indicate the progress which is being made in carrying forward your program for orderly development of our natural resources. The report also provides an evaluation of the vital effort for natural resource conservation, which is inherent in all the diverse activities and operating policies of the Department.

While much has been accomplished, we recognize that a great deal remains to be done to assure future generations a constant abundance of the natural resources which are an important portion of their heritage. We pledge our continued best efforts in striving to achieve this goal.

Sincerely yours,

Fred A. Seaton

Secretary of the Interior.

The President,
The White House,
Washington, D. C.

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PART I

THE CONSERVATION OF NATURAL RESOURCES

The Conservation of Natural Resources

"CONSERVATION" is a magic word of many meanings, but the common denominator of most definitions is the concept that sound conservation demands wise and prudent use—without either waste or abuse—of our natural resources.

Within the framework of this concept, the Department of the Interior has promulgated the policies to which it adheres in carrying out the resource programs which are its responsibility. Judicious use of our natural resources is of paramount concern to all Americans. Each succeeding generation faces the ever-present responsibility to put natural resources to their most beneficial use, all the while employing conservation practices that will assure future generations of abundant supplies for their own use and enjoyment.

Trend to Conservation

During the earlier years of our still-young Nation, many envisioned our natural resources as inexhaustible. As modern-day American society became increasingly complex, and a growing population made more and more demands upon natural resources, the view of inexhaustibility gave way to recognition of the necessity for conservation. It became clear that our natural resources supply indeed was not limitless and that appropriate conservation measures were urgently needed if current and future requirements were to be satisfied.

Thus, the trend swung from capricious disregard for conservation to a serious effort to provide for the future and at the same time derive the greatest benefit for the greatest number.

Conservation practices may vary in the sense that conservation as applied to one type of resource may not be identical to the practices employed to conserve other resources. While the modus operandi may differ, the end result spells conservation nonetheless.

In the case of resources such as timber and water, conservation calls for programs to promote renewal of the resources. Sustained-yield

timber management, for example, can assure our Nation of abundant and continuing supplies of this valuable resource.

Many sections of the country already are confronted with water shortage problems, and these problems give promise of becoming more widespread and more acute in the years ahead. We still have about the same amount of water available, but we are using more of it—an increase of 24 percent from 1950 to 1955. Because this is true, the water situation rapidly is developing into one of the most critical in the natural resources field. It is becoming more and more imperative that we intensify our efforts to make better use of the perpetual supply from the heavens.

Only 17 percent of the water we have available is put to use, with about one-fourth of the water used being consumed during use; the remainder still is available for reuse.

Part of the solution may be found in more effective water storage facilities on the surface and replenishment of underground supplies, to conserve for beneficial use a greater portion of the presently unused runoff. Research is continuing meanwhile to develop economical methods of converting saline and brackish waters into fresh water. Development of large-scale, low-cost means of conversion may write a whole new chapter in this Nation's water history.

Not All Resources Renewable

All of our resources, however, are not renewable in the same sense as water and trees. Some resources, indeed, once used, are gone forever.

Because such resources as minerals and coal and oil do not renew themselves, the problem concerning them is twofold. First, we must find and develop new deposits and improve our processes for making full use of low-grade ores. Secondly, we must continue and expand our efforts to develop substitutes from those resources we have in abundance.

In both areas the Federal Government and the Department of the Interior bear grave responsibilities to aid industry in solving the problems. Increasing imports of such minerals as copper, bauxite, lead, and zinc indicate the extent to which this Nation is relying upon foreign supplies sources. A combination of increased requirements with decreasing reserves has magnified the importance of effective action to forestall depletion and to make better use of low-grade ores and substitute sources.

Thus, it is in the national interest for the Federal Government and this Department to combine forces with industry in seeking answers to many questions relating to these resources.

Our aim must also be to protect the unsurpassed beauty of our national parks, and to preserve their scenic grandeur in its original state, so far as is possible.

The basic act which created the National Park Service to promote and regulate the use of national parks, monuments, and similar reservations, declared that the fundamental objective must be to "conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Through the years the Department of the Interior has conducted its programs in the spirit of that ideal, rejecting invasions or impairment of the parks and providing for their public enjoyment in a manner that will preserve their wonders for Americans yet unborn.

Congress has provided for multiple use of our wildlife areas where this is compatible with primary wildlife values. There are some areas, however, upon which economic uses are not permitted unless such uses contribute directly to wildlife values. These areas are principally those which provide habitat for rare and endangered species and where nonwildlife use would be detrimental to the primary values.

In its assigned function as the Nation's principal resource agency, the Department of the Interior bears a special obligation to see to it that our expendable resources are conserved, that those which can be are multiplied, and that all of them contribute their full measure to the progress, prosperity, and security of America, now and in the future.

The manner in which the Department pursues the search for new and more efficient ways to utilize resource supplies, the diligence of its exploration for fresh reserves, the vigilance to resist wasteful processes, and the safeguarding of irreplaceable features of scenic beauty—all can contribute to our Nation's natural wealth and to the well-being of tomorrow's citizens.

Realistic Partnership Necessary

Sound conservation, successfully achieved, requires a realistic partnership shared by all Americans. The several levels of Government, Federal, State, and local, necessarily assume leadership in this endeavor; but the role of the private individual and groups of individuals should not be minimized. Governmental leadership should not be construed either as domination by Government or as a device to relieve private initiative from carrying out its rightful share of responsibility in furthering resource conservation.

This is a task which demands alertness from all. We must employ our best talents in working toward solution of natural resource problems for our common good.

The Department of the Interior is keenly aware of the solemn obligation upon the present generation to conserve our physical and scenic resource for our children and our children's children.

We are conscious, too, that America's high standards of living today provide ample proof that intelligent conservation and orderly development of natural resources are compatible.

The sections of this report which follow outline the specific applications of the conservation policies of the Department of the Interior—policies dedicated to the basic philosophy that our natural resources should be so administered that they may yield the greatest good for the greatest number, over the greatest period of time.

CONSERVATION OF MINERALS AND FUELS

Minerals resources are irreplaceable assets indispensable to our Nation's continued prosperity and security. A dozen years ago, many analysts were stunned by World War II's drain upon these resources. They proclaimed that we should rely heavily upon imported metals and petroleum, hoarding our own reserves for some future emergency.

Today, the Nation's mineral policy recognizes that hoarding will not assure future generations an adequate supply. This policy is founded upon the premise that wise and full use over the longest possible period of time is true conservation.

With this recognition has come acceptance of the concept that continuing technologic advance, leading to more efficient and less wasteful extraction, treatment, and use of basic materials and to the creation of new mineral commodities, is the best road to an improved domestic situation. It has brought us to a new era of industrial greatness and prosperity.

The Department of the Interior carries heavy responsibilities in furthering mineral conservation. The breadth of the field is indicated by a 1,042-page Bureau of Mines report, "Mineral Facts and Problems," published during the past fiscal year. In independent chapters, this reviews the background, outlook, and problems of 85 separate mineral commodity groups.

Best Utilization Is Objective

Recognizing that the United States must continue to rely upon imports for certain materials where our native supplies are inadequate or negligible, such as manganese, nickel, and tin, the Department's

mineral conservation program cannot be aimed at complete self-sufficiency. Rather, its objective is to determine how materials, whether imported or domestic, can be utilized most efficiently and if new metals and nonmetals can be won from new or latent domestic sources, even to the extent of replacing those traditionally used.

The Department approaches this objective through several channels. It conducts research on producing metals and minerals from lower grade and more complex materials, learning more about submarginal deposits and improving techniques for utilizing newly developed materials, and recovering metals more effectively from scrap. It helps preserve and, where necessary, expand foreign sources of materials in which we are deficient. It keeps close watch on developments abroad, often aiding important foreign mineral enterprises to assure continued or improved availability of their products to the United States. It strives to create an improved environment for the beneficial investment of private capital in foreign mineral properties.

In addition, the Department works with the International Cooperation Administration to help friendly nations conserve and develop their own mineral resources, sending technologists to advise on applying advanced engineering and metallurgical principles to local problems and training foreign technologists in the Department's laboratories.

Research Coordinated

As a Government agency, the Department coordinates its research with that of private groups, whether in industry, universities, or foundations, concentrating on projects that other organizations cannot or will not undertake or cannot pursue as expeditiously. Many of its findings are basic or preliminary, since it carries its studies only to the point where it has laid a groundwork on which private groups are able and willing to build commercial enterprises. Exceptions are projects of great national interest, such as the development and temporary production of the new metals, titanium and zirconium, the Government's urgent need for which would not permit waiting for industry to develop production techniques and facilities.

Mining and Metallurgy

The Department is engaged in a broad basic research program designed to develop instruments, equipment, and methods for more efficient mining and substantially higher recovery of coal and ore. This involves field tests and observations and laboratory studies. Such research lies at the very heart of mineral conservation, since it paves the way for fuller and less wasteful use of our resources.

Light Metals Research Significant

Some of the Department's more significant recent metallurgical research has been in light metals. Investigation of low-grade aluminous materials now lying fallow has included making aluminum-silicon alloys directly from those high in silica. Economic production of aluminum, most plentiful metal in the earth's crust, from such sources would broaden our resource base immediately and solve complex supply problems.

Growing demand for steel motivates other research. Besides seeking ore-dressing methods to permit mining lower grade iron ores, this includes studies designed to reduce the 25-percent loss of nickel in treating nickeliferous lateritic iron ores and to recover the cobalt, chromium, and iron now largely lost. Demonstration that titanium can be substituted for manganese to prevent hot shortness in steel and discovery that considerable manganese and potash can be recovered from blast-furnace flue dust now wasted are among recent significant results.

Less advanced, but filled with promise, are studies of the rare earths, a group of 15 little-known metals. These are rare only in the sense that techniques for their economic separation and utilization are yet to be developed.

Fuels Technology

Our use of energy has risen steadily for years, and conservative estimates point to a further rise of at least two-thirds in the next 25 years. For the foreseeable future, the major source will continue to be fossil fuels—coal, of which our known reserves are greatest; petroleum, and natural gas, on which we have drawn for years; and oil shale, whose utilization has been brought nearer by the Department's research.

Recent studies showing that for every ton of coal mined in this country over the years, another has been left in the ground illustrate the magnitude of opportunities for conserving fuels through technologic advancement. Loss of petroleum is believed equally great, although information is much less exact. Loss of natural gas was enormous in the oil industry's youth, when gas that was produced with petroleum was wasted into the air. This loss has been reduced greatly in recent years.

Besides contributing to more efficient mining, the Department's research and factfinding have aided in technologic advancements in mechanical cleaning of coal. Determination of the technologic factors involved in mechanical cleaning has aided industry in providing the consumer with an acceptable fuel, despite the progressive de-

terioration in quality of mined product as a result of increased mechanization underground and the more active exploitation of inferior-grade deposits.

The Department is continuing its cooperation with industry in experimentally gasifying coal in the ground. Many difficulties have been encountered and more are expected, but ultimately this process may permit us to use coal in beds which are too thin or of too low quality for conventional mining.

Coal Conversion Studied

To supplement the naturally occurring fluid hydrocarbons and to conserve them for their highest end use, which ultimately may be preponderantly as primary chemical substances rather than as fuels, the Department studies conversion of coal to fluid fuels, both liquid and gaseous. These conversions long since have been shown to be technically feasible, but their economics are unfavorable, as yet. Accordingly, emphasis is placed on improving the economics of known processes and on developing new processes with prospect of economic advantage.

Since declining demand leading to abandonment of collieries is a major and immediate threat to our anthracite reserves, the Department is conducting research directed principally toward expanding the market for "hard" coal, bringing about more effective utilization, and developing improved mining methods to conserve reserves.

Preliminary testing indicated that heat-treating lump anthracite improves its physical properties; the treated fuel will be tested in metallurgical furnaces during the coming year.

Conservation Leadership Provided

In petroleum and natural gas conservation, the Department has exerted leadership for nearly half a century. Often called "the father of petroleum engineering," its present standing is attested by industry's financial participation in a large number of its research projects.

Many of the industry's standard production practices stem from the Department's early engineering studies. By developing technical data to assure efficient use of the energy associated with oil and gas in natural underground reservoirs, the research leads to improved methods and greater ultimate recovery.

Petroleum is more susceptible to irrecoverable loss than other resources, since between point of production and ultimate consumer it suffers varying degrees of waste and loss because of its liquid-gaseous, evaporative-explosive nature. These losses are minimized

by numerous conservation precautions devised by Government and industry.

The Department encourages conservation and prevention of waste, more by suggestion than compulsion. Through administration of the Connally Act of 1935, which prohibits interstate shipment of contraband oil, the Federal Government does not regulate oil production or interfere with a State's right to do so, but does assist States in enforcement of their own laws. While this is compulsive observance of conservation, the act's greatest virtue is as a deterrent to would-be violators of conservation practices.

Cooperative Financing

For several years the American Gas Association has contributed part of the cost of fundamental research on transportation, including studies of the flow of natural gas through pipelines at high pressures and velocities, phase relationships of gas-condensate fluids, and underground storage of natural gas. The findings enable industry to reduce waste of energy and materials.

In cooperation with industry, the Department continually compiles data on the quality and characteristics of motor and aviation gasoline and diesel and burner fuels sold in the United States.

Related projects, financed partly by industry and the Department of Defense, provide data on the composition and availability of aviation and diesel fuels, stability in storage, and compatibility of like fuels when mixed.

Oil Shale Research Progressing

An 11-year research and development program, begun as a hedge against petroleum shortages during World War II, has taken oil shale to the threshold of economic utility. The research phase, which is continuing on a limited scale, has contributed significantly to knowledge of the technologic, theoretical, and economic aspects of oil shale.

This program is typical of the Department's contributions to development of new sources of raw materials to replace or supplement those that are scarce or nonrenewable; like many others, it has provided a wealth of facts that can be drawn upon when the need arises.

Helium

The Department's helium program is another outstanding example of conservation in action. It has transformed helium, a minor con-

stituent of a few southwestern natural gases, from a laboratory rarity with no practical uses, to a strategic, industrial, and medical gas of ever-increasing importance.

Lightweight, nonflammable helium has as its oldest and still most familiar application the job of lifting airships and balloons. Its combination of unique properties, however, particularly suits it for such modern developments as shielded-arc welding, titanium and zirconium production, atomic energy, and electronics. Through research, development, and finally large-scale production, the Department has made it a valuable national asset.

A thorough study completed during fiscal year 1956 emphasized the need for saving more of the helium being lost in burning unprocessed helium-bearing natural gas. This study also disclosed that 70 percent of the helium shipped from the Department's plants is used directly by Federal agencies and another 15 percent by companies working on Government contracts.

Saving Coal From Fire and Flood

Besides its technologic research, the Department has two action programs to conserve coal reserves.

Under the first, it has saved more than 250 million tons of coal from destruction by fire during the past 7 years. The Government pays the full cost of controlling fires on its own land and requires local sources to pay half the cost of controlling those on private holdings.

The second program, designed to save anthracite reserves from loss by flooding, was authorized early in fiscal year 1956 and still is in its early stages. Under it, the Department is to contribute up to $8.5 million, on a matching basis, to the Commonwealth of Pennsylvania for the construction of facilities to control water in the anthracite formations. The Department's function is to review and approve proposed projects and inspect approved ones during construction and upon completion. Actual construction is the Commonwealth's responsibility.

Economic Data for Conservation Decisions

The complexities and rapid expansion of the Nation's economy require frequent decisions in Government and industry to prevent crippling shortages of minerals or fuels. The Department is responsible for collecting and assembling much of the economic and statistical information on which such decisions can be based soundly.

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Geological Survey Stresses Conservation

The Geological Survey has long been a proponent of conservation, and will continue to sponsor or encourage all cooperative effort to this end.

Cooperation is extended to or derived from various State bodies and such Federal departments as Justice, Defense, Agriculture, Health, Education, and Welfare, and the Office of Alien Property. There is also a high degree of intradepartmental cooperation between the Bureau of Land Management, Bureau of Indian Affairs, Geological Survey, Fish and Wildlife, as well as with private organizations, industrial companies, etc. With such cooperation, the conservation of our mineral wealth is assured.

Progress Is Noted

During the past year there have been numerous examples of excellent progress.

Unitization or unit operations of a common source of supply has resulted in prolonging the life of many oil pools and has often doubled or even tripled the ultimate oil recovery from such fields. Unit operation of oil pools benefits all parties because it results in greater ultimate recovery with a minimum expenditure of money and materials. It works equally well in aid of secondary recovery when applied to waterflooding operations, pressure maintenance, gas cycling or gas injection. In fact, more often than not, secondary recovery operations would not be economically feasible except through unitization.

A solution leading to better conservation of mineral resources has been reached between the conflicting interests of oil and potash operators in southeast New Mexico through cooperative efforts of the Department of the Interior with State officials and industry. Rules have been promulgated whereby dual development of lands in the area may be accomplished with safety and without waste.

Minerals Nonrenewable

Mineral deposits unlike agricultural crops are nonrenewable. New sources of minerals and mineral fuels must be developed constantly either through discovery of new deposits or through adaptation of lower grade, offgrade, or entirely new types of materials.

True conservation of minerals therefore, means wise use of known resources backed up by a vigorous, imaginative and sustained program of search for deposits usable under current practices and conditions—plus an equally sustained and imaginative effort to develop ways in which materials not now usable can be utilized.

In the Nation's expanding economy such a program cannot remain static. It must be flexible enough to take advantage of all technologic improvements in methods of exploration, on the one hand, and to meet the challenge of shifting use patterns and enlarged demands, on the other.

Minerals Exploration Aided

The Department conducts a program of exploration for domestic sources of strategic and critical minerals.

This program plays an important part in the conservation of these resources. Under this program a continuing search is made for new sources of minerals vital to the Nation's welfare. More emphasis is placed on the search for scarcer minerals than for those in greater supply. Depending upon the mineral or minerals sought, the Government will participate in cooperation with industry, to the extent of 50 or 75 percent of the cost of the exploration work, with certain repayment provisions.

Topographic Mapping Essential

Topographic mapping has continued to be an essential part of the Department program for the conservation and development of our natural resources. During the past fiscal year some 1,800 new maps were published, and mapping projects were underway in every State of the Union, the Hawaiian Islands, Puerto Rico, the Virgin Islands, and Alaska.

Mineral Activities Accelerated on Public Lands

A marked upswing in mineral activities on both the public domain and acquired lands owned by the United States, particularly with respect to uranium, contributed to the national economy and to national defense during the year.

The Department's programs foster conservation and beneficial use of federally owned mineral resources for some 750 million acres of lands in the United States and Alaska. New procedures and regulations were promulgated to further the conservation objective in connection with new legislation enacted during the fiscal year.

WATER RESOURCES DEVELOPMENT

A major contribution toward development of a sound water policy to assure conservation of the Nation's water resources was the "Report of the Presidential Advisory Committee on Water Resources Policy."

This group, consisting of the Secretary of the Interior, as chairman, the Secretary of Agriculture, and the Secretary of Defense, submitted its report to the President on December 22, 1955. Their report, which the President transmitted to the Congress on January 17, 1956, outlines policies embodying a framework within which the Federal Government with State and local governments and other non-Federal interests may effectively develop our water resources.

The deliberations of this body led to several general conclusions and principles upon which it based its recommendations for a water policy. These are:

First, the greatest single weakness of the Government's activities in the field of water resources development has been the lack of cooperation and coordination of the Federal agencies with each other and with the States and local interests. This has been occasioned by the fact that the Federal interest in water resources development has been expressed in different laws empowering different agencies to pursue particular programs for different purposes.

Second, it is not practicable and certainly not desirable for the Federal Government alone to assume responsibility for the complete development of the Nation's water resources. This reasoning stems not only from the practical impossibility of assuming the financial burden which such a policy would require but also from the fact that such complete Federal assumption of responsibility would tend to create local and regional dependence on Federal action, to destroy individual and local initiative, to destroy the effectiveness of the government of the States, and to work a profound and undesirable change in our traditional plan of government. Lack of funds and regional rivalries have delayed for years many meritorious projects in the expectation of Federal action which has not been forthcoming.

Third, it is believed that the principle of equal contribution for equal benefits received should be applied to the beneficiaries of all Federal water resources developments, although it is recognized that historically the programs of the Federal agencies have differed widely as to the contribution required from the beneficiaries of such projects.

Fourth, and last, there has been a great controversy raging between those persons who believe they have vested water rights—property rights lawfully acquired under the laws of the States, and those who believe that the Federal Government has a superior right to all of the water in all of the streams of the United States.

Basic Data Essential

On the basis of these general conclusions, the Committee approached the overall problem by first recognizing that basic data form the foundation of any water resources policy.

The first major recommendation in the report is that the present program of basic data collection (such as streamflows, rainfall, soil conditions, hydrology, meteorology, and other factors which control the quantity, usability, and the desirability of water uses) be accelerated and be programed and carried out on a more consistent and definite basis.

The report makes clear that there is no one national water problem, but that there are dozens of problems; and that they differ from State to State and from area to area. It recognizes that a uniform national blueprint for water resources development is neither practical nor desirable; and that each area must be considered in the light of its own present and anticipated problems which can be solved only by utilizing the best collective judgment possible, as to what is most needed for the river basin, the State, the region, and the Nation.

Implementation Underway

Consideration is now being given to the implementation of the Advisory Committee's report and it is expected to provide a sound basis for the Nation's future water resources developments.

The Department has actively supported efforts to resolve water resource problems by means of interstate compacts between States having mutual problems arising from the allocation and use of interstate streams. This is in accord with the policy of encouraging a full measure of responsibility for water resource development at the State and local level.

Converting Saline Water

The increased demand for water can be partially met by conservation, but a need exists for entirely new sources of fresh water as well.

In recognition of the needs and the potential benefits to be gained from large-scale purification of saline waters, the Congress authorized a research and development program directed toward the development of processes for producing fresh water from saline and brackish waters. The resulting program of the Department has as its primary objective the development of economically feasible processes of this nature.

The Department carries out the program by sponsoring scientific research and development through federally financed contracts and grants, by some research in Federal scientific organizations, and by stimulating and coordinating private activities in this field.

Gradual progress is being made toward low-cost production. Even now, existing conversion processes compete economically with the development of fresh water sources for specialized purposes. With

continued improvements in processes, steady increase in the number of uses is assured.

Saline water conversion may be expected to take the form of many different processes, of many sizes, ranging from small household stills to large municipal and industrial plants. Each serve specific uses dictated by geography and availability of saline and other water, climate, local conditions, and the value of the end product for which the water is used.

Federal Cooperation Dates From 1902

Federal cooperation with State and local agencies in wise development and use of our water resources began in 1902, when President Theodore Roosevelt approved the first Federal Reclamation Act. Some of the earliest and most successful reclamation projects are in operation today as monuments to the wisdom of that act. Among these are the Salt River project in Arizona, the Yakima in Washington, the Boise in Idaho, the North Platte in Wyoming and Nebraska, and the Newlands in Nevada. These and other projects were created under cooperative agreements by which the water users, organized into irrigation districts, contract to repay the cost of construction to the Federal Government.

Years later, the Colorado River was harnessed by construction of Hoover Dam to help meet the water and power needs of the Southwest. This world's highest concrete dam structure demonstrated the feasibility of such colossal structures and opened a new era of reclamation development.

Today, after 54 years of partnership with the water users, Federal reclamation projects are capable of furnishing water for more than 7 million acres of land through water conservation facilities in the 17 States. The facilities include 136 storage dams and reservoirs, 105 diversion dams, about 24,000 miles of canals and laterals, and about 7,600 miles of drains.

Colorado Project Notable

A notable event was authorization of the Colorado River storage project and 11 participating projects. This monumental authorization by the Congress, which was signed by President Eisenhower on April 11, 1956, will permit continued economic expansion of four Upper Colorado River States in an area of rich resources which is now virtually untapped. Coupled with the existing reclamation development in the Lower Colorado River Basin, it will ultimately establish the most complete control and utilization of the water resources of any major river basin in America. This project will supply water for

360,000 acres of land in Colorado, New Mexico, Utah, and Wyoming, and have about 1 million kilowatts of hydroelectric generating capacity.

Equally significant to the upbuilding and strengthening of the economic structure of the West was the further acceptance by the Congress in the enactment of the Colorado River storage project of the precept that development of and revenue from the sale of hydroelectric power is an essential paying partner of reclamation.

Rising Costs Foreseen

During the early decades of Federal reclamation, the simple, inexpensive projects were virtually all completed. These were the projects with the most favorable ratio of benefits to cost. Today, it is clearly evident that the unit costs of most future reclamation work will continue to rise.

Since repayment is the foundation of the reclamation program, and the cornerstone of congressional acceptance of the case for Federal development, the return by the beneficiaries of irrigation of their fair share of the cost must continue as a primary requirement. However, it seems problematical whether many major water developments of the future can be undertaken which can be completely repaid by the water user. There are a great many smaller projects with tremendous implications for the future, which the people of the West can and undoubtedly will build for themselves—often by individual or cooperative action among themselves—and, when occasion requires, in partnership with the Federal Government. Nevertheless, it is apparent that we must continue to look to power, even more in the future than in the past, as the paying partner of reclamation.

Power Programs

On June 30, 1956, the installed capacity of powerplants constructed and operated by the Bureau of Reclamation, as a part of multipurpose projects, totaled 4,974,550 kilowatts, and the capacity installed and operated by other agencies for which the Bureau is the marketing agent totaled 596,500 kilowatts—a total of 5,571,050 kilowatts.

Sale of electric power during the year aggregated 25,181,596,876 kilowatt-hours, with revenues from sales totaling $55,362,728.71.

Northwest Power Integration

The primary function of the Bonneville Power Administration is to market the electric power and energy produced at hydroelectric projects operated by the Army Corps of Engineers and the Bureau of Reclamation.

For this propose, the BPA constructs, operates, and maintains a high-voltage transmission system. This transmission grid forms the backbone system permitting the integration of both Federal and non-Federal power generating systems in the region, and allows for "pool" operation of the facilities of the major utilities in the Northwest. By means of the Northwest power pool, large blocks of power are transferred on a scheduled basis, and within contractual arrangements, between different areas in the Northwest.

The pool arrangement permits the major utilities to coordinate their operations, including the use of both steam and hydroelectric generating facilities, and thus enables the most economic use of the areas' total energy resources. The flexibility of the pool operation makes it possible to utilize the water resources in such a manner as to generate the maximum amount of prime power for the region.

Power Where Needed

The diversity of streamflows in various parts of the Northwest served by the Bonneville transmission grid makes it possible to send surplus power from one part of the area to another at certain times of the year and to reverse the process at other times of the year.

The ability of the transmission grid to supply electric energy to widely scattered parts of the Northwest makes it unnecessary to build standby steam generating facilities in those areas where streamflow conditions make hydroelectric generation inadequate for certain periods each year. This results in a reduction in the investment required for generating facilities as well as a saving of nonreplaceable energy sources such as coal, oil, and natural gas.

New generating facilities, Federal or non-Federal, when connected to the backbone transmission system serve the power loads located closest to them and release generation closer to load centers. This, in contrast to a nonintegrated system, saves the building of duplicate transmission lines, reduces the required capacity of lines, reduces powerline losses to a minimum, and thus provides more power at the load centers at lower cost to the consumer.

Coordinated Operation Useful

The coordinated operation of the main transmission grid with the generating facilities of the Federal and non-Federal generating plants permits the most economical use of water released from storage at upstream plants. This storage release is scheduled so that water may be used not only at plants releasing it from storage, but reused many times at downstream plants. Uncoordinated operation of these facilities, on the other hand, might easily mean less power available at

downstream plants due to the release of storage at times when these downstream plants were not capable of utilizing additional quantities of water.

While the coordinated operation of hydroelectric generating facilities is the most important contribution which Bonneville makes to the conservation of natural resources, this operation must also take into account uses of the river for purposes other than electric power production. The operation of the power system also takes into account the minimum streamflows required for navigation and the maintenance of fishlife. Release of water from storage is designed not only for power production but also flood control and to keep adequate water in the river for navigation and fish migration and pollution abatement.

Southeastern Power Needs Met

Southeastern Power Administration's power sales contracts provide for the integration and the generation of power produced from water available from flood control projects of the Corps of Engineers of the Department of the Army in a manner which best meets the need of the area in which a particular project is located, in the light of the type and location of other power generating facilities in the area.

The Federal projects generally are operated to produce as peaking power. Energy is made available from the projects on the basis of long-range and day-to-day operational studies showing the most efficient use of available water, and the day-to-day dispatching of power available is done in accordance with the needs of the power systems into which such power is delivered.

Conservation of water resources will also result from the integrated operation of various Federal hydroelectric projects and other power systems in the Southeast. Negotiations are continuing to affect these operations.

Southwestern Power Operations

The Southwestern Power Administration operates and leases extensive high-voltage electric power transmission facilities for the integration of Federal hydroelectric power with many public and private power systems in the area to produce economy and flexibility in servicing power sales contracts. Power generated at flood control projects of the Corps of Engineers, Department of the Army, is thus integrated with other systems to secure reliable sources of electric energy for customers throughout the area.

In the interest of conservation of our natural resources, comprehensive planning is performed in connection with hydroelectric gener-

ation and other purposes for proper coordination in use of water stored in the several Federal reservoirs.

Recently, the marketing of power has been reviewed extensively by congressional committees and other interested groups. Southwestern Power Administration is engaged in striving towards meeting the objective of optimum benefits from all the Nation's resources as well as the comprehensive planning of resources development measures.

Partnership Is Guiding Policy

Partnership with the water users in the initiation, financing, construction, and operation of multiple-purpose water conservation projects in the West was a guiding policy in 1956.

A striking example of the effectiveness of this policy was the $27.5 million Ventura project in California. As a result of prompt completion of a repayment contract and the advancement to the Bureau of Reclamation in 1954 by the local water officials of $700,000 for preconstruction and design work, construction was advanced more than a year. It was the first time in 54 years of reclamation history that a repayment contract had been ready for signature on the same day that the President approved authorization of the project.

The Department was especially diligent during 1956 in its effort to transfer the responsibility for operation and maintenance of irrigation projects to the water users. With a few important exceptions, the Federal Government actually operates and maintains only the reserved work of multiple-purpose projects, while the balance of the facilities are operated and maintained by the various irrigation districts. During fiscal year 1956, the irrigation distribution facilities serving approximately 85 percent of the total irrigable acreage included in Federal reclamation projects were operated and maintained by the water users.

Recreation a Major Item

Approximately 9,858,000 persons enjoyed the use of recreational facilities on 140 reservoirs on reclamation projects throughout the 17 Western States in 1956. Estimates on expenditures at these reclamation playgrounds vary considerably, but is conservatively calculated at about $6 per day. This represents an appropriate share of investments in boats, hunting and fishing equipment, etc., traveling expenses, and food and lodging. Applied to the total number of visitors, this estimate indicates an "extra dividend" each year of approximately $59 million from reclamation.

PUBLIC LANDS

The use or acquisition of public lands by the people of the United States through the Department programs as custodian of the public domain is governed by a system of land classification which assures wise use with minimum depletion of our land resources.

Land classification and subsequent lease or disposal actions are based upon established conservation principles including that of attaining the highest and best use of lands. This requires close cooperation and coordination with a wide variety of conservation organizations, including the land management agencies of various Federal, State, and local governments, as well as the representatives of various major land users such as farmers, ranchers, owners, and lumbermen.

Of foremost consideration in the lands program is the concern for the continuing growth and expansion of the economy of the Far West and Alaska. As the Federal Government is the greatest single land custodian in these two large geographic regions, it has become incumbent to pursue a program fitted to the developmental requirements of these areas, which form a vast and vital part of the national economy.

As the demand for land intensifies, a closer look must be given to the factors which control the optimum uses for lands. Where conflicting land uses become manifest, a reconciliation of those uses must be effected wherever possible. In so striving, assessment must be given to all factors which determine the highest and best land use. Wherever practicable, and when the circumstances permit, compatible use demands are being molded to permit simultaneous multiple use of public lands.

Conservation Is Keynote

The nonrenewable nature of some of the basic land resources points up the need for continuing "minimum depletion, wise use, without abuse" conservation policies.

The technology and skills developed by the Department in evaluating various land uses and applying the principles of multiple land use, assure a well conceived and balanced program for the proper management and orderly lease or disposal of the public domain lands in the United States.

Fundamental to that program is completion of a project for modernizing the basic land records. With the aid of modern technology, wornout documents are being permanently preserved on microfilm and electronic tabulating cards to permit easy reference and the preparation of plat diagrams that will greatly facilitate record searching and use by the public as well as other agencies.

Cadastral Surveys

Adequate cadastral surveys are essential to the successful management and conservation of the natural resources of the public lands. These surveys create, reestablish, and identify the public land boundaries, indicating the limits of the lands under the Department's jurisdiction and subdividing the areas into usable economic units.

Of major importance, especially to some of the Western States, has been the stepped-up survey of school sections in those States so that they could obtain title to the lands granted to them and thus utilize the resources of those lands.

Range Management

The Department's responsibility for conservation of Federal rangelands in the United States and Alaska is of vital importance to the future of the Nation. The range livestock industry, one of the more important activities of the western range, is basic to the economy of the Western States. Closely related to this is utilization of the range for food and shelter by wild game birds and animals.

For a number of years effort has been directed toward apportionment of livestock grazing privileges to qualified range users on the basis of the best grazing capacity survey information obtainable.

Cooperation Is Seen Improved

Cooperation with the various State game agencies continues to improve with active participation by the Department in evaluation of game range grazing capacities, determination of desired populations and proper hunter licensing, and in research for improvement of wildlife habitat.

Coupled with this is the intensive range improvement and protection program which encompases: supervision of range use; protection from fire, insects, rodents, noxious and poisonous plants; and a comprehensive land treatment program.

The Bureau of Land Management has reseeded over a million acres of rangeland which will be passed on to the next generation in much more productive condition.

Forestry

The forest lands administered by the Bureau of Land Management fall into three categories: the revested O & C Railroad grant lands and other areas generally identified as O & C lands; the public domain forest lands in the continental United States; and the public domain

forest land in the Territory of Alaska. They approximate 2½ million acres in the O & C area, 4½ million acres of the United States public domain, and 40 million acres in Alaska.

These forest lands comprise a basic resource having an actual value of billions of dollars. The estimated sustained allowable annual cut of sawtimber is approximately 4 billion board-feet, or about 10 percent of the annual national consumption. In addition, the woodland areas provide a permanent source of material for fuel wood, posts, poles, and other products equivalent to an allowable cut of 2½ billion board-feet per year.

Proper management of this invaluable asset dictates that the allowable annual cut (the quantity which nature and man can replace) be harvested each year in order to provide an everlasting supply of timber for future generations. Wise and judicious perpetuation of this national resource by attaining the maximum allowable harvest is the Department's responsibility. For the past 5 years, the O & C lands have been unique in that they are one of the few major forest areas under Government administration in which the actual cut has come up to the allowable cut for perpetuation of the forest, without exceeding the allowable cut.

Wherever feasible, the practice of private tree farming is facilitated and extended either by integrating the management of public domain forest with such enterprises, or by disposal of isolated tracts.

Controlled cutting, intelligently planned access roads, increasingly better protection, constantly improving forest practices, and more and more reforestation reflect proper management. These activities expedite the harvesting of salvage and overmature timber, and turn more acres over to the immature growing stock that will supply future generations with wood products, insure recreation values, and protect water supplies.

INDIAN AFFAIRS

The Department has trust responsibility for somewhat more than 39 million acres of tribal and about 14 million acres of allotted Indian lands.

Unlike public lands, these lands are the private property of the Indians with the fee title held in trust by the Federal Government. The resources involved include an estimated 3,600,000 acres of farmland, of which 860,000 acres have irrigation facilities available. Indian rangelands comprise slightly more than 44 million acres with an annual forage production sufficient for 880,000 cow units, and having an annual use value of $6,500,000.

There are about 6 million acres of commercial timber with an estimated volume of 30 billion board-feet. The value of the annual

cut is aproaching $11,750,000. While the acreage of land under which minerals may be found is unknown, in excess of 5 million acres are covered by oil, gas, and other mineral leases which earned approximately $30 million in rentals, bonuses, and royalties.

Objectives

In connection with its trust responsibilities, it is the aim of the Department to assist the Indians in obtaining maximum return from the use and development of the resources consistent with sound management and conservation practices; to preserve the renewable resources in a perpetually productive state; and to build up to optimum productivity those resources where they have deteriorated.

Soil and water conservation activities are an integral part of the Department 20-year plan of soil and moisture conservation development program. During the first few years of activity in this field, the critical erosion condition of the land and the magnitude of the problem made it necessary to limit basic investigation to sites where structural and other control measures were being applied. The most pressing situations have now been met sufficiently so that attention can be given to securing a complete inventory of improvements, soil, water, forage, and wildlife resources.

Coordinated surveys have been initiated in all areas within the past 2 years. It is anticipated that such surveys will be completed within the 15-year goal set by the President for a complete inventory of the Nation's soil and water resources. Watershed, farm, ranch, and reservation development and management plans are formulated in accordance with these basic data.

Conservation Results Seen

Conservation activities and practices now being applied on Indian lands are transforming them into some of the most productive lands in their respective localities.

Over one-half of all Indian lands in the United States are included in organized soil conservation districts. Active participation on the part of land owners and operators has increased materially as a result of leadership and technical guidance furnished by the Department, as well as that furnished by State and local agencies. These activities are permitting Indians to realize an increasing amount from each dollar spent on conservation.

An analysis of the results of applying conservation practices made on 15 reservations where the program has been in effect since 1945 on 2,309,379 acres treated showed an increase in 1955 of 51.29 percent in agriculture production. This was a return of $37.97 for each dollar

expended by the Federal Government. Cooperators contributed $13 for each dollar expended by the Department. Total increased production was $4.48 for each dollar of total expenditure by all participants.

Practically half of the Indian land was critically or severely eroded. In some areas approximately one-fourth of the cultivated land had been abandoned. The most severe erosion has been materially checked and the productivity of extensive areas materially improved. About 20 percent of the total estimated job has been completed.

Indian Range Management

The management of Indian rangelands during 1955 was high-lighted by the development of new grazing regulations for the Navajo Reservation after several years of consultation with tribal representatives. The regulations place considerable responsibility in central and district grazing committees in administration of grazing permits which provide for the conservative use of the Navajo range.

Irrigation Development Essential

Agricultural development by irrigation on most of the reservations in an arid and semiarid West constitutes an important opportunity whereby Indians may become self-supporting and make proper use of their lands. The continued development of Indian irrigation projects is essential to preserve the water rights appurtenant to the reservations which have been established by treaties or other Federal enactment.

Indian irrigation projects create wealth in the same measure as do reclamation projects, but are constructed primarily for the benefit of the resident reservation Indian families.

Thus they serve in part to discharge the obligation of the Federal Government to the Indian people in promoting their welfare toward true equality with their fellow Americans.

Indian Forest Management

A very important resource requiring full-time conservation efforts and wise use are the Indian forests. These forests are working forests in the sense that they are expected to make their full contribution to the economic welfare of the Indian owners.

The primary objective in managing these forests is to provide a continuing harvest of usable wood products. There are also the collateral objectives of watershed protection, forage production for grazing purposes, the development of fish and game resources, and the preservation of scenic and recreational values.

In recent years, a few Indian tribes have authorized the use of tribal funds to finance inventories of their timber resources. These inventories, based upon modern techniques of aerial and ground surveys, have supplied the information required for a more exact determination of allowable cut under sustained-yield management.

The results have been impressive. On the Navajo Reservation, for example, logging operations have formerly been restricted to a maximum cut of about 14 million board-feet a year, because the meager data available regarding the forest did not justify any larger scale operations.

A careful inventory, begun in 1952, revealed that the annual cut can be increased safely to 28 million board-feet. This doubling of the annual cut has been approved, and plans are nearing completion for putting it into effect.

There is reason to believe that the time is approaching when all Indian forests will be making their full contribution to the economic welfare of the Indian owners, and to the stabilization of dependent wood-using industries.

Mineral Development Encouraged

In addition to the surface resources, Indians also possess considerable wealth in oil, gas, and various other minerals. Indian tribes and individual Indians are encouraged to lease their trust land for oil and gas and other mineral development with the aim of obtaining a maximum recovery and income consistent with a sound conservation program.

Conservation is promoted by providing for mineral development under leases, the terms of which authorize supervision of operations and cooperation with the lessees in proceeding with development.

Under the terms of the leases, if the Secretary believes that economic conditions are unsatisfactory, he may authorize mining lessees to suspend operations for definite periods. Oil and gas leases contain specific provisions requiring the lessees to abide by any act of Congress or order or regulation concerning conservation. Regulations have been promulgated governing oil and gas operations. These leases also provide that the Secretary of the Interior may impose drilling and production restrictions in the interests of conservation and he may take into consideration among other things, Federal and State laws, regulations, rules, and lawful agreements.

Unit Development Frequent

As a conservation device Indian lands under oil and gas leases are frequently included in approved unit development agreements along

with lands owned by other individuals and also lands owned by the State and Federal Governments. The lands included in the agreements are operated as a single unit without regard to separate ownership.

The planned drilling program authorized in the agreements results in the economy of drilling fewer wells, conservation of the gas energy and higher ultimate recovery.

Where conditions warrant, authorizations are given for the injection of air and gas in the oil sands for repressuring. Likewise, under proper conditions, agreements are approved for secondary recovery under waterflooding programs.

THE NATIONAL PARK SYSTEM

The existence of the national park system is proof that the American people believe that the best use to be made of the finest of the Nation's natural scenery and the most significant of its historic and prehistoric resources is to give them the fullest possible degree of protection, and to devote them to the inspiration and enjoyment of present and future generations.

The Congress has repeatedly made it clear that this kind of management was to be applied to these great possessions of all the people of the United States.

The national park system contributes tremendously to present-day needs of the American people. This is shown conclusively by the steady and rapid increase in volume of patronage, up nearly 150 percent since World War II, to more than 50 million visits in the calendar year 1955. The increased rate of use is even more rapid the first half of the 1956 calendar year.

As expanding benefits of our thriving national economy provided increasing millions of Americans with the leisure time and the means to enjoy the great inspirational and cultural resources of our park system, grave problems involving the conservation of those resources arose.

So it was that, a year and a half ago, it became apparent that increasing park use, accompanying changes in American vacation and travel habits and requirements, necessitated a complete new look at the development, staffing, and adequacy of the park system to meet the challenge it faced.

Mission 66

Out of this study emerged a bold and comprehensive long-range program designed to provide the American people with a park system

adequate in all ways necessary for their enjoyment and inspiration. This program is scheduled for completion in 1966—the golden anniversary of the establishment of the National Park Service. It is known as Mission 66.

In February the program was submitted to the Congress with the firm endorsement of President Eisenhower. The President informed Congress that "Unless vigorous action is taken, many Americans visiting the parks will be frustrated in gaining the scenic and educational benefits they seek and deserve."

Congressional approval of the objectives of Mission 66 was evidenced in the 1957 appropriations which provided the National Park Service with $68,020,000, an increase of $19,153,700 over 1956 appropriations.

Advance planning permitted an immediate start on a number of Mission 66 projects and tangible evidence of the program's benefits will begin appearing in the parks next summer. The program calls for substantial annual increases in Service appropriations to overcome longstanding deficiencies and to make possible the effective use and satisfactory maintenance of the additional facilities which will be provided.

A Program of Conservation

Although considerable construction will be required to provide the campgrounds, interpretative facilities, roads, trails, lodges and maintenance facilities, Mission 66 essentially is a program of conservation. Preservation of the wilderness qualities and primitive settings which give precious meaning to the existence of our parks and national monuments is a paramount goal of Mission 66. By providing facilities which discourage overcrowding and permit fuller understanding, the park system can benefit greater numbers of people and still be passed on unimpaired for the enjoyment of future generations.

The conservation character of Mission 66 is emphasized in all phases of the program which fully recognizes the need for alertness to prevent any damaging impact on the superlative feature of the national park system.

The problem of providing healthful outdoor recreational facilities extends well beyond the national park system. The rapidly increasing population and the consequent shrinking of undeveloped areas require the provision of a greatly expanded system of public recreation areas throughout the States and Territories. This calls for understanding cooperation between Federal, State, and local governments.

Recreation Plan Provided

An important facet of the Mission 66 program is the provision for developing by 1961 a national recreation plan and to cooperate with other Federal, State, and local agencies in meeting the growing need for additional recreation facilities.

Even before funds for starting the national recreation study became available, the Service with a limited staff assisted the States and Territories on 350 occasions on a wide variety of park and recreation programs.

Development of the Mission 66 program was a venture in which all employees of the Service, regardless of rank, were invited to contribute ideas and suggestions. It represents a distillation of the contributions of literally hundreds of men and women, who saw in it promise of a remedy for conditions which were threatening—which had, indeed, already resulted in serious damage to—priceless and irreplaceable resources.

As originally conceived the program represents the best estimates of the men closest to our parks and monuments of the needs of the system in the years ahead. Mission 66 was conceived, however, as a dynamic, flexible program which will require adjustments from time to time to keep abreast of changing costs and variations in the visitor travel pattern.

New Areas Established

The national park system was enlarged and strengthened in numerous ways during the past fiscal year. Two new areas were established—Cumberland Gap National Historical Park, in Kentucky, Tennessee, and Virginia, and Fort Union National Monument in New Mexico.

Pending as the year closed and subsequently enacted were bills authorizing establishment of the Virgin Island National Park on the Island of St. John in the Caribbean; Pea Ridge National Military Park, Ark.; and Horse Shoe Bend National Military Park, Ala. Zion National Monument and Zion National Park were incorporated into a single national park.

Some 46,000 acres of private holdings within the boundaries of national park areas were acquired during the year by purchase, donation, or exchange.

Thus as the fiscal year ended and Mission 66 was launched, the national park system embarked on what promises to be the most rewarding era in the history of the National Park Service.

FISH AND WILDLIFE RESOURCES

To keep pace with the inroads which industrial and agricultural progress is making on the fish and wildlife resources of the country, the Department continued to expand its programs to assure sound conservation, full development, and wise use of these resources.

The policy is based primarily on the concept that conservation is concerned as much with the proper utilization of the fish and wildlife resources as it is with their protection, since the maximum value to the Nation of these renewable resources comes only when they are fully utilized, consistent with good management.

Pursuit of Facts Important

Any intelligent program of natural resource management, therefore, is constantly in pursuit of facts. Facts are needed to establish management procedures permitting full realization of maximum production. Facts are necessary to establish annual population levels and to show the portion of such an annual population that can be harvested without detriment to the capital stock. Thus, basic research becomes the foundation of the Fish and Wildlife Service's operational activities.

Fishery Biological Research

Fishery biological research is largely concerned with reaching explanations of fluctuations and with using such understanding for the benefit of fishermen and good management of the resource. What now seem to be capricious changes in fish behavior, or overfishing, or mismanagement, but which probably are interrelated effects of changes in climate, currents or flows, food, predation, disease incidence, and fishing effort, will be understood when many skills and specializations are brought to bear upon the forces which affect fish.

With fuller understanding through research will come fuller realization of true conservation. For many species it will be possible to direct fishing to take fish at the time in their lives—considering growth rates and mortality rates—when the yield is greatest, and to deploy fishing time to encourage the most profitable and productive balance among fish stocks.

With more knowledge gained from research, fishery conservation will move closer and closer toward the concept of true fish husbandry—wise use, maximum sustained yield, and greater productivity.

Development of the Commercial Fisheries

The marine fisheries are a vast resource, capable of considerable further development. It is the Department's responsibility, through its commercial fisheries program, to explore and develop this potential national wealth and at the same time seek the wisest utilization of the resource which insures its conservation for future generations.

Exploratory fishing and gear research is directed towards the most efficient utilization of the nation's fishing resources. Deepwater and distant-water explorations have developed new potential resources, thereby widening the scope of opportunity for the present fishing fleet. This also results in reduced fishing pressure for presently heavily fished areas, thereby aiding in conservation but not reducing the total output of the commercial fishing industry. Applied research on fishing gear function has resulted in methods to harvest fish and shellfish in new fishing areas.

Restoration of the Alaska Salmon Fisheries

Because of the depleted condition of the pink salmon runs in southeastern Alaska and Prince William Sound, a vigorous restoration program was initiated in 1954 and continued in 1955. This consisted of complete closure of the pink salmon fishery in Prince William Sound, and a reduction in trap fishing effort by 50 percent in southeastern Alaska coupled with large increases in closed areas in various bays to reduce purse seine catches.

This program of reserving a large proportion of the runs for spawning stock resulted again in generally satisfactory escapements of pink salmon from which larger future runs can be expected.

The Bristol Bay red salmon restoration program of recent years also began to pay dividends in 1956, and much improved runs appeared in the major districts, yielding 50 percent larger catches than the parent year, and at the same time providing an adequate seeding of the spawning grounds.

Wildlife Habitat Research

If wildlife is to survive and continue to perpetuate itself, it must have adequate habitat. This required food and cover is affected by the use man makes of the land.

Increasing human populations which require more food, more building materials, and more intense use of the land cause radical changes in living conditions for wildlife. Wild animals, however, are tough and resilient and can respond and acclimate themselves re-

markably well to certain of these changes. In recent years, for instance, wildlife investigators have found that wildlife can withstand much heavier hunting than was previously thought possible.

To obtain these facts for the basis of an efficient management program, some 80 wildlife biologists are stationed throughout the United States and Alaska engaged in research on a wide variety of species and problems.

River Basin Studies

Development of the Department of Agriculture's soil bank program has opened up new opportunities for the preservation and enhancement of wildlife habitat throughout the country. The Fish and Wildlife Service has taken an active part in planning for the implementation of this program to assure that full consideration of measures to improve wildlife habitat is included in the policies and practices established for the program.

The nationwide wetlands preservation and development program made considerable progress during the past year. Cooperative preservation programs with numerous State fish and game agencies got under way. Several committees, both statewide and regionwide, were set up to create greater interest in wetlands.

Federal Aid Restoration Programs

In the sport fishery field under the Dingell-Johnson program, many new impoundments were created and stocked to provide more recreational opportunities for the millions of Americans who annually search for good fishing spots.

Means by which productivity of both the manmade and natural fishing waters could be increased were the subject of a wide variety of research spread across the country.

Wildlife restoration operations under the Pittman-Robertson program were varied and highly productive. Field surveys and investigations stressed the assembling of information that was used to set open seasons and bag limits to insure the most effective cropping of game bird and mammal surpluses.

National Wildlife Refuge Program

Two new national wildlife refuges were placed under administration during the past year. This was made possible by the secondary use of two flood control reservoirs which were secured by agreements from the Corps of Engineers, Department of the Army.

One of these new refuges, the McNary Wildlife Management Area, is on the Columbia River in Washington; the other, the Snake Creek National Wildlife Refuge, is on the Garrison Reservoir in North Dakota.

Nearly 1,500 acres were purchased in fiscal year 1956 for the Quivira National Wildlife Refuge in Kansas. This refuge was established in the preceding year because of the need for a waterfowl wintering area in that part of the Great Plains.

Management of Migratory Waterfowl

Several years ago the management of migratory birds entered a new era with the establishment of organizations built around the four flyways which in turn are the management units for most migratory birds.

Beginning primarily as an organization including administrative heads of the respective State conservation departments, each of the flyway organizations has since developed within their ranks technical committees composed of trained personnel from all 48 States. The Service has given leadership to these research crews through the appointment of a representative in each of the four flyways.

Controlling Predatory Animals

The control of destructive animals is frequently necessary to maintain populations of these wildlife species at a level where their numbers will not be in serious conflict with human interests.

Operations to accomplish this were conducted during the year on both public and private lands to reduce losses to livestock and game caused by wide-ranging predatory animals. The work also included measures taken for the suppression of various forms of field rodents destructive to agricultural crops, horticulture, irrigation structures, timber production, and range vegetation.

The economic livelihood of many persons engaged in the utilization of these resources is dependent upon keeping losses from all causes at a minimum.

Maintaining the Inland Fisheries

The Fish and Wildlife Service cooperates very closely with the States and other agencies of the Federal Government in the maintenance of the inland fisheries in all parts of the country.

It is Federal policy to aid the States wherever and whenever it is necessary to maintain and preserve game-fish populations. Studies

are conducted on large management areas to obtain information on fish habitat, environmental factors affecting reproduction and carrying capacities, and on wise utilization of the fishery resource.

The operation and maintenance of 91 fish hatcheries is an important part of the program. The fish produced at these hatcheries are distributed to areas where the restocking of waters is most urgent and to the States for supplementing programs as necessary.

Foreign Activities

The work of the several international fishery commissions of which the United States is a member continues to demonstrate the usefulness of this type of organization as a means for bringing about cooperation between governments.

Broadening this system to deal with yet unsolved problems, the United States and Canada established during the last year a new organization known as the Great Lakes Fishery Commission.

An equally important function is the promotion and coordination of general fishery research in the Great Lakes to obtain information which will enable the two Governments to assist the commercial and sport fishermen in solving problems which have plagued them for years.

CONSERVATION IN THE TERRITORIES

The story of conservation in the Territories can best be told in terms of cooperative action rather than through separate consideration of the work of individual bureaus of the Department. It is a story which largely concerns Alaska. While both Hawaii and Puerto Rico have larger populations and more land in current use, neither can compare with our great northern Territory in those natural resources which are the Department's special province.

The Department's conservation responsibilities are not, however, confined to Alaska. In the Pacific the Department's Office of Territories often deals directly with conservation problems since in American Samoa, and particularly in the Trust Territory, it exercises direct governmental functions.

Resource Important to Living Standard

In these areas land resources, while meager, are all important to islander standards of living. The Department is therefore greatly concerned with the conservation and use of island agricultural lands, not only for the production of tropical crops such as coconuts, taro,

breadfruit, cocoa and coffee, but also for truck crops and livestock as well.

In the Virgin Islands the scarcity of fresh water makes the conservation of water resources a major problem. Here the Virgin Island Corporation has been engaged for a considerable period in a program of building small dams to impound surface runoff. Those completed to date have an impounding capacity of over 400 million gallons. This program has had an invaluable effect in raising water tables and thus increasing the availability of well water. VICORP is also engaged in both land clearance and reforestation activities and operates a livestock improvement program.

Hawaii Requires Little Aid

In the Hawaiian Islands resources in sugar and pineapple land and in scenery and climate, which have made tourism a major industry, are the prime concern of the Territorial Government and little Federal assistance is needed.

The National Park Service contributes to the conservation of the scenic wealth of Hawaii by maintaining the Hawaii National Park on the Island of Hawaii and Maui.

Emphasis on natural resources should not overshadow a most important Department function of helping to conserve resources in human beings in areas under its jurisdiction. Through active and often direct promotion of Territorial health and education programs, and through a program of training islanders in the difficult art of self-government, the Department is increasing both the significance and the usefulness of its other conservation activities.

Greatest Effort in Alaska

While the conservation programs described previously are all important to the people whom they affect, they are dwarfed by the conservation effort of the Department directed toward Alaska.

In that magnificent region, one-fifth as large as the area of the States, currently used natural resources—fish, fur, minerals, coal, forests, and water—produce a great deal of Alaska's annual income, while currently unused resources constitute a tremendous storehouse of wealth for the future.

The Federal ownership of all but an insignificant percentage of Alaska's land greatly magnifies Federal responsibility for these resources and also affords a dramatic opportunity for the Federal Government to transform conservation philosophy into practical down-to-earth realities.

Seal Herd Restored

What can be accomplished in this respect has been demonstrated impressively in the Pribilof Islands, home of the fur seal. Once under Russian ownership and once again after Alaska was purchased by the United States, unrestricted commercial exploitation all but exterminated the Pribilof Island seal population.

A combination of international cooperative control measures, protection of the rookeries and of seals in the open sea, and strict control over the number of seals taken each year, has brought the herd back to its former abundance. Not only have the fur seals been saved from extinction but the Federal Government now grosses over $3 million annually from the sale of skins.

Salmon Problem Difficult One

The salmon of Alaska represent the Territory's most important and most difficult conservation problem. The current year provides a bright exception to a long-term trend of decline in the size of the salmon pack.

The annual wholesale value of the pack, even in a relatively poor season, is more than $60 million, an amount which is certain to be exceeded by the time all the returns are in for 1956.

The Department's program of salmon conservation measures includes control over fishing gear, control over fishery waters and over the periods during which fish may be caught, protection of spawning salmon, the destruction of predators, an intensive research program, and cooperation with the Territorial Department of Fisheries in all phases of salmon research and conservation.

The place of fish traps in a conservation program is still a matter of great controversy in Alaska.

Irrespective of the conflict between those who regard fish traps as having economic rather than conservation significance and those who hold the reverse of this view, it is obvious that strict control of the use of fish traps is essential to any salmon conservation program. This conclusion represents a major premise in the Department's efforts to protect the salmon runs. Thus, the Department has substantially reduced the number of fish traps in many areas of Alaska.

Sport Fishing Controls

The work of the Fish and Wildlife Service is also of great importance in protecting sport fishing as well as Alaska's great wealth in wildlife, including fur-bearing animals. Both sport fishing and hunting constitute fascinating attractions to the visitor to the Terri-

tory and the resource could not be maintained without careful control measures.

The Alaskan moose represent a prime illustration of the success of wildlife conservation. Their numbers have increased and their range has extended northward. This has been accomplished by strict control of hunting, by the establishment of game refuges, and by the control of predators of which the wolf is the most dangerous. Each season sees hunters get their quota of these handsome but vicious animals.

Wise Use Emphasized

Even more important to the economic development of Alaska are the Department's conservation measures in connection with coal, minerals, oil, forests, and hydroelectric resources. It is axiomatic that wise use and conservation of these sources of much of Alaska's wealth are but opposite sides of the same shield. Because many of the natural resources of the Territory remain to be developed, wise use is often the most important side of this shield.

The Department, through its railroad and highway building and maintenance activities, also makes possible both wise use and conservation in areas that, without these means of transportation, would remain inaccessible to economic development.

Petroleum Development Noted

Petroleum is still a relatively unknown quantity among the Territory's natural resources. The Department's leasing program is encouraging a widespread and responsible search for oil. With an eye to future conservation requirements, a development contract was secured during the year, covering 1,200,000 acres in 470 Federal land leases in the Icy Bay-Cape Fairweather region of Alaska.

Power Sites Surveyed

An auspicious beginning has been made in the appraisal and conservation of Alaska's water and hydroelectric resources. Intensive surveys of many potentially valuable water power sites have been made. Some, like the Eklutna project near Anchorage, are already adding to Alaska's wealth through production of electricity.

It is apparent from this consideration of the Department's conservation programs in Alaska that the Territory is providing a unique opportunity for a demonstration of the effectiveness of the partnership principle, both in extracting wealth from Alaska's natural resources and in conserving them for the wealth they will provide in the years to come.

PART II

ANNUAL REPORTS OF THE BUREAUS AND OFFICES OF THE DEPARTMENT OF THE INTERIOR

PART VI

ANNUAL REPORTS OF THE BUREAUS AND OFFICES OF THE DEPARTMENT OF THE INTERIOR

Office of the Assistant Secretary
Water and Power Development

Fred G. Aandahl, *Assistant Secretary*

THE ASSISTANT SECRETARY for Water and Power Development discharges the duties of the Secretary with respect to the Department's programs in the field of water and power development. In this connection, the Assistant Secretary exercises secretarial direction and supervision over the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, and Southwestern Power Administration. The principal function of the latter three agencies is to market surplus power generated in their respective areas at Federal projects. The Bureau of Reclamation constructs water-use projects whose primary purpose is the reclamation of arid and semiarid lands in the West, and also markets surplus power produced at Federal projects in the West outside the boundaries of the Bonneville Power Administration and Southwestern Power Administration. The Assistant Secretary for Water and Power Development is also responsible for carrying out the defense functions of the Secretary with respect to electric power and for supervising and directing the Office of Saline Water. The activities of the water and power agencies of the Department and the Office of Saline Water are more fully described in sections of this report covering each of the Department's bureaus and offices.

The table on the next page, prepared on a consolidated basis for fiscal year 1956, shows the installed capacity of plants whose power is marketed by Interior Department agencies, net energy generation, energy marketed, and gross revenues.

The Assistant Secretary for Water and Power Development participated in the negotiation of contracts for the marketing of power in the operating areas of Southwestern Power Administration and Southeastern Power Administration. Negotiations were completed and a

Power marketing data, fiscal year ended June 30, 1956

Marketing agency	Installed capacity (as of June 30, 1956) (kilowatts)	Net energy generated (million kilowatt-hours)	Energy marketed (million kilowatt-hours)	Gross revenue (thousands of dollars)
Bureau of Reclamation	[1] 5,571,050	25,814	[4] 10,759	[5] 39,233
Bonneville Power Administration	[2] [3] 1,910,000	13,102	25,970	60,993
Southeastern Power Administration	[2] 1,031,000	2,110	[6] 2,248	11,445
Southwestern Power Administration	[2] 501,000	938	[6] 1,493	8,183
Total	9,013,050	41,964	40,470	119,854

[1] Includes 565,000 kilowatts in Corps of Engineers, 31,500 kilowatts in International Boundary and Water Commission, and 4,974,550 in Bureau of Reclamation projects.
[2] Capacity in Corps of Engineers projects.
[3] Bonneville Power Administration also markets power from Bureau of Reclamation Grand Coulee, Hungry Horse, and Chandler powerplants with a capacity of 2,271,000 kilowatts. (This amount included in Bureau of Reclamation installed capacity.)
[4] Excludes 14,423 million kilowatt-hours delivered at Grand Coulee, Hungry Horse, and Chandler powerplants by Bureau of Reclamation to Bonneville Power Administration. (This amount included in Bonneville Power Administration energy marketed.)
[5] Excludes $16,129,430 revenue received by Bureau of Reclamation from Bonneville Power Administration. (This amount included in Bonneville Power Administration gross revenue.)
[6] Includes purchased energy.

sales, wheeling, and firming-type agreement for marketing of the remaining one-third of John H. Kerr project power was signed on December 7, 1955, with the Carolina Power and Light Co. to serve preferred agencies in North Carolina. Negotiations were also completed and a three-party arrangement for sale, wheeling, and firming was signed on May 16, 1956, with the Georgia Power Co. to serve preferred agencies in Georgia for the marketing of one-half of Clark Hill project power. Service to preferred agencies in Georgia was initiated on June 20, 1956. In the Southwest, at the direction of Congress, 4 inoperative lease-operate-with-option-to-purchase transmission agreements and 4 companion power sales and exchange agreements with generation and transmission cooperatives were reactivated. Negotiations were conducted to remove the option-to-purchase provision and to have operation performed by the cooperatives.

The Assistant Secretary for Water and Power Development directed a review of cost allocations and power rates for certain projects in the Southeast and Southwest. In the Southwest, a proposed upward adjustment of the average rate level for firm power was the subject of extensive review by the Congress and other interested agencies. The existing interim rate has been extended by the Federal Power Commission on a temporary basis. Studies indicated the necessity of an increase to provide repayment of the Federal investment in production and transmission facilities allocated to power on a 50-year basis with 2½-percent interest.

As a part of the partnership program approval was given Bonneville Power Administration to enter into long-term firm contracts with non-Federal generating utilities for transmission of power over the Federal transmission grid in the Northwest. In order to obtain full

regional integration and to secure the most economical use of resources, Bonneville Power Administration will build feasible additional transmission facilities as needed. Reimbursement will be on a use-of-facilities basis.

During the fiscal year ending June 30, 1956, the Department through the Assistant Secretary for Water and Power Development reviewed 31 reports of the Corps of Engineers, Department of the Army, concerned primarily with flood control and navigation, and 34 applications for permits and licenses referred to the Department by the Federal Power Commission. Total construction costs of these projects is estimated at over $2.4 billion. The desire of non-Federal agencies to participate in the Federal Government's partnership program continues to be evidenced by the large number of applications for licenses to the Federal Power Commission to construct hydroelectric projects. The total estimated construction cost of applications for licenses reviewed by the Department during the year is estimated at over $1.3 billion. A number of statutory provisions assure special consideration of Interior Department interests. In presenting its views to the Commission, the Department has taken the position that non-Federal development of hydroelectric power resources is desirable where such development is consistent with the public interest and, to the extent necessary, the Department has recommended special provisions which would safeguard the public interest and insure coordination with overall river basin programs.

The Assistant Secretary for Water and Power Development served as departmental representative on the Interagency Committee on Water Resources and on the President's Advisory Committee on Federal Public Works. Staff of the office served as departmental representatives on interagency committees concerned with radio frequency allocation, turbine procurement, international water developments, public works planning, coordination of water resources projects, cost allocation, financial practices, economic analysis, atomic energy, and similar subjects.

Other significant activities of the Office of the Assistant Secretary for Water and Power Development during the 1956 fiscal year included coordination of studies on Canadian-United States reservoir storage and hydroelectric projects and initiation of review of the Hetch Hetchy power operation of the city and county of San Francisco, Calif. An economic analysis of the Missouri River Basin completed by the Bureau of Reclamation was discussed with concerned congressional and State interests. Reappraisal of certain irrigation benefits was initiated with the cooperation of the Department of Agriculture.

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BUREAU OF RECLAMATION

Wilber A. Dexheimer, *Commissioner*

Introduction

EFFORTS of the Federal Government in cooperation with State and local agencies and private interests in the Western United States resulted in major progress in planned development and use of our water resources during 1956 fiscal year.

The Bureau of Reclamation added irrigation facilities to serve 203,000 acres of land with a new or supplemental supply of water and provided 120,000 additional kilowatts of hydroelectric generating capacity in multipurpose dams.

About $160 million was added to the Bureau's $2.6 billion investment in western projects through completion of these and other irrigation and power features.

Partnership with the water users in the initiation, financing, construction, and operation of multiple-purpose water conservation projects in the West was a guiding policy in Bureau of Reclamation administration in 1956. A striking example of the effectiveness of this policy was the $27.5 million Ventura project in California. As a result of prompt completion of a repayment contract and the advancement to the Bureau in 1954 by the local water officials of $700,000 for preconstruction and design work, construction was advanced more than a year. It was the first time in 54 years of Reclamation history that a repayment contract had been ready for signature on the same day that the President approved authorization of the project.

Another notable feature is the steadily increasing use which is made of reclamation facilities by seekers of recreation. Last year more than 10 million persons visited water playgrounds in the arid West made available on Reclamation projects through cooperative administrative arrangements between the Bureau, the National Park Service, the Forest Service, or State recreational agencies.

Bureau of Reclamation reservoirs rendered extraordinary service during the year in helping to control floods from heavy spring snowmelt in several States. In Washington, Idaho, and Oregon, particularly, the runoff of most streams of the Columbia River Basin was of flood proportions and storage in Bureau reservoirs prevented several local disasters as well as reducing the flood crest of the Columbia River. In California, flood control regulation of releases of water was required in varying degrees at all of the Bureau's 12 reservoirs but one—Cachuma.

The total harvest from all Reclamation projects in calendar year 1955, which included one-half of the 1956 fiscal period, was valued at over $827.7 million, an average of $132.18 per irrigated acre. This was the fifth consecutive year in which the total crop value exceeded the three-quarter-billion dollar mark, increasing the cumulative value of all Reclamation harvests through 1955 to more than $11.3 billion.

The Bureau of Reclamation has been especially diligent in its effort to transfer the responsibility for operation and maintenance of irrigation projects to the water users. With a few exceptions, the Bureau actually operates and maintains only the reserved works of multiple purpose projects. The balance of the facilities are operated and maintained by the various irrigation districts. During fiscal year 1956, irrigation distribution facilities serving approximately 85 percent of the total irrigable acreage included in Federal reclamation projects were operated and maintained by the water users.

A notable event of the year was authorization of the Colorado River Storage Project and 11 participating projects. This monumental authorization by the Congress, which was signed into law by President Eisenhower on April 11, 1956, will permit continued economic expansion of four Upper Colorado River States in an area of rich resources which is now virtually untapped. Coupled with the existing Reclamation development in the Lower Colorado River Basin, it will ultimately establish the most complete control and utilization of the water resources of any major river basin in America.

To undertake the design and construction of features of the Colorado River storage project and other new projects in fiscal year 1957, as well as proceed with engineering activities on projects under construction, the Bureau strengthened its staff by several administrative changes, undertook recruitment of new engineering personnel, largely from university graduates, and streamlined procedural techniques for greater efficiency and economy of operations.

IRRIGATION AND CROP PRODUCTION

During fiscal year 1956, the Bureau of Reclamation was responsible for overall supervision of the care, operation, maintenance, and re-

placement of facilities capable of delivering irrigation water to more than 7½ million acres of land—more than one-fourth of the total irrigated land area of the Western United States.

These facilities included 136 storage dams and reservoirs, 105 diversion dams, almost 24,000 miles of canals and laterals, and almost 7,600 miles of drains.

Crop Production

The total harvest from all Reclamation projects in calendar year 1955 was valued at over $827.7 million, an average of $132.18 per irrigated acre. Irrigable lands for service totaled 7,367,735 acres, of which 6,261,761 acres were actually irrigated. As compared to 1954, this represents an increase of 135,995 irrigated acres.

Forage crops were produced on 52.6 percent of the net area irrigated on all Reclamation projects, and 25.3 percent of the irrigated lands were utilized in producing cereals. The crops within these two groups, totaling more than 14.8 million tons, are utilized principally as livestock feeds, generally in the local areas of production.

Over 5.6 millions of tons of fresh vegetables, fruits, and nuts were produced from more than 719,000 acres of irrigated lands in 1955, and miscellaneous food crops such as dry beans, sugar beets, mint, hops, etc., totaling over 5.9 million tons were produced from almost 677,000 acres. Data on crop production by crop groups follow:

Crop groups	Irrigated crops		Gross crop value	
	Acres	Percent of total	Total	Percent of total
Cereals	1,585,465	25.3	$98,554,656	11.9
Forage	3,294,765	52.6	169,856,696	20.5
Field crops, miscellaneous	1,119,288	17.9	231,936,540	28.0
Seeds	285,800	4.6	28,485,153	3.4
Vegetables	458,901	7.3	143,133,802	17.4
Fruits and nuts	260,463	4.2	132,784,946	16.0
Other [1]			22,953,949	2.8
Total reported	7,004,682	111.9		
Less residue and multiple crops	888,631	14.2		
Plus soil-building crops	145,710	2.3		
Net acres irrigated	6,261,761	100.0	827,705,742	100.0

[1] Additional revenues from Federal and commercial agencies.

The volume of agricultural production totaled over 27 million tons in 1955, an increase of almost 458,000 tons over 1954. Increases were noted for all crop groups except miscellaneous field crops, which decreased more than 735,000 tons. The production of cotton was down more than 200,000 bales, sugar beets decreased almost 600,000 tons, and dry beans fell off about 18,000 tons. Average per acre crop yields

were slightly higher than in 1954 for the principal crops produced on most Federal irrigation projects, and in all, 1955 was a good crop year.

Average unit prices received by irrigation farmers for their products were generally somewhat lower than in 1954. This was true for all the principal crops except alfalfa hay, lettuce, dry onions, and peaches, which increased slightly in 1955.

The most significant individual crops produced on irrigated project lands in 1955 were barley, wheat, alfalfa hay, pasture, sugar beets, cotton, dry beans, late potatoes, tomatoes, lettuce, carrots, sweet corn, apples, peaches, table grapes, and citrus fruits. The acreage irrigated and gross crop value for each of these crops follow:

Crop	Acres	Gross crop value	
		Per acre	Total
Barley	518,146	$52.64	$27,277,488
Wheat	406,402	78.13	31,751,977
Alfalfa hay	1,549,665	77.40	119,949,491
Pasture	1,013,612	29.07	29,465,392
Sugar beets	326,285	168.64	55,024,398
Cotton	426,561	282.78	120,623,944
Beans, dry	324,364	84.06	27,267,356
Potatoes, late	183,256	201.15	36,862,363
Tomatoes, fresh	11,697	1,012.01	11,837,461
Lettuce	51,244	504.67	25,861,095
Carrots	10,070	801.98	8,075,981
Sweet corn	24,163	159.89	3,863,426
Apples	37,502	709.40	26,604,003
Peaches	27,212	419.29	11,409,607
Table grapes	51,645	506.76	26,171,705
Citrus fruit	43,834	565.08	24,769,563

The 73 Reclamation irrigation projects, located throughout the 17 Western States, are divided into 7 regions for administrative purposes. States located mainly within each region are as follows:

Region 1—Washington, Oregon, Idaho, and western Montana;
Region 2—California, except southern portion;
Region 3—Arizona, southern California, and southern Nevada;
Region 4—Nevada, Utah, western Colorado, and southwestern Wyoming;
Region 5—Texas, New Mexico, Oklahoma, and southern Kansas;
Region 6—Eastern Montana, North Dakota, South Dakota, and northern Wyoming;
Region 7—Eastern Colorado, Nebraska, northern Kansas, and southeastern Wyoming.

Region 1, with 2,229,614 acres of irrigated lands, the largest in area irrigated of the seven Bureau Regions, produced crops valued at over $242 million. This region contains 36 percent of the irrigated lands and accounted for 29 percent of the total value of crops produced on all Reclamation projects in 1955. Region 3, with less than half as much irrigated land as Region 1, produced crops valued at almost $213 million, or 26 percent of the total production from all Federal projects during this same year. Comparative data for regions follow:

Region	Irrigated acres		Gross crop value	
	Acres	Percent	Total	Percent
1	2,229,614	36	$242,676,213	29
2	869,765	14	184,086,738	22
3	911,397	15	212,984,713	26
4	543,421	9	39,502,914	5
5	261,536	4	45,921,093	6
6	469,803	7	20,013,649	2
7	976,225	15	82,520,422	10
Total	6,261,761	100	827,705,742	100

Each of the 17 Western States participated in the Reclamation harvest for 1955. Idaho had a larger acreage of irrigated project lands than any of the other States, followed by California, Colorado, Washington, Oregon, Arizona, Nebraska, Utah, and Montana. The gross value of crops produced on Federal projects located in California was higher than for the other Western States; however, the average gross crop value per acre was highest for Arizona, followed by California, Texas, Washington, New Mexico, Oklahoma, etc., respectively. Irrigated acreage and crop value data are presented for each State as follows:

TABLE 1.—*Projects in operation—Irrigation and crop value data for the calendar year 1955*

State, project and division	Irrigable acreage	Irrigated [1] acreage	Gross crop value	Gross crop value per acre irrigated
Arizona	*Acres*	*Acres*	*Dollars*	*Dollars*
Gila	82,600	53,627	7,448,713	138.90
Salt River	332,553	275,053	72,347,191	263.03
Yuma	51,936	45,539	14,617,590	320.99
Yuma Auxiliary	3,423	2,484	683,248	275.06
Subtotal	470,512	376,703	95,096,742	252.44
California				
Boulder Canyon:				
Coachella division	74,800	50,140	26,650,603	531.52
Imperial division	530,000	474,557	89,624,039	188.86
Central Valley	852,204	654,425	165,964,875	253.60
Klamath	90,390	78,021	7,591,119	97.30
Orland	19,439	16,661	1,212,728	72.79
Yuma	14,610	9,997	1,613,329	161.38
Subtotal	1,581,443	1,283,801	292,656,693	227.96
Colorado				
Colorado-Big Thompson	615,000	615,000	51,210,768	83.27
Fruitgrowers Dam	2,662	1,850	309,181	167.12
Grand Valley	42,495	36,653	5,106,614	139.32
Mancos	8,746	7,217	308,644	42.77
Missouri River Basin:				
Upper Republican division: St. Francis unit	745	745	47,762	64.11
Paonia	11,500	8,900	736,891	82.80
Pine River	40,718	34,878	1,294,092	37.10
Pine River Indian Irrigation District	10,062	9,797	349,615	35.69
Uncompahgre	88,601	73,762	4,990,262	67.65
Subtotal	820,529	788,802	64,353,829	81.58

[1] Includes a minor acreage of Class 6 land irrigated on a temporary annual water rental basis.

TABLE 1.—*Projects in operation—Irrigation and crop value data for the calendar year 1955*—Continued

State, project and division	Irrigable acreage	Irrigated acreage	Gross crop value	Gross crop value per acre irrigated
Idaho	*Acres*	*Acres*	*Dollars*	*Dollars*
Avondale	927	287	18,925	65.94
Boise	356,130	326,095	31,186,619	95.64
Dalton Gardens	944	484	39,043	80.67
Lewiston Orchards	3,528	2,198	777,682	353.81
Minidoka	1,095,802	1,020,177	82,135,124	80.51
Owyhee	33,454	31,809	3,127,168	98.31
Preston Bench	4,500	3,733	300,671	80.54
Rathdrum Prairie	4,236	3,415	341,052	99.87
Subtotal	1,499,521	1,388,198	117,926,284	84.95
Kansas				
Missouri River Basin:				
Bostwick division: Superior-Courtland unit	9,785	2,385	122,821	51.50
Montana				
Bitter Root	16,665	16,386	551,643	33.67
Buffalo Rapids	25,726	23,052	1,263,640	54.82
Frenchtown	4,810	3,932	214,679	54.60
Huntley	33,152	25,324	1,291,072	50.98
Intake	881	690	17,160	24.87
Lower Yellowstone	37,395	32,591	2,125,155	65.21
Milk River	132,220	78,261	3,372,380	43.09
Missoula Valley	977	830	31,033	37.39
Missouri River Basin:				
Three Forks division: Crow Creek pump unit	1,542	813	20,750	25.52
Yellowstone division: Savage unit	2,215	2,022	62,041	30.68
Sun River	95,646	76,406	2,387,297	31.24
Subtotal	351,229	260,307	11,336,850	43.55
Nebraska				
Mirage Flats	11,657	11,190	980,887	87.66
Missouri River Basin:				
Bostwick division: Superior-Courtland unit	13,813	10,434	893,882	85.67
Frenchman-Cambridge division	22,390	15,528	1,318,983	84.94
North Platte	286,728	242,431	22,039,980	90.91
Subtotal	334,588	279,583	25,233,732	90.25
Nevada				
Humboldt	37,446	20,275	1,119,452	55.21
Newlands	71,013	53,472	3,076,505	57.53
Truckee storage	29,212	22,697	1,774,290	78.17
Subtotal	137,671	96,444	5,970,247	61.90
New Mexico				
Carlsbad	25,055	20,000	3,695,724	184.79
Fort Sumner	6,500	5,379	464,416	86.34
Rio Grande	102,126	86,153	19,635,324	227.91
Tucumcari	42,214	33,616	1,869,467	55.61
Vermejo	7,379	3,763	106,534	28.31
Subtotal	183,274	148,911	25,771,465	173.07
North Dakota				
Buford-Trenton	10,510	9,074	403,985	44.52
Lower Yellowstone	19,405	16,456	1,020,203	62.00
Missouri River Basin:				
Heart division:				
Dickinson unit	288	288	15,010	52.12
Heart Butte unit	70	70	4,285	61.21
North Dakota pumping division: Fort Clark unit	2,056	455	26,766	58.83
Subtotal	32,329	26,343	1,470,249	55.81
Oklahoma				
W. C. Austin	47,809	42,847	4,717,599	110.10
Oregon				
Arnold	4,248	2,632	134,592	51.14
Baker	7,312	7,305	342,988	46.95
Boise	1,724	1,424	86,058	60.43
Burnt River	15,230	15,115	736,934	48.76
Crescent Lake Dam	6,831	5,611	390,923	69.67
Deschutes	99,662	94,550	10,078,899	106.60
Grants Pass	10,369	7,408	946,280	127.74
Klamath	127,159	120,658	9,318,016	77.23
Ochoco	8,500	8,140	605,470	74.38
Owyhee	85,485	80,517	10,080,577	125.20
Umatilla	32,769	23,717	1,895,665	79.93
Vale	32,000	30,415	1,703,606	56.01
Subtotal	431,289	397,492	36,320,008	91.37

TABLE 1.—*Projects in operation—Irrigation and crop value data for the calendar year 1955*—Continued

State, project and division	Irrigable acreage	Irrigated acreage	Gross crop value	Gross crop value per acre irrigated
South Dakota	*Acres*	*Acres*	*Dollars*	*Dollars*
Belle Fourche	57,400	54,537	2,241,588	41.10
Missouri River Basin:				
Cheyenne division:				
Angostura unit	8,971	8,084	424,733	52.54
Rapid Valley	8,900	7,583	189,378	24.97
Subtotal	75,271	70,204	2,855,699	40.68
Texas				
Balmorhea	10,608	8,094	991,095	122.45
Rio Grande	94,220	61,684	14,440,934	234.11
Subtotal	104,828	69,778	15,432,029	221.16
Utah				
Hyrum	6,800	5,764	359,301	62.34
Moon Lake	75,256	49,720	1,036,819	20.85
Newton	2,200	1,963	106,265	54.13
Ogden River	23,656	15,765	1,714,788	108.77
Provo River	46,609	38,610	4,025,045	104.25
Sanpete	13,663	12,063	496,168	41.13
Scofield	15,609	14,219	660,170	46.43
Strawberry Valley	44,374	41,123	2,800,798	68.11
Weber River	109,032	90,960	8,937,343	98.26
Subtotal	337,199	270,187	20,136,697	74.53
Washington				
Columbia Basin	246,849	149,229	16,960,981	113.66
Okanogan	5,316	3,983	739,128	185.57
Yakima	449,099	393,955	79,551,144	201.93
Subtotal	701,264	547,167	97,251,253	177.74
Wyoming				
Kendrick	22,128	12,857	537,060	41.77
North Platte	70,676	65,655	5,368,279	81.76
Riverton	62,283	58,110	2,292,667	39.45
Shoshone	94,107	75,987	2,855,539	37.58
Subtotal	249,194	212,609	11,053,545	51.99
Grand total	7,367,735	6,261,761	827,705,742	132.18

State	Projects or major divisions	Irrigated acreage	Gross crop value	
			Average per acre	Total
	Number	*Acres*	*Dollars*	*Dollars*
Arizona	4	376,703	252.44	95,096,742
California	6	1,283,801	227.96	292,656,693
Colorado	9	788,802	81.58	64,353,829
Idaho	8	1,388,198	84.95	117,926,284
Kansas	1	2,385	51.50	122,821
Montana	11	260,307	43.55	11,336,850
Nebraska	4	279,583	90.25	25,233,732
Nevada	3	96,444	61.90	5,970,247
New Mexico	5	148,911	173.07	25,771,465
North Dakota	4	26,343	55.81	1,470,249
Oklahoma	1	42,847	110.10	4,717,599
Oregon	12	397,492	91.37	36,320,008
South Dakota	3	70,204	40.68	2,855,699
Texas	2	69,778	221.16	15,432,029
Utah	9	270,187	74.53	20,136,697
Washington	3	547,167	177.74	97,251,253
Wyoming	4	212,609	51.99	11,053,545
Total	89	6,261,761	132.18	827,705,742

The acreage and value of crops produced on each of the Federal Reclamation projects in calendar year 1955 are shown in table 1, while similar cumulative figures for all projects for the years 1906 to 1955, inclusive, are listed in table 2.

TABLE 2.—*Annual acreage and cumulative crop values—calendar years 1906–55*

Year	Federal irrigation projects [1]					Warren Act lands and special contractors					Entire area				
	Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value		Irrigable acreage	Irrigated acreage	Net area in cultivation	Total crop value	
				For year	Cumulative total				For year	Cumulative total				For year	Cumulative total
1906	39,300	[2] 22,300	[2] 20,100	[2] $244,900	$244,900						39,300	[2] 22,300	[2] 20,100	[2] $244,900	$244,900
1907	266,300	[2] 187,628	[2] 169,000	[2] 4,760,460	5,005,360						266,300	[2] 187,628	[2] 169,000	[2] 4,760,460	5,005,360
1908	488,942	[2] 289,549	[2] 260,500	[2] 7,635,888	12,641,248						488,942	[2] 289,549	[2] 260,500	[2] 7,635,888	12,641,248
1909	730,601	410,628	410,628	11,920,663	24,561,911						730,601	410,628	410,628	11,920,663	24,561,911
1910	917,751	473,423	473,423	12,974,639	37,536,550						917,751	473,423	473,423	12,974,639	37,536,550
1911	1,042,609	564,681	564,681	13,121,224	50,657,774						1,042,609	564,681	564,681	13,121,224	50,657,774
1912	1,205,236	618,680	641,397	14,479,368	65,137,142						1,205,236	618,680	641,397	14,479,368	65,137,142
1913	1,255,381	699,183	642,216	15,732,215	80,869,357						1,255,381	699,183	642,216	15,732,215	80,869,357
1914	1,240,875	761,271	703,424	16,475,517	97,344,874						1,240,875	761,271	703,424	16,475,517	97,344,874
1915	1,472,772	856,778	757,613	18,164,452	115,509,326						1,472,772	856,778	757,613	18,164,452	115,509,326
1916	1,405,452	922,821	858,291	32,815,972	148,325,298						1,405,452	922,821	858,291	32,815,972	148,325,298
1917	1,599,525	1,057,513	966,784	56,462,313	204,787,611						1,599,525	1,057,513	966,784	56,462,313	204,787,611
1918	1,732,374	1,141,516	1,051,193	66,821,396	271,609,007	951,987	[2] 501,100	[2] 481,600	[2]$35,000,000	$35,000,000	2,684,361	[2] 1,642,616	[2] 1,532,793	[2] 101,821,396	306,609,007
1919	1,636,159	1,187,255	1,113,469	88,974,137	360,583,144	1,011,815	916,313	880,613	64,004,750	99,004,750	2,647,974	2,103,568	1,994,082	152,978,887	459,587,894
1920	1,661,960	1,223,480	1,153,820	66,171,650	426,754,794	1,183,292	981,940	950,830	47,505,770	146,510,520	2,845,252	2,205,420	2,104,710	113,677,420	573,265,314
1921	1,674,100	1,227,500	1,157,900	49,620,300	476,375,094	1,146,810	1,001,250	969,550	44,906,130	191,416,650	2,820,910	2,228,750	2,127,450	94,526,430	667,791,744
1922	1,692,700	1,202,130	1,169,100	50,360,850	526,735,944	1,101,700	983,290	951,270	33,240,840	224,657,490	2,794,400	2,185,420	2,120,370	83,601,690	751,393,434
1923	1,718,400	1,213,700	1,179,870	65,046,300	591,782,244	1,231,400	1,051,380	993,040	37,557,860	262,215,350	2,949,800	2,265,080	2,172,910	102,604,160	853,997,594
1924	1,805,730	1,290,890	1,216,610	66,488,560	658,270,804	1,237,885	930,670	889,460	43,237,470	305,452,820	3,043,615	2,221,560	2,106,070	109,726,030	963,723,624
1925	1,802,970	1,320,300	1,242,750	77,608,880	735,879,684	1,340,000	1,019,170	951,250	53,655,850	359,108,670	3,142,970	2,339,470	2,194,000	131,264,730	1,094,988,354
1926	1,844,550	1,411,020	1,361,470	60,664,900	796,544,584	1,329,020	1,097,190	949,590	49,750,040	408,858,710	3,173,570	2,508,210	2,311,060	110,414,940	1,205,403,294
1927	1,956,910	1,378,990	1,431,560	72,047,200	868,591,784	1,482,950	1,148,115	1,072,486	61,160,010	470,018,720	3,439,860	2,527,105	2,504,046	133,207,210	1,338,610,504
1928	1,882,930	1,442,080	1,489,240	81,077,750	949,669,534	1,490,735	1,235,020	1,192,030	62,495,320	532,514,040	3,373,665	2,677,100	2,681,270	143,573,070	1,482,183,574
1929	1,922,330	1,483,900	1,512,250	88,459,390	1,038,128,924	1,480,040	1,234,230	1,192,990	72,720,490	605,234,530	3,402,370	2,718,130	2,705,240	161,179,880	1,643,363,454
1930	1,993,390	1,504,810	1,550,967	65,007,270	1,103,136,194	1,640,722	1,286,046	1,254,493	54,654,550	659,889,080	3,634,112	2,790,856	2,805,460	119,661,820	1,763,025,274
1931	2,027,264	1,552,718	1,520,354	40,554,037	1,143,690,231	1,588,972	1,293,889	1,251,830	33,406,340	693,295,420	3,616,236	2,846,607	2,772,184	73,960,377	1,836,985,651
1932	2,039,074	1,555,144	1,578,880	31,531,162	1,175,221,393	1,512,405	1,214,461	1,196,400	18,627,219	711,922,639	3,551,479	2,769,605	2,775,280	50,158,381	1,887,144,032
1933	2,025,508	1,589,770	1,598,702	48,765,863	1,223,987,256	1,514,201	1,239,017	1,199,113	35,425,870	747,348,509	3,539,709	2,828,787	2,797,815	84,191,733	1,971,335,765
1934	1,986,268	1,552,124	1,527,104	60,928,969	1,284,916,225	1,508,377	1,285,081	1,229,594	40,014,745	787,363,254	3,494,645	2,837,205	2,756,698	100,943,714	2,072,279,479
1935	2,113,506	1,640,936	1,604,166	63,601,663	1,348,517,888	1,500,589	1,294,680	1,256,970	43,179,631	830,542,885	3,614,095	2,935,616	2,861,136	106,781,294	2,179,060,773
1936	2,166,409	1,702,192	1,629,174	78,902,818	1,427,420,706	1,527,008	1,335,995	1,272,745	57,599,662	888,142,547	3,693,417	3,038,187	2,901,919	136,502,480	2,315,563,253
1937	2,194,830	1,725,463	1,700,969	72,893,649	1,500,314,355	1,571,382	1,389,338	1,333,800	45,764,623	933,907,170	3,766,212	3,114,801	3,034,769	118,658,272	2,434,221,525
1938	2,275,882	1,777,584	1,764,363	67,859,804	1,568,174,159	1,507,051	1,329,115	1,276,332	45,633,656	979,510,826	3,782,933	3,106,699	3,040,695	113,463,460	2,547,684,985
1939	2,492,740	1,922,868	1,903,269	73,769,654	1,641,943,813	1,396,800	1,218,108	1,174,803	40,313,140	1,019,823,966	3,889,540	3,140,976	3,078,072	114,082,794	2,661,767,779
1940	2,780,811	2,152,808	2,138,927	80,098,196	1,722,042,009	1,399,057	1,238,262	1,177,103	37,690,481	1,057,514,447	4,179,868	3,391,070	3,316,030	117,788,677	2,779,556,456
1941	3,547,816	2,199,179	2,178,288	110,399,807	1,832,441,816	1,398,338	1,249,204	1,202,172	49,486,191	1,107,000,638	4,946,154	3,448,383	3,380,460	159,885,998	2,939,442,454
1942	3,487,944	2,688,723	2,615,048	193,783,707	2,026,225,523	1,360,757	1,247,512	1,206,651	78,264,809	1,185,265,447	4,848,701	3,936,235	3,821,699	272,048,516	3,211,490,970
1943	2,957,806	2,422,288	2,398,922	218,064,208	2,244,289,731	1,896,026	1,633,041	1,615,424	170,636,761	1,355,872,208	4,853,832	4,055,329	4,014,346	388,670,969	3,600,161,939
1944	2,970,714	2,468,842	2,475,280	224,683,280	2,468,973,011	1,969,281	1,694,861	1,664,069	186,543,084	1,542,415,292	4,939,995	4,163,703	4,139,349	411,226,364	4,011,388,303

1945	2,975,590	2,416,961	2,464,672	232,545,321	2,701,518,332	2,054,746	1,745,627	1,731,060	202,639,074	1,745,054,366	5,030,336	4,162,588	4,195,732	435,184,395	4,446,572,698
1946	3,079,761	2,513,687	2,567,050	279,711,300	2,981,229,632	2,071,070	1,808,282	1,829,531	250,912,645	1,995,967,011	5,150,831	4,321,969	4,396,581	530,623,945	4,977,196,643
1947	3,091,977	2,629,727	2,683,253	300,474,560	3,281,704,192	2,074,806	1,831,975	1,871,099	254,946,244	2,250,913,255	5,166,783	4,461,702	4,554,352	555,420,804	5,532,617,447
1948	3,221,464	2,664,619	2,760,493	277,160,874	3,558,865,066	2,158,551	1,894,136	1,939,241	257,462,667	2,508,375,922	5,380,015	4,558,755	4,699,734	534,623,541	6,067,240,988
1949	3,296,297	2,792,108	2,848,896	277,347,763	3,836,212,829	2,382,215	2,028,481	2,067,338	238,981,245	2,747,357,167	5,678,512	4,820,589	4,916,234	516,329,008	6,583,569,996
1950	3,398,168	2,857,533	2,918,105	287,683,368	4,123,896,197	2,626,342	2,219,653	2,271,358	290,554,341	3,037,911,508	6,024,510	5,077,186	5,189,463	578,237,709	7,161,807,705
1951	4,049,409	3,596,094	3,624,299	445,407,191	4,569,303,388	2,663,606	2,279,675	2,317,714	376,314,474	3,414,225,982	6,713,015	5,875,769	5,942,013	821,721,665	7,983,529,370
1952	4,264,906	3,643,544	3,681,216	504,544,596	5,073,847,984	2,729,572	2,312,206	2,345,138	431,135,159	3,845,361,141	6,994,478	5,955,750	6,026,354	935,679,755	8,919,209,125
1953	4,354,911	3,728,218	3,784,963	417,790,763	5,491,638,747	2,792,617	2,369,397	2,407,453	368,149,105	4,213,510,246	7,147,528	6,097,615	6,192,416	785,939,868	9,705,148,993
1954	4,468,641	3,704,189	3,757,365	455,025,858	5,946,664,605	2,763,129	2,421,577	2,437,766	409,999,824	4,623,510,070	7,231,770	6,125,766	6,195,131	865,025,682	10,570,174,675
1955	4,563,099	3,805,778	3,874,219	427,900,236	6,374,564,841	2,804,636	2,455,983	2,489,734	399,805,506	5,023,315,576	7,367,735	6,261,761	6,363,953	827,705,742	11,397,880,417

[1] Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by the United States.
[2] Estimated.

Land Openings

During fiscal year 1956, the Bureau conducted 4 land openings on 4 Reclamation projects, making 235 farm units embracing 26,898 irrigable acres of new land available for settlement.

The greatest number of the foregoing were on the North-Side Pumping Unit of the Minidoka project in Idaho where 194 units were opened for settlement under the provisions of reclamation and homestead laws. Similarly, 17 farm units were offered for homestead entry on the Kennewick division of the Yakima project in Washington. Fifteen farm units on the Columbia Basin project in Washington were offered for sale under the provisions of the Columbia Basin Project Act, and 9 units on the Wellton-Mohawk division of the Gila project in Arizona were offered for sale under provisions of that project's authorization act. Public response to the announced availability of new farm units under the Bureau's settlement program continued at the high level evidenced since the close of World War II, with an average of nearly 88 qualified applicants for each unit offered.

Since the close of World War II, 52 land openings have been held on 13 Reclamation projects. A total of 2,394 new farm units encompassing approximately 200,000 irrigable acres of public land has thus been made available for selection by qualified applicants.

Both technical and financial assistance has continued to be available to settlers during developmental years through cooperative working relations established by the Bureau with the Farmers' Home Administration, the Agricultural Extension Service, the several State colleges and universities, and other appropriate agencies.

During fiscal year 1957 the availability of additional new farm units is anticipated on the Columbia Basin project in Washington, the Minidoka project in Idaho, and on the Gila and Yuma projects in Arizona. Additional privately owned lands in the Central Valley, Columbia Basin, and Missouri Basin projects will be supplied with irrigation water. A considerable amount of this privately owned land may be available for sale by the owners.

Development Farms

The development farm program which was started in 1947 is a vital part of the settlement program on areas being newly developed for irrigation. These farms are conducted in cooperation with various Department of Agriculture agencies and State agricultural colleges.

The field scale operations demonstrate to the inexperienced irrigation farmers the layout of most practical farm irrigation systems, the best methods of irrigation, the crops best adapted to the area, and most effective cultural practices.

During fiscal year 1956 there were 16 development farms in operation located in the Columbia Basin, Gila, and Missouri River Basin projects. Several new farms are proposed for the latter project.

Repayment and Water Service Contracts

During fiscal year 1956, contracts were executed with a number of districts for the repayment of the cost of new project works. The repayment contract for the Ventura River project, signed 6 days after the President approved authorization of the project, established a new record for promptness in securing repayment contract coverage. The contract is the first to require repayment of municipal water costs with interest during construction. The rate of interest, established by the Secretary of the Treasury, is 2.591 percent.

Execution of the repayment contract for the Santa Maria project on April 6, 1956, cleared the way for initiation of construction as the authorizing legislation required execution of a repayment contract in advance of construction. Construction of the Cachuma project was completed and supply works except for Cachuma Dam were transferred under a special contract to the local water users' organizations for operation and maintenance. Officials of the Corning and Colusa County water districts approved forms of water service contracts—the first to be agreed upon by water users' organizations of the Sacramento Canals unit, Central Valley project.

Rehabilitation and betterment contracts were negotiated for the Salt River, Riverton, Orland, Boise, and Rogue River projects.

Construction was initiated on the Michaud Flats project following the execution of a repayment contract with the Falls irrigation district. Construction was also initiated on two units of the Foster Creek division, Chief Joseph Dam project, following execution of repayment contracts by the Bridgeport Bar and Brewster Flat irrigation districts. Execution of an amendatory contract by the Frenchman-Cambridge irrigation district, Missouri River Basin project, permitted continuation of construction of distribution system works.

Special legislation enacted by the Congress this year authorized execution of a repayment contract with the Yuma Mesa irrigation and drainage district, Gila project. The contract, negotiated pursuant to section 7 of the 1939 Reclamation Project Act, adjusted reimbursable obligations for the Yuma Mesa division, and the repayment contract was executed in May 1956. Legislation was also adopted by the Congress authorizing the execution of a repayment contract with the Tule Lake irrigation district, Klamath project. The draft of repayment contract was accepted by the district board and in July 1956 was approved by the local electorate. Enactment of S. 2202 by the Congress authorized negotiation of a repayment contract providing for final repayment settlement for the Valley division of the Yuma project. Legislation was also adopted authorizing a contract with the Riverside irrigation district, Idaho, and amendment of existing contracts with the city of Rapid City, S. Dak.

Table 3 shows that the total value of repayment contracts on June 30, 1956, amounted to $747,342,204.79. Of this amount, a total of $121,473,956.73 had been repaid and delinquencies were insignificant. In addition, over $100 million will be returned to the Government in water service payments under contracts now in force.

TABLE 3.—*Repayment contracts—matured and unmatured, June 30, 1956*

Project and State	Value of repayment contracts			Construction water-right charges, unmatured	Water-right charges, deferred and unmatured	Rehabilitation and betterment charges, unmatured	Total unmatured	Repayments contracts, matured	Due and unpaid
	Construction	Rehabilitation and betterment	Total						
Arnold, Oreg		$197,925.82	$197,925.82			$166,314.33	$166,314.33	$31,611.49	$2,500.03
Avondale, Idaho	$277,000.00		277,000.00	$277,000.00			277,000.00		
W. C. Austin, Okla	3,262,188.49		3,262,188.49	2,771,170.00			2,771,170.00	491,018.49	
Baker, Oreg	225,014.54		225,014.54	92,314.94	$20,193.25		112,508.19	112,506.35	
Balmorhea, Tex	255,600.00		255,600.00	233,848.50			233,848.50	21,751.50	
Belle Fourche, S. Dak	4,230,188.73		4,230,188.73	2,729,613.18			2,729,613.18	1,500,575.55	
Bitter Root, Mont	1,052,741.05		1,052,741.05	681,214.48			681,214.48	371,526.57	
Boise, Idaho-Oreg.:									
Arrowrock division	13,682,811.30		13,682,811.30	2,373,126.82	1,017,508.89		3,390,635.71	10,292,175.59	78,206.13
Payette division	9,439,254.55		9,439,254.55	8,123,562.97			8,123,562.97	1,315,691.58	
Anderson Ranch Dam	5,146,511.01		5,146,511.01	4,526,464.62			4,526,464.62	620,046.39	19,570.67
Boulder Canyon, Ariz.-Calif.:									
All-American Canal system	52,444,205.61		52,444,205.61	51,860,770.73			51,860,770.73	583,434.88	
Buffalo Rapids, Mont., District 1	930,000.00		930,000.00	903,400.00			903,400.00	26,600.00	6,650.00
Buffalo Rapids, Mont., District 2	696,000.00		696,000.00	678,800.00			678,800.00	17,200.00	4,300.00
Burnt River, Oreg	599,735.00		599,735.00	344,835.24			344,835.24	254,899.76	
Cachuma, Calif	5,800,000.00		5,800,000.00	5,800,000.00			5,800,000.00		
Carlsbad, N. Mex	3,741,760.67	25,000.00	3,766,760.67	1,890,063.68	64,070.00	24,500.00	1,978,633.68	1,788,126.99	
Central Valley, Calif	62,483,022.05		62,483,022.05	62,398,609.55			62,398,609.55	84,412.50	
Colorado-Big Thompson, Colo	26,031,000.00		26,031,000.00	26,029,000.00			26,029,000.00	2,000.00	
Colorado River, Tex	5,510,500.00		5,510,500.00	5,510,500.00			5,510,500.00		
Columbia Basin, Wash	87,547,900.96		87,547,900.96	87,484,684.64			87,484,684.64	63,216.32	401.37
Crescent Lake Dam, Oreg		320,000.00	320,000.00			320,000.00	320,000.00		
Dalton Gardens, Idaho	270,200.00		270,200.00	270,200.00			270,200.00		
Deschutes, Oreg	12,689,221.44		12,689,221.44	12,486,877.04			12,486,877.04	202,344.40	
Eden, Wyo	1,500,000.00		1,500,000.00	1,500,000.00			1,500,000.00		
Fort Sumner, N. Mex	2,432,166.55		2,432,166.55	2,340,960.31			2,340,960.31	91,206.24	
Frenchtown, Mont	297,282.04		297,282.04	235,791.63			235,791.63	61,490.41	
Fruitgrowers Dam, Colo	198,240.71		198,240.71	143,371.61			143,371.61	54,869.10	
Gila, Ariz	48,116,167.45		48,116,167.45	48,100,334.13			48,100,334.13	15,833.32	
Grand Valley, Ariz	3,129,154.21	1,838,327.73	4,967,481.94	1,708,375.55		1,815,827.73	3,524,203.28	1,443,278.66	
Grants Pass, Oreg		950,000.00	950,000.00			940,000.00	940,000.00	10,000.00	
Humboldt, Nev	1,211,244.68	123,000.00	1,334,244.68	745,858.94		123,000.00	868,858.94	465,385.74	
Huntley, Mont	1,839,545.68		1,839,545.68	719,210.17	91,478.47		810,688.64	1,028,857.04	
Hyrum, Utah	944,046.36		944,046.36	670,042.00			670,042.00	274,004.36	
Intake, Mont	46,900.00		46,900.00	43,435.00			43,435.00	3,465.00	
Kendrick, Wyo	2,800,000.00		2,800,000.00	2,800,000.00			2,800,000.00		
Klamath, Oreg.-Calif	4,432,552.87	40,200.26	4,472,753.13	1,325,689.31	184,377.40	36,180.00	1,546,246.71	2,926,506.42	330.81
Lewiston Orchards, Idaho	2,500,000.00		2,500,000.00	2,436,303.58			2,436,303.58	63,696.42	
Lower Yellowstone, Mont.-N. Dak	4,084,366.39		4,084,366.39	1,394,368.77	309,165.54		1,703,534.31	2,380,832.08	45,037.39
Mancos, Colo	900,000.00		900,000.00	870,000.00			870,000.00	30,000.00	

Michaud Flats, Idaho	2,875,000.00		2,875,000.00	2,875,000.00			2,875,000.00		
Middle Rio Grande, N. Mex	16,533,000.00		16,533,000.00	16,533,000.00			16,533,000.00		
Milk River, Mont	7,764,044.89	134,851.00	7,898,895.89	6,436,710.87	48,508.78	134,851.00	6,620,070.65	1,278,825.24	16,001.84
Minidoka, Idaho-Wyo	20,804,525.02		20,804,525.02	4,883,289.86	120.37		4,883,410.23	15,921,114.79	1,214.68
Mirage Flats, Neb	846,300.00		846,300.00	823,410.00			823,410.00	22,890.00	11,390.00
Missoula Valley, Mont	45,000.00		45,000.00	44,578.00			44,578.00	422.00	
Missouri River Basin:									
Bostwick division, Nebr.-Kans	6,605,000.00		6,605,000.00	6,605,000.00			6,605,000.00		
Angostura unit, S. Dak	718,000.00		718,000.00	718,000.00			718,000.00		
Frenchman-Cambridge Division, Nebr	4,401,000.00		4,401,000.00	4,401,000.00			4,401,000.00		
Fort Clark unit, N. Dak	66,000.00		66,000.00	66,000.00			66,000.00		
Kirwin unit, Kans	1,500,000.00		1,500,000.00	1,500,000.00			1,500,000.00		
Savage unit, Mont	143,750.00		143,750.00	143,665.02			143,665.02	84.98	
Sargent unit, Nebr	1,785,400.00		1,785,400.00	1,785,400.00			1,785,400.00		
Hanover-Bluff unit, Wyo	672,560.00		672,560.00	672,560.00			672,560.00		
Moon Lake, Utah	1,592,267.76		1,592,267.76	1,074,780.73			1,074,780.73	517,487.03	
Newlands, Nev	3,257,749.35		3,257,749.35	427,865.36	80,000.00		507,865.36	2,749,883.99	
Newton, Utah	350,000.00		350,000.00	280,000.00			280,000.00	70,000.00	
North Platte, Nebr.-Wyo	20,236,195.85	3,851,821.27	24,088,017.12	3,917,924.13	90,860.00	3,760,973.64	7,769,757.77	16,318,259.35	1,705.57
Ochoco, Oreg		500,000.00	500,000.00			500,000.00	500,000.00		
Ogden River, Utah	4,734,935.11		4,734,935.11	3,471,401.85			3,471,401.85	1,263,533.26	
Okanogan, Wash	468,597.85	126,000.00	594,597.85	222,321.07		126,000.00	348,321.07	246,276.78	6,138.25
Orland, Calif	2,457,212.15	542,413.23	2,999,625.38	695,602.02	296,871.03	451,364.58	1,443,837.63	1,555,787.75	11,722.22
Owyhee, Oreg.-Idaho	19,826,659.47		19,826,659.47	17,537,887.31			17,537,887.31	2,288,772.16	7,327.15
Palisades, Idaho	6,651,450.00		6,651,450.00	6,651,450.00			6,651,450.00		
Palo Verde, Calif	1,675,000.00		1,675,000.00	1,675,000.00			1,675,000.00		
Paonia, Colo	2,320,000.00		2,320,000.00	2,320,000.00			2,320,000.00		
Pine River, Colo	1,500,000.00		1,500,000.00	1,206,240.00			1,206,240.00	293,760.00	35,420.00
Preston Bench, Idaho	453,000.00		453,000.00	453,000.00			453,000.00		
Provo River, Utah	19,443,650.00		19,443,650.00	19,443,650.00			19,443,650.00		
Rapid Valley, S. Dak	1,100,000.00		1,100,000.00	987,500.00			987,500.00	112,500.00	
Rathdrum Prairie, Idaho:									
Hayden Lake unit	118,409.19		118,409.19	93,017.25			93,017.25	25,391.94	
Post Falls unit	190,000.00		190,000.00	156,750.00			156,750.00	33,250.00	
Rio Grande, N. Mex.-Tex	10,144,123.26		10,144,123.26	2,566,335.35	334,777.23		2,901,112.58	7,243,010.68	
Riverton, Wyo	7,381,827.26		7,381,827.26	6,754,797.67			6,754,797.67	627,029.59	22,344.20
Rogue River, Oreg		1,712,000.00	1,712,000.00			1,712,000.00	1,712,000.00		
Salt River, Ariz	17,482,687.89	5,771,869.50	23,254,557.39	4,712,682.10		5,020,112.73	9,732,794.83	13,521,762.56	
San Luis Valley, Colo	2,520,000.00		2,520,000.00	2,520,000.00			2,520,000.00		
Sanpete, Utah	373,375.94		373,375.94	223,815.68	2,375.00		226,190.68	147,185.26	
Santa Maria, Calif	13,969,000.00		13,969,000.00	13,969,000.00			13,969,000.00		
Scofield, Utah	247,000.00		247,000.00	167,400.00			167,400.00	79,600.00	
Shoshone, Wyo.-Mont	6,827,609.52	380,000.00	7,207,609.52	4,184,190.51	6,964.28	380,000.00	4,571,154.79	2,636,454.73	
Strawberry Valley, Utah	3,349,423.92		3,349,423.92	749,749.76			749,749.76	2,599,674.16	
Sun River, Mont.:									
Fort Shaw division	401,384.56	38,151.04	439,535.60	64,573.27		37,551.04	102,124.31	337,411.29	
Greenfields division	9,555,084.41		9,555,084.41	8,255,621.25			8,255,621.25	1,299,463.16	
Truckee Storage, Nev	1,000,000.00		1,000,000.00	674,660.42			674,660.42	325,339.58	
Tucumcari, N. Mex	5,901,896.86		5,901,896.86	5,871,326.30			5,871,326.30	30,570.56	
Umatilla, Oreg	1,141,982.46		1,141,982.46	623,963.78			623,963.78	518,018.68	6,998.84
Uncompahgre, Colo	6,874,017.36		6,874,017.36	5,667,179.07			5,667,179.07	1,206,838.29	
Vale, Oreg	5,022,287.50		5,022,287.50	4,515,429.26			4,515,429.26	506,858.24	

TABLE 3.—*Repayment contracts—matured and unmatured, June 30, 1956*—Continued

Project and State	Value of repayment contracts			Construction water-right charges, unmatured	Water-right charges, deferred and unmatured	Rehabilitation and betterment charges, unmatured	Total unmatured	Repayments contracts, matured	Due and unpayed
	Construction	Rehabilitation and betterment	Total						
Vermejo, N. Mex.	$2,107,943.33		$2,107,943.33	$2,107,943.33			$2,107,943.33		
Weber Basin, Utah	57,694,000.00		57,694,000.00	57,694,000.00			57,694,000.00		
Weber River, Utah	2,685,871.83		2,685,871.83	881,929.04			881,929.04	$1,803,942.79	
Yakima, Wash.:									
Kennewick division	4,809,700.00		4,809,700.00	4,809,700.00			4,809,700.00		
Kittitas division	11,225,652.54		11,225,652.54	8,997,762.78			8,997,762.78	2,227,889.76	
Roza division	19,228,100.00		19,228,100.00	18,264,318.05			18,264,318.05	963,781.95	
Storage division	3,600,134.12	$719,262.47	4,319,396.59	720,301.25		$540,267.12	1,260,568.37	3,058,828.22	
Sunnyside division	4,184,933.34		4,184,933.34	243,360.74	$45,779.67		289,140.41	3,895,792.93	
Tieton division	3,449,113.59		3,449,113.59					3,449,113.59	
Yuma, Ariz.-Calif.	5,608,580.23		5,608,580.23	358,591.64	107,509.10		466,100.74	5,142,479.49	$249.74
Yuma Auxiliary, Calif.	1,404,423.57		1,404,423.57	878,314.77			878,314.77	526,108.80	424.69
Grand total	730,071,382.47	17,270,822.32	747,342,204.79	607,078,746.88	2,700,559.01	16,088,942.17	625,868,248.06	121,473,956.73	277,933.58

Soil and Moisture Conservation Operations

The Bureau of Reclamation has continued to make progress in its objective to protect the land and facilities under its jurisdiction from wind and water erosion.

This program, which is in keeping with the Department's overall conservation policies, has included structural installations, reseeding, and other means of erosion control and stabilization.

The planning, financing, and performance of the work are accomplished in cooperation with other Federal agencies and State and local agencies, including water-users' organizations.

Weed Control

During fiscal year 1956, the weed-control program conducted by the Bureau on irrigation systems has proved effective in reducing the problems caused by undesirable vegetation and in decreasing operation and maintenance costs. It also has aided materially in reducing water losses resulting from transpiration, evaporation, and seepage due to weed growths.

More efficient and economical methods of controlling weeds infesting banks and channels of irrigation systems have been developed and put into practice through the research programs conducted by the Agricultural Research Service, Department of Agriculture, for and in cooperation with the Bureau of Reclamation. This work has been accomplished at field stations at Phoenix, Ariz.; Prosser, Wash.; Bozeman, Mont.; and Laramie, Wyo., and in Reclamation's weed-control laboratory in Denver.

Under the provisions of the Halogeton Glomeratus Act (P. L. 529, July 14, 1952), the Bureau is cooperating in the control of the poisonous weed Halogeton on Bureau lands in Utah, Nevada, Colorado, Wyoming, Montana, and Idaho.

Flood Control and Recreation

When the Bureau of Reclamation constructs a dam which creates a reservoir for irrigation and power development, this by no means represents the full extent of the benefits to be derived from the project. Storage space in which to confine rampaging floodwaters and facilities for recreation at water playgrounds in the otherwise arid portions of the West, are two additional dividends paid under the Federal water resource conservation partnership.

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Bureau reservoirs were able to render extraordinary service in helping to control floods during 1956. In Washington, Idaho, and Oregon, particularly, the runoff of heavy snowmelt on most streams of the Columbia Basin was of flood proportions, and storage in the Bureau of Reclamation reservoirs prevented several local disasters as well as reducing the flood crest of the Columbia River itself.

The peak flow of the Columbia River at The Dalles, Oreg., on June 3 was 814,000 cubic feet per second. Had it not been for upstream storage, this peak would have been 110,000 cubic feet per second higher. Translated into river level, the flood crest would have been 2.7 feet higher were it not for the storage which was largely provided by existing Reclamation reservoirs.

In the Upper Snake River area in Idaho, the operation of Jackson Lake, the principal reservoir of the Minidoka Reclamation project, as a flood-control reservoir reduced the peak flow at Heise, Idaho, nearly one-fourth. In the Boise Valley in Idaho, although the upstream flow was about 23,000 cubic feet per second, the Boise River was held to 7,500 cubic feet per second at Boise by the operation of Anderson Ranch, Arrowrock, and Lucky Peak Reservoirs. Anderson Ranch and Arrowrock are Bureau of Reclamation structures, and Lucky Peak was built by the Corps of Engineers as a flood control structure whose releases are coordinated with those from Anderson Ranch and Arrowrock for irrigation purposes during the summer.

The peak flow of the Payette River at Emmett, Idaho, reached on May 27, was 15,000 cubic feet per second, which was about equal to flood stage. At the same time, Cascade and Deadwood Reservoirs, upstream, were storing at the rate of nearly 12,000 cubic feet per second. Had it not been for this storage, the river, already flowing at flood stage, would have sharply increased its peak crest.

Numerous other reservoirs on the Snake River and its tributaries were filling during the spring runoff and thus contributed to cutting down the crest. These included the American Falls Reservoir in Idaho and the Owyhee Reservoir in Oregon.

The peak flow of the Yakima River at Parker, Wash., was about 19,000 cubic feet per second on May 20. This is 4,000 feet over flood stage. Were it not for water stored in five irrigation reservoirs upstream, the peak flood flow would have reached 37,000 cubic feet per second.

Hungry Horse Reservoir on the South Fork of the Flathead River in Montana curtailed the peak flow of the Flathead at Columbia Falls where it emerges from the mountains by 31,000 cubic feet per second, or nearly one-third. Operation of this single reservoir is estimated to have curtailed the flood crest of the Columbia by more than 6 inches.

In California, flood control regulation of release of water was required in varying degrees at all of the Bureau's 13 reservoirs but one—Cachuma.

An estimated 9,858,000 persons enjoyed the use of recreational facilities on 140 reservoirs on Reclamation projects throughout the 17 Western States in 1956.

Estimates on expenditures at these Reclamation playgrounds vary considerably, but it is conservatively calculated that out-of-town and local visitors spend about $6 per day. This represents an appropriate share of investments in boats, hunting and fishing equipment, etc., traveling expenses, and food and lodging. Applied to the total number of visitors, this estimate indicated an extra dividend each year of approximately $59 million from Reclamation. A folder entitled "Reclamation Recreational Opportunities" issued during the year, contains information concerning the location of these western water playgrounds and describes the facilities available for swimming, fishing, boating, hunting, camping, picnicking, and lodging.

It is the policy of the Bureau to transfer recreational areas at Federal Reclamation reservoirs to other Federal, State, or local agencies for development and administration. Areas of national significance, such as Lake Mead, at Hoover Dam on the Colorado River in Arizona-Nevada, are administered by the National Park Service, areas wholly or substantially in the national forests are transferred to the Forest Service, U. S. Department of Agriculture, and areas of local interest are transferred to State or local government agencies. The Bureau of Reclamation administers recreational facilities on only 40 of the 140 reservoirs.

HYDROELECTRIC POWER DEVELOPMENT

On June 30, 1956, the installed capacity of powerplants constructed and operated by the Bureau of Reclamation, as a part of multipurpose Reclamation projects, totaled 4,974,550 kilowatts, whereas the capacity installed and operated by other agencies for which the Bureau is the marketing agent totaled 596,500 kilowatts.

The installed capacity of hydroelectric powerplants at Bureau of Reclamation multipurpose projects and at projects for which the Bureau is responsible for marketing the power, increased 320,000 kilowatts during fiscal year 1956.

Sale of electric power during the year aggregated 25,181,596,876 kilowatt-hours, with revenues from sales totaling $55,362,617.68 as shown in table 4. This compared to the previous year's sales of 25,031,325,608 kilowatt-hours, and revenues of $51,764,256.48.

TABLE 4.—*Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1956* [1]

Projects	Sales of electric energy, kilowatt-hours	Revenues from sales
Boise project	212,909,761	$410,011.16
Columbia Basin project [2]	13,832,121,000	12,668,441.35
Minidoka project	153,571,616	656,256.66
Yakima project [3]	24,980,175	172,064.59
Hungry Horse project [4]	1,208,009,400	3,621,374.28
Central Valley project	2,708,621,791	9,862,210.89
Boulder Canyon project	2,662,983,968	7,378,331.57
Parker-Davis project	1,096,509,537	4,519,415.81
Yuma project	7,319,247	22,129.30
Rio Grande project	57,443,312	390,239.80
Falcon project	73,855,500	199,409.88
Fort Peck project	447,044,143	1,903,246.84
North Platte project	74,912,200	494,232.86
Missouri River Basin—Western division, including power systems of Riverton, Shoshone, Colorado-Big Thompson, Kendrick projects	1,094,173,931	6,817,224.26
Missouri River Basin, Eastern division	1,411,641,247	5,024,700.79
Eklutna project, Alaska	115,500,048	1,223,327.64
Grand total	25,181,596,876	55,362,617.68

[1] Does not include energy sales and revenues in transactions between Bureau projects.
[2] Totals include 13,190,098,250 kilowatt-hours delivered to Bonneville Power Administration for marketing and $12,347,430 in payments by that agency not including river regulation benefits.
[3] Totals include 24,967,650 kilowatt-hours delivered to Bonneville Power Administration for marketing and $172,000 in payments by that agency.
[4] Totals include 1,205,446,638 kilowatt-hours delivered to Bonneville Power Administration for marketing and $3,610,000 in payments by that agency.

Present Installed Capacity

During the fiscal year ending June 30, 1956, the Bureau of Reclamation operated 35 powerplants with a total nameplate capacity of 4,974,550 kilowatts, an increase of 120,000 kilowatts over fiscal year 1955. In addition, the Bureau marketed the power generated from plants constructed by the Corps of Engineers and the International Boundary and Water Commission, totaling 596,500 kilowatts, which is an increase of 240,000 kilowatts during fiscal year 1956.

The capacity installed during fiscal year is as follows:

		Kilowatts
Bureau of Reclamation:		
Central Valley project (Folsom powerplant)	108,000	
Yakima project (Chandler powerplant)	12,000	120,000
U. S. Corps of Engineers:		
Missouri River Basin project:		
Fort Randall	80,000	
Garrison	160,000	240,000
		320,000

Additional Capacity Under Construction

At the end of fiscal year 1956, the Bureau of Reclamation had under construction four powerplants, which will have an ultimate installed nameplate capacity of 154,250 kilowatts. They are: Palisades (114,000 kw.) on the Snake River in Idaho; Deer Creek (5,000 kw.) on the

Provo River in Utah; Roza (11,250 kw.) on the Yakima-Roza Canal in Washington; and Glendo (24,000 kw.) on the North Platte River in Wyoming.

The United States Army Corps of Engineers is proceeding with the construction of its plants on the Missouri River Basin project. The ultimate nameplate capacity of the two plants—Gavins Point and Oahe, in South Dakota—under construction by the Corps will respectively be 100,000 and 425,000 kilowatts. The Bureau of Reclamation will be the marketing agent for energy generated from these plants as is the case for other plants constructed by the Corps on the Missouri River Basin project.

Hydroelectric Powerplants

The status of hydroelectric powerplants for which the Bureau of Reclamation has responsibilities is shown in table 5.

TABLE 5.—*U. S. Department of the Interior, Bureau of Reclamation, hydroelectric powerplants*

A. CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

State or territory	Project	Name of plant	Calendar year of initial operation	Nameplate rating	
				Existing (kilowatts)	Ultimate (kilowatts)
1. Alaska	Eklutna	Eklutna	1955	30,000	30,000
2. Alaska	do	Little Eklutna [1]	1955	2,000	2,000
3. Arizona-Nevada	Boulder Canyon	Hoover [2]	1936	1,249,800	1,354,300
4. Arizona-Nevada	Parker-Davis	Davis	1951	225,000	225,000
5. Arizona-California	do	Parker	1942	120,000	120,000
6. California	Central Valley	Folsom	1955	162,000	162,000
7. California	do	Keswick	1949	75,000	75,000
8. California	do	Nimbus	1955	13,500	13,500
9. California	do	Shasta	1944	379,000	379,000
10. California	Yuma	Siphon Drop	1926	1,600	1,600
11. Colorado	Colorado-Big Thompson	Estes	1950	45,000	45,000
12. Colorado	do	Flatiron	1954	71,500	71,500
13. Colorado	do	Green Mountain	1943	21,600	21,600
14. Colorado	do	Marys Lake	1951	8,100	8,100
15. Colorado	do	Pole Hill	1954	33,250	33,250
16. Colorado	Grand Valley	Grand Valley [3]	1932	3,000	3,000
17. Idaho	Boise	Anderson Ranch	1950	27,000	40,500
18. Idaho	do	Black Canyon	1925	8,000	8,000
19. Idaho	do	Boise Diversion	1912	1,500	1,500
20. Idaho	Minidoka	Minidoka	1909	13,400	13,400
21. Montana	Missouri River Basin	Canyon Ferry	1953	50,000	50,000
22. Montana	Hungry Horse	Hungry Horse	1952	285,000	285,000
23. New Mexico	Rio Grande	Elephant Butte	1940	24,300	24,300
24. South Dakota	Missouri River Basin	Angostura	1951	1,200	1,200
25. Washington	Columbia Basin	Grand Coulee	1941	1,974,000	1,974,000
26. Washington	Yakima-Kennewick	Chandler	1956	12,000	12,000
27. Wyoming	Kendrick	Alcova	1955	36,000	36,000
28. Wyoming	do	Seminoe	1939	32,400	32,400
29. Wyoming	Missouri River Basin	Boysen	1952	15,000	15,000
30. Wyoming	do	Kortes	1950	36,000	36,000
31. Wyoming	North Platte	Guernsey	1927	4,800	4,800
32. Wyoming	do	Lingle	1919	1,400	1,400
33. Wyoming	Riverton	Pilot Butte	1925	1,600	1,600
34. Wyoming	Shoshone	Heart Mountain	1948	5,000	5,000
35. Wyoming	do	Shoshone	1922	5,600	5,600
Subtotal A				4,974,550	5,092,550

See footnotes at end of table.

TABLE 5.—*U. S. Department of the Interior, Bureau of Reclamation, hydroelectric powerplants*—Continued

B. CONSTRUCTED AND OPERATED BY OTHERS—POWER MARKETED BY BUREAU OF RECLAMATION

1. Montana	Fort Peck (USCE)	Fort Peck	1943	85,000	165,000
2. South Dakota	Missouri River Basin (USCE)	Fort Randall	1954	320,000	320,000
3. North Dakota	do	Garrison	1956	160,000	400,000
4. Texas	Falcon (IBWC)	Falcon	1954	31,500	31,500
Subtotal B				596,500	916,500

C. UNDER CONSTRUCTION BY BUREAU OF RECLAMATION

1. Idaho	Palisades	Palisades	1956	0	114,000
2. Utah	Provo River Basin	Deer Creek	1957	0	5,000
3. Washington	Yakima-Roza	Roza	1958	0	11,250
4. Wyoming	Missouri River Basin	Glendo	1958	0	24,000
Subtotal C				0	154,250

D. UNDER CONSTRUCTION BY OTHERS—POWER TO BE MARKETED BY BUREAU OF RECLAMATION

1. South Dakota	Missouri River Basin (USCE)	Gavins Point	1956	0	100,000
2. South Dakota	do	Oahe	1962	0	425,000
Subtotal D				0	525,000
Total				5,571,050	[4] 9,135,700

[1] Acquired from city of Anchorage for operation with Eklutna project, fiscal year 1955.
[2] Powerplant units operated by Southern California Edison Co. and city of Los Angeles Department of Water and Power as agents of the United States.
[3] Leased to Public Service Co. of Colorado for operation.
[4] Includes 2,273,400 kilowatts in 37 additional powerplants authorized for construction by Bureau and 174,000 kilowatts in 2 powerplants authorized by others.

USCE—United States Corps of Engineers.
IBWC—International Boundary and Water Commission.

Transmission Lines

On June 30, 1956, the Bureau of Reclamation's transmission system consisted of 9,371.4 circuit miles of line. During fiscal year 1956, 302.4 circuit miles of transmission lines were completed. These are shown in table 6.

TABLE 6.—*Transmission lines completed during fiscal year 1956*

Project and Line	Voltage (kilovolts)	In-service date	Circuit miles
Missouri River Basin project:			
Fort Thompson to Huron	230	March 1956	59.1
Huron to Watertown	230	March 1956	70.9
Jamestown to Fargo	230	[1]	83.0
Lovell to Yellowtail	115	[1]	45.9
Gavins Point Tap to Gavins Point powerplant	115	December 1955 [2]	8.0
Gavins Point to Belden	115	November 1955	32.5
Fort Peck project:			
O'Fallon Creek tap extensions	69	March 1956	3.0
Total			302.4

[1] Completed but not in service June 30, 1956.
[2] Completed but only 1 circuit of 4 miles in service June 30, 1956.

Power Contracts

During fiscal year 1956 there were 120 contracts executed for the delivery of electric power supply. A number of renewals of operating contracts and revisions of existing contracts resulting from changed operating conditions were consummated. Included are:

Number of contracts:

18 with private utilities.
53 with REA cooperatives.
29 with municipalities.
5 with other Federal agencies.
3 with public power districts.
7 with State authorities.
1 with irrigation district.
4 miscellaneous type contracts.

The Bureau continued its policy of contracting whenever possible with private utilities, public bodies, and cooperatives for wheeling power and energy over existing facilities. The Bureau also entered into several interchange agreements with its customers. Contracts for wheeling Palisades project power to preference customers were executed with Idaho Power Co. and Utah Power and Light Co.

A summary by classification of customers served by Reclamation during fiscal year 1956 is shown in table 7.

TABLE 7.—*Summary by classification of customers for 12 months ending June 30, 1956* [1]

Type of customers	Number of customers	Sales of electric energy	Revenues from sales of electric energy
		Kilowatt-hour	
Privately owned utilities	28	3,133,834,649	$10,779,798.73
Municipal utilities	63	1,069,405,778	4,530,021.71
State government utilities	14	3,027,255,244	11,272,130.45
Cooperative utilities (Rural Electrification Administration projects)	125	1,182,433,336	6,832,358.55
Other Federal utilities [2]	6	14,496,695,046	16,473,647.50
Residential and domestic	298	4,980,530	29,816.48
Rural (other than Rural Electrification Administration projects)	7	155,420	1,013.31
Commercial and industrial	20	91,983,921	467,216.36
Public authorities	56	1,245,874,395	3,967,265.62
Interdepartmental	47	928,978,557	1,009,348.97
Total all customers	664	25,181,596,876	55,362,617.68

[1] Does not include energy sales and revenues in transactions between Bureau projects.
[2] Totals include 14,420,512,538 kilowatt-hours delivered to Bonneville Power Administration for marketing and $16,129,430 in payments by that agency.

The Bureau at the end of fiscal year 1956 had 123 contracts under active negotiation. This included 28 contracts with municipalities, 44 with REA cooperatives, 9 with non-REA cooperatives, 21 with private utilities, 4 with public power districts, 5 with other Federal agencies, 7 with State authorities, 1 with an irrigation district, and 4 miscellaneous type contracts. A number of these are to renew the

existing contract or to revise contracts in existence due to changes in operating conditions.

ENGINEERING AND CONSTRUCTION

Through its design and construction accomplishments in developing the water resources of the western United States, the Bureau of Reclamation in fiscal year 1956 made a major contribution to the conservation of the Nation's natural resources.

The dimensions of the year's achievement in construction are indicated by the completion of irrigation facilities to serve 203,000 acres of land and installation of 120,000 kilowatts of hydroelectric generating capacity. Construction was completed on 4 storage dams which have a combined capacity of more than 2 million acre-feet, 507 miles of electrical transmission lines, and 585 miles of canals and related water conveyance facilities.

An investment of about $160 million was added to the Bureau's $2.6 billion investment in western projects through completion of these and other irrigation and power features.

Awarded for the fiscal year period were 496 construction, material, equipment, and supply contracts. The total value of these contracts was about $63 million. Contracts for construction totaled about $57 million of this amount, or about 90 percent. The 220 construction contracts in progress at the end of the year had a total value of $122 million.

Highlights of the year were completion of Tiber, Webster, and Kirwin Dams on the Missouri River Basin project and Crescent Lake Dam on the Crescent Lake Dam project in Oregon; the placing in full service of the 162,000-kilowatt Folsom powerplant in California and the 12,000-kilowatt Chandler power and pumping plant on the Yakima project in Washington; and the beginning of full operation of the Cachuma project in California, following completion of the 6-mile Tecolote Tunnel. In August 1955, the completion of the Eklutna project, first major Bureau project in Alaska, was dedicated.

Of signal interest were the new starts of construction on the Palo Verde Diversion Dam on the Palo Verde diversion project in California-Arizona; the American Falls pumping plant on the Michaud Flats project in Idaho; the 5,000-kilowatt Deer Creek powerplant on the Provo River project, Utah; the 11,250-kilowatt Roza powerplant on the Yakima project, Washington; and the diversion tunnel for the Trinity Dam on the Central Valley project in California, which will be a principal feature in the transbasin diversion of water from the Trinity coastal basin into the Central Valley. On the Santa Maria project in California a contract was awarded for construction of the Vaquero Dam.

Table 8 lists the major construction contracts (more than $1 million each) awarded by the Bureau of Reclamation in fiscal year 1956. Among features for which contracts were awarded were Vaquero Dam and access road on the Santa Maria project in California, Palo Verde diversion dam and levee system on the Palo Verde diversion project in California-Arizona, the diversion tunnel for the Trinity Dam on the Central Valley project in California, 19.5 miles of the Texas Hill Canal and distribution system on the Wellton-Mohawk division of the Gila project in Arizona, and 19 miles of the Sargent Canal on the Sargent unit of the Missouri River Basin project in Nebraska.

Listed in table 9 are the principal features on Bureau of Reclamation projects completed in fiscal year 1956. The table includes 4

TABLE 8.—*Major Bureau of Reclamation contracts awarded in fiscal year 1956*

Feature	Project	Amount of award
Vaquero Dam and access road	Santa Maria	$6,179,639
Palo Verde diversion dam	Palo Verde diversion	2,900,760
5.7 miles of pipelines and open channel for Shafter-Wasco laterals, Friant-Kern Canal distribution system.	Central Valley	1,849,118
19.5 miles of Texas Hill Canal and distribution system, Wellton-Mohawk division.	Gila	1,554,847
Trinity Dam diversion tunnel	Central Valley	1,348,000
19 miles of Sargent Canal, 2 miles of wasteway, and 34.4 miles of laterals and drains, Sargent unit.	Missouri River Basin	1,167,901
14.1 miles of laterals, Ralph's Mill area, Wellton-Mohawk division.	Gila	1,164,494
6.2 miles of Putah South Canal	Solano	1,147,921
Palo Verde levee system	Palo Verde diversion	1,012,097

TABLE 9.—*Principal features completed on Bureau of Reclamation projects in fiscal year 1956*

Feature	Project	State
272 miles laterals, wasteways, and drains	Columbia Basin	Washington.
21 miles pipelines	do	Do.
26 pumping plants	do	Do.
Crescent Lake Dam	Crescent Lake Dam	Oregon.
Chandler power and pumping plant	Yakima	Washington.
Amon pumping plant	do	Do.
12 miles Kennewick main canal	do	Do.
Unit "A" pumping plant	Minidoka	Idaho.
Tecolote Tunnel, 6 miles long	Cachuma	California.
Folsom powerplant	Central Valley	Do.
17 pumping plants for Friant-Kern Canal distribution system.	do	Do.
91 miles pipeline for Friant-Kern Canal distribution system.	do	Do.
8 miles of Corning Canal	do	Do.
64 miles of laterals	Gila	Arizona.
15 miles of laterals, sublaterals, and wasteways	Eden	Wyoming.
Stoddard diversion dam	Weber Basin	Utah.
Alamogordo Dam enlargement	Carlsbad	New Mexico.
Rehabilitation of El Vado Dam	Middle Rio Grande	Do.
102 miles of drain rehabilitation	do	Do.
Rehabilitation of Vermejo diversion dam and Vermejo and Eagle Tail Canals.	Vermejo	Do.
Tiber Dam	Missouri River Basin	Montana.
Webster Dam	do	Kansas.
Kirwin Dam	do	Do.
Milburn Diversion Dam	do	Nebraska.
417 miles 230-kilovolt transmission lines	do	North Dakota, South Dakota, Minnesota.
90 miles 115-kilovolt transmission lines	do	North Dakota, South Dakota, Wyoming.
102 miles of canals, laterals, and drains	do	Nebraska, Kansas.

storage dams, 2 diversion dams, 2 powerplants, 46 pumping plants, rehabilitation and enlargement of 2 storage dams, 507 miles of transmission lines, 585 miles of canals, pipelines, laterals, wasteways, and drains, and 102 miles of rehabilitated drains.

Progress of Construction

On the Columbia Basin project in Washington, construction progressed rapidly on the irrigation system. The system was extended to serve an additional 54,000 acres in fiscal year 1956. Completed were 272 miles of laterals, wasteways, and drains, and 26 pumping plants.

In Idaho, on the Palisades project, good progress was made on placing the earth embankment of the 13-million cubic yard Palisades Dam. The structure for the 114,000-kilowatt Palisades powerplant was completed and the turbines and generators were being installed at year's end.

The Chandler power and pumping plant on the Yakima project in Washington was completed and the plant's two 6,000-kilowatt generators were placed in service. Also on the Yakima project, the Amon pumping plant and a 12-mile section of the Kennewick main canal were completed. Construction of the project's 11,250-kilowatt Roza powerplant was begun during the year and was about 30 percent completed at the end of the year.

Crescent Lake Dam on the Crescent Lake Dam project in Oregon was completed, and Haystack Dam on the Deschutes project, in the same State, was placed under construction. The unit A pumping plant on the Minidoka project in Idaho was essentially completed.

In California, a construction highlight was completion of the 6-mile Tecolote Tunnel on the Cachuma project. The tunnel, one of the most difficult of the Bureau's construction undertakings in recent years because of large inflows of hot water, was placed in service to connect the project's Cachuma Reservoir with the south coast conduit serving the Santa Barbara area, thus augmenting the community's municipal water supply.

On the Central Valley project in California, construction was completed on the Folsom powerplant and the last 2 of the plant's 3 54,000-kilowatt generators were placed in service. Lateral distribution pipelines totaling 91 miles in length on the project's Friant-Kern Canal distribution system were completed for unit 3 of the Delano-Earlimart irrigation district and units 2 and 3 of the Exeter irrigation district. Work was started on the Shafter-Wasco irrigation district distribution system.

A significant construction milestone on the Central Valley project was start of work on the diversion tunnel for the Trinity Dam late in

the spring of 1956. The 500-foot high dam, to be placed under construction in fiscal year 1957, will probably be the highest earthfill dam in the world.

On the Solano project in California, concrete placement for the 302-foot high Monticello Dam neared two-thirds of completion at year's end. A 10-mile section of the highway relocation at Monticello Reservoir was completed, and another 5-mile section neared completion at the end of the fiscal year.

A "new start" late in the fiscal year was the beginning of construction under the Palo Verde diversion project for the Palo Verde diversion dam and levee system on the Colorado River between California and Arizona. Work on the Gila project in Arizona included bringing the Texas Hill Canal and distribution system to substantial completion; construction began on the project's Mohawk laterals of the Ralph's Mill area. In Utah, the Stoddard diversion dam and the 10-mile Gateway Canal were completed on the Weber Basin project. Work on Wanship Dam, an earthfill structure, was ahead of schedule; placing of the dam embankment was brought to about 80 percent of completion. The first 17-mile section of the Davis Aqueduct was about two-thirds completed. Work continued on the 4-mile second section and on the 4-mile Weber aqueduct. Enlargement of the Pineview Dam neared the midway point of completion.

On the Provo River project in Utah, work was begun on the 5,000-kilowatt Deer Creek powerplant.

Indicative of the Bureau's efforts to improve existing irrigation facilities were the rehabilitation of the El Vado Dam and 102 miles of drains on the Middle Rio Grande project, and the rehabilitation of the Vermejo diversion dam and Vermejo and Eagle Tail Canals on the Vermejo project, all in New Mexico. On the Carlsbad project in the same State, the enlargement of the earthfill Alamorgordo Dam was completed.

Progress on the Missouri River Basin was highlighted by completion of three major earthfill dams—Tiber in Montana and Webster and Kirwin in Kansas. In Nebraska, the Milburn diversion dam was completed. More than 500 miles of major electrical transmission lines which extend to areas in North and South Dakota, Minnesota, and Wyoming were completed. The high-voltage lines were placed in service to transmit initial power from the Corps of Engineers' Garrison and Fort Randall powerplants on the main stem of the Missouri River, in North and South Dakota, respectively. Work continued on an additional 240 miles of "backbone" transmission lines in the Dakotas.

In Wyoming, rapid construction progress was made on the Glendo Dam and 24,000-kilowatt powerplant. Overall construction was about 65 percent completed in 50 percent of the contract time. In the same

State, six pumping plants for the project's Hanover-Bluff unit were completed, and construction on the Lucerne Canal and pumping plant on the Owl Creek unit was advanced to the point that completion is expected early in the next fiscal year. The earthfill Pactola Dam in South Dakota is also scheduled for completion early in fiscal year 1957.

In other areas of the Missouri River Basin project, construction was begun on the Upper Meeker Canal on the Frenchman-Cambridge division in Nebraska, which will convey water from the completed Trenton Dam. On the Bostwick division, Kansas, the final section of the Franklin Canal and laterals were completed, a 35-mile reach of the Courtland Canal was completed to the Lovewell Reservoir, and the earthfill Lovewell Dam was about 50 percent completed.

The Bureau continued its efforts to prevent accidents and minimize the occupational hazards of construction work by maintaining its safety program during the year. Significant progress was made in the reduction of accidents on construction operations; the accident frequency rate for the fiscal year 1956 was lowered 12 percent below the fiscal year 1955 rate.

Design Activities and Developments

Design work was facilitated by increased efficiency of operations, and by adoption of new techniques. Major economy in certain designs was an accompanying achievement. The average cost of design as related to the overall Bureau construction and rehabilitation program for the 1956 fiscal year was 4.1 percent.

Design work proceeded on the 500-foot-high, 30-million-cubic-yard Trinity Dam. A new source of impervious material for this earthfill structure was investigated which will provide embankment material at a considerable saving in cost over that considered in the preliminary design.

Underwater television equipment was demonstrated as an effective means of surveying certain eroded areas of the spillway bucket at Shasta Dam on the Central Valley project. The television camera carried underwater by a diver to a depth of 38 feet scanned the eroded areas. The images of the areas appeared on monitors mounted on a barge where they were viewed and evaluated by engineers.

Substantial economies in construction of the new Vaquero Dam on the Santa Maria project in California, will be realized by a design modification in which the outlet works were enlarged to function as a service spillway, and a secondary tunnel spillway was selected to serve as an auxiliary or emergency structure.

A design method was developed to start the generators at the Kortes powerplant by remote control from the Seminoe powerplant, features of the Missouri River Basin project and Kendrick project in Wyoming,

respectively. At a signal from the Seminoe powerplant a master relay at the unattended Kortes plant operates a control to open the turbine gates and start the generators.

Designs were completed on the Bureau's first microwave radio system. The system, which will operate between Parker Dam and Phoenix, Ariz., will provide 5 telephone channels for voice communication regarding the power system between Hoover, Parker, and Davis powerplants, the Metropolitan Water District, and the city of Phoenix, 19 telemetering channels for dispatching of data on power generation, and a service channel.

The new Wanship and Gateway powerplants on the Weber Basin project were under design as fully outdoor structures, the first such installations to be built on a Reclamation project. In addition to savings in construction made possible by selection of the outdoor type of design, economies will be achieved in switchyard equipment and steel structures by use of "package-type" switchyard equipment for the powerplants.

Utilizing equipment loaned by the U. S. Geological Survey, the Bureau applied for the first time in its geophysical exploration work a new seismic geophysical technique on the Weber Basin project. By detonating explosives in relatively shallow holes, shock waves were "bounced back" from different strata underground. As a result, it was possible to secure data on the thickess and continuity of possible water-bearing strata to depths up to 4,000 feet. The Bureau also utilized for the first time in its geophysical investigations the technique of "air shooting" (seismic exploration using small explosive charges suspended above the ground surface), thus minimizing the hazard of damage from flying rock particles or pebbles.

Foreign Manufacturers

A total of 40 contracts, principally for electrical equipment, was awarded to companies offering equipment manufactured outside the United States. These contracts, which included 20 Italian, 6 Austrian, 3 English, 5 German, 2 Lebanese, and 4 Swiss, totaled $2,166,763. This total value of awards to foreign manufacturers during fiscal year 1956 was an increase of 125 percent over the value of foreign awards during the previous fiscal year. A differential of 6 percent was added to all foreign bids before comparison was made with domestic bids, in accordance with departmental regulations applying to determinations under the "Buy American Act." An additional 6-percent differential was added if the low domestic bidder indicated that equipment or materials would be produced in an area of substantial labor surplus, as determined by the Secretary of Labor.

The Bureau's engineering laboratories continued test and research programs to help solve design and construction problems and to improve the economy and serviceability of Reclamation projects.

A combined retarding, air-entraining, and plasticizing agent for concrete, which had been subject to intensive laboratory and field testing, was used successfully as a retarder to facilitate lining operations at the Tecolote Tunnel on the Cachuma project in California and at a canal on the Gila project in Arizona where high temperatures tended to accelerate setting of the concrete.

A heated precipitation gage developed by design, planning, and research engineers was constructed on the Eklutna project in Alaska. The gage, having a thermostatically controlled heating system, will operate unattended throughout the winter to provide valuable data for forecasting seasonal water yield inflow to Eklutna Lake.

In soils research, methods were developed for rapidly determining soil density and moisture content. Included were radioisotope methods for density determinations, and calcium carbide, alcohol ignition, and alcohol hydrometer methods for moisture determinations.

Radioisotope methods were successfully used at Soap Lake, Washington, in studying the mixing characteristics of the lower level highly saline water with fresh water introduced in the upper level of the lake. In protective coatings research, a zinc-silicate inorganic type of protective coating, particularly notable for its abrasion resistance, was found to be one of the more promising new materials under test in the laboratories.

In weed control research, tests of variously treated concrete slabs submerged in the Pole Hill Canal on the Colorado-Big Thompson project indicated that incorporation of sulphur in the surface of concrete at the time of casting of the slabs is beneficial to inhibiting algae growth.

During the year 106 laboratory reports were issued covering the subjects of research and testing of concrete materials, hydraulic laboratory studies, earth materials investigations, and protective coatings investigations.

The Bureau continued to contribute its technical resources and skills to the solution of problems of other public organizations and of private agencies.

Construction Costs

Construction costs on Reclamation projects increased about 8.5 percent during fiscal year 1956. Although adequate competition was received under most of the construction specifications and supply invitations for which bids were opened, bidding interest in all types of reclamation construction work continued to decrease from the interest

shown in fiscal years 1954 and 1955. The average number of bids per construction schedule, amounting to 8.5 in fiscal year 1954, dropped to 7 in fiscal year 1955, and to about 5.4 in fiscal year 1956.

Table 10 shows cost indexes for Bureau of Reclamation construction work based on the combined costs of material and labor supplied by contractors and materials and labor supplied by the Government.

TABLE 10.—*Bureau of Reclamation construction indexes, fiscal year 1956*

[Cost indexes based on January 1940 costs=1.00]

	July 1955	January 1956	June 1956
Dams:			
Earth	2.10	2.14	2.27
Concrete	2.15	2.19	2.32
Pumping plants:			
Building and equipment	2.60	2.70	2.79
Structures and improvements [1]	2.82	2.86	2.94
Equipment	2.35	2.50	2.58
Pumps and prime movers	2.43	2.59	2.70
Accessory electric and miscellaneous equipment	2.23	2.32	2.41
Discharge pipes	2.96	3.20	3.32
Canals and conduits:			
Canals	2.27	2.29	2.44
Conduits (tunnels, free flow, concrete lined)	2.62	2.64	2.74
Laterals and drains	2.86	2.86	3.00
Powerplants, hydro:			
Building and equipment	2.49	2.59	2.69
Structures and improvements [1]	2.78	2.83	2.90
Equipment	2.34	2.49	2.57
Turbines and generators	2.36	2.50	2.58
Accessory electrical equipment	2.28	2.37	2.46
Miscellaneous equipment	2.40	2.52	2.60
Penstocks	2.96	3.20	3.32
Transmission switchyards and substations	2.55	2.61	2.72
Transmission lines (wood pole 115-kv.)	2.06	2.14	2.20
Transmission lines (steel tower 230-kv.)	2.33	2.44	2.52
Permanent general property buildings	2.71	2.82	2.90
Roads and bridges:			
Primary roads	2.33	2.33	2.40
Secondary roads, unsurfaced	2.06	2.06	2.12
Bridges (steel)	2.88	2.96	3.04
Composite index	2.35	2.44	2.55

[1] Indexes for structures and improvements on pumping plants and powerplants are based on a reinforced concrete structure.

TABLE 11.—*Bureau of Reclamation storage dams, June 30, 1956*

State and project	Name of dam	River	Type	Capacity (acre-feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Alaska: Eklutna	Eklutna	Eklutna Creek	Earth dike and concrete buttressed wall weir.	[1] 182,000	26	555	5,000	1955 [2]
Arizona: Salt River	Bartlett	Verde	Concrete multiple arch	180,000	287	1,063	182,000	1939
	Cave Creek	Cave Creek	do	11,000	109	1,648	18,780	([3])
	Horse Mesa	Salt	Concrete arch	245,000	305	803	162,000	1937 [2]
	Mormon Flat	do	do	58,000	224	505	59,900	1938 [2]
	Roosevelt	do	Masonry gravity	1,382,000	280	1,125	355,800	1911
	Stewart Mountain	do	Concrete arch	70,000	207	1,260	120,500	1936 [2]
Arizona-California: Parker-Davis.	Parker [2]	Colorado	do	717,000	320	856	380,000	1938
Arizona-Nevada:								
Boulder Canyon	Hoover	do	Concrete gravity	29,830,000	726	1,244	4,400,000	1936
Parker-Davis	Davis	do	Earth	1,820,000	200	1,600	4,360,000	1950
California:								
Cachuma	Cachuma	Santa Ynez	do	205,000	275	2,975	6,700,000	1953
	Glen Anne	Offstream	do	500	102	240	323,000	1953
	Lauro	do	do	640	110	540	499,000	1952
Central Valley	Folsom [4]	American	Concrete gravity, embankment wings.	1,010,000	340	10,200	9,010,000	1955
	Friant [2]	San Joaquin	Concrete gravity	521,000	319	3,488	2,135,000	1942
	Keswick	Sacramento	do	24,000	159	1,046	197,000	1950
	Martinez	Offstream	Earth		62	1,200	183,000	1947
	Nimbus	American	Concrete gravity	8,800	76	1,093	205,000	1955
	Shasta	Sacramento	Concrete gravity, embankment wing	4,500,000	602	3,460	6,541,000	1945
	Sly Park	Sly Park Creek	Earth	41,000	190	760		1955
	Sly Park dike	Offstream	do		130	600		1955
	Trinity							([5])
Orland	East Park	Little Stony Creek	Concrete gravity	50,900	139	266	15,750	1910
	Stony Gorge	Stony Creek	Concrete slab-and-buttress	[1] 50,100	139	868	43,100	1928
Solano	Monticello	Putah Creek	Concrete arch	1,600,000	295	1,000	273,000	([5])
Colorado:								
Colorado-Big Thompson	Carter Lake	Offstream	do	112,000	214	1,235	2,550,000	1952
	Dixon Canyon	do	do	152,000	240	1,265	2,960,000	1949
	Horsetooth	do	do		155	1,840	1,870,000	1949
	Soldier Canyon	do	do		226	1,438	3,212,000	1949
	Spring Canyon	do	do		220	1,120	2,100,000	1949
	Flatiron	Chimney Hollow Creek	do	760	86	1,725	382,000	1953
	Granby	Colorado	do	540,000	298	861	2,970,000	1950
	Green Mountain	Blue	do	155,000	309	1,150	4,360,000	1943
	Marys Lake dike No. 1	Offstream	do	930	29	820	90,300	1949
	Marys Lake dike No. 2	do	do		35	950		1949
	Olympus [2]	Big Thompson	Earth, concrete overflow section	3,070	70	1,951	312,000	1949

	Rattlesnake	Rattlesnake Creek	Earth	2,180	130	1,100	432,000	1952
	Shadow Mountain [2]	Colorado	do	18,400	63	3,077	167,000	1946
	Willow Creek	Willow Creek	do	10,600	127	1,100	392,000	1953
Fruitgrowers Dam	Fruitgrowers	Alfalfa Run	do	4,580	55	1,520	136,000	1938
Mancos	Jackson Gulch	Offstream	do	10,000	180	1,900	1,710,000	1949
Pine River	Vallecito	Los Pinos	do	130,000	162	4,010	3,740,000	1941
San Luis Valley	Platoro	Conejos	do	60,000	165	1,538	912,000	1951
Uncompahgre	Taylor Park	Taylor	do	[1] 106,000	206	675	1,115,000	1931
Idaho-Oregon:								
Boise	Anderson Ranch	Boise, South Fork	Earth	493,000	456	1,400	9,650,000	1950
	Arrowrock	Boise	Concrete gravity	287,000	350	1,150	636,000	1915
	Cascade	Payette, North Fork	Earth	704,000	107	785	395,000	1948
	Deadwood	Deadwood	Concrete arch	162,000	165	749	56,400	1931
	Deer Flat, upper	Offstream	Earth	190,000	74	4,000	1,250,000	1908
	Deer Flat, lower	do	do		46	7,200	1,240,000	1908
Idaho-Wyoming:								
Minidoka	American Falls	Snake	Concrete, gravity, embankment, wings.	[1] 1,700,000	94	5,227	314,000	1927
	Grassy Lake	Grassy Creek	Earth and rock	15,400	118	1,170	539,000	1939
	Island Park	Snake, Henry's Fork	do	128,000	91	9,448	564,000	1938
	Jackson Lake	Snake	Concrete gravity, embankment wings.	[1] 847,000	78	4,920	492,000	1911
	Minidoka [3]	do	Earth and rock, concrete powerhouse section.	210,000	86	4,475	257,000	1906
Palisades	Palisades	Snake, South Fork	Earth	1,400,000	260	2,100	13,600,000	(4)
Kansas:								
Bostwick division (Missouri River Basin).	Lovewell	White Rock Creek	do	94,000	93	8,500	3,190,000	(4)
Smoky Hill division (Missouri River Basin).	Cedar Bluff	Smoky Hill	do	377,000	199	12,560	8,490,000	1952
Solomon division (Missouri River Basin).	Kirwin	Solomon, North Fork	do	315,000	169	12,646	9,710,000	1955
	Webster	Solomon, South Fork	do	272,000	108	10,600	5,500,000	1956
Kansas-Colorado:								
St. Francis unit (Missouri River Basin).	Bonny	Republican, South Fork	do	170,000	158	9,200	9,031,000	1951
Montana:								
Bitter Root	Como	Rock Creek	do	36,600	65	2,550	1,110,000	1910
Helena-Great Falls division (Missouri River Basin).	Canyon Ferry	Missouri River	Concrete gravity	2,050,000	225	1,000	414,400	1954
Hungry Horse	Hungry Horse	Flathead, South Fork		3,470,000	564	2,115	3,054,000	1953
Huntley	Anita	Offstream	Earth	400	42	1,050	143,000	1937
Lower Marias division (Missouri River Basin).	Tiber	Marias	do	1,340,000	205	4,300	10,000,000	1956
	Tiber Dike	do	do		60	17,000	2,000,000	1956
Milk River	Fresno	Milk	do	129,000	111	2,070	2,110,000	1939
	Nelson	Offstream	do	85,500	28	9,900	233,000	1915
	Sherburne Lake	Swiftcurrent Creek	do	66,100	96	1,086	228,000	1921
Sun River	Gibson	Sun, North Fork	Concrete arch	105,000	199	960	167,500	1929
	Pishkun dikes	Offstream	Earth	46,300	50	9,050	599,000	1921
	Willow Creek	Willow Creek	do	32,400	93	650	275,000	1911

See footnotes at end of table.

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TABLE 11.—*Bureau of Reclamation storage dams, June 30, 1956*—Continued

State and project	Name of dam	River	Type	Capacity (acre-feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Nebraska:								
Frenchman-Cambridge division (Missouri River Basin).	Enders	Frenchman Creek	Earth	74,500	134	2,603	1,950,000	1950
	Medicine Creek	Medicine Creek	do	90,900	165	5,665	2,730,000	1949
	Trenton	Republican	do	254,000	145	7,800	8,130,000	1954
Mirage Flats	Box Butte	Niobrara	do	31,100	87	5,508	1,420,000	1946
Nebraska-Wyoming:								
North Platte	Guernsey	North Platte	do	44,800	135	560	586,000	1927
	Lake Alice, upper	Offstream	do	11,200	30	3,100	241,000	1912
	Lake Alice, lower	do	do		23	2,550	119,000	1913
	Minatare	do	Earth and gravel, concrete-faced	62,200	63	3,700	696,000	1915
	Pathfinder	North Platte	Masonry arch	1,016,000	214	432	65,700	1909
	Pathfinder	do	Earth		38	1,650	152,000	1909
Nevada: Humboldt	Rye Patch	Humboldt	do	[1] 179,000	75	914	356,000	1936
Nevada-California:								
Newlands	Lahontan	Carson	Earth and gravel	[1] 291,000	162	5,400	733,000	1915
	Lake Tahoe [3]	Truckee	Concrete slab-and-buttress, lake outlet regulator.	[1] 732,000	16	109	425	1913
Truckee Storage	Boca	Little Truckee	Earth	41,100	116	1,629	912,000	1939
New Mexico:								
Carlsbad	Alamogordo	Pecos	Earth	122,000	164	3,084	2,250,000	1937
	Avalon [3]	do	Earth and rock, concrete core wall	6,000	58	1,025	202,000	1907
	McMillan	do	Earth	32,300	57	2,114	234,000	1908 [2]
Middle Rio Grande	El Vado	Rio Chama	Earth, steel-faced	195,000	175	1,300	608,000	1955 [2]
Vermejo	Dam No. 2	Offstream	Earth	2,880	12	10,730	206,000	1954
	Dam No. 13	do	do	4,950	32	8,237	248,000	1954
	Stubblefield	do	do	16,160	47	15,700	827,000	1954
New Mexico-Texas:								
Rio Grande	Caballo [3]	Rio Grande	do	341,000	112	4,558	1,240,000	1938
	Elephant Butte	do	Concrete gravity	2,190,000	301	1,674	629,500	1916
	Picacho North	Picacho Arroyo, North Branch.	Earth	[6] 790	45	1,600	149,000	1953
	Picacho South	Picacho Arroyo, South Branch.	do	[6] 460	29	1,680	86,000	1954
North Dakota:								
Heart division (Missouri River Basin)	Dickinson	Heart River	do	16,500	69	2,275	324,000	1950
	Heart Butte	do	do	226,000	174	1,850	1,140,000	1949
Missouri-Souris Division (Missouri River Basin).	Jamestown	James	do	230,000	110	1,418	963,000	1953
Oklahoma: W. C. Austin	Altus [3]	Red, North Fork	Concrete gravity, masonry-faced	164,000	110	1,112	70,200	1945

Oregon:								
Baker	Thief Valley	Powder	Concrete slab-and-buttress	17,600	70	390	6,290	1932
Burnt River	Unity	Burnt	Earth and rock	25,800	83	694	254,000	1938
Crescent Lake	Crescent Lake	Crescent Lake	Earth	86,000	40	450	19,000	1956
Deschutes	Crane Prairie	Deschutes	do	55,300	36	285	29,700	1940
	Haystack	Offstream	do	6,600	105	1,200	535,000	[3]
	Wickiup	Deschutes	do	187,000	100	13,860	1,850,000	1949
Ochoco	Ochoco	Ochoco Creek	do	47,500	125	1,350	750,000	1950 [2]
Rogue River Basin	Four Mile Lake	Four Mile Lake	Rock, concrete facing					1956 [6]
	Fish Lake	Fish Lake	Earth and rock					1956 [6]
Umatilla	Cold Springs	Offstream	Earth	[1] 50,000	117	3,450	793,000	1908
	McKay	McKay Creek	Gravel, concrete-faced	[1] 73,800	180	2,700	2,360,000	1927
Vale	Agency Valley	Malheur, North Fork	Earth	60,000	110	1,850	646,000	1935
	Warm Springs	Malheur, Middle Fork	Concrete arch	192,000	106	469	19,500	1919 [7]
Oregon-California:								
Klamath	Clear Lake	Lost	Earth and rock	527,000	39	840	63,400	1910
	Gerber	Miller Creek	Concrete arch	[1] 94,300	88	485	11,900	1925
Oregon-Idaho: Owyhee	Owyhee [3]	Owyhee	Concrete gravity	1,120,000	417	833	537,500	1932
South Dakota:								
Belle Fourche	Belle Fourche	Owl Creek	Earth, concrete-faced	192,000	122	6,262	1,780,000	1911
Cheyenne Division	Angostura	Cheyenne	Concrete gravity, embankment wing.	160,000	189	2,030	750,000	1949
(Missouri River Basin).	Pactola	Rapid Creek	Earth	99,600	230	1,340	4,225,000	1956
Grand Division (Missouri River Basin).	Shadehill	Grand	do	358,000	145	12,843	3,500,000	1951
Rapid Valley	Deerfield	Castle Creek	do	15,700	133	825	607,000	1946
Texas: Colorado River	Marshall Ford	Colorado (Texas)	Concrete gravity, embankment wings.	1,954,000	278	5,093	3,390,000	1942
Utah:								
Hyrum	Hyrum [3]	Little Bear	Earth	18,800	116	540	430,000	1935
Moon Lake	Midview	Offstream	do	[1] 5,800	54	663	139,000	1937
	Moon Lake	Lake Fork, West Fork	do	49,500	101	1,108	513,000	1938
Newton	Newton	Clarkson Creek	do	5,600	101	3,340	410,000	1946
Ogden River	Pine View	Ogden	do	110,000	132	600	418,000	1937
Provo River	Deer Creek	Provo	do	153,000	235	1,304	2,830,000	1941
Scofield	Scofield	Price	do	73,600	125	575	203,000	1945
Strawberry Valley	Strawberry	Strawberry	Earth, concrete core wall	283,000	72	490	118,000	1913
	Indian Creek Dike	do	do		37	1,311	114,000	1913
Weber Basin	Wanship	Weber	Earth	60,000	156	2,010	3,020,000	[4]
	Weber Aqueduct Equalizing.	Offstream	do		40	500	60,000	[5]
Weber River	Echo	Weber	do	[1] 73,900	158	1,887	1,540,000	1931
Washington:								
Columbia Basin	Dry Falls	Offstream	Earth	1,275,000	123	9,880	1,660,000	1949
	North	do	do		145	1,400	1,470,000	1951
	Grand Coulee	Columbia	Concrete gravity	9,402,000	550	4,173	10,590,000	1942
	Long Lake	Offstream	Earth	65,000	163	1,900	1,460,000	1948
	North Scooteney Dike	do	do		16	3,700	62,200	1952
	O'Sullivan	Lower Crab Creek	do	[8] 616,000	225	19,000	8,770,000	1949
	Soda Lake Dike	Soda Lake	do		61	1,750	216,000	1952

See footnotes at end of table.

TABLE 11.—*Bureau of Reclamation storage dams, June 30, 1956*—Continued

State and project	Name of dam	River	Type	Capacity (acre-feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Washington—Continued								
Okanogan	Conconully	Salmon Creek	Earth	[1] 13,000	70	1,000	359,000	1910
	Salmon Lake	do	do	[1] 10,500	42	1,260	195,000	1921
Yakima	Bumping Lake [3]	Bumping	do	33,700	45	3,660	253,000	1910
	Clear Creek [3]	Tieton, North Fork	Concrete arch	5,300	80	404	5,800	1914
	Cle Elum	Cle Elum	Earth	437,000	160	1,801	1,410,000	1933
	Kachess	Kachess	Earth and gravel	[1] 239,000	114	1,400	200,000	1912
	Keechelus	Yakima	do	[1] 158,000	103	6,550	684,000	1917
	Tieton	Tieton	Earth, concrete core wall	198,000	235	920	2,050,000	1925
Wyoming:								
Boysen division (Missouri River Basin).	Boysen	Big Horn	Earth	970,000	220	1,143	1,530,000	1952
Cheyenne division (Missouri River Basin).	Keyhole	Belle Fourche	do	200,000	168	3,420	1,340,000	1952
Eden	Big Sandy	Big Sandy Creek	do	39,700	85	2,400	840,000	1952
Kendrick	Alcova [3]	North Platte	do	190,500	265	763	1,640,000	1936
	Seminoe	do	Concrete arch	1,012,000	295	530	210,000	1939
Oregon Trail division (Missouri River Basin)	Glendo	do	Earth	800,000	207	2,200	3,020,000	([5])
	Kortes	do	Concrete gravity	4,740	244	440	147,000	1951
Riverton	Bull Lake	Bull Lake Creek	Earth	152,000	81	3,456	820,000	1938
	Pilot Butte	Offstream	do	37,000	51	1,300	135,000	1926
Wyoming-Montana:								
Shoshone	Buffalo Bill	Shoshone	Concrete arch	440,000	325	200	82,900	1910
	Deaver	Offstream	Earth	680	14	1,300	30,300	1918
	Ralston	do	do	1,500	35	2,200	24,700	1908

[1] Live storage—dead storage not evaluated.
[2] Non-Reclamation construction. Date is of supplemental construction by Bureau of Reclamation.
[3] Storage and diversion.
[4] Dam constructed by U. S. Army Corps of Engineers, reservoir operated by Bureau of Reclamation.
[5] Under construction.
[6] For flood retention only.
[7] Non-Reclamation construction. Bureau purchased half-interest in 1926.
[8] Greater part of active storage behind O'Sullivan provided through wasteways from primary irrigation features of project.

DEFINITIONS

Capacity: Total reservoir storage to highest controlled water surface, except where indicated by footnote.[1]
Height: Distance between lowest point in foundation and normal crest of dam.
Length: Extent of barrier in dam and integral features constructed between natural abutments.
Volume: Space occupied by all material in dam and its appurtenant features.
Year: Date original construction was completed by Bureau of Reclamation, except as indicated in footnote [2].

TABLE 11A.—*Bureau of Reclamation diversion dams, June 30, 1956*

State and project	Name of Dam	River	Type	Capacity (second-feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Arizona:								
Salt River	Granite Reef	Salt	Concrete weir, embankment wings	3,600	18	1,128	35,000	1908
	Joint Head	do	Concrete weir, embankment wing	200	4	2,600	5,400	1914
	Power Canal	do	do	220	8	862	16,000	1906
Arizona-California:								
Gila and Boulder Canyon, All-American Canal system.	Imperial	Colorado	Concrete slab-and-buttress, overflow section.	17,155	23	3,475	196,800	1938
Palo Verde	Palo Verde	do	Earth, concrete gate structure	1,800	15	1,300	215,000	(1)
Yuma	Laguna	do	Rockfill weir, concrete-surfaced	1,950	10	4,780	487,000	1909
California:								
Central Valley	Camp Creek	Camp Creek	Concrete weir	500	20	119	3,000	1953
Orland	North	Stony Creek	Concrete weir, removable crest	125	3	375	650	1954
	Rainbow	do	Concrete arch, overflow	200	29	155	1,780	1914
	South	do	Concrete weir	225	3	895	3,600	1916
Colorado:								
Colorado-Big Thompson	East Portal	Wind	Rock, concrete core wall	550	10	245		1947
	Horsetooth Supply	Big Thompson	Concrete box	600	8	90	1,300	1950
	Little Hell Creek	Little Hell Creek	Earth and rock	550	33	220	10,000	1952
	North Poudre supply canal.	Cache la Poudre	Concrete weir, embankment wing	250	6	200	1,262	1952
	Pole Hill Afterbay	Little Hell Creek	Earth and rock	550	21	220	6,000	1953
	South Platte supply canal.	Boulder Creek	Concrete weir	230	5	64		1956 [2]
	Willow Creek pump forebay.	Offstream	Earth and rock		11	580	15,000	1953
Fruitgrowers Dam	Dry Creek	Dry Creek	Concrete weir	100	5	36	242	1940
Grand Valley	Grand Valley	Colorado	do	1,675	14	546	25,700	1916
Paonia	Fire Mountain Canal	Gunnison, North Fork	Timber sheet piling, rockfill	180		187		1950
Uncompahgre	East Canal	Uncompahgre	Concrete weir, embankment wing	330	8	764	1,009	1915
	Garnet	do	Rockfill weir, concrete-surfaced	50	4	75	500	1918 [2]
	Gunnison	Gunnison	Timber-crib weir, concrete wings, removable crest.	1,000	10	244	3,200	1912
	Ironstone	Uncompahgre	Concrete gate structure, timber-crib wing.	350	8	[3] 31	155	1915 [2]
	Loutsenhizer	do	Timber weir	290	9	114	400	1911 [2]
	Montrose and Delta	do	Concrete gate structure, movable crest.	500	12	68	500	1915 [2]
	Selig	do	Timber weir, removable crest	300	10	96	500	1914 [2]
Idaho:								
Lewiston Orchards	Sweetwater	Sweetwater Creek	Rockfill weir, concrete diaphragm	77	8	80	400	1948
	Webb Creek	Webb Creek	do	20	10	75	600	1948

See footnotes at end of table.

TABLE 11A.—*Bureau of Reclamation diversion dams, June 30, 1956*—Continued

State and project	Name of Dam	River	Type	Capacity (second-feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Idaho-Oregon:								
Boise	Black Canyon [4]	Payette	Concrete gravity, overflow	1,360	111	1,039	81,200	1925
	Boise River	Boise	Concrete and masonry weir, removable crest.	2,815	39	500	26,100	1908
Idaho-Wyoming:								
Minidoka	Cascade Creek	Cascade Creek	Timber-crib weir	220	6	217	3,070	1937
	Cross Cut	Snake-Henry's Fork	Concrete weir	591	10	457	7,375	1938
Montana:								
Bitter Root	Rock Creek	Rock Creek	Timber sheet piling, concrete weir cap.	350		80		1950
Frenchtown	Frenchtown	Missoula	Earth and rock	172	13	489	12,200	1936
Huntley	Yellowstone River	Yellowstone	Concrete weir	400	8	250	1,674	1934
Milk River	Dodson	Milk	Timber-crib weir, movable crest, embankment wings.	700	23	8,154	87,400	1910
	Saint Mary	Saint Mary	Concrete weir	850	6	198	1,230	1915
	Swift Current	Swift Current Creek	Earth, timber-crib core		13	4,800	98,400	1915
	Vandalia	Milk	Concrete slab-and-buttress weir, movable crest, embankment wing.	300	27	2,350	15,210	1917
Sun River	Sun River	Sun, North Fork	Concrete arch, overflow	1,400	114	261	6,470	1915
Montana-North Dakota: Lower Yellowstone.	Lower Yellowstone	Yellowstone	Timber-crib weir, embankment wing.	840	4	700	22,500	1910
Nebraska:								
Bostwick division (Missouri River Basin).	Superior-Courtland	Republican	Concrete weir, embankment wings	890	21	4,000	179,000	1950
Frenchman-Cambridge (Missouri River Basin).	Bartley	do	do	130	35	3,100	58,000	1954
	Cambridge	do	Concrete weir, embankment wing	325	33	4,650	13,850	1948
Middle Loup division (Missouri River Basin).	Milburn	Middle Loup	Concrete gate structure, embankment wings.	260	12	3,600	70,000	1956
Mirage Flats	Dunlap	Niobrara	Concrete weir, embankment wing	220	6	577	6,360	1945
Nebraska-Wyoming:								
North Platte	Dry Spotted Tail Creek	Dry Spotted Tail Creek	Steel sheet pile and earth		13	255	650	1954
	Horse Creek	Horse Creek	Concrete weir, embankment wing	430	6	720	5,260	1923
	Tub Springs Creek	Tub Springs Creek	Steel sheet pile and earth		9	205		1954
	Whalen	North Platte	Concrete weir, embankment wing	3,700	11	2,460	81,700	1909
Nevada-California:								
Newlands	Carson River	Carson	Concrete gate structure	1,950	14	241	2,707	1905
	Derby	Truckee	Concrete gate structure, embankment wing.	1,500	15	1,331	36,570	1905
New Mexico:								
Fort Sumner	Fort Sumner	Pecos	Concrete weir	100	11	715	27,260	1951
Middle Rio Grande	Angostura	Rio Grande	Concrete, wall weir		27	800		(2)
	Isleta	do	Concrete gate structure	1,051	5	674	2,820	1955 [2]
	San Acacia	do	do		47	700		(2)
Vermejo	Vermejo	Vermejo	Concrete weir, embankment wing	600	5	1,021	4,430	1955 [2]
New Mexico-Texas:								
Rio Grande	Leasburg	Rio Grande	Concrete weir, embankment wings	700	7	2,865	22,500	1907
	Mesilla	do	Concrete weir	915	10	303	23,600	1916

	Percha	do	Concrete weir, embankment wings	350	12	2,720	43,240	1917
	Percha Arroyo	Percha Arroyo	Earth	30,000	19	2,489	193,000	1939
	Riverside	Rio Grande	Concrete weir, movable crest	1,000	8	283	145,200	1928
Oregon:								
Deschutes	North Canal	Deschutes	Concrete arch-gravity, overflow	1,000	28	293	4,900	(2)
Grants Pass	Savage Rapids	Rogue	Concrete gravity and multiple arch	207	30	456	5,600	1955 [2]
Umatilla	Feed Canal	Umatilla	Concrete, rock, and timber weir, embankment wing.	350	4	2,100	14,100	1907
	Maxwell	do	Concrete and timber-crib weir, embankment wing.	140	5	400	465	1912
	Three Mile Falls	do	Concrete multiple arch, overflow	360	23	915	5,070	1914
Vale	Harper	Malheur	Concrete gate structure, embankment wing.	662	12	914	9,260	1929
Oregon-California:								
Klamath	Lost River	Lost	Concrete multiple arch, overflow, embankment wings.	3,000	26	675	19,920	1912
	Lower Lost River	do	Concrete slab-and-buttress	810	12	324	690	1921
	Malone	do	Concrete gate structure, embankment wing.	220	18	515	21,200	1923
	Miller	Miller Creek	Concrete weir, removable crest, embankment wings.	190	5	290	1,620	1924
South Dakota: Belle Fourche	Belle Fourche	Belle Fourche	Concrete weir, embankment wings	1,635	18	2,523	35,700	1907
Utah:								
Moon Lake	Duchesne Feeder Canal	Duchesne	Concrete weir, embankment wings	200	6	[3] 220	4,000	1939
Provo River	Broadhead	Broadhead Creek	Concrete weir, embankment wing			40	710	1953
	Duchesne	Duchesne, North Fork	Rockfill weir, concrete core wall	600		480		1952
	Murdock	Provo	Concrete weir, embankment wing	550	10	100	9,040	1950
	Weber River	Weber	Concrete weir, embankment wings	1,000	10	1,795	15,400	1930
Strawberry Valley	Indian Creek Crossing	Indian Creek	do	750	9	1,350	15,200	1913
	Spanish Fork	Spanish Fork	Concrete weir	500	13	74	1,020	1908
Weber Basin	Slaterville	Weber	Concrete gate structure	1,660	8	162	1,900	(1)
	Stoddard	do	do	715	8	110		1956
Washington:								
Okanogan	Salmon Creek	Salmon Creek	Concrete weir, embankment wing	300	5	140	800	1906
Yakima	Easton [4]	Yakima	Concrete gravity, overflow, movable crest.	1,320	43	248	5,760	1929
	Prosser	do	Concrete weir	1,500	7	741	2,470	1956 [2]
	Roza	do	Concrete weir, movable crest	2,200	34	486	21,710	1939
	Sunnyside	do	Concrete weir, embankment wing	1,320	6	[3] 500	1,810	1907
	Tieton	Tieton	do	320	2	510	1,370	1908
Wyoming: Riverton	Wind River	Wind River	do	2,200	19	2,464	124,000	1923
Wyoming-Montana:								
Shoshone	Corbett	Shoshone	Concrete slab-and-buttress weir, embankment wing.	1,000	12	938	10,200	1908
	Willwood	do	Concrete gravity, overflow, embankment wing.	320	41	476	22,120	1924

[1] Under construction.
[2] Non-Reclamation construction. Date is of supplemental construction by Bureau of Reclamation.
[3] Weir length only.
[4] Diversion and storage.

DEFINITIONS

Capacity: Amount of diversion provided by canal headworks at dam.
Height: Distance between original streambed and highest controlled water surface.
Length: Extent of barrier in dam and integral features constructed between natural abutments, except as indicated in footnote [3].
Volume: Space occupied by all material in dam and its appurtenant features.
Year: Date original construction was completed by Bureau of Reclamation, except as indicated in footnote [2].

Inspection

During the fiscal year major facilities on 34 projects and minor facilities on 21 projects were inspected to assure that equipment and structures were in safe operating condition and were properly maintained.

Facilities on 9 projects were transferred from operation and maintenance by the Bureau to similar responsibility by the water users. Facilities for an additional 18 projects were cleared for such transfer. A total of 22 contracts for project repayment and water service was reviewed.

PROJECT DEVELOPMENT

The project development program involves preparation of comprehensive plans for development of river basin resources and the investigation and planning of potential projects for the conservation and utilization of the water resources of the West. It also includes detailed preconstruction work on newly authorized projects awaiting the initial allotment of construction funds.

Comprehensive Basin Surveys

During fiscal year 1956, the Bureau of Reclamation was engaged in comprehensive surveys in 13 basins throughout the West. Of these, the studies in the San Luis Obispo County Basin and the Santa Ynez River Basin were completed and by the end of the fiscal year, field work on the Upper American River Basin survey was substantially completed. Final review of the comprehensive report on the Arkansas-White-Red River Basins was completed by concerned Federal agencies and the report was transmitted to the Congress by the Director, Bureau of the Budget, on June 18, 1956.

Permanent authorization was provided for the Bureau's investigation program in Alaska which in the past had been carried forward on a year-to-year basis on language in the annual appropriation acts.

Project Planning Reports

Feasibility reports were completed on the Norman project in Oklahoma, the Harlingen and Mercedes division of the Lower Rio Grande rehabilitation project in Texas and the Rio Grande and Weminuche Pass divisions of the San Luis Valley project in Colorado, and the reports were under review by the affected States and interested Federal agencies. By the close of the year reports had been submitted to the Department for the Palisades reregulating dam and reservoir

in Idaho and the San Angelo project in Texas preparatory to their being submitted to the States and Federal agencies and for the San Luis Valley unit of the Ultimate Central Valley project preparatory to its being submitted to the Bureau of the Budget.

Definite Plan Reports

During the fiscal year a definite engineering plan was prepared for the Palo Verde diversion project, Arizona-California, and definite plan reports were prepared, reviewed, and approved for the following projects:

Chief Joseph Dam project, Foster Creek division, Washington.
Michaud Flats project, Idaho.
Rogue River Basin project, Talent division, Oregon.
Santa Maria project, California.

River Compacts

Legislation was passed granting consent of the Congress to the negotiation of compacts between the States of Oregon and California regarding the Klamath River; the States of Kansas and Oklahoma concerning the Arkansas River; the States of Arkansas, Louisiana, Oklahoma, and Texas regarding the Red River; and the States of California and Nevada regarding the Truckee, Carson, and Walker Rivers.

Hydrology

Studies have been performed in several of the basic problem areas experienced in hydrologic investigations of proposed reclamation projects, encompassing the fields of flood control, sediment, water utilization, and evaporation.

Flood studies involving snowmelt and interflow problems and complex storm patterns were developed utilizing the Blackfoot and the Beaverhead River Basins in Montana as data source areas.

Investigation of evaporation along several lines has continued in collaboration with the Geological Survey. The final report on the Lake Mead study was released to the public. High-altitude studies at Granby Reservoir, and ultra-high-altitude study on Pikes Peak, both in Colorado, were initiated to assist in evaluating reservoir evaporation in the higher and more remote areas of the Western States.

Evaluation of river flow forecasting methods of the Bureau of Reclamation by comparison with those of other agencies was continued.

Investigation in collaboration with the Geological Survey of total sediment transport covered the computation of total sediment transport in alluvial streams for flows with no ice cover and temperatures of 32° F. to 39° F.; improvement of techniques for bed material sampling, and the comparison of the equal transit rate method of suspended sampling with current procedures.

International Streams Investigations

The Bureau of Reclamation is represented on two International Engineering Boards of the United States section of the International Joint Commission. The Souris-Red Rivers Engineering Board continued its engineering studies of the Souris River for use of the Commission in its consideration of an apportionment of waters of that international stream between the United States and Canada under the Souris-Red Rivers reference of January 12, 1948. During the fiscal year the Waterton-Belly Rivers Engineering Board was inactive in connection with the Waterton-Belly Rivers reference of the same date.

PROGRAM COORDINATION AND FINANCING

Greater efficiency in the maintenance of detailed work schedules and statistical services essential to the estimating, financing, accounting, and reporting of the Federal reclamation program was achieved by continued refinement of bookkeeping and reporting procedures in the Bureau during 1956 fiscal year.

Programing of operation and maintenance activities on an organizational rather than a functional basis was instituted and proved to be simpler to prepare and more informative than the method previously used.

Financial operations included plans for the preparation annually of a "Statement of Project Costs and Repayment"; a uniform guide for compliance factors, accounting procedures, and internal controls; study of developments in the field of electronics and other mechanical equipment; and centralization of accounting in regional offices.

Inquiries by the Bureau of the Budget and the introduction of legislation in the Congress indicated the possibility of a requirement to prepare appropriation requests on the basis of costs rather than obligations. In anticipation of this change, studies were made to determine the applicability of existing scheduling procedures to such a requirement. This analysis indicated that the Bureau's activity programs as presently prepared will meet the requirements of a cost-type budget presentation with little or no revision.

Statistical periodicals provided throughout the year included the Monthly Report on Progress and Status of Funds, Monthly Program

Briefs, Monthly Federal Civilian Employment, Bureau Quarterly Progress, Quarterly Office Budget—Employment, Statistical Appendix to Commissioner's Annual Report, Fund Tables, Commissioner's Cost Report and other related interim reports and chart exhibits on all activities as the official source for frequently required administrative and management data.

The Bureau's initial Annual Consolidated Financial Report for fiscal year 1955 was compiled. Plans were completed for preparing manuscript and publishing new editions of the three related volumes entitled "Reclamation Project Feasibilities and Authorizations," "Reclamation Appropriation Acts and Allotments," and "Reclamation Repayment Histories and Payout Schedules," to bring these 1952 publications up to 1957 in accordance with the 5-year timing element of the Bureau's long-range statistical publication program.

BUDGET

Appropriations made available to the Bureau of Reclamation for fiscal year 1956 totaled $180,155,000 including $160,000 in supplemental funds to cover the cost of pay increases authorized by Public Law 533. This does not include revolving funds or in permanent appropriations. The appropriation for 1956 was $16,948,000 more than was appropriated for fiscal year 1955.

With an unobligated balance of $17.3 million, plus funds advanced by water users, trust funds, and a continuing fund for emergency expenses, Fort Peck project, the money available to Reclamation was $208.6 million. Of this amount there remained unobligated at the close of 1956 funds in the amount of $36.2 million.

Obligations for 1956 totaled $172.4 million or 83 percent of the obligations programed as compared with 94 percent of the program accomplished in 1955.

The 1956 Appropriation Act, as in recent years imposed certain restrictions upon the Bureau. The Bureau was again directed not to initiate construction on transmission facilities in areas covered by power wheeling contracts unless the wheeling agencies were unable or unwilling to provide this service.

The limitation on the amount of money which may be expended for work by Government forces (force account work) was repeated in the 1956 act. This limitation provided that not to exceed 12 percent of the allotment for any one project or unit of the Missouri River Basin project, with a maximum of $225,000 for any such project or unit, was to be so used. Also again as in recent years a limitation was placed upon the amount of money that could be expended for information services. By administrative determination this limitation was placed at $18,250.

The amounts appropriated by activity for fiscal year 1956, together with the amounts to be derived from the special and general funds, follow:

TABLE 12.—*Condensed statement of appropriations, fiscal year 1956 exclusive of trust funds and permanent appropriations*

General investigations	$5,104,000
Reclamation fund	(4,421,812)
Colorado River dam fund, Colorado River development fund	(532,188)
General fund	(150,000)
Construction and rehabilitation	146,041,000
Reclamation fund	(69,287,000)
General fund	(76,754,000)
Operation and maintenance	24,750,000
Reclamation fund	(20,171,138)
Colorado River dam fund	(1,749,500)
General fund	(2,829,362)
General administrative expenses	3,760,000
Reclamation fund	(3,760,000)
Emergency fund	500,000
Reclamation fund	(500,000)
Grand total	180,155,000
Reclamation fund	(98,139,950)
Colorado River dam fund	(2,281,688)
General fund	(79,733,362)

TABLE 13.—*Annual appropriations from reclamation and other funds, fiscal years 1902–56*

Fiscal year	Reclamation fund [1]	General fund	Colorado River dam fund	Emergency relief funds [2]	Fort Peck continuing fund	Permanent appropriations	Total
1902	[3] $165,000						[3]
1903	[3] 5,950,000						[3]
1904	[3] 18,440,000						[3] $2,000,000
1905	[3] 8,758,000						[3]
1906	[3] 24,894,961						[3] 15,363,800
1907	[3] [4] 41,979,161						[3]
1907	19,186,161						[3] 18,051,161
1908	9,562,038						9,562,038
1909	9,180,700						9,180,700
1910	8,183,300						8,183,300
1911	26,896,790						26,896,790
1912	8,262,367						8,262,367
1913	8,300,508						8,300,508
1914	15,931,922						15,931,922
1915	1,261,411						1,261,411
1916	13,530,000						13,530,000
1917	8,887,557	$15,000					8,902,557
1918	8,227,000	310,213					8,537,213
1919	9,397,081	443,196					9,840,277
1920	7,300,000	548,927					7,848,927
1921	8,463,000	661,177					9,124,177
1922	20,266,000	335,871					20,601,871
1923	14,800,000	559,530					15,359,530
1924	13,800,000	314,067					14,114,067
1925	11,890,809						11,890,809
1926	12,563,240	687,336					13,250,576
1927	7,436,320	75,000					7,511,320
1928	12,148,800	122,640					12,271,440
1929	14,328,400	115,000					14,443,400
1930	8,643,000	10,760,000					19,403,000
1931	9,482,000	100,000					9,582,000
1932	7,271,000	25,100,000					32,371,000
1933	2,817,288	13,050,000					15,867,288
1934	3,408,000	8,048,000		$103,535,000			114,991,000
1935	1,176,750			34,076,000			35,252,750
1936	1,388,100	15,950,000		25,438,000			42,776,100
1937	12,344,600	34,850,000	$350,000	[4] 4,873,000			42,671,600
1938	12,322,600	30,570,000	500,000	37,047,500		$1,100,000	81,540,100
1939	10,940,600	32,995,000	500,000	[4] 2,502,488		4,600,000	46,533,112
1940	13,875,600	64,215,000	575,000	28,347		5,700,000	84,393,947
1941	10,000,600	63,260,000	768,000	[4] 124,300		6,600,000	80,504,300
1942	8,111,000	92,862,031	1,000,000	[4] 19,961		2,600,000	104,553,070
1943	3,607,960	86,745,460	1,379,250	[4] 1,131		2,600,000	94,331,539
1944	4,514,475	35,712,000	1,443,100	[4] 72,709	$300,000	5,600,000	47,496,866
1945	7,649,800	18,637,200	2,200,000	[4] 22,332	100,000	13,100,000	41,664,668
1946	36,617,890	83,527,750	2,550,000		200,000	4,856,302	127,751,942
1947	39,600,213	75,901,805	1,814,330	[4] 30,396		4,600,000	121,885,952
1948	25,676,750	115,505,288	2,088,000		308,000	5,280,000	148,858,038
1949	36,952,264	227,636,453	2,450,000		355,000	4,440,000	271,833,717
1950	44,759,817	312,269,875	2,123,100		403,229	7,641,440	367,197,461
1951	46,917,165	222,453,635	2,308,000		358,605	5,694,729	277,732,134
1952	51,422,347	180,665,175	2,171,000		634,900	6,665,088	241,558,510
1953	72,945,450	130,859,541	2,643,000		695,796	7,743,965	214,887,752
1954	74,884,496	65,505,454	2,679,710		633,802	4,610,748	148,314,210
1955	83,553,419	75,444,114	2,442,778		735,900	5,953,500	168,129,711
1956	98,139,950	79,733,362	2,281,688		715,881	4,403,500	185,274,381
Total	1,015,055,338	2,106,545,100	34,266,956	192,478,530	5,441,113	[5]103,789,272	3,457,576,309

[1] Prior to fiscal year 1916 funds were made available to Reclamation Service by allotments from the reclamation fund, authorized by the Secretary of the Interior.

[2] Emergency relief funds include allocations to Reclamation from NIRA, PWA, and ERA funds.

[3] Allotments made prior to Fallon, Nev., Conference on July 27, 1907, were canceled and summary allotments issued. Original amounts excluded from total column.

[4] Credit.

[5] Repayment of advances included: Boulder Canyon, $21,952,606 and All-American Canal system, $3,052,000.

TABLE 14.—*The reclamation fund, fiscal years 1955–57, funds available for appropriation*

Receipts and appropriations	Actual 1955	Actual 1956	Estimated 1957
Unappropriated balance brought forward (as of June 30)	$88,033,071	$92,751,703	$87,217,904
Add items intransit			16,011
Accretions and collections:			
Bureau of Reclamation and other agencies, .100	16,014,551	11,970,724	15,436,600
Other agencies, .200	32,282,541	35,583,729	39,914,200
Power revenues, .300	38,462,092	43,736,392	46,825,400
Subtotal, accretions and collections	86,759,184	91,290,845	102,176,200
Plus lapsed appropriations	1,666,367	1,318,806	950,000
Plus returned from fiscal year 1956 O. and M. for fiscal year 1956, increased pay costs		52,500	
Total available for appropriation	176,458,622	185,413,854	190,360,115
Less permanently authorized appropriations for:			
Refund of revenue collections	150,000		125,000
Farmers' irrigation district, North Platte project, Nebraska	3,500	3,500	8,000
Deduct annual appropriation or estimate for:			
General investigations	3,150,000	4,421,812	4,970,000
Construction and rehabilitation	57,946,197	69,287,000	63,083,000
Operation and maintenance	18,257,222	[1] 20,223,638	22,055,700
General administrative expenses	4,000,000	[2] 3,760,000	3,942,000
Emergency fund	200,000	500,000	
Total annual appropriation or estimate	83,553,419	98,192,450	94,050,700
Total appropriations	83,706,919	98,195,950	94,183,700
Balance carried forward	92,751,703	87,217,904	96,176,415

[1] Of this amount $52,500 was returned to the receipt account to be appropriated for fiscal year 1956, increased pay costs.
[2] Of this amount $160,000 was appropriated for fiscal year 1956, increased pay costs.

TABLE 15.—*Accretions to reclamation fund by States, fiscal year 1956*

State	Sale of public land		Proceeds from Oil Leasing Act		Total to June 30, 1956
	Fiscal year 1956	To June 30, 1956	Fiscal year 1956	To June 30, 1956	
Alabama			$349.92	$209,260.58	$209,260.58
Arizona	$97,616.88	$3,160,956.82	32,141.72	378,344.74	3,539,301.56
Arkansas			12,459.57	31,813.86	31,813.86
California	449,339.55	10,801,181.40	4,563,891.73	65,575,032.54	76,376,213.94
Colorado	164,512.71	11,231,668.14	4,565,668.97	29,637,054.59	40,868,722.73
Florida			232.32	2,169.96	2,169.96
Idaho	262,832.96	8,223,682.78	164,760.48	725,237.60	8,948,920.38
Illinois			32.81	74.81	74.81
Kansas	753.41	1,046,296.83	72,930.76	415,066.69	1,461,363.52
Louisiana			134,876.96	723,288.13	723,288.13
Michigan			2,263.78	27,910.65	27,910.65
Mississippi			2,877.20	16,757.61	16,757.61
Montana	201,488.68	16,290,654.66	1,296,073.13	11,087,957.25	27,378,611.91
Nebraska	3,326.78	2,213,307.22	7,034.47	59,514.98	2,272,822.20
Nevada	255,726.35	1,463,705.74	749,012.86	2,981,564.65	4,445,270.39
New Mexico	97,217.90	7,289,785.89	5,254,018.34	35,941,036.88	43,230,822.77
North Dakota	10,881.59	12,285,252.64	127,921.02	808,707.58	13,093,960.22
Oklahoma	582.32	5,969,392.02	31,124.22	227,401.15	6,196,793.17
Oregon	724,726.66	15,296,269.33	129,052.81	236,348.80	15,532,618.13
South Dakota	45,060.41	7,840,995.95	135,700.16	620,815.66	8,461,811.61
Utah	91,362.63	4,893,460.56	2,101,847.87	11,701,916.77	16,595,377.33
Washington	190,573.93	8,736,258.23	10,552.36	72,892.68	8,809,150.91
Wyoming	122,797.69	9,465,490.32	11,755,901.57	114,839,460.05	124,304,950.37
Total	2,718,800.45	126,208,358.53	31,150,725.03	276,319,628.21	402,527,986.74

Other accretions

	Fiscal year 1956	Totals to June 30, 1956
Proceeds, Federal water-power licenses	$43,973.67	$1,458,593.39
Proceeds, potassium royalties and rentals	1,669,858.95	10,939,492.12
Receipts from naval petroleum reserves, 1920–38, act of May 9, 1938		29,778,300.23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919	370.85	12,008.04
Miscellaneous items, other		5.78
Total	1,714,203.47	42,188,399.56
Grand total	35,583,728.95	444,716,386.30

TABLE 16.—*Cost of plant, property and equipment, by States, June 30, 1956*

State and project	Completed works					Construction in progress	Other physical property	Total
	Multipurpose	Irrigation	Electric	Municipal water	Flood control			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total	$1,003,032,411	$898,255,111	$620,326,586	$14,041,374	$12,938,158	$272,070,629	$15,044,441	$2,835,708,710
(Alaska): Eklutna			32,368,539			8,149		32,376,688
Arizona, subtotal	90,810,434	52,138,854	107,705,473		3,454,942	8,832,004	106,848	263,048,555
Boulder Canyon:								
All-American Canal system (California)	2,179,950					2,019		2,181,969
Hoover Dam and powerplant (Nevada)	44,610,662		33,523,773			55,743		78,190,178
Colorado River front work and levee system (California-Nevada)					3,454,942	4,731		3,459,673
Gila		36,785,777				6,971,447	106,848	43,864,072
Palo Verde diversion (California)						243,473		243,473
Parker-Davis (California-Nevada)	38,794,932		69,803,220			1,512,818		110,110,970
Salt River	5,224,890	10,753,355	4,266,443					20,244,688
Yuma (California)		3,542,161	112,037					3,654,198
Yuma auxiliary		1,057,561				41,773		1,099,334
California, subtotal	297,737,787	193,807,215	125,326,629		9,108,166	51,784,316		677,764,113
Boulder Canyon: All-American Canal system (Arizona)	38,459,058	16,720,336	45,090		3,329,786	64,959		58,619,229
Cachuma	23,791,897					19,132,769		42,924,666
Central Valley	230,132,139	165,251,300	106,349,371			12,162,387		513,895,197
Colorado River front work and levee system (Arizona-Nevada)					5,778,380	57,862		5,836,242
Klamath (Oregon)		6,088,700				69,761		6,158,461
Orland		2,583,870						2,583,870
Palo Verde diversion (Arizona)						786,512		786,512
Parker-Davis (Arizona-Nevada)	5,354,693		18,449,846			13,799		23,818,338
Santa Maria						729,551		729,551
Solano						18,761,149		18,761,149
Truckee storage (Nevada)								
Yuma (Arizona)		3,163,009	482,322			5,567		3,650,898
Colorado, subtotal	53,415,784	105,346,129	41,988,129			187,687		200,937,729
Colorado-Big Thompson	36,266,667	80,349,030	41,126,673			38,019		157,780,389
Fruitgrowers Dam		200,309						200,309
Grand Valley		6,866,731	213,669			96,469		7,176,869
Mancos		3,906,362						3,906,362
Missouri River Basin	13,279,498		647,787			38,878		13,966,163

Paonia		1,602,687						1,602,687
Pine River		3,455,051				12,725		3,467,776
San Luis Valley	3,869,619					1,596		3,871,215
Uncompahgre		8,965,959						8,965,959
Idaho, subtotal	42,702,249	45,065,651	7,774,231	1,020,096		55,307,134	67,458	151,936,819
Avondale		238,491				6,044		244,535
Boise (Oregon)	33,129,761	25,921,187	5,030,810			185,319		64,267,077
Dalton Gardens		258,660						258,660
King Hill		1,877,732						1,877,732
Lewiston Orchards	426,999	1,037,302		1,020,096				2,484,397
Michaud Flats						459,802		459,802
Minidoka (Wyoming)	8,634,010	13,897,819	2,743,421			3,256,519	67,458	28,599,227
Owyhee (Oregon)		902,000				57,974		959,974
Palisades (Wyoming)	511,479					51,063,238		51,574,717
Preston Bench		450,100						450,100
Rathdrum Prairie		482,360						482,360
Rogue River						278,238		278,238
Iowa:								
Missouri River Basin transmission lines			1,144,700			1,136,536		2,281,236
Kansas, subtotal	27,362,597	1,139,098				22,986,960		51,488,655
Garden City		334,475						334,475
Missouri River Basin	27,362,597	804,623				22,986,960		51,154,180
Minnesota: Missouri River Basin transmission lines						2,382,213		2,382,213
Montana subtotal	99,863,220	32,301,266	41,150,241			24,157,312	236,560	197,708,599
Bitter Root		1,000,212				31,823		1,032,035
Buffalo Rapids		4,573,987				96,164		4,670,151
Fort Peck (North Dakota)			10,154,127			242,454		10,396,581
Frenchtown		290,797						290,797
Hungry Horse	79,447,032		22,086,052			67,658		101,600,742
Huntley		1,552,159						1,552,159
Intake		87,513						87,513
Lower Yellowstone (North Dakota)		3,037,418						3,037,418
Milk River		9,385,945				267,595		9,653,540
Missoula Valley		278,320						278,320
Missouri River Basin	20,416,188	2,053,207	8,910,062			23,406,098	236,560	55,022,115
Shoshone (Wyoming)		16,400						16,400
Sun River		10,025,308				45,520		10,070,828
Nebraska, subtotal	36,981,485	38,550,523	7,283,061			6,815,559		89,630,628
Mirage Flats		3,061,631						3,061,631
Missouri River Basin	36,981,485	26,348,259	7,043,082			6,673,591		77,046,417
North Platte (Wyoming)		9,140,633	239,979			141,968		9,522,580

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TABLE 16.—*Cost of plant, property and equipment, by States, June 30, 1956*—Continued

State and project	Completed works					Construction in progress	Other physical property	Total
	Multipurpose	Irrigation	Electric	Municipal water	Flood control			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Nevada, subtotal	$53,471,187	$9,861,880	$36,109,538		$102,123	$218,632	$7,414,517	$107,177,877
Boulder Canyon:								
Hoover dam and powerplant (Arizona)	50,041,226		32,088,274			173,190	1,712,052	84,014,742
Boulder City Municipal							5,702,465	5,702,465
Colorado River front work and levee system (Arizona-California)					102,123	4,731		106,854
Humboldt		1,214,321				31,987		1,246,308
Newlands		7,555,136	344,343					7,899,479
Parker-Davis (Arizona-California)	3,429,961		3,676,921			8,724		7,115,606
Truckee Storage (California)		1,092,423						1,092,423
New Mexico, subtotal	16,232,022	35,043,597	7,815,493		272,927	4,688,161		64,052,200
Carlsbad	3,155,028	2,065,771						5,220,799
Fort Sumner		2,371,407						2,371,407
Hondo		339,377						339,377
Middle Rio Grande	3,546,424	8,200,199				4,546,341		16,292,964
Rio Grande (Texas)	8,132,596	5,541,400	7,815,493		272,927	127,977		21,890,393
Tucumcari		15,474,365						15,474,365
Vermejo	1,397,974	1,051,078				13,843		2,462,895
North Dakota, subtotal	8,891,394	3,349,502	21,134,826			6,781,883		40,157,605
Buford-Trenton		1,006,152						1,006,152
Buford-Trenton (old)		223,423						223,423
Fort Peck (Montana)			1,528,456			647		1,529,103
Lower Yellowstone (Montana)		555,682						555,682
Missouri River Basin	8,891,394	1,155,150	19,606,370			6,781,236		36,434,150
Williston		409,095						409,095
Oklahoma: W. C. Austin	6,955,676	5,144,860		$152,027				12,252,563
Oregon, subtotal		48,815,006	516,002			665,748	13,332	50,010,088
Arnold								
Baker		281,589						281,589
Boise (Idaho)		4,275						4,275
Burnt River		601,026						601,026
Crescent Lake Dam						276,405		276,405
Deschutes		11,596,561	447,366			236,768		12,280,695
Grants Pass								

Klamath (California)		8,177,113	68,636			104,427	13,332	8,363,508
Ochoco								
Owyhee (Idaho)		17,976,465				48,148		18,024,613
Umatilla		5,311,153						5,311,153
Vale		4,866,824						4,866,824
South Dakota, subtotal	17,636,201	8,506,339	33,030,166			16,522,487	73,630	75,768,823
Belle Fourche		5,000,791						5,000,791
Missouri River Basin	16,715,978	3,505,548	33,030,166			16,522,487	73,630	69,847,809
Rapid Valley	920,223							920,223
Texas, subtotal	23,439,644	5,273,938				46,843		28,760,425
Balmorhea		406,533						406,533
Colorado River	23,439,644							23,439,644
Falcon								
Rio Grande (New Mexico)		4,867,405				46,843		4,914,248
Utah, subtotal	16,304,059	18,507,794	91,969	12,869,251		19,745,973	61,086	67,580,132
Hyrum		953,854						953,854
Moon Lake		1,799,859						1,799,859
Newton		712,592						712,592
Ogden River		5,013,283						5,013,283
Provo River	15,360,222	3,708,875		12,869,251		469,105		32,407,453
Sanpete		433,940						433,940
Scofield	943,837							943,837
Strawberry Valley		3,345,939	91,969				61,086	3,498,994
Weber Basin						19,276,868		19,276,868
Weber River		2,539,452						2,539,452
Washington, subtotal	165,397,710	238,134,157	108,552,860			33,590,881	3,065,707	548,741,315
Chief Joseph Dam						254,972		254,972
Columbia Basin	160,949,436	197,670,606	107,165,592			20,950,537	3,065,707	489,801,878
Okanogan		1,484,324				21,305		1,505,629
Yakima	4,448,274	38,979,227	1,387,268			12,364,067		57,178,836
Wyoming, subtotal	45,830,962	57,269,302	48,334,729			16,212,151	1,000,403	168,647,547
Eden		3,783,436				1,478,341		5,261,777
Kendrick	5,166,889	9,869,691	15,120,826			235,465		30,392,871
Minidoka (Idaho)		2,209,904						2,209,904
Missouri River Basin	32,831,967		27,958,903			12,693,825	11,582	73,496,277
North Platte (Nebraska)	3,292,933	8,861,597	1,350,672			105,108		13,610,310
Palisades (Idaho)						842,181		842,181
Riverton	2,968,699	16,597,547	472,293			683,778	988,821	21,711,138
Shoshone (Montana)	1,570,474	15,947,127	3,432,035			173,453		21,123,089
Nonproject property							3,004,900	3,004,900

NOTES.—Name of State in which balance of project is located is indicated by parentheses (except Missouri River Basin, located in 10 States). Irrigation plant listed at gross construction cost prior to deduction of chargeoffs authorized by Congress.

ADMINISTRATION

Strengthening of the various segments of service elements in the Bureau organization was carried forward in 1956 to insure continuing efficient administration of the Federal reclamation program.

Responsibility for Bureau activities is vested in the Commissioner of Reclamation. The Assistant Commissioner and Chief Engineer directs operations of the engineering center in Denver, Colo. Regional offices under the supervision of Regional Directors are located at Boise, Idaho; Sacramento, Calif.; Boulder City, Nev.; Salt Lake City, Utah; Amarillo, Tex.; Billings, Mont.; and Denver, Colo. An Alaska District Office, headed by a district manager, is maintained in Juneau.

Highlights of accomplishment in the administration of the Bureau during the 1956 fiscal year were:

Property Management

Examination of internal functions and activities was continued in an effort to identify and, where feasible, to discontinue any such functions and activities which were in competition with private enterprise. As a concrete example of the results of this undertaking, it was decided privately owned printing plants in the Nevada-California area could adequately handle printing formerly performed by our own employees in that area, and such plants were invited to bid to perform this work without competition from our own printers.

During the year the Bureau disposed of unneeded real property having an acquisition cost of $3,761,105, resulting in a substantial reduction in costs of operating and maintaining such property. The Bureau disposed of 750 housing units, 22 percent of its housing, which were either no longer needed in connection with program activities or were located in areas where private housing was available.

Disposal of trailer houses and demountable-type houses was curtailed in anticipation of an expanded construction program. Several of such units were rented to other bureaus of the Department and other Government agencies on a short-term basis. Retention of these units paid handsome dividends, as nearly all have been put to use at new construction sites within the Bureau, thus saving the acquisition cost of replacement units.

Organization and Methods

Operating offices of the Bureau were established, abolished, or adjusted as to scope and staff in keeping with the progress of the Bureau's program. Principal activity in this respect related to the

formation of field organizations and staffing requirements for the units of the Upper Colorado River storage project.

The Incentive Awards Program increased in all respects. A total of 831 suggestions was received from employees. Of those evaluated, 362, or 46 percent, were adopted. Tangible savings of $132,028, plus intangible benefits, were realized for which $9,630 was paid in cash awards. Superior performance awards were presented to 159 employees for outstanding performance of duties; and four special act awards were granted for specific improvements in Bureau operations. Considerable intangible benefits were gained through the operation of the incentive awards program. These were in the form of better employee morale, increased job satisfaction, and a greater sense of achievement through the wise use of manpower, money, and materials.

General Services

The volume of stored Bureau records was reduced within the fiscal year from 123,000 cubic feet to 112,000 cubic feet. Savings of approximately $155,000 in the cost of space and equipment alone resulted from the disposition of 18,500 cubic feet of documents by destruction or by transfer to low-cost space.

In response to 3,300 requests for the Bureau's publications and informational material received from individuals in this country and in foreign countries, more than 12,000 copies of technical publications and informational pamphlets were sold at Denver or distributed from there. Sales of Bureau publications at Denver totaled $24,300, approximately one-half of this total being made to foreign countries. Sales of publications sold by the Bureau as agent for the Superintendent of Documents totaled $7,800.

In response to 800 requests for Bureau publications, the Publications Branch at Washington, D. C., distributed 12,500 copies. Of these requests, 150 were of congressional origin for 545 publications and 170 were from agencies of the executive branch of the Federal Government for 1,425 copies.

The branch at Washington received 160 requests for photographs for illustration or exhibition purposes. One thousand four hundred prints were provided for reproduction in Bureau publications, non-Government text books and encyclopedias, various agricultural and engineering magazines and newspapers, and to supplement exhibits and lectures. Requests by mail and in person for visual materials were also received from congressional offices and from agencies of the executive branch of the Federal Government. Some of this material was published, and some was exhibited or used to illustrate lectures in the United States or abroad.

Six hundred ninety-six films were distributed to television stations, agricultural and engineering institutions, water users' associations, organizations of farmers, and to conventions in the United States and abroad. The greatest number of requests were for the Bureau's construction film, Hoover Dam.

General Engineering

Coordination and liaison was maintained throughout fiscal year 1956 with the Department of the Interior, the Renegotiation Board, General Accounting Office, the Department of Labor, and other agencies on matters relating to the Bureau's activities.

The Bureau participated in the work of the Departmental Advisory Board on Safety and in the activities of the Departmental Safety Council. A highly successful record was established by the Bureau in its participation in the National No-Accident Week. An award to the construction forces of Webster Dam, Kansas, for 4 years without a single disabling lost-time injury or motor-vehicle accident was approved by the Secretary of the Interior, and a gold seal certificate and citation of outstanding safety performance presented shortly after the close of the fiscal year.

The Bureau's participation in professional, scientific, and technical activities, and committee assignments was reviewed and coordinated. A grant was awarded to the Bureau by the National Science Foundation for basic research in concrete.

Arrangements were carried out for participation and the presentation of papers at international meetings of the World Power Conference, the International Commission on Large Dams, CIGRE, and the International Commission on Irrigation and Drainage, and for the exchange of technical and scientific information with these organizations.

Comptroller

During the past year added emphasis was placed on the constructive aspects of audit reporting, both as to quality and effectiveness of reports, and the highlighting for management of the more significant segments of audit determinations. Special effort was also concentrated on the major aspects of financial administration and the adequacy, accuracy, and effectiveness of the accounting system. With management support, timely and speedy consideration has been given to the recommendations in the audit reports.

Fifty-four field audit assignments were completed during fiscal year 1956. Included were 40 financial audits of individual projects; 3 financial audits of water users' organizations performed at their re-

quest; 2 special audits; 2 audits of power and multipurpose operations of project units; and 3 special reports.

Members of the Comptroller's staff took an active part in effectuating compliance by the Bureau of Reclamation with Public Law 841, 80th Congress. This legislation directed that expenditures for the Boulder Canyon project be segregated as between project and nonproject items. This work required the cooperative effort of the Washington, regional, and project offices. It has been completed and the provisions of the law have been fully complied with. In connection with the segregation of nonproject investment of the Boulder Canyon project, members of the Comptroller's staff also prepared an overall reconciliation of costs to funds.

Personnel

Fiscal year 1956, with its new project authorizations, brought about a need for increased attention to the conservation and effective utilization of the skills and experience possessed by career Bureau employees. This led to the initiation of action in several areas, all designed to aid in the effective accomplishment of Bureau objectives in natural resources development. Bureau employment increased from 9,607 full-time employees at the beginning of the year to 10,018 at the end, with almost all of the increase coming in the final month.

Programs for student and beginning engineer training were reformulated. Through these programs, and with increased attention given to college recruitment, the Bureau hopes to recruit, develop, and retain the professional and administrative engineering talent needed for accomplishing future Bureau programs. A total of 58 beginning engineers were hired during the year and 342 students in engineering were appointed for summer work.

An inventory was made of the development needs of all Bureau employees in grades GS–12 through GS–14. A summary sheet was obtained on each employee showing previous training and experience and listing kinds of further assignments that would ready him for more responsible positions. This information has been used to work out several exchange assignments which will permit employees to acquire broader experience. Further actions along these lines will be taken as circumstances permit. This will contribute to a more flexible, versatile, and effective work force.

Initial steps were taken leading to the establishment, early in fiscal year 1957, of an employee roster covering all employees in grades GS–9 through GS–14. This will provide for matching employee skills and position vacancies on a bureauwide basis. It will help to assure employees of continuity of employment and improve the manner in which they are considered and selected for filling vacancies.

FOREIGN ACTIVITIES

In fiscal year 1956, the Bureau of Reclamation continued its program of technical assistance at the request of the International Cooperation Administration which took over the work formerly administered by FOA, TCA, and Mutual Security Agency. The Bureau program includes three broad phases, (1) the training and development of foreign nationals in the techniques, processes, and practices of the Bureau of Reclamation, (2) the undertaking of laboratory studies, design review and other technical advice to agencies of foreign government, and (3) the selection of Bureau employees to act as technical advisers and to be part of actual work teams engaged in the training of foreign nationals and advising Government bureaus in planning and construction of irrigation and power projects in other lands. The Bureau also handled a number of requests for technical assistance from the Department of State, United Nations, International Bank for Reconstruction and Development, and other agencies, both public and private, directly concerned with water resource development throughout the world. It also, in cooperation with the Technical Review Staff, effects liaison on water resource matters with the Department of State's Office of International and Social Affairs, for the development and representation of the United States position before the United Nations.

The Division planned, coordinated, and guided the program of 127 inservice trainees during fiscal year 1956, including engineers and government officials from 22 different countries. In addition, there were 67 official observers and 91 accredited visitors representing 21 different countries. The Bureau also coordinated the selection and participation of individual specialists and missions of Reclamation technicians to other countries. At the close of the fiscal year, there were 28 people remaining on Reclamation rolls on overseas assignments, 1 in Ethiopia, 2 in Formosa, 3 in Iran, 12 in Lebanon, 1 in Pakistan, 3 in Turkey, 5 in Australia, and 1 in Thailand.

During the year the Bureau of Reclamation received $1,750,000 from various agencies for financing these technical assistance and training programs. The dollar volume of our technical assistance program was reduced from last year's $2,726,480, by the fact that approximately 50 fewer people in overseas positions were on the Bureau rolls.

Engineering services available in the Denver office continued in demand during the past year. Under the authority of Public Law 402, 80th Congress, and at the request of ICA, work was accomplished for Snowy Mountains Hydroelectric Authority, Australia; Wu Sheh and Shimen projects, Taiwan; Central Water and Power Commission,

India; Chao Phya and Yan Hee projects, Thailand; Koka Dam project, Ethiopia; Rio Elqui project, Chile; and several projects in Lebanon.

LEGAL

The fiscal year ending June 30, 1956, was a productive one in terms of Reclamation legislation. Of general interest are the Acts of July 4, 1955, and May 14, 1956, providing for the construction of distribution systems under authorized reclamation projects by local water users' organizations, the act of June 13, 1956, providing for local construction of drainage work and other minor completion items, the act of May 10, 1956, repealing an archaic provision of the original Reclamation Act which prohibited the employment of Mongolian labor on reclamation construction jobs, and the act of August 9, 1955, providing a permanent statutory basis for the investigation by the Interior Department of water resource projects in Alaska. A bill to provide a system of loans and grants for the construction of small reclamation projects was signed into law shortly after the close of the fiscal year.

Major enactments in the field of project authorization cover the Colorado River storage and participating projects, the Trinity River division of the Central Valley project, the Ainsworth and Red Willow units of the Missouri River Basin project, and the Washita, Ventura, and Wapinitia projects. Bills providing authorization for the Crooked River and Little Wood River projects and reauthorization for the Farwell unit of the Missouri River Basin project were enacted by the Congress and signed into law after the close of the fiscal year.

Federal representation in interstate negotiations looking to compacts on the Klamath, the Arkansas, the Red, and the Truckee, Carson, and Walker Rivers has been provided for by legislation enacted during the year.

Bills authorizing the execution of amendatory repayment contracts with the Yuma County Water Users' Association (Yuma project) and the Yuma Mesa irrigation and drainage district (Gila project), making adjustments in the boundaries of the Yuma auxiliary project, deleting the incremental value provisions of the Arch Hurley conservancy district contract (Tucumcari project), authorizing service to the town of Glendo, Wyo., in connection with the Government's sewerage system at Glendo dam, and permitting temporary irrigation service to be furnished the Toston irrigation district from the works of the Crow Creek unit, Missouri River Basin project, also were enacted.

Litigation

Major litigation involving water and power problems during the year were:

1. *Rank* v. *Krug et al.*—A history of this case prior to June 30, 1955, appears on pages 85 and 86 of the 1955 annual report of the Secretary. On February 7, 1956, the United States District Court for the Southern District of California filed an opinion, dated February 6 (No. 685–ND), generally acceding to the plaintiffs' prayers for relief. The 247-page opinion, which has not as yet been published in the official reports, is that the court will grant an injunction against the defendants, requiring the water of the San Joaquin River to be let down into the river bed in the equivalent of the full natural flow of the stream to satisfy the rights of the plaintiffs; but that if the defendants will construct and operate a plan for a physical solution so as to supply the equivalent of the full natural flow, then all water over and above that required for the physical solution may be stored and diverted by Friant Dam and its related canals. The basic elements of the physical solution are discussed beginning on page 206 of the opinion.

On May 22 and 23, the court took further evidence concerning elements of the physical solution and on July 11 made and filed a supplemental memorandum, which states, among other things, the following:

"* * * the present minimum requirements for the protection of the rights of plaintiffs and their class require, a decree of injunction prohibiting the impoundment and diversion of waters of the San Joaquin river at Friant, except upon condition that the defendants, at their cost, shall provide a physical solution by the construction of a minimum of ten dams * * *

"* * * the release of sufficient water from Friant as will permit a continuous flow of five cubic feet per second over the last downstream dam, and also for flushing releases as indicated in plaintiffs' plan of physical solution."

No final order or decree has been entered.

2. *In the matter of the California Oregon Power Co.* (FPC project No. 2082).—This was a proceeding, in which the Secretary of the Interior intervened, on an application by Copco to the Federal Power Commission for a license for its proposed Big Bend No. 2 project. The Commission issued a license to Copco subject to the condition that it obtain an extension or renewal, for the 50-year term of the license, of a 1917 contract with the United States covering the operation of Link River Dam, or a new contract substantially similar to the 1917 contract. The Secretary of the Interior took no appeal from the Commission's decision. However, Copco appealed, on jurisdictional grounds, from the decision to the United States Court of Appeals for the District of Columbia. That court, while retaining jurisdiction, remanded the case to the Federal Power Commission to obtain the answers to certain questions. In Opinion No. 266–A, Supplemental

Opinion and Order Amending Order Issuing License, issued February 28, 1956, the Commission answered those questions. Supplemental materials were filed by Copco and the Federal Power Commission with the court.

In Opinion No. 266–A, the Commission also amended its previous order authorizing issuance of a license to Copco in order, among other things, to adjust certain terms and conditions of the preferred license to the provisions of the contract which had been made subsequently between Copco and Reclamation, dated January 31, 1956, covering the operation of Link River Dam for the period of the license. This contract satisfied the condition in the Commission's order referred to above.

3. *In the matter of the California Oregon Power Co.* (FPC Docket No. E–6390).—This proceeding was closely related to the proceeding on Copco's application for a license for the Big Bend No. 2 project. The Secretary of the Interior took no appeal from the Federal Power Commission's decision but Copco did. The appeal was consolidated with the appeal from the Commission's order in the related proceeding. The status of the appeal is described above.

4. *State of Arizona, plaintiff* v. *State of California et al.*—In this action in the Supreme Court of the United States, Arizona is seeking a determination of its rights in and to the use of the waters of the Colorado River, as against such rights claimed by the defendants, under the Colorado River compact, the Boulder Canyon Project Act, and the California Limitation Act. The Supreme Court announced on October 10, 1955, the appointment of Judge Simon H. Rifkind as Special Master to succeed the late George I. Haight, and formally received the latter's report, filed in July, on the motion of the California defendants that the Upper Basin States—Colorado, Wyoming, Utah, and New Mexico—be made parties to the suit. Following the former Special Master's recommendations, California's motion that the Upper Basin States be joined, as such, was denied by the Court December 12, 1955. The motion was granted regarding Utah and New Mexico, but only to the extent of their interest in lower basin waters. Special Master Rifkind held an organization meeting in New York City on January 30, 1956, and a pretrial conference at San Francisco, April 10 to 13, inclusive, at both of which all parties were represented. As a result of the San Francisco conference, the Special Master entered a pretrial order controlling the subsequent course of the action unless otherwise directed by him or by the Court. Extensive pleadings, motions, interrogatories, and related documents were filed on behalf of the several parties during the year. Trial of the case before Special Master Rifkind got underway at San Francisco on June 14, and was still in progress at the close of the fiscal year.

5. *Desert Beach Corp.* v. *United States, Imperial Irrigation District, Coachella Valley County Water District et al.*—This was an action seeking to recover $450,000 in damages to plaintiff's properties alleged to have been caused by the negligent and wrongful acts or omissions of the defendants in connection with the construction, operation and maintenance of the All-American Canal system and related irrigation works. The case was dismissed by the United States District Court for the Southern District of California, Central Division, June 5, 1956, for lack of prosecution.

6. *Arthur E. Graham, also known as Bud E. Graham* v. *United States.*—In this action in the United States District Court, District of Arizona, plaintiff seeks to recover $35,100 in damages to his property located downstream from Parker Dam, alleged to have resulted from defendant's negligence in connection with dredging operations of the Bureau of Reclamation on the Colorado River. The action is a sequel to a damage claim for the like amount, and rejected by the regional solicitor, Los Angeles region, on June 24, 1955, without consideration of its merits, pursuant to the Federal Tort Claims Act (28 U. S. C., secs. 2401, 2671–2680), which limits the authority of Federal agencies to determine and settle negligence claims against the United States to those not exceeding $1,000.

7. *Citizens Utilities Co.* v. *E. G. Nielsen* (an employee of the Bureau of Reclamation) *et al.*, United States Court of Appeals for the Ninth Circuit. This was an action originally instituted in the United States District Court for the District of Arizona on December 24, 1954, to enjoin and restrain the United States from doing or failing to do any act or thing which would cause or result in an interference with or disruption of the delivery of Hoover Dam electrical energy to the plaintiff company under its contract for purchase of unused metropolitan water district energy which terminated December 31, 1954. On January 24, 1955, plaintiff appealed from a judgment entered on January 21, 1955, dismissing the complaint and quashing the temporary restraining order issued thereunder. The appeal was dismissed without prejudice upon stipulation to that effect filed on July 29, 1955.

8. *Citizens Utilities Co.* v. *United States* and *California-Pacific Utilities Co.* v. *United States.*—Following dismissal of its appeal in the foregoing injunction suit, the Citizens Utilities Co. on September 30, 1955, filed suit in the Court of Claims for damages totaling $12,216,775 alleged to have been sustained as the result of the wrongful and unlawful failure and refusal of the United States to renew its contract for purchase of a portion of metropolitan water district's unused Hoover energy. On October 12, 1955, California-Pacific Utilities Co., holder of a similar energy contract terminated December 31, 1954, also filed suit for damages totaling $4,579,807 alleged to have been sustained by

reason of the wrongful and unlawful failure and refusal of the United States to renew its said contract. Defendant filed answer in each case, and the defendant's motion that the two cases be consolidated was granted by the court on December 29, 1955. Thereupon defendant filed its motion for leave to file motion for notice to third parties, and motion for notice to third parties, namely, the city of Los Angeles, Southern California Edison Co., California Electric Power Co., and the Metropolitan Water District of southern California. Defendant's motions were granted, and the notices to said parties were issued by the Clerk of the Court on February 1, 1956. On April 16, 1956, defendant filed motion for summary judgment and brief in support thereof.

9. *United States* v. *Ira R. Ure et al.* and *United States* v. *Fine Sheep Co.*, involved two suits against the United States under the Federal Tort Claims Act to recover for flooding of land following a break in an irrigation canal operated by the Bureau of Reclamation. The United States District Court for the District of Oregon rendered judgments for the landowners in 1950. The United States appealed. By decision dated September 12, 1955, the United States Court of Appeals, Ninth Circuit, held that the United States could not be held liable under the Federal Tort Claims Act for flooding of land either on the principle that one who permits a highly dangerous instrumentality or agency, located on his property and under his control, to escape and damage another is liable for damage irrespective of negligence or fault, or under common-law doctrine of liability without fault applicable in cases of trespass upon property of another. The court found that Government evidence was sufficient to rebut all inferences of Government negligence under doctrine of *res ipsa loquitur*. The case is reported in 225 F. 2d 709 (1955).

10. In *United States* v. *1,284.61 acres of land, more or less, in the county of Bonneville, State of Idaho; Floyd Bagley et al.*, the Government appraisal was $86,000 for land to be acquired for the Palisades project. Subsequent appraisals justified a stipulated settlement of $104,837.50. Judgment was entered May 28, 1956, in accordance with the stipulation.

11. In *United States* v. *1,001.99 acres of land, more or less, in the county of Bonneville, State of Idaho; Bert Ruud, et al.*, the Government appraisal totaled $152,250 for land required for the Palisades Reservoir. The case was tried November 7, 1955. On December 13, 1955, judgment on the verdict of $172,150 was entered. Defendants have asked for a new trial. Briefs have been filed by both parties and the Court has the case under consideration.

12. Two cases, both entitled *Provo Bench Canal & Irrigation Co. et al.* v. *Linke, State Engineer, and the United States*, to review decisions of the State engineer approving applications by the United States to change the point of diversion and place of use of water

acquired by the United States for the Provo River project, were tried on their merits in the District Court of the Fourth Judicial District in and for Utah County, State of Utah. The trial court decided the case adversely to the Government's petitions. On appeal, the Supreme Court of Utah reversed the decision of the State district court and remanded the cases with directions to approve the applications filed by the United States and approved by the State engineer.

13. *El Paso County Water Improvement District No. 1 and the United States et al.* v. *The city of El Paso*, was filed in the United States District Court, Western District of Texas, El Paso Division, in January 1953, to resolve a number of controversies existing between the litigants, including the extent of certain alleged water rights of the city, the validity of obligations previously entered into, the validity of conveyances of the Franklin Canal right-of-way, and obligations for maintenance of bridges. The district court, Dooley, judge, held, *inter alia*, that in view of compact among the States of Texas, New Mexico, and Colorado concerning the use of Rio Grande water, and in view of the United States appropriation of water for use of the water improvement district, the city of El Paso was not entitled to appropriate water already appropriated for use of the District. The case is reported in 133 F. Supp. 994 (1955).

14. *The Atchison, Topeka and Santa Fe Railway Co.* v. *United States.*—Petition was filed in the Court of Claims in February 1954 for damages allegedly arising in connection with the construction of Elephant Butte Dam from heavy siltation and sedimentation in the San Marcial area. Hearings were held by the Commissioners of the Court of Claims. No decision has been rendered.

Contract Litigation

Northern Pacific Railway Company v. *United States* was filed in the United States Court of Claims in October 1955 to recover $199,563.47 on cement shipments over plaintiff's railroad consigned to the Bureau of Reclamation at Odair, Wash., on the theory that the full commercial rates applied rather than the rates provided for in a special rate contract entered into between the parties in November 1934. This case is the fourth in a series of cases which have been filed periodically during the past 16 years. The same parties, the same rate contract, and some of the same issues are involved in these suits. Recovery was denied plaintiff in the first case. A nominal payment was made in the second case and it was dismissed. The third case for $122,531.62 and this case are pending.

BONNEVILLE POWER ADMINISTRATION

William A. Pearl, *Administrator*

FINANCIAL RESULTS OF OPERATIONS

WATER conditions for the generation of hydroelectric powers were considered to be good during the 1956 fiscal year. One small generating unit was added at Albeni Falls and two at Chandler. Four 70,000-kilowatt units at McNary and four 64,000-kilowatt units at Chief Joseph were energized during the fiscal year. These installations added 562,200 kilowatts of installed capacity during the year.

Gross revenues increased $8,926,141 or 17.14 percent over the previous year, for a total of $60,992,623. After provision for all costs of operation, including maintenance charges, interest and depreciation expense, and miscellaneous charges, net revenues for the year amounted to $5,949,412. During fiscal year 1956, no deferral was made for interest and depreciation expense on plant allocated to downstream river regulation. Deferral of these expenses, as was done in fiscal year 1955, would have added approximately $2 million to net revenues.

Table I presents a combined statement of revenues and expenses for the system. The data are prepared from commercial cost accounts kept in accordance with the Federal Power Commission system of accounts prescribed for electric utilities.

Summary of Revenue

Table II summarizes by customer categories the source of revenues by fiscal years to and including 1956. The aluminum industry accounted for 32.96 percent of the revenue dollar for fiscal year 1956,

while industries other than aluminum accounted for 13.42 percent, making a total of 46.38 percent of the gross revenues for the year provided by industrial customers.

Sales to publicly owned utilities were 31.98 percent of the total and privately owned utilities 19.67 percent. Other operating revenues amounted to 1.97 percent.

Increased sales occurred in all categories. Sales to aluminum industries increased $3,188,522, other industries $1,365,024, publicly owned utilities $1,904,096, and privately owned utilities $2,073,325.

Repayment of Federal Investment

The gross Federal investment in the power portion of all the generating projects in operation and in related transmission facilities comprises the total of all funds appropriated and requisitioned for construction and operations, together with indirect items such as WPA expenditures and amounts transferred from other Federal agencies, plus interest at 2½ percent on the unrepaid balance.

As of June 30, 1956, this investment amounted to $1,569,975,868, as shown in table IV. This includes accumulated interest in the amount of $195,600,457. A summary of the interest accumulation is shown in table III.

With the exception of the amounts transferred to the continuing fund, all receipts from power sales and miscellaneous sources allocated to power are deposited in the Treasury to repay the Federal investment.

As of June 30, 1956, repayments total $449,689,085, leaving an unpaid balance of $1,120,286,783. Of the total repaid, $247,513,025 represents payment of all current expenses since inception of the program; the remaining amount of $202,176,060 is repayment on the capital investment of $1,322,462,843 as shown in table IV.

Inasmuch as no increase in the basic $17.50 kilowatt-year rate will be made prior to December 1957, additional generation scheduled for future years, while increasing gross revenues, will reflect lower net revenue due to higher interest and depreciation expenses because of the relatively higher construction costs for the new projects.

A summary of plant accounts as of June 30, 1956, is shown in table V.

Based on individual projects the return of power capital investment has been as follows:

Project	Power capital investment [1]	Repaid as of June 30, 1956	Percent repaid	Net power investment [1]
Bonneville Power Administration	$412,098,422	$103,597,390	25.14	$308,501,032
Bonneville Dam project	59,839,067	24,662,894	41.22	35,176,173
Columbia Basin project	207,000,732	51,972,069	25.11	155,028,663
Hungry Horse project	87,502,575	4,783,408	5.47	82,719,167
Albeni Falls project	30,549,336	641,001	2.10	29,908,335
McNary Dam project	272,972,262	12,843,739	4.71	260,128,523
Detroit-Big Cliff project	41,905,270	2,044,687	4.88	39,860,583
Lookout Point-Dexter project	41,542,590	1,053,352	2.54	40,489,238
Chief Joseph project	131,848,105	455,850	.35	131,392,255
Chandler project	3,494,519	121,670	3.48	3,372,849
Total	1,288,752,878	202,176,060	15.68	1,086,576,818

[1] Exclusive of unexpended funds in U. S. Treasury.

Foregoing data on repayment of the investment are based on cost accounts maintained in accordance with the Federal Power Commission uniform system of accounts.

TABLE I.—*Columbia River power system—condensed summary of revenues and expenses—operating projects only*

	Fiscal year 1955 [1]	Fiscal year 1956 [2]	Total to June 30, 1956 [3]
Operating revenues	$52,066,482	$60,992,623	$462,805,892
Expenses of operation, maintenance, etc	13,101,399	14,865,090	123,335,770
Provision for depreciation	14,516,958	18,539,972	101,347,677
Interest expense	15,937,409	21,691,302	137,702 338
Miscellaneous deductions, etc	(80,589)	(53,153)	1,674,500
Total deductions	43,475,177	55,043,211	364,060,285
Accumulated net revenues from operations	8,591,305	5,949,412	98,745,607

[1] These figures provide for deferral of interest expense in the amount $1,673,330 and depreciation expense of $366,949 on plant allocated to downstream river regulation.

[2] These figures do not provide for any deferral of interest and depreciation expense on plant allocated to downstream river regulation.

[3] These figures include the writeoff of the accumulated deferred interest and depreciation expense to June 30, 1955, on plant allocated to downstream river regulation as follows:

Interest expense	$15,039,591
Depreciation	2,348,204
Total	17,387,795

TABLE II.—*Revenue by class of customers through fiscal year 1956*

Class of customer	1951 and prior	1952	1953	1954	1955	1956	Total to June 30, 1956	1956 percentage (dollar revenue)
Industry:								
Aluminum	$101,072,840	$13,376,207	$13,545,562	$15,944,356	$16,909,588	$20,098,110	$180,946,663	32.96
Other [1]	24,890,143	4,650,425	4,715,747	5,417,177	6,821,850	8,186,874	54,682,216	13.42
Publicly owned utilities	38,969,757	12,973,025	13,882,890	14,882,997	17,601,135	19,505,231	117,815,035	31.98
Privately owned utilities	54,744,490	8,526,775	6,239,276	7,882,879	9,926,150	11,999,475	99,319,045	19.67
Other operating revenue	5,396,509	653,714	791,734	1,190,284	807,759	1,202,933	10,042,933	1.97
Total operating revenue	225,073,739	40,180,146	39,175,209	45,317,693	52,066,482	60,992,623	462,805,892	100.00

[1] Includes sales to Federal agencies.

TABLE III.—*Columbia River power system—summary of interest on Federal investment as of June 30, 1956*

Interest during construction, to be returned during repayment period as part of the Federal investment:		
Transmission system	$6,138,823	
Bonneville Dam project	2,333,547	
Columbia Basin project	9,687,397	
Hungry Horse project	4,708,543	
McNary Dam project	19,449,222	
Albeni Falls project	1,025,874	
Detroit-Big Cliff project	2,683,524	
Lookout Point-Dexter project	3,052,036	
Chief Joseph project	8,694,344	
Chandler project	124,808	
Subtotal		$57,898,118
Interest charged to operations:		
Transmission system	43,227,304	
Bonneville Dam project	19,956,839	
Columbia Basin project	52,752,518	
Hungry Horse project	7,061,125	
McNary Dam project	8,415,796	
Albeni Falls project	1,435,690	
Detroit-Big Cliff project	2,651,538	
Lookout Point-Dexter project	1,352,499	
Chief Joseph project	817,737	
Chandler project	31,293	
Subtotal		137,702,339
Gross interest accumulation		195,600,457

TABLE IV.—*Columbia River power system—summary of Federal investment in operating power projects and repayment as of June 30, 1956*

	Gross investment	Repayments	Net investment
Investment in current expenses:			
Operation, maintenance, etc.	$109,810,687	$109,810,687	
Interest [1]	137,702,338	137,702,338	
Total current expenses	247,513,025	247,513,025	
Investment in capital assets:			
Electric plant investment [2]	1,288,752,878		
Unexpended appropriations	33,709,965		
Total capital investment	1,322,462,843	202,176,060	$1,120,286,783
Total Federal investment	1,569,975,868	449,689,085	1,120,286,783

[1] The Columbia River power system does not receive appropriations for payment of interest, but imputes and includes in its accounts provisions for interest expense and returns receipts to the Treasury in repayment of such expenses.

[2] Includes interest during construction of $57,898,118, which will be repaid to the Treasury as part of capital cost of electric plant.

TABLE V.—*Columbia River power system—summary of plant accounts in operating projects as of June 30, 1956*

Project	Total	Allocation	
		Nonpower	Power
Bonneville Power Administration	$397, 494, 532		$397, 494, 532
Bonneville Dam project	86, 946, 718	$27, 320, 612	59, 626, 106
Columbia Basin project	496, 501, 499	292, 033, 152	204, 468, 347
Hungry Horse project	107, 529, 495	20, 662, 037	86, 867, 458
Albeni Falls project	30, 947, 946	298, 685	30, 649, 261
McNary Dam project	301, 537, 202	25, 814, 420	275, 722, 782
Detroit-Big Cliff project	66, 193, 692	24, 455, 594	41, 738, 098
Lookout Point-Dexter project	92, 753, 321	51, 176, 604	41, 576, 717
Chief Joseph Dam project	135, 911, 164	261, 435	135, 649, 729
Chandler project	12, 456, 924	8, 960, 904	3, 496, 020
Total plant	1, 728, 272, 493	450, 983, 443	1, 277, 289, 050
Less: Combined reserve for depreciation			94, 236, 032
Total less reserve			1, 183, 053, 018

SUMMARY OF OPERATIONS

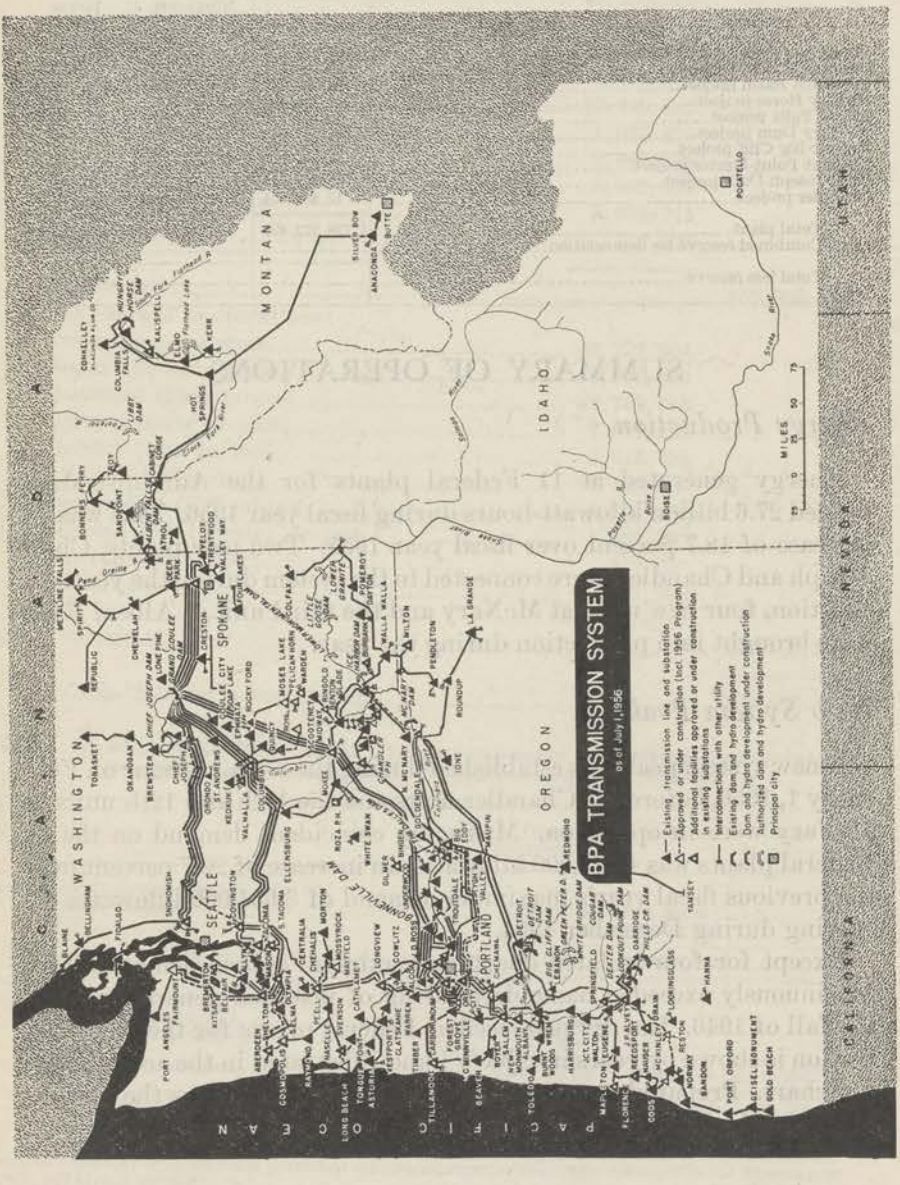
Energy Production

Energy generated at 11 Federal plants for the Administration totaled 27.6 billion kilowatt-hours during fiscal year 1956. This was an increase of 18.7 percent over fiscal year 1955. Two new plants, Chief Joseph and Chandler, were connected to the system during the year. In addition, four new units at McNary and the third unit at Albeni Falls were brought into production during the year.

New System Peak

A new system peak was established during the 8–9 a. m. hour on February 1, 1956, before the Chandler units and the 11th and 12th units at McNary were in operation. Maximum coincident demand on the 10 Federal plants was 4,479,000 kilowatts, an increase of 22.7 percent over the previous fiscal year's maximum demand of 3,651,000 kilowatts occurring during December 1954.

Except for four isolated quarters, maximum system demands have continuously exceeded nameplate rating of installed generators since the fall of 1946. Energy produced at Federal plants for the Administration is shown by years in table VI and illustrated in the accompanying chart. Prepared on a quarterly basis, the chart shows the general trends of the Bonneville Power Administration's system-load growth.


BPA TRANSMISSION SYSTEM
as of July 1, 1956
Existing transmission line and substation
Approved or under construction (incl. 1956 Program)
Additional facilities approved or under construction
Existing lines with other utility
Existing dam and hydro development
Dam and hydro development under construction
Authorized dam and hydro development
Principal city
MILES
WASHINGTON
OREGON
IDAHO
MONTANA
NEVADA
UTAH
CALIFORNIA
SEATTLE
PORTLAND
SPOKANE
BOISE
POCATELLO
BUTTE

Receipts and Deliveries

Bonneville Power Administration's transmission grid forms the backbone of the interconnected transmission system of public and private utilities in the Pacific Northwest. As a result, electric energy receipts and deliveries on Bonneville's transmission system cover many complex transactions in addition to receipts from Federal powerplants and deliveries by sales.

The integrated transmission grid makes possible the fullest utilization of power facilities in the area through diversity in peaking and water capabilities and diversity of system-load conditions. Substantial quantities of energy are received and delivered as transfers from other utilities.

Transactions also involve storage by the Administration in non-Federal reservoirs as well as storage by non-Federal utilities in the Grand Coulee Reservoir. Disposition of energy includes deliveries from storage in Grand Coulee or to storage in other reservoirs, energy transfers for the Bureau of Reclamation from Grand Coulee, energy used by the Administration, and energy losses in transmission and transformation.

Table VII, electric energy account, summarizes energy receipts and deliveries for fiscal year 1956.

Sale of 26 Billion Kilowatt-Hours

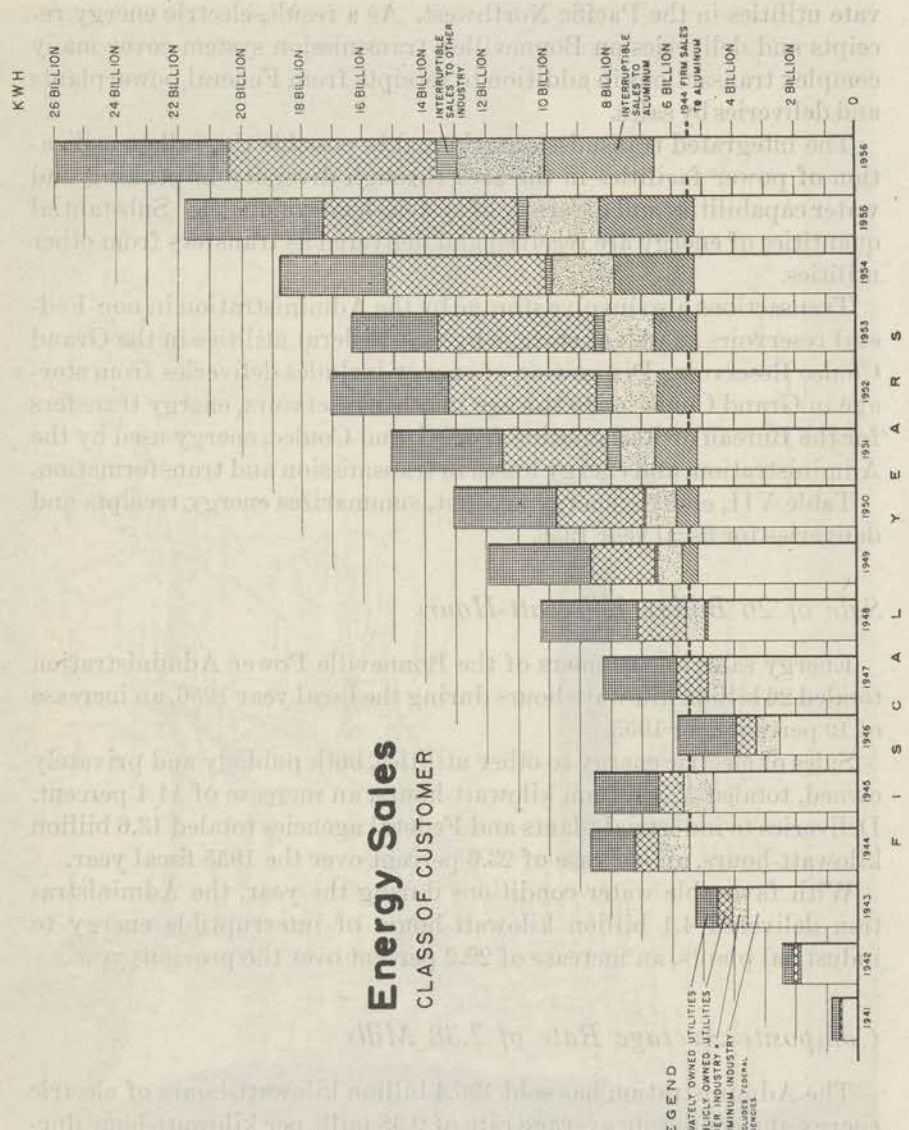
Energy sales to customers of the Bonneville Power Administration totaled 26 billion kilowatt-hours during the fiscal year 1956, an increase of 19 percent over 1955.

Sales of electric energy to other utilities, both publicly and privately owned, totaled 12.4 billion kilowatt-hours, an increase of 14.4 percent. Deliveries to industrial plants and Federal agencies totaled 13.6 billion kilowatt-hours, an increase of 23.6 percent over the 1955 fiscal year.

With favorable water conditions during the year, the Administration delivered 4.1 billion kilowatt-hours of interruptible energy to industrial plants, an increase of 22.2 percent over the previous year.

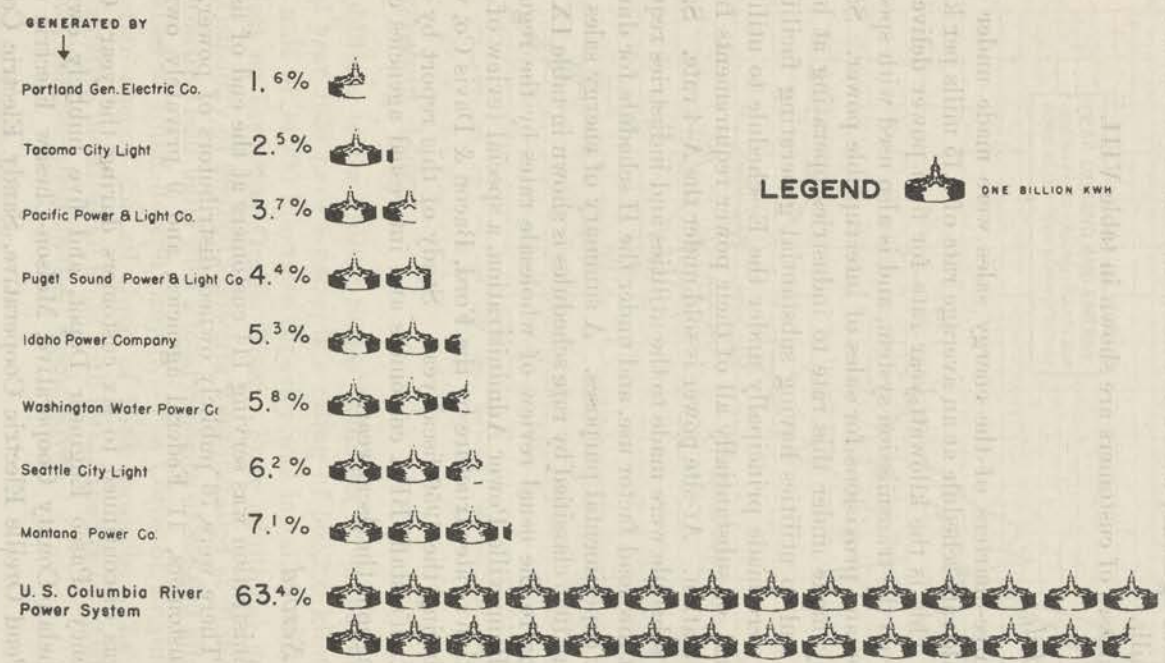
Composite Average Rate of 2.38 Mills

The Administration has sold 190.4 billion kilowatt-hours of electric energy at a composite average rate of 2.38 mills per kilowatt-hour during the 18 years of operation ended June 30, 1956. Sales to publicly owned utilities for the 18 years were 42 billion kilowatt-hours at an average of 2.81 mills. Privately owned utilities received 43 billion kilowatt-hours at an average of 2.30 mills, and industries 105.4 billion kilowatt-hours at 2.24 mills per kilowatt-hour.


Energy Sales
CLASS OF CUSTOMER
KWH
26 BILLION
24 BILLION
22 BILLION
20 BILLION
18 BILLION
16 BILLION
14 BILLION
INTERRUPTIBLE SALES TO OTHER INDUSTRY
12 BILLION
10 BILLION
8 BILLION
INTERRUPTIBLE SALES TO ALUMINUM
6 BILLION
1944 FIRM SALES TO ALUMINUM
4 BILLION
2 BILLION
0
1956
1955
1954
1953
1952
1951
1950
1949
1948
1947
1946
1945
1944
1943
1942
1941
FISCAL YEARS
LEGEND
PRIVATELY OWNED UTILITIES
PUBLICLY OWNED UTILITIES
OTHER INDUSTRY
ALUMINUM INDUSTRY
* INCLUDES FEDERAL AGENCIES

Power Generated BY THE PRINCIPAL ELECTRIC UTILITIES OF THE PACIFIC NORTHWEST

YEAR ENDED JUNE 30, 1966



TOTAL 49.0 BILLION KWH

SOURCE: WEEKLY OPERATING REPORTS OF N.W. POWER POOL

THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL. UTAH POWER & LIGHT CO. AND BRITISH COLUMBIA ELECTRIC CO. ARE ALSO POOL MEMBERS BUT ARE NOT INCLUDED IN THIS CHART BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST REGION.

Power sales to aluminum plants were 85.1 billion kilowatt-hours at an average of 2.13 mills. These plants characteristically take power at very high load factors, approaching 100 percent, which results in the exceptionally low average cost on the Administration's C and A rate schedules. Sales to industries other than aluminum, including sales to Federal agencies, were 20.3 billion kilowatt-hours at an average of 2.68 mills.

Sales by classes of customers are shown in table VIII.

Rate Schedules

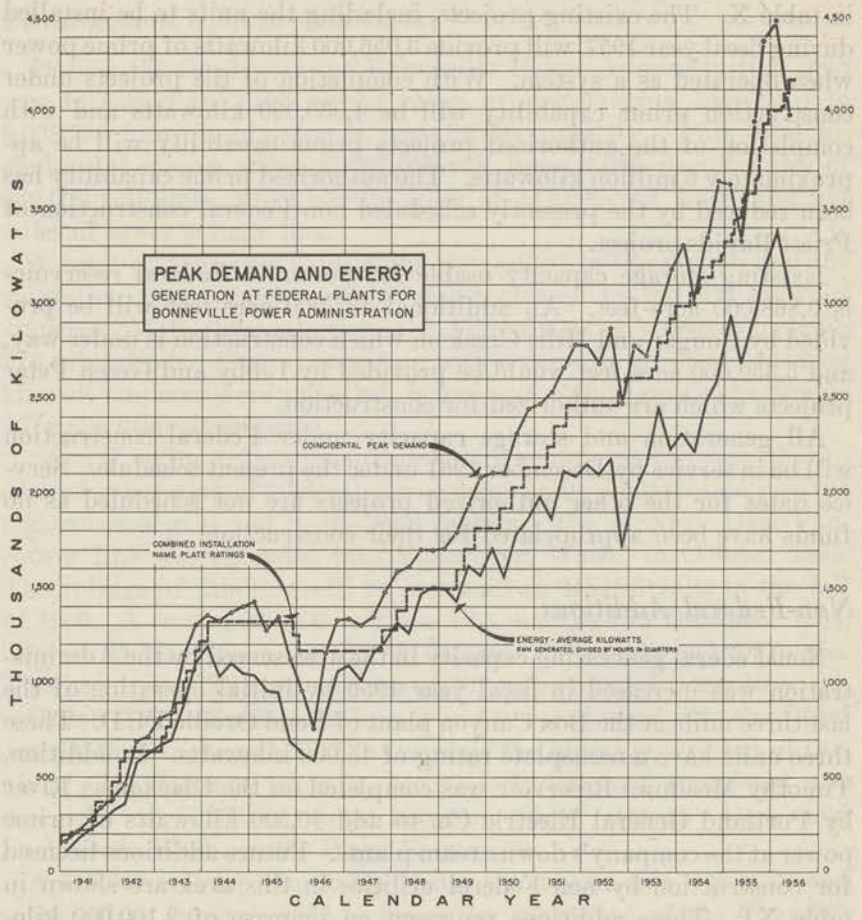
Almost three-quarters of the energy sales were made under the C–4 wholesale rate schedule at an average rate of 2.15 mills per kilowatt-hour. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system, and is also used with special measured demand provisions for sales of interruptible power. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities. Other sales were made principally under the E schedule to utilities purchasing all or substantially all of their power requirements from the Administration. At-site power is sold under the A–4 rate. Sales under the F schedule were made to the utilities and industries requiring power at low-load factor use, and under the H schedule for dump, exchange, or experimental purposes. A summary of energy sales for the fiscal year 1955 classified by rate schedules is shown in table IX.

In addition to the usual review of wholesale rates by the regular staff of the Bonneville Power Administration, a special review of the Administration's rate structure by the Ford, Bacon & Davis Co. was completed during the 1956 fiscal year. Study of this report by the Administration's staff, BPA customers and interested agencies continued throughout the fiscal year.

Customers Served

The Administration was serving 114 customers at the end of fiscal year 1956. There were 76 publicly owned distributors of power, 18 industrial customers, 11 Federal agencies, and 9 privately owned utilities.

Service was discontinued to six customers during the year: One Federal agency—Pasco Engineer Depot, and five publicly owned utilities—Chelan County Cooperative, Molson-Chesaw Electric Cooperative, Pend Oreille Electric Cooperative, Sandy Electric Cooperative, and Stevens County PUD. The loss of these customers does not represent a loss in load, since service was assumed by other customers of the Administration.



Generation Added

Additions to the United States Columbia River power system in fiscal year 1956 have a nameplate rating of 562,200 kilowatts. The last unit of 14,200 kilowatts capacity was installed at Albeni Falls project on the Pend Oreille River. Four additional units with a total capacity of 280,000 kilowatts were installed at McNary project, and the first four units with a total capacity of 256,000 kilowatts were installed at Chief Joseph project. The Corps of Engineers is construction agency for all three of these projects. The Bureau of Reclamation installed all units with total capacity of 12,000 kilowatts at the Chandler plant on the Yakima River.

Projects Summarized

Projects existing, under construction, and authorized for construction by the Corps of Engineers and Bureau of Reclamation are shown

in table X. The existing projects, including the units to be installed during fiscal year 1957, will provide 3,056,000 kilowatts of prime power when operated as a system. With completion of the projects under construction prime capability will be 4,030,000 kilowatts and with completion of the authorized projects prime capability will be approximately 6 million kilowatts. The authorized prime capability has been reduced by the presently scheduled non-Federal construction of Priest Rapids project.

Existing storage capacity usable for power in Federal reservoirs is 9,868,000 acre-feet. An additional 437,000 acre-feet will be provided by Cougar and Hills Creek on which construction is under way, and 5,332,000 acre-feet would be provided by Libby and Green Peter projects which are authorized for construction.

All generation and storage capacity under Federal construction will be in service by December 1961 under the present schedule. Service dates for the other authorized projects are not scheduled as no funds have been appropriated for their construction.

Non-Federal Additions

Non-Federal generating capacity in the area served by the Administration was increased in fiscal year 1956 by initial operation of the last three units at the Box Canyon plant of Pend Oreille PUD. These three units have a nameplate rating of 45,000 kilowatts. In addition, Timothy Meadows Reservoir was completed on the Clackamas River by Portland General Electric Co. to add 10,500 kilowatts of prime power at the company's downstream plants. Future additions licensed for construction by non-Federal utilities in this area are shown in table XI. These additions represent an increase of 2,100,000 kilowatts of nameplate rating over projects in a comparable status 1 year previously.

Northwest Power Pool

Generation during fiscal year 1956 by the principal electric utility systems of the Pacific Northwest is shown in table XII. All of these utilities are members of the Northwest power pool. The Utah Power & Light Co. and the British Columbia Electric Co. are also members of the pool but are not included as their major service areas are outside the region.

A total of 63.4 percent of the energy generated by major utilities of the region was produced by the United States Columbia River power system. In addition to power requirements of nonpool utilities and major industries served through the Administration's transmission system, 7.2 billion kilowatt-hours of energy were provided to other pool utilities for meeting their requirements.

Transmission System Additions

During the fiscal year the Bonneville Power Administration grid was increased to 7,195 circuit miles of transmission lines and to 8,008,750 kilovolt-amperes of transformer capacity. This total includes 231 circuit miles of 287,000-volt lines, 4,054 circuit miles of 230,000-volt lines, 2,679 circuit miles of 115,000-volt lines, and 231 miles of lower voltage line.

A total of four new substations was added to the system and the substation transformer capacity was increased by 681,300 kilovolt-amperes. With these additions the Administration's system includes 178 substations. Static capacitors with a capacity of 68,550 reactive kilovolt-amperes were installed, bringing the total on the system to 1,736,695 kilovolt-amperes.

Several major transmission lines were completed to bring the increased generation of Federal power dams under construction into the transmission grid and to the load centers. The McNary Dam-Vancouver line was extended into Vancouver, Wash., in October 1955. The voltage of this line will be increased to 345,000 volts in the fall of 1956. A second 230,000-volt line was energized in December 1955, between McNary Dam and the Willamette Valley in western Oregon. This required additional erection of 152 miles of steel tower line.

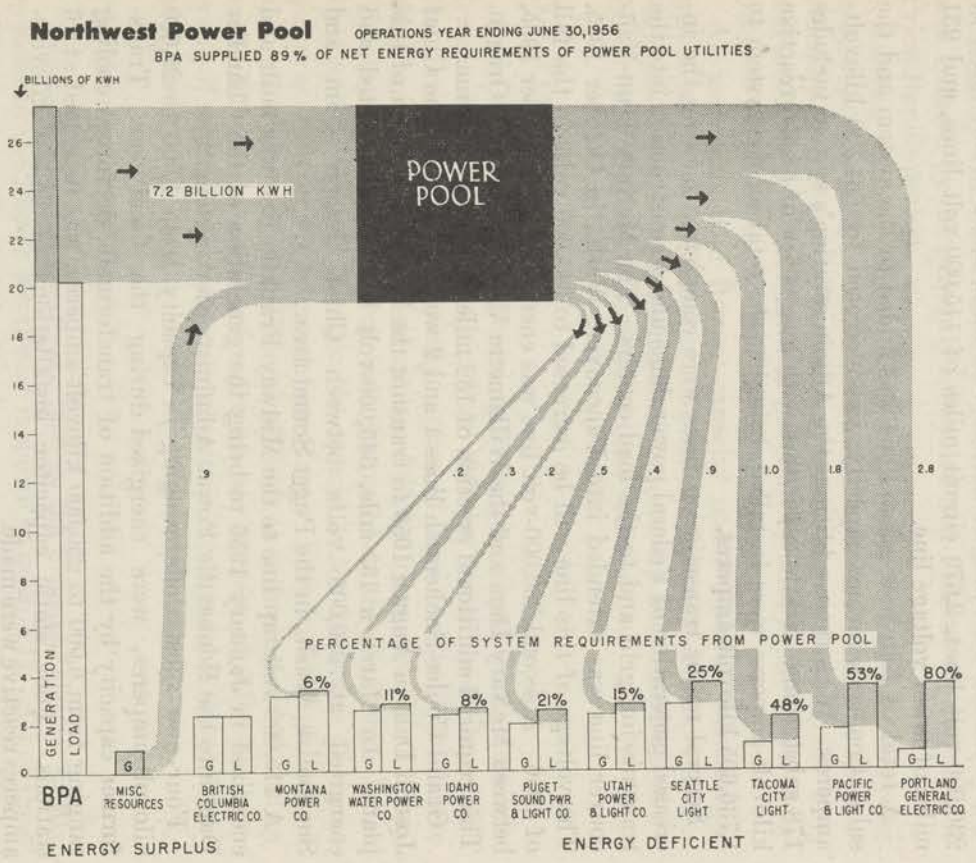
Grand Coulee-Snohomish lines 1 and 2 were looped into the Chief Joseph Dam in August 1955 to transmit the initial generation of this plant. In March a 133-mile, 345,000-volt line was completed and energized at 230,000 volts between Chief Joseph Dam and Snohomish, Wash., in the Puget Sound area.

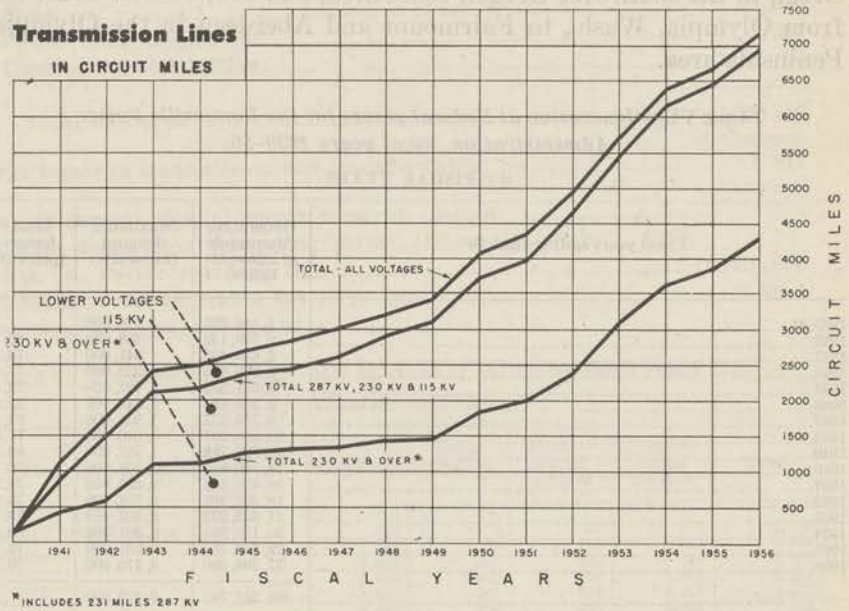
A 115,000-volt tap line to the Midway-Franklin line was built and energized in January 1956 to bring the generation of the Chandler Dam into the Bonneville Power Administration system.

Four new substations, ranging in capacity from 1,000 to 20,000 kilovolt-amperes, were energized during the fiscal year. Transformer capacity by the addition of transformers, or forced cooling ranging from 6,000 to 250,000 kilovolt-amperes, was increased at 16 stations. Four static capacitor installations of 68,550 kilovolt-amperes reactive were made.

New Construction

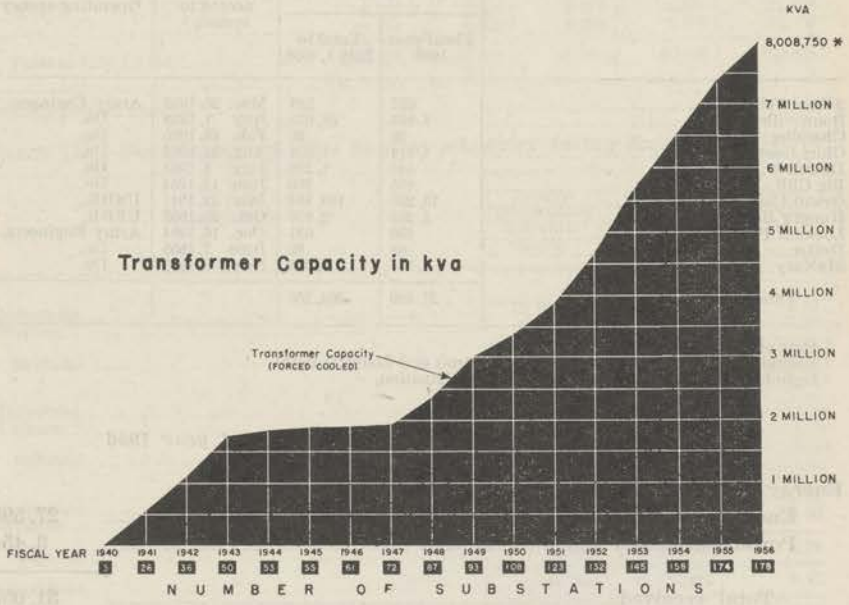
Major construction concentration during the fiscal year continued on the second 345,000-volt line between Chief Joseph Dam and Covington in the Puget Sound area, a 230,000-volt line between McNary Dam and Franklin, Wash., in the Columbia Basin area, and a 230,000-volt line between The Dalles Dam and Chemawa, Oreg., in the northern Willamette Valley. Additional 230,000-volt transmission facilities are being extended from the Alvey, Oreg., substation to Fairview,


Northwest Power Pool
OPERATIONS YEAR ENDING JUNE 30,1956
BPA SUPPLIED 89% OF NET ENERGY REQUIREMENTS OF POWER POOL UTILITIES
BILLIONS OF KWH
7.2 BILLION KWH
POWER POOL
GENERATION
LOAD
.9
.2
.3
.2
.5
.4
.9
1.0
1.8
2.8
PERCENTAGE OF SYSTEM REQUIREMENTS FROM POWER POOL
6%
11%
8%
21%
15%
25%
48%
53%
80%
BPA
MISC. RESOURCES
BRITISH COLUMBIA ELECTRIC CO.
MONTANA POWER CO.
WASHINGTON WATER POWER CO.
IDAHO POWER CO.
PUGET SOUND PWR & LIGHT CO.
UTAH POWER & LIGHT CO.
SEATTLE CITY LIGHT
TACOMA CITY LIGHT
PACIFIC POWER & LIGHT CO.
PORTLAND GENERAL ELECTRIC CO.
ENERGY SURPLUS
ENERGY DEFICIENT



*INCLUDES 231 MILES 287 KV

Note: VOLTAGES SHOWN ARE OPERATING VOLTAGES



* INCLUDES 400,000 KVA OF AUTOTRANSFORMERS OPERATED AS PART OF TRANSMISSION LINES

Oreg., in the southwest Oregon coast area, and 115,000-volt facilities from Olympia, Wash., to Fairmount and Aberdeen in the Olympic Peninsula area.

TABLE VI.—*Generation at Federal plants for the Bonneville Power Administration, fiscal years 1939–56*

BY FISCAL YEARS

Fiscal years ending June 30	Generation (thousands of kilowatt-hours)	Maximum demand (kilowatts)	Load factor (percent)
1939–41	1,144,932	210,000	----------
1942	2,549,153	468,000	62.2
1943	5,618,436	841,000	76.3
1944	9,239,823	1,355,000	77.6
1945	9,051,573	1,427,000	72.4
1946	6,236,163	1,346,000	52.9
1947	8,753,737	1,335,000	74.9
1948	10,885,907	1,610,000	77.0
1949	12,925,788	1,797,000	82.1
1950	14,140,834	2,106,000	76.7
1951	16,472,384	2,535,000	74.2
1952	18,555,401	2,784,000	75.9
1953	17,633,232	2,867,000	70.2
1954	20,195,833	3,301,000	69.8
1955	23,253,186	3,651,000	72.7
1956	27,599,380	4,479,000	70.1
Total	204,255,762	4,479,000	----------

BY PLANTS

	Generation (millions of kilowatt-hours)		Date connected to system [1]	Operating agency
	Fiscal year 1956	Total to July 1, 1956		
Albeni Falls	237	258	Mar. 25, 1955	Army Engineers.
Bonneville	4,303	56,075	July 1, 1938	Do.
Chandler	26	26	Feb. 13, 1956	Do.
Chief Joseph	1,914	1,914	Aug. 22, 1955	Do.
Detroit [2]	445	1,238	July 1, 1953	Do.
Big Cliff	105	206	June 12, 1954	Do.
Grand Coulee [3]	13,266	130,884	Mar. 22, 1941	USBR.
Hungry Horse	1,205	2,970	Oct. 29, 1952	USBR.
Lookout Point [2]	436	621	Dec. 16, 1954	Army Engineers.
Dexter	88	96	June 7, 1955	Do.
McNary	5,574	9,968	Nov. 6, 1953	Do.
Total	27,599	204,256		

[1] Date of commercial operations.
[2] Excludes energy for condenser power at Detroit and Lookout Point.
[3] Includes energy transferred for Bureau of Reclamation.

TABLE VII.—*Electric energy account for fiscal year 1956*

Energy received (millions of kilowatt-hours):	
Energy generated at Federal plants for BPA [1]	27,599
Power purchased and interchanged in	3,454
Total received	31,053

See footnote at end of table

Energy delivered (millions of kilowatt-hours):	
Sales	25,976
Power interchanged out	3,237
Used by Administration	29
Total delivered	29,242
Energy losses in transmission and transformation	1,811
Losses as percent of total energy received—percent	5.8
Maximum demand on generating plants (kilowatts), Feb. 1, 1956, 8–9 a. m., Pacific standard time	4,479,000
Load factor, total generated for BPA—percent	70.1

[1] For detail by plants, see table VI.

TABLE VIII.—*Electric energy sales by class of customer, fiscal years 1939–56*

[Millions of kilowatt-hours]

Fiscal years ending June 30	Aluminum	Other industries [1]	Publicly owned utilities	Privately owned utilities	Total
1939–41	523	5	35	537	1,100
1942	1,845	79	143	358	2,425
1943	3,589	507	435	739	5,270
1944	5,454	1,022	728	1,467	8,671
1945	4,667	965	824	2,057	8,513
1946	2,492	800	636	1,903	5,831
1947	4,212	627	1,045	2,378	8,262
1948	4,902	647	1,561	3,181	10,291
1949	5,666	881	2,081	3,342	11,970
1950	5,863	1,024	2,840	3,312	13,039
1951	6,545	1,538	3,414	3,579	15,076
1952	6,472	1,943	4,803	3,794	17,012
1953	6,547	1,947	5,110	2,791	16,395
1954	7,862	2,254	5,127	3,531	18,774
1955	8,352	2,624	6,274	4,578	21,828
1956	10,141	3,422	6,909	5,502	25,974
Total to July 1, 1956	85,132	20,285	41,965	43,049	190,431

[1] Includes Federal agencies.

TABLE IX.—*Electric energy sales by rate schedules during fiscal year 1956*

Rate schedule	Energy (thousands of kilowatt-hours)	Revenue	Mills per kilowatt-hour
C–4:			
Industries	12,152,389	$25,503,711	2.10
Utilities	7,026,985	15,659,415	2.23
Subtotal	19,179,374	41,163,126	2.15
F–4:			
Industries	23,078	98,634	4.27
Utilities	153,585	603,426	3.93
Subtotal	176,663	702,060	3.97
A–4:			
Industries	896,988	1,541,580	1.72
Utilities	11,589	40,600	3.50
Subtotal	908,577	1,582,180	1.74
E–4: Utilities [1]	4,065,206	12,679,874	3.12
Experimental, H–3 and exchange: Industries and utilities	1,643,907	4,109,767	2.50
Total	25,973,727	60,237,007	2.32

[1] Including Federal agency pumping loads.

TABLE X.—*General specifications—projects existing, under construction and authorized*

	Location	Stream	Plant installations		Nominal prime power (kilowatts)[2]	Pool elevation (feet)	Usable storage (acre-feet)[4]	Average head (feet)	Initial date in service	Principal purpose[5]
			Number of units	Total capacity (kilowatts)[1]						
Existing projects:										
Bonneville	Washington-Oregon	Columbia	10	518,400	458,000	72		59	June 1938	P, N.
Grand Coulee	Washington	Columbia	18	1,944,000	1,631,000	1,288	5,072,000	326	September 1941.	P, I, FC, N.
Hungry Horse	Montana	South Fork Flathead	4	285,000	187,000	3,560	2,982,000	364	October 1952	P, I, FC, N.
Detroit	Oregon	North Santiam	2	100,000	29,000	1,564	323,000	299	July 1953	P, I, FC, N.
McNary	Washington-Oregon	Columbia	14	980,000	548,000	340		78	November 1953.	P, I, N.
Big Cliff	Oregon	North Santiam	1	18,000	10,000	1,206		91	June 1954	P.
Lookout Point	Oregon	Middle Fork Willamette.	3	120,000	36,000	926	336,000	185	December 1954.	P, I, FC, N.
Albeni Falls	Idaho	Pend Oreille	3	42,600	29,000	2,062	1,155,000	24	March 1955	P, FC, N.
Dexter	Oregon	Middle Fork Willamette.	1	15,000	12,000	695		53	June 1955	P.
Chief Joseph	Washington	Columbia	16	1,024,000	815,000	946		169	August 1955	P, I.
Chandler	Washington	Yakima	2	12,000	11,000	620		118	February 1956	P, I.
Total				5,059,000	3,766,000		9,868,000			
Projects under construction:										
The Dalles	Washington-Oregon	Columbia	16	1,119,000	651,000	160		87	April 1957	P, N.
Roza	Washington	Yakima	1	11,250	6,000	1,221		140	March 1958	P, I.
Cougar	Oregon	South Fork McKenzie.	2	25,000	14,000	1,690	188,000	418	November 1960.	P, I, FC, N.
Hills Creek	Oregon	Middle Fork Willamette.	2	30,000	14,000	1,543	249,000	210	November 1961.	P, I, FC, N.
Ice Harbor	Washington	Snake	3	270,000	137,000	440		97	December 1961.	P, I, N.
Total				1,455,250	822,000		437,000			

Authorized projects:										
Libby	Montana	Kootenai	6	516,000	264,000	2,459	5,010,000	267		P, FC, N.
Lower Monumental	Washington	Snake	3	270,000	130,000	533		92		P, I, N.
Little Goose	Washington	Snake	3	270,000	139,000	633		99		P, N.
Lower Granite	Washington	Snake	3	225,000	114,000	715		80		P, N.
John Day	Washington-Oregon	Columbia	13	1,105,000	725,000	262		101		P, I, FC, N.
Green Peter	Oregon	Middle Santiam	2	81,000	22,000	984	322,000	315		P, I, FC, N.
White Bridge	Oregon	Middle Santiam	1	15,000	9,000	670		93		P.
Total				2,482,000	1,403,000 [3] −28,000		5,332,000			
Total, 23 projects				8,996,250	5,963,000		15,637,000			

[1] Nameplate rating.
[2] Average capability in a coordinated system during an 8-month storage release period (September 1936 through April 1937).
[3] Pumping requirements of 28,000 average kilowatts for 450,000 acres of the Columbia Basin project.
[4] Storage usable for power production.
[5] P—Power; I—Irrigation; FC—Flood Control; N—Navigation.

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TABLE XI.—*Non-Federal utilities generator installation schedule, August 1, 1956*

Utility and plant	Stream	Unit No.	Nameplate rating (thousands of kilowatts)	Date in service
City of Seattle:				
Ross	Skagit	4	90	January 1957.
Gorge (reconstruction of diversion dam).	do		(1)	December 1958.
Puget Sound Power & Light Co.:				
Snoqualmie Falls No. 2	Snoqualmie	2	20	April 1957.
Upper Baker	Baker	1 and 2	85	September 1959.
Lower Baker (addition)	do	3	55	September 1960.
Portland General Electric Co.: Pelton.	Deschutes	1	36	December 1957.
		2	36	January 1958.
		3	36	March 1958.
City of Tacoma:				
Mayfield	Cowlitz	1	40	January 1959.
		2, 3, and 4	120	October 1959.
Mossyrock	do	1	75	October 1961.
		2	75	January 1962.
		3	75	April 1962.
		4	75	July 1962.
Washington Water Power Co.: Noxon Rapids.	Clark Fork	1	84	September 1959.
		2	84	December 1959.
		3	84	March 1960.
		4	84	June 1960.
Grant County PUD:				
Priest Rapids	Columbia	1–8	630	September 1960.[2]
Wanapum	do	1–8	570	September 1962.[2]
Chelan County PUD: Rocky Reach.	do	1 and 2	180	September 1961.
		3–7	450	September 1962.

[1] Will increase head by 100 feet and peaking capability by 57,000 kilowatts.
[2] Date of river closure after installation of units.

TABLE XII.—*Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1956* [1]

Utilities	Kilowatt-hours (billion)	Percent of total generation
Publicly owned:		
Bonneville Power Administration	27.5	63.4
Seattle City Light	2.7	6.2
Tacoma City Light	1.1	2.5
Total publicly owned	31.3	72.1
Privately owned:		
Puget Sound Power & Light Co	1.9	4.4
Washington Water Power Co	2.5	5.8
Pacific Power & Light Co	1.6	3.7
Portland General Electric Co	.7	1.6
Montana Power Co	3.1	7.1
Idaho Power Co	2.3	5.3
Total privately owned	12.1	27.9
Total generation	43.4	100.0

[1] Generation shown is for the members of the Northwest power pool. Utah Power & Light Co. and British Columbia Electric Co. are not included because their service areas lie outside the Pacific Northwest region.

SOUTHWESTERN POWER ADMINISTRATION

Douglas G. Wright, *Administrator*

FOR THE fiscal year 1956, Southwestern Power Administration received $1,250,000 in direct appropriations for its operation and maintenance program, and authorization by the Congress making available $6 million out of receipts, for all costs in connection with the purchase of power and energy, and rentals for the use of transmission facilities. Additional funds in the amount of $1,200,000 remained available for completion of the Administration's construction program.

POWER RESOURCES

The installed and dependable capacity in the hydroelectric and steam plants in the integrated system as of June 30, 1956, is shown in the following table:

Project or plant	River basin	Capacity	
		Installed	Dependable
Hydroelectric:		*Kilowatts*	*Kilowatts*
Interconnected System:			
Bull Shoals	White	160,000	130,000
Denison	Red	70,000	60,000
Fort Gibson	Grand	45,000	48,000
Norfork	White	70,000	63,000
Tenkiller Ferry	Illinois	34,000	30,000
Subtotal		379,000	331,000
Isolated plants:			
Blakely Mountain [1]	Ouachita (Red)	75,000	75,000
Narrows	Little Missouri	17,000	17,000
Whitney	Brazos	30,000	28,000
Subtotal		122,000	120,000
Total, hydroelectric		501,000	451,000
Steam: [2]			
Western Farmers Electric Cooperative		30,000	30,000
Central Electric Power Cooperative		15,000	16,000
N. W. Electric Power Cooperative		40,000	42,000
Total steam		85,000	88,000
Grand total		586,000	539,000

[1] In commercial operation October 1, 1955.
[2] Contracts with G & T Cooperatives reactivated July 1955.

This hydroelectric capacity of 501,000 kilowatts will be increased by 100,000 kilowatts when Table Rock project on the White River comes into production, which is presently scheduled for early 1959.

ENERGY PRODUCTION

Hydroelectric Projects

The adverse water conditions which have existed in the SPA area since May 1952 were partially alleviated during the period January 1955 through June 1955. However, during the fiscal year 1956 stream flow conditions have been near normal only for the Narrows, Whitney, and Blakely Mountain projects. The reservoir system, up through June 30, 1956, has experienced below median flow for approximately 40 months of the past 4 years.

Project	Percent of median flow	
	July 1952 to July 1955	July 1955 to July 1956
	Percent	*Percent*
Bull Shoals	69	76
Denison	94	91
Fort Gibson	35	44
Norfork	68	78
Tenkiller Ferry	76	44
Narrows	100	101
Whitney	----------	95
Total	65	71

Stream flow conditions during June 1956 were above normal and pool levels, with the exception of the Denison project, are only slightly below normal. During the past year some secondary energy was generated at Denison. The total net generation for the year for the interconnected system was equal to the annual primary energy for the previous critical period. It is expected that normal operations will be continued during the coming year with a reasonable expectation of considerable secondary energy being available.

The annual primary energy and net generation for each project is given in the table below. During the 1956 fiscal year the total net generation of hydroelectric energy is shown to have amounted to 938,140,240 kilowatt-hours, of which 802,261,700 kilowatt-hours were from the interconnected system. Blakely Mountain project, on the Ouachita River near Hot Springs, Ark., went into commercial operation October 1, 1955.

Project	Annual primary energy [1] (kilowatt-hours)	Fiscal year 1956 net generation (kilowatt-hours)
Interconnected System Operation:		
Bull Shoals	414,400,000	386,641,000
Denison	140,000,000	196,989,000
Fort Gibson	[2] 78,800,000	74,756,900
Norfork	116,000,000	105,510,000
Tenkiller Ferry	[2] 51,300,000	38,364,800
Subtotal	800,500,000	802,261,700
Isolated plants:		
Narrows	18,400,000	21,158,540
Whitney	33,200,000	48,588,000
Blakely Mountain [3]	122,000,000	66,132,000
Subtotal	173,600,000	135,878,540
Total	974,100,000	938,140,240

[1] Former critical period.
[2] Data from Corps of Engineers cost allocation report 1955.
[3] In commercial operation October 1, 1955.

Steam Plants

The contracts with the G and T Cooperatives, deactivated July 1953, were reactivated with some changes in July 1955. The amounts of energy generated by these plants for marketing during fiscal year 1956 are shown in the following table:

Plant	Net generation
	Kilowatt-hours
Western Farmers Electric Cooperative (Anadarko, Okla.)	200,778,228
Central Electric Power Cooperative (Chamois, Mo.)	125,698,227
N. W. Electric Power Cooperative (Missouri City, Mo.)	274,913,000
Total	601,389,455

MARKETING

During the fiscal year 1956 billing periods, the Southwestern Power Administration had available for sale a total of 1,594 million kilowatt-hours of energy, of which 713.4 million kilowatt-hours represented purchases or withdrawals [1] and 880.6 million kilowatt hours represented hydroelectric generation. Of the total of 1,492.6 million kilowatt-hours marketed, after losses, 1,429.4 million kilowatt-hours represented primary and firm energy, while 63.2 million kilowatt-hours represented secondary energy. Energy deliveries to preferred customers amounted to 1,079.3 million kilowatt-hours or 122.6 percent of

[1] Represents generation adjusted to billing periods, without Blakely Mountain contract withdrawals, which are shown under purchases or withdrawals.

the total hydroelectric energy available for sale and 67.7 percent of the total energy available for sale. At the end of the firscal year, the Arkansas Power & Light Co. was entitled to 217.7 million kilowatt-hours under the Aluminum contract, the purchase and delivery of which was deferred in fiscal year 1955, and the delivery of energy purchased by the Oklahoma utility companies, still deferred, amounted to 3.1 million kilowatt-hours.

Service under the Arkansas Power & Light Co.—Blakely Mountain contract—began on October 1, 1955. Generation at this project under the contract amounted to 63.7 million kilowatt-hours. The Government withdrew 85.6 million kilowatt-hours, 21.9 million kilowatt-hours in excess of generation, from the Arkansas Power & Light system for delivery by the Government to other customers.

Revenue from sales by SPA during the fiscal year billing periods amounted to $8,183,030. This amount included sales to preferred customers of $5,980,015, and sales to private utility companies of $2,203,015.

By the end of the fiscal year, wholesale power and energy generated by the hydroelectric facilities under the marketing jurisdiction of SPA were being sold to 16 distribution cooperatives, 21 municipalities, 5 private utilities, 5 military installations, and 7 generation and transmission cooperatives.

Power and energy deliveries to preferred customers were made directly over SPA lines through the facilities of the Texas Power & Light Co., the Southwestern Gas & Electric Co., the Public Service Co. of Oklahoma, the Oklahoma Gas & Electric Co., the Central Electric Power Cooperative, the Western Farmers Electric Cooperative, the M & A Electric Power Cooperative, the N. W. Electric Power Cooperative, Inc., and the KAMO Electric Cooperative, Inc.

CONTRACTING

Contract negotiations began with five generation and transmission cooperatives in Missouri and Oklahoma to amend the lease option and power sales agreements between the cooperatives and the Government, which were rendered inoperative in July 1953. The primary considerations in the negotiations are: Deletion of the Government's option to purchase; addition of provisions for balancing off accounts; addition of provisions for operation and maintenance of the cooperatives' transmission system by the cooperatives; and addition of a provision whereby each of the cooperatives, except the N. W. Electric Power Cooperative, Inc., has an option to assume amortization, and operation and maintenance financial requirements of its 69 kilovolt transmission system. As an interim measure, pending conclusion of these

negotiations, and at the direction of the Congress, the agreements which were rendered inoperative in July 1953, were reactivated on July 15, 1955, with the exception of that with the Sho-Me Power Corp. with which a temporary substitute agreement was executed to be effective for 1 year from July 1, 1956, to June 30, 1957. It is expected that the negotiations with the generation and transmission cooperatives will be completed in fiscal year 1957.

Negotiations with the cities of Fulton and Eldorado Springs, Mo., and Bentonville, Ark., were initiated during the fiscal year, to provide service to them under standard power sales agreements. The negotiations with the city of Eldorado Springs have also included consideration for the wheeling of power by the Government for service to the city for a period of approximately 2 years until the Table Rock project is placed in commercial operation.

Negotiations were also initiated with the city of Springfield, Mo., for the purchase of excess energy from the city when available, and needed by the Government. The negotiations with Springfield also included consideration for the wheeling of power by the Government for service to Springfield. Negotiations with the city of Carthage, Mo., were initiated on a standard power sales agreement to include a provision for purchase of excess energy when available, and when needed, by the Government, from the city's thermal generating plant.

Negotiations initiated with rural electric cooperatives during the fiscal year included those with the Kay Electric Cooperative of Blackwell, Okla., with service to begin after the Table Rock project is placed in commercial operation, and with the Central Missouri Electric Cooperative of Sedalia, Mo.

During the year a contract was executed and service initiated to one new preferred customer, the city of Paris, Ark., for 1,200 kilowatts, and contracts were amended providing for increases in contract demand and contract obligation of 66,880 kilowatts. The increases in contract demand consisted of 1,300 kilowatts to distribution cooperatives and 3,480 kilowatts to municipalities. Contract obligations were increased by 62,100 kilowatts to the generation and transmission cooperatives. Contracts were also amended to provide for 105 new or reactivated points of delivery for existing preferred customers and to abandon 14 delivery points.

At the end of fiscal year 1956, the sum of the power commitments to all preferred customers served by SPA amounted to 291,540 kilowatts, and were comprised of the following:

	Kilowatts
Rural electric distribution cooperatives	34,570
G and T Cooperatives	213,650
Military installations	9,900
Municipalities	33,420

RATES

During the fiscal year, a repayment and average rate determination study was made, based on the 1954 Corps of Engineers cost allocations to power and the costs of the Southwestern Power Administration. As a result, a revised rate schedule was proposed which provided a substantial increase over the existing rate schedule "A." The filing of this revised rate schedule with the Federal Power Commission was delayed at the request of the chairmen of the House and Senate Committees on Interior and Insular Affairs and on Public Works.

LABOR MANAGEMENT COOPERATION

Negotiations were conducted with the International Brotherhood of Electrical Workers, Local Union 1002, as representatives of hourly employees of the Administration, which resulted in a general agreement for the promotion of the common interests and the establishment and maintenance of labor-management cooperation between SPA and its hourly employees. This general agreement became effective October 10, 1955.

FEDERAL CIVIL DEFENSE ACTIVITIES

Under the provisions of Departmental Order 2751, Southwestern Power Administration continued its liaison work and coordination of civil-defense activities among the departmental bureaus and with the Federal Civil Defense Administration until April 6, 1956. At that time SPA was relieved of this responsibility and the Director, Bureau of Indian Affairs, Muskogee, Okla., who is chairman of the Southwest field committee, was designated as departmental defense liaison officer for FCDA Region 5. Thereafter, SPA's civil-defense coordinator worked closely with the newly appointed Federal civil-defense liaison officer in making capabilities of this bureau available for civil-defense purposes.

Federal Civil Defense Administration Delegation No. 4 delegated to the Secretary of the Interior the responsibility to:

> Plan a national program, provide technical guidance to the States and direct Federal activities concerned with the emergency restoration of electric utility service to attacked areas and provision of adequate electric utility service to support areas.

Under this delegation, the Secretary appointed the executive director of the operating committee of the interconnected systems, Southwest area, as director, Defense Electric Power Area No. 12, to administer the Secretary's authority under the delegation within this electric power area.

This Administration as participant of the interconnected systems, Southwest area, has assisted in perfecting the Department's procedures under this delegation for aid and assistance among the companies during disasters or other emergencies, and for the use of manpower, equipment, and material for restoration of service in the area. SPA will continue to be governed in matters of electric power for civil defense by the director, Defense Electric Power Area No. 12.

SOUTHWEST FIELD COMMITTEE

During fiscal year 1956, as in the past, Southwestern Power Administration has actively participated in the programs and activities of the Southwest field committee.

The committee, under new chairmanship this year, has been advised of our continued participation and our interest as an agency in water compact negotiations, development of watersheds approved for planning under P. L. 566, and all other matters pertaining to the conservation and development of natural resources.

ARKANSAS-WHITE-RED BASINS INTERAGENCY COMMITTEE

Upon completion of its assigned task in June 1955, the Arkansas-White-Red Basins Interagency Committee was reorganized by action of the Interagency Committee on Water Resources, in accordance with the expressed desire of the Federal agencies and States concerned.

The participation of this agency, for the past 5 years, in the studies conducted to complete this comprehensive framework plan for the development of the natural resources in the Arkansas, White, and Red River Basins has proved conclusively that the liaison, coordination, and personal contacts were invaluable in carrying out the functions of this Administration's part in the development, conservation, and utilization of the natural resources of the Southwest.

The Department of Interior is the chairman agency for fiscal year 1957, and this Administration is continuing its participation in and representation on this committee with a view toward achieving the ultimate goal of a reduction of flood losses; irrigation of new lands and supplemental water supply; drainage of land for agricultural purposes; additional hydroelectric power facilities; storage facilities for municipal and industrial water supply; improved navigation facilities; and other benefits to be derived from the development and conservation of natural resources in the Southwest.

LITIGATION

In *Kansas City Power & Light Company et al.* v. *McKay* (substituted) *et al.*, the District Court of the District of Columbia upheld the validity of numerous complicated contracts between Southwestern Power Administration and various rural electric cooperatives in Missouri. The plaintiffs appealed from the final judgment entered in the case. Thereafter, the Court of Appeals, District of Columbia Circuit, vacated the judgment and remanded the case to the District Court with directions to dismiss the complaint. The plaintiffs then applied for a writ of certiorari which was denied by the Supreme Court of the United States, thus ending the case.

In *Kansas City Power & Light Company, et al.* v. *N. W. Electric Power Cooperative, Inc., and Douglas G. Wright, Administrator of Southwestern Power Administration* (Docket No. 12,095, before the Public Service Commission of Missouri), six privately owned electric utility companies sought to require the cooperative to obtain a certificate of convenience and necessity for construction and operation of a thermal generating plant and transmission system in Missouri, and to require the Administrator of SPA to comply with the rules and regulations of the Commission with respect to the sale and transmission of electric power and energy in Missouri. Counsel for the Administrator of SPA appeared specially before the Commission on March 23, 1951, and moved for dismissal of the proceeding on jurisdictional grounds. Thereafter, counsel for the cooperative appeared specially and moved for dismissal on similar grounds. Briefs of the defendants and complainants were subsequently filed. Upon motion by complainants, an order of the Commission was entered, dismissing the case without prejudice, June 21, 1956.

SOUTHEASTERN POWER ADMINISTRATION

Chas. W. Leavy, *Administrator*

THE hydroelectric output marketed by the Southeastern Power Administration in fiscal year 1956 consisted of 1,041,400 kilowatts of capacity and 2,247,121,601 kilowatt-hours of energy. It was sold to 4 public bodies, 32 rural electric cooperatives, 1 Federal agency, and 5 privately owned utilities. The sales earned $11,444,558.33, an increase of $1,661,453.52 over earnings of the previous year, and brought revenues earned in all years to a total of $43,172,260.96.

The output was generated at seven Corps of Engineers projects. They were the Wolf Creek, Dale Hollow, and Center Hill projects in Kentucky and Tennessee, the Allatoona project in Georgia, the Clark Hill project in Georgia and South Carolina, the John H. Kerr project in Virginia and North Carolina, and the Philpott project in Virginia. The installed generating capacity of 1,031,000 kilowatts at these projects at the beginning of the fiscal year was not increased during the year. Construction by the Corps continued on four other projects (Jim Woodruff in Georgia and Florida, Buford in Georgia, and Old Hickory and Cheatham in Tennessee) that are to have an installed capacity totaling 252,000 kilowatts and was begun on two additional projects (Hartwell in Georgia and South Carolina and Fort Gaines in Georgia and Alabama) that are to have an installed capacity totaling 328,000 kilowatts.

The combined output of Wolf Creek, Center Hill, and Dale Hollow was sold to the Tennessee Valley Authority under a long-term contract. All power generated at Allatoona was sold under a long-term contract to the Georgia Power Co. All of the Philpott output was sold to Appalachian Electric Power Co. under temporary arrangements pending the conclusion of negotiations for long-term sales. Part of the Clark Hill output was sold under long-term contracts to two pub-

lic bodies in South Carolina, and part of the Kerr project's output was sold under long-term contracts to the Virginia Electric and Power Co. and to 17 rural electric cooperatives in Virginia and North Carolina. The remainder of the Clark Hill and Kerr output was sold on a temporary basis for a portion of the year pending the making of long-term arrangements which were completed or in the process of completion at the end of the fiscal year. At the end of the fiscal year the remainder of the output of the Kerr project was being sold under contracts executed during the fiscal year with Carolina Power and Light Co. and 16 preferred agencies in South Carolina. The one-half of the output of the Clark Hill project to be marketed in Georgia will be marketed under a contract executed on May 16, 1956, with Georgia Power Co. and contracts with 77 preferred customers in Georgia which were executed or in the process of negotiation at the close of the fiscal year.

Applications which had been made for Federal Power Commission approval of rates for the sale of power from the Clark Hill project, the Kerr project (sold pursuant to the Carolina Power and Light Co. contract) and the Cumberland projects were pending at the close of the fiscal year.

The Congress appropriated $244,000 for headquarters operation and maintenance, and $1,160,000 for the purchase of firming energy and the payment of wheeling fees. Southeastern's working force numbered 33 employees at the beginning of the fiscal year and 34 employees when the year ended.

DEFENSE ELECTRIC POWER FUNCTIONS

THE Assistant Secretary—Water and Power Development—also exercises direct supervision over activities in the field of defense electric power. The administration of electric power functions is vested in the Secretary of the Interior under the Defense Production Act, Executive Order, and delegations from Office of Defense Mobilization and Federal Civil Defense Administration.

Activities in the defense electric power field are concerned with assuring an adequate power supply for the Nation under partial and full mobilization conditions. These activities include, among others: assembling and evaluating data as to the production capacity of electric utilities and the supplying of electric power under mobilization conditions; serving as an allotting agency to the electric power industry for the power expansion program to serve Atomic Energy Commission installations; recommending establishment or modification of expansion goals; screening and making recommendations to the Office of Defense Mobilization on requests for accelerated tax amortization for electric power facilities under expansion goals established by the Office of Defense Mobilization; and conducting various activities concerned with departmental and electric power functions in the event of a national emergency to assure continuity of supply of essential electric power. Brief summaries of progress in these functional areas are herewith presented.

December peak capabilities, peak loads, and gross reserves (percent of loads) as actually occurred in 1954 and 1955, and as forecast for the years 1956 through 1959, on the basis of median hydro conditions, are shown for the country as a whole in tabulation below.

Year	December capabilities (millions of kilowatts)	December peak loads (millions of kilowatts)	Reserves (percent of loads)
1954 actual	103.4	85.7	20.6
1955 actual	116.3	98.1	18.6
1956 estimated	123.6	105.8	16.8
1957 estimated	132.1	114.1	15.9
1958 estimated	145.7	122.3	19.2
1959 estimated	154.2	130.6	18.1

The actual peak load for 1955 and those estimated for the years 1956 through 1958 are higher than previously reported. These revisions of estimated peak loads coupled with lowered estimates of capabilities in 1956 and 1957 result in substantially lower gross reserves than previously forecast for the years 1956 through 1958. Reserves are estimated to fall below 15 percent in Federal Power Commission Regions I, III, and VII during the years 1956 and 1957, and in Regions I and VII during the years 1958 and 1959. Reserves in these and other regions may be somewhat lower especially during 1956 and 1957, and to some extent in 1958, if the work stoppage in a major equipment manufacturer's plant is not ended soon. A general work stoppage began October 16, 1955, and ended 156 days later on March 16, 1956, throughout most of the works but is still continuing in its turbine shop where the larger sized turbines have been manufactured. Furthermore, the 1956 steel strike will adversely affect capabilities and hence reserves although presently its effect is undetermined.

The Office of the Assistant Secretary—Water and Power Development—is the allotting agency of the program which provides allotments and priority assistance on materials and equipment for construction of certain facilities to furnish interim, firm, and backup power to Atomic Energy Commission installations. Since the program started in 1953, facilities with a total capacity of 10,136,000 kilowatts have been placed in service by June 30, 1956. The final unit was scheduled to be in service during April of this year. However, the work stoppage in a major equipment manufacturer's plant has delayed the installation of the last three units with 585,000 kilowatts of capacity. Latest indications are that the last unit can be in operation some 7 months after termination of the turbine shop strike.

Due to closing of the goal no applications were eligible for consideration after December 31, 1955, on expansion goal 55 (electric power), which was revised and issued on August 26, 1952, and amended and enlarged on April 15, 1955, to 150 million kilowatts to be installed by the end of 1958. Expansion goal 225, for power facilities for military, atomic energy, and defense-related needs, was established March 17, 1955.

Through December 31, 1955, under the original and amended expansion goal 55, and through June 30, 1956, under expansion goal 225, applications for certificates of necessity for rapid tax amortization have been received for 1,215 electric utility projects and 43 industrial plants. Of these, 965 utility plants and 39 industrial powerplants were recommended for issuance. The certificates of necessity issued by ODM are related to an increase in the Nation's electric power

capacity of 34,856,055 kilowatts by electric utility systems and 777,000 kilowatts by industrial powerplants.

A study chaired by this Department with representatives from other Government departments participating is under way to evaluate the power situation in a major defense area in the event of an attack. Similar studies of other critical areas will be undertaken.

New criteria for rating electric power facilities such as generating plants, transmission lines, and substations have been formulated jointly by representatives from this and other Government departments. These new criteria have been recommended to and accepted by the Industry Evaluation Board for use in reviewing the ratings of electric power facilities nationwide.

A study of the wartime supply requirements for the electric power industry has been made. This study involved the determination of the industry's consumption during full mobilization years by shape and form of aluminum, copper, and steel for construction of projects, and for maintenance, repair, and operating supplies—commonly known as M. R. O. requirements.

The Defense Electric Power Staff has participated with the Office of Defense Mobilization and Federal Civil Defense Administration in the development of plans for action by Government and industry in the event of full mobilization or of enemy attack, and is proceeding to implement approved readiness policies and programs. Planning for steps to be taken in event of a national emergency is being carried on in order to assure a continuation of essential electric power supply. Conferences have been held throughout the Nation with electric power industry officials in connection with the establishment of area offices and the appointment of area power administrators who will function in case of an attack.

OFFICE OF SALINE WATER

David S. Jenkins, *Director*

IN RECENT YEARS shortages of fresh water in many parts of the nation and throughout the world have emphasized the extreme importance of conserving this natural resource and of developing entirely new sources to serve the growing populations, industries and agriculture. Therefore, it is clear that the many saline underground and surface waters of our inland areas, and the ocean waters at our shores must now be counted among our natural resources and put to increasing uses within the next 1 or 2 decades.

The Congress recognized these needs and the potential sources of additional fresh water, and in 1952 authorized a program of research and development of improved processes for converting saline waters to fresh water. In June 1955 the program was extended and enlarged by amendments to the act of 1952, and during the past year the activity was accelerated within the Department in accordance with the amendment.

The conversion program supplements and is by no means a substitute for the program now underway for conservation of the existing water supplies. The objective is primarily one of reducing the cost of the water produced by development of new methods or improvement of known processes. Results of this research to date are encouraging.

Several distillation processes have been investigated during the past 12 months, particularly vapor compression and multiple effect distillation. Fabrication of a Badger-Hickman vapor compression prototype unit having design capacity of 25,000 gallons per day is about 50 percent complete, and will be field-tested next year. Meanwhile a private industrial firm is developing a small Hickman still. Additional research on distillation carried out during the year involved forced circulation and dropwise condensation, separation at high temperature and pressure, and comparative cost analyses of several distillation cycles. The latter study, conducted by Mr. W. L. Badger,

pointed out the theoretical potentials of combinations of distillation equipment, provided scale-free operation can be obtained. One method proposed by Mr. Badger which appears attractive is use of a large number of multiple-effect evaporators heated by exhaust steam from a powerplant. As a result of the increased interest in this field, several industrial firms also have been devoting considerable effort to examining the potentialities of large-scale multiple-effect systems. A great deal of experimental work will be necessary to substantiate the theoretical advantages of the various systems.

Research on solar distillation was carried out by Dr. George O. G. Löf, Denver, Colo., Dr. Maria Telkes, New York University, and Bjorksten Research Laboratories with the primary objectives of reducing the investment costs, improving materials, increasing efficiencies, and developing a multiple effect cycle. Considerable progress has been made on all four objectives. Cooperation on solar distillation was continued with a European working party.

Work during the year indicated the need of improved membranes for all processes utilizing membrane separations, e. g., electrodialysis, reverse osmosis or osmotically-driven cells. Consequently, fundamental research investigations aimed at improving the selectivity and other characteristics of these membranes were carried on by the National Bureau of Standards and Polytechnic Institute of Brooklyn.

Two field tests on the Ionics, Inc., membrane demineralizer were completed during the year. Successful operation was obtained, but conversion costs are higher than predicted from laboratory data. Research and testing of this unit is being continued at the Bureau of Reclamation Laboratories in Denver. Informal cooperation, including exchange of results, was continued with the T. N. O. Netherlands cooperative project on electrodialysis which is making excellent progress on an improved unit. Two American firms have developed improved membranes.

Laboratory results have demonstrated that an osmotically-powered cell (osmionic process) developed by Dr. G. W. Murphy of State University of New York, can demineralize brackish waters. Southern Research Institute is now engaged in design, construction, and testing of a practical unit.

Work at the University of Florida on reverse osmosis was continued and includes a fundamental investigation of the causes of reverse osmosis and mechanism of flow through such membranes.

Various phases of freezing as a means to convert saline waters were investigated. The Applied Science Laboratories obtained basic data on ice crystal formation and phase separation, the University of Washington tested commercial types of freezers on sea water, and Battelle Memorial Institute is evaluating a zone-purification process.

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The investigation of solvent extraction as a means of demineralization was continued by Texas A. & M. Research Foundation. Results have shown that the process is technically feasible, but to become economically attractive, improved solvents must be developed.

The Office of Salines Water, with assistance from several of its consultants, developed and published a standardized procedure for making preliminary cost estimates of saline water conversion.

Results to date from the saline water conversion program have been encouraging and gradual progress toward low-cost production of converted water is being made. As a result of the stimulation given to the subject by the saline water program, scientific interest in the problem is increasing. The present and contemplated rate of conversion research and development, sharply accelerated from time to time when the laboratory results justify, should produce a number of economically feasible processes in 5 to 15 years. With the increasing emphasis on conservation of existing supplies, and in the absence of an emergency, this result appears timely and sufficient.

During the coming year, both fundamental and applied research on the problem will be continued and accelerated, with emphasis on larger pilot plants and new approaches.

Office of the Assistant Secretary

Mineral Resources

Felix Edgar Wormser, *Assistant Secretary*

THE Assistant Secretary for Mineral Resources discharges the responsibilities of the Secretary of the Interior with respect to the Department's programs in the field of the development and utilization of minerals and metals, including mineral fuels. He exercises supervision over the Geological Survey, the Bureau of Mines, the Defense Minerals Exploration Administration, the Office of Oil and Gas, the Office of Minerals Mobilization, and the Division of Geography.

The Assistant Secretary serves as the principal spokesman for the Department of the Interior in the field of mineral affairs at the policymaking level within the Federal Government. He participates in meetings of the Council on Foreign Economic Policy as the Department's liaison representative, and sits frequently with the Defense Mobilization Board as problems involving minerals and fuels are considered.

The office coordinates the Department's representation on the interdepartmental advisory committees that the Department of Commerce utilizes in carrying out its responsibilities under the Export Control Act of 1949. Requiring particular attention in this area during the year were problems with respect to iron and steel scrap, copper, aluminum, nickel, and selenium.

In addition to the foregoing responsibilities, the Office of the Assistant Secretary, Mineral Resources, is the principal point of contact between the Federal Government and the mineral industries. The Assistant Secretary met frequently with industry advisory committees which were established to assist the Office of Minerals Mobilization in carrying out its responsibilities in connection with mobilization problems.

The Assistant Secretary also met informally with representatives of the coal industry to discuss methods of encouraging an accelerated and coordinated program of coal research. As a result of these conferences the Bureau of Mines, in cooperation with Bituminous Coal Research, Inc., undertook a comprehensive survey of research being conducted within this field. A report published in May 1956, entitled "Outlook and Research Possibilities for Bituminous Coal," discussed work currently in progress, reviewed the economic position of the bituminous coal industry over the past several decades, and summarized the competitive forces within the energy field.

The Assistant Secretary consulted with and advised the Director of the Office of Defense Mobilization concerning the operation and effect of a plan to restrict oil imports by voluntary action upon the part of the oil industry. This program was established as a defense mobilization measure in response to a recommendation by the President's Advisory Committee on Energy Supplies and Resources Policy.

The Office of the Assistant Secretary supplied information and advice to the Director of ODM concerning the administration of the Government's long-range strategic stockpiling program. The Office also worked closely with the ODM and the Department of Agriculture in setting up criteria to govern the acquisition for a supplemental stockpile of metals and minerals by barter or by purchase with local currencies obtained from the sale abroad of agricultural commodities.

In response to recommendations made by the President's Advisory Committee on Minerals Policy, the Assistant Secretary arranged for a comprehensive review of all minerals research and development activities of the Department. Particular emphasis was placed upon an examination of those functions designed to strengthen the Nation's mineral position by promoting wise development and use of its resources. As a result action was taken to accelerate those activities which must precede or supplement private exploration such as topographic and geologic mapping, geologic research and the development of geochemical and geophysical theories and techniques. Steps also were taken to expand and intensify programs of mineral and metal research aimed at the development of latent resources, new mineral raw materials, and improved utilization of existing materials. These programs were coordinated fully with those of other scientific Federal agencies and as closely as practicable with minerals research and development activities of private industry.

The Office of the Assistant Secretary reviewed legislative proposals designed to maintain the domestic production of tungsten, asbestos, fluorspar and columbium-tantalum by extending government purchase programs initiated during the Korean emergency. Following

these exhaustive case-by-case analyses the Department recommended a maximum interim program to provide a transition period during which orderly adjustment might be made to minimize economic dislocations. Following legislative approval of the program the Department received an initial appropriation of $21 million for the purchase of these materials.

The Office of the Assistant Secretary also continued to work toward the development of a longer range program to implement fully the recommendations of the President's Advisory Committee on Minerals Policy and thereby encourage the most efficient utilization and conservation of domestic mineral resources.

The Office of the Assistant Secretary aided in the preparation of the Department's report and testimony on the renewal of the Reciprocal Trade Agreements Act and the legislation authorizing the Office of Trade Cooperation. The Office of the Assistant Secretary also coordinated studies and analyses of the tariffs on several minerals and metals as a basis for developing the Department's position relative to tariff negotiations under the General Agreement on Tariffs and Trade at Geneva, Switzerland.

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*

A STRONG, prosperous America is backed by such fact-finding research agencies as the Geological Survey, responsible for seeking out new supplies and appraising known supplies of minerals and mineral fuels, classifying the public lands, mapping the surface features of the United States, and determining the quantity and quality of our Nation's life-giving water supplies.

This is a report of Survey activities during fiscal year 1956, the 77th such annual report since the Bureau was established in 1879. It shows the principal directions in which Survey scientists and engineers have shared in the task of promoting continued national economic security. It shows how the Geologic, Topographic, Water Resources, and Conservation Divisions are mobilizing for peacetime demands in the face of our expanding population. The Survey's maps, reports, and other publications arising from its scientific investigations and engineering accomplishments, form a backlog of data for future needs.

To accomplish such publications approximately 7,500 Survey employees are currently engaged in gaging streams, conducting mineral investigations, mapping, studying underground water, administering the mineral- and fuel-leasing laws, and at the same time developing new tools and methods with which to achieve improved results.

The following are summary statements of the technical divisions of the Geological Survey:

GEOLOGIC DIVISION

During fiscal year 1956 the Geologic Division continued its study of the geology of the United States and of the mineral resources of the Nation.

Survey geologists continued to provide technical data and evaluation in the programs of the Defense Minerals Exploration Adminis-

tration, the Office of Minerals Mobilization, and the General Services Administration; geologic investigations of mineral resources in Latin America, Asia, and Africa were made for the International Cooperation Administration; a broad program of research in fissionable materials was continued for the Atomic Energy Commission; investigations of terrane conditions of selected areas were also continued for the Armed Forces; and, as in past years, Survey geologists served as advisers and consultants to the National Science Foundation, the Office of Defense Mobilization, and the Department of Defense.

Mineral Deposits

Systematic geologic mapping and study of active and potential mining districts was conducted in 98 projects in 29 States, to determine the geologic setting of ore deposits in the crustal framework, and the physical-chemical factors controlling their localization and distribution. Of these projects, 40 were supported by the Atomic Energy Commission, and 14 were carried out in cooperation with State agencies. In addition, 7 projects were concerned with field and laboratory studies of fundamental problems of ore genesis; 2 involved reconnaissance mapping and compilation of geologic maps of the States of Arizona and Oregon. A considerable effort went into mineral commodity studies and reviews of information on resources of various mineral commodities.

Most discoveries of new mineral resources and additions to old result from a complex sequence of ideas, events, and persons. Behind many discoveries, however, will be found the inspiration or geologic authority derived from a report of the Geological Survey, perhaps old or perhaps recently off the press. The principal value of the Geological Survey's investigations of mineral deposits, therefore, lies in the steady, long-term usefulness to the mineral industry of the geologic data and interpretations they provide. Though this vital element in discovery plays its part early in the normal train of events and is therefore relatively unspectacular, some of its results are noteworthy. Commercial exploration in the Copper Ridge area in Tennessee, for example, based in part on Geological Survey mapping and geologic interpretations, has disclosed a new and potentially major zinc-producing district. Geologic maps of the Blackbird district, Idaho, and of the Iron River district, Michigan, have been significant elements in recent discoveries that have notably increased district reserves. During the year several major mining companies have joined in an exploration program for the Tintic district, Utah, based largely on Survey mapping and studies of rock alteration. But over and above recognized applications like these, countless well-

thumbed copies of Geological Survey publications in the hands of mining men and prospectors are evidence of their usefulness and influence in day-to-day exploration activities throughout the country.

Occasionally it is possible to point to a closer connection between geologic investigation and discovery. The largest physical exploration program conducted by the Geological Survey in its 77-year history was concluded in April 1956, on the Colorado Plateau. Since November 1947, a geologically guided diamond-drilling program carried out on behalf of the Atomic Energy Commission has maintained a high rate of discovery, measured in terms of the number of holes drilled. Geologic criteria and drilling techniques particularly applicable in the search for uranium deposits in sandstone have been recognized and developed by the Survey. Many of these ideas have been adopted by private industry in its ever-increasing program of exploration. For example, as an outgrowth of geologic mapping in Monument Valley, Arizona and Utah, channels were recognized as favorable sites for uranium deposits and were delineated. Subsequent geophysical tests outlined what were believed to be buried channel fillings. Diamond drilling was then undertaken in El Capitan Flat area to test the geophysical data; this drilling confirmed the interpretation of the geophysical results and discovered uranium mineralization in the channel fillings. Subsequent drilling by private industry resulted in the discovery of three significant uranium deposits.

Geologic work by the Survey in the Black Hills indicated that areas marginal to some of the larger masses of carbonate-cemented sandstones are a favorable geochemical environment for the localization of uranium deposits. To check the validity of these observations a limited experimental core-drilling program was carried out along the margin of a carbonate-cemented sandstone mapped by the Survey and an extensive uranium deposit was discovered. The deposit has not yet been fully developed but from the data now available it seems that the tonnage of mineralized rock, some of ore grade, is very large.

A program of systematic geologic mapping and minerals appraisal was continued in cooperation with the Puerto Rico Economic Development Administration.

Petroleum and Natural Gas

The Geological Survey's program of mapping and research in potential oil- and gas-producing areas is nationwide and provides background information needed in the formulation of sound exploration programs. In fiscal 1956 the Survey's program resulted in the release of 17 oil and gas maps and charts and 9 book publications re-

lating to the majority of the petroleum-producing States. The reports completed and the projects in operation involve geologic mapping, stratigraphic reasearch both at the surface and in the subsurface, structural studies, and broad regional studies in potential oil-producing regions of 13 States.

Of particular interest because of its unusual nature was a research project started in cooperation with Scripps Institute of Oceanography to study living Foraminifera on the Continental Shelf. Variations in types and numbers of species in differing marine environments will be determined as an aid to understanding the significance of foraminiferal variations in the petroliferous Miocene rocks of California which contain similar faunas. Samples were collected during one of the research cruises of Scripps Institute, and studies of the abundant foraminifera recovered from the ocean floor are well underway.

The Survey collaborated with the West Virginia Geological Survey and several private institutions in making detailed studies of cores from a well in West Virginia, the first well in the heart of the northern Appalachian oil and gas basin that has yet penetrated the sedimentary sequence down to rocks of the basement complex. The first part of the intensive study of the core has been completed and other parts are in progress.

The Survey published the 11th edition of the map showing oil and gas fields of the United States.

Coal

During the year geologic field investigations were carried on in 10 coal-producing States including Alabama, Tennessee, Kentucky, Ohio, Pennsylvania, Arkansas, Montana, Colorado, Utah, and New Mexico, and detailed reports on 14 coal-bearing areas were published. Appraisals of coal reserves are under way in Alabama, Arkansas, Colorado, eastern Kentucky, and western Pennsylvania. A revision of the coal map of the United States was started. The series of maps thus far published on the anthracite coal of eastern Pennsylvania has provided accurate, timely data and geological interpretations for use in planning mine development and in mine-water control in more intensely mined areas.

The Survey's coal investigations included intensive study of uranium in western coals, particularly in the area of the Dakotas, Montana, and Wyoming. These studies, which have been going on for several years, have stimulated interest in the possibility of commercial production of uranium from coal, and during the past year private companies for the first time have found ore-grade uranium in

Tertiary coals in northwestern South Dakota. Studies of uranium-bearing coals are continuing in both Dakotas and in eastern Montana.

Oil Shale

A report showing the relationship of oil-bearing black shale to other rocks of the west-central part of New York State was compiled from field data; a study and report of the spore assemblage of oil-bearing Upper Devonian and Lower Mississipian rocks of Ohio was completed; and reports were prepared on the Green River oil shale in the eastern Uinta Basin, Utah. As a result of a completed study in the Piceance Creek Basin of northwestern Colorado, the amount of oil present in the oil-shale deposits of the area has been shown to be approximately double the amount previously estimated.

Engineering Geology

During the year engineering geologic investigations continued in the metropolitan areas of Seattle-Portland, Oreg.; San Francisco; Los Angeles; Denver; Knoxville, Tenn.; and Anchorage, Alaska, to provide basic geologic information pertinent to urban development. Cooperative geologic mapping programs with the States of Massachusetts and Rhode Island were continued, and a new cooperative project was started with Connecticut. The bedrock geology and the surficial geology of these States are being systematically mapped by quadrangles, and geologic information of selected sites is made available to State construction agencies as needed. Seven additional mapping projects were in progress in the States of Colorado, Montana, Nebraska, Utah, and Washington, and summary reports were completed for a group of projects in northeastern Kansas. In these areas geologic mapping, and studies of the engineering characteristics of the geologic map units, provide geologic data for regional planning and development of large-scale engineering works such as hydroelectric, irrigation, and flood control projects, and transportation routes.

Special geologic studies were made for the National Park Service and the Federal Housing Administration, to provide a basis for judging whether construction operations at proposed sites might encourage landsliding. Geologic investigations continued at the Air Force Academy site near Colorado Springs, Colo., provided detailed geologic maps and geologic advice on location of test wells, thickness of overburden, and foundation and excavation characteristics.

General Geology

Reports on the general geology and volcanology of several of the Aleutian Islands, studied in earlier years for the Department of Defense, have been completed. Studies of the surficial geology of Death Valley and the Amargosa Valley, California-Nevada, and of the volcanic and structural history of the Black Mountains, California-Nevada, were begun, to serve as background for the current economic studies of the salines in the region. Field work was completed on parts of the Snake River Plain, Idaho; Three Forks area, Montana; and northern Shoshone Range, Nevada.

Field studies continued in the Toston and Browning quadrangles, Montana; Snake River Plains and Mackay districts, Idaho; Kemmerer, and Sage quadrangles, Wyoming. In cooperation with the State of Connecticut, studies were undertaken in the area of Norwich, Conn., and in cooperation with the State of Nevada, in the Carlin and Pine Valley quadrangles, Nevada.

Scientists at the Hawaiian Volcano Observatory continued their observations of the active volcanoes there, in further efforts to comprehend the mechanism of volcanic activity. Continued studies of this kind may ultimately lead to more accurate predictions of activity.

A new multicolor geologic map of Montana, at a scale of 1 : 500,000, was published during the year.

Geophysics

Studies of the physical properties of rocks and minerals were increased, and facilities are now available for measurement of electrical resistivity, dielectric constant, magnetic susceptibility, remanent magnetization, and dynamic elastic moduli. Studies of the strength and elasticity of rocks have been started. An analog computer has been designed and built to simulate the resistance and dielectric constant of a layered earth.

As part of the program of development, testing, and modification of geophysical instruments and techniques, an experimental model of an alpha-gamma logger was successfully tested for study of radon contamination in drill holes; a scintillation core scanner and a time interval differentiator for isotope identification were also developed. A prototype model of a system of induced polarization logging has been completed for testing, and work is in progress on an acoustic logging device and a probe for determination of thermal conductivity at depths of several hundred feet in boreholes. Tests in Ohio using a sonar-type transducer placed on the ground indicate that high-frequency sonic methods may be used to determine geologic structure

at shallow depths. Analysis of a vast accumulation of thermal data from northern Alaska is underway. A mathematical solution has been developed for a problem in heat conduction which will be of significance in studies of ground temperatures disturbed by bodies of water or engineering modifications of the surface, such as the erection of a heated building.

Regional geophysical surveys were expanded during the year and are now being carried on in the Colorado Plateau, in several parts of the Basin and Range Province, and in the Lake Superior region.

About 45,000 traverse miles of airborne magnetic and radioactivity surveys were flown in 14 States. In the Texas Coastal Plain a distinct and recognizable contrast in the "normal" radioactivity of adjacent formations was observed, indicating that radioactivity measurements can guide geologic mapping where formation boundaries are difficult to delineate because of poor exposures. New data on the depth and configuration of some of the sedimentary basins of Alaska have been obtained from analysis of aeromagnetic surveys in the Copper River and Bethel regions. A map of the Precambrian basement in Indiana has been prepared from analysis of the aeromagnetic survey of the State.

Geochemistry and Petrology

Chemical and spectrographic analyses, mineralogic and petrologic examinations, radioactivity and other determinations were made on approximately 46,000 samples, in support of mineral exploration and resources-evaluation programs.

Studies of the composition of cerium minerals and of all the rare-earth elements as phosphates were completed. Experimental work was begun on various proposed methods of disposal of radioactive fission-product wastes into geological environments.

Adoption of new improved techniques and instrumentation contributed to greater efficiency in service operations. The construction of a curved crystal X-ray spectrometer was completed. Application of this tool to the rapid, nondestructive analysis of substances in thin and polished sections and in extremely small samples has saved considerable laboratory time normally required for determination of various elements by conventional analytical methods. A new, quick optical test for the rare-earth minerals, adaptable to field work, was developed. A new model automatic sample changing and recording scintillation counter was modified and improved making it available for 24 hour operation. An automatic sample changer for the X-ray diffractometer was completed. It is designed to record automatically diffractometer charts for 12 samples in 16 hours, enabling the X-ray unit to be run overnight.

Investigation was completed of the ternary systems formed by the three pairs of albite, anorthite, and orthoclase with water; these studies and other studies in the system orthoclase—albite—anorthite—quartz—water—show considerable promise for application to the problem of geothermometry of feldspar-bearing rocks. The program of fundamental research on Pleistocene geochronology has resulted in a reliable sequence of radiocarbon dates for North American glacial events, and its extension to worldwide glacial correlations is well underway. Radiocarbon age determinations made on a series of deep-sea-core carbonates have allowed an extrapolation to the earliest Pleistocene climatic cycles, on the assumption of uniform sedimentation rate. Climatic cycles older than the range of the radiocarbon dating method, recorded in the oxygen isotope ratios of ocean sediments, were dated back through the entire Pleistocene epoch by assuming that the rate of deposition was the same as during the later Pleistocene. A critical study of all Larsen method (lead-alpha) age determinations to date showed that in areas of good stratigraphic and paleontologic control, zircon ages are in good agreement with the geology for about 85 percent of the rocks investigated.

Geochemical Exploration

Research in geochemical exploration has continued to provide new geochemical and geological concepts and techniques to aid in the discovery of mineral deposits. An investigation of the oxygen isotopes in limestone and related rocks near ore deposits disclosed pronounced changes in the ratios of O^{18}/O^{16}/ near ore deposits, suggesting the possibility of using these ratios to locate hidden ore bodies. Geobotanical and hydrogeochemical techniques for finding radioactive ore deposits were further investigated, and new, rapid, sensitive, cheap analytical methods for uranium were developed suitable for use in geochemical prospecting. These and other analytical and exploration methods developed have been made available by publication and by demonstration; methods have been adopted widely in the United States and in some 25 foreign countries by government and commercial organizations.

Paleontology and Stratigraphy

More than 45,000 fossils from 32 States, Alaska, Puerto Rico, and 14 areas outside the continental United States were examined by specialists and the resulting information incorporated in 551 administrative reports for use in guiding the field work of other geologists and for eventual inclusion in publications by them on the geology and mineral resources of numerous areas.

Research in stratigraphic paleontology contributed materially to understanding of subsurface geology of huge areas in Texas, the Williston Basin of North and South Dakota, and of Florida. Investigations of the Floridian-Bahaman carbonate province made significant contributions toward understanding the processes of limestone accumulation.

Geologic Investigations in Alaska

Reconnaissance petroleum investigations in the Lower Yukon-Koyukuk basin in western Alaska resulted in extension of known geologic units west and north from the Yukon River and collection of data for a geologic map of the Nulato and Kateel River areas. A preliminary study of petroleum possibilities was made in the Puale Bay area of the Alaska Peninsula, and field mapping was completed in the Nelchina area northeast of Anchorage.

Coal investigations continued to be largely concentrated in the railbelt. Systematic collecting of plant fossils was done in the Matanuska and the Nenana coal fields to aid in correlating the coal measures of the two fields, and subsurface exploration by power auger was begun in a critical area of the Nenana field near Healy Lake.

Mineral deposit investigations in progress included continuation of geologic mapping north of Nome to appraise the possibilities of tungsten and other minerals, a reconnaissance study in the Baird Mountains of northwestern Alaska, and preliminary examinations of several other promising areas. In southeastern Alaska systematic geologic mapping of an area northwest of Kasaan Peninsula on central Prince of Wales Island was done to appraise the mineral potential of the area. A long-term project was begun to study and map placer deposits to gain knowledge of their geologic background and to provide information useful in prospecting and exploiting such deposits. Following preliminary studies at a number of localities, detailed studies were begun late in the fiscal year in the Tofty area west of Fairbanks. Systematic use of geochemical exploration techniques as an added tool in the location of minerals in Alaska was started. To provide basic regional geologic information needed to guide in the search for mineral deposits in southeastern Alaska systematic geologic mapping of the region was begun late in the fiscal year. Results of field studies in the Lower Kuskokwim, Nutzotin Mountains, and a part of the Katmai National Monument are in a process of compilation.

Reconnaissance surveys for fissionable materials continued and a radiometric laboratory was maintained at College during the prospecting season. Detailed study was begun late in the fiscal year in the Bokan Mountain-Kendrik Bay area on southern Prince of Wales Island.

Compilation-type projects were under way on a study of Alaska metallogenic provinces and on a glacial map of the Territory. Compilation also continued on geologic quadrangle maps of the Territory at a scale of 1:250,000 utilizing existing geologic information supplemented by photogeologic study.

Reconnaissance photogeologic maps of approximately 40,000 square miles of the Territory were completed or are near completion. The geologic data contained in these maps are in large part interpreted from aerial photographs and have received only limited field checking. These reconnaissance maps are designed primarily to serve as bases for future geologic work and as interim geologic maps until more detailed studies can be made. Several large-scale photogeologic maps of mining areas in southeastern Alaska have been produced.

Military Geology

Geologic investigations on rock types, soil, vegetation and water resources were continued to provide technical advice to the Corps of Engineers, U. S. Army, and other agencies of the Armed Forces. During the year 42 comprehensive studies of foreign regions and 10 technical reports and maps were prepared by geologists, botanists, soil scientists, and other technicians in the Washington Office. In addition, numerous advisory consultations, briefings, and lectures were provided to military personnel on the military aspects of the geology in foreign, territorial, and domestic areas.

Technical assistance to the Corps of Engineers in Germany and Japan was continued. A team of specialists (geologists and soil scientists) assigned to headquarters in Heidelberg directed and instructed military technicians in the preparation of special-purpose terrain maps. A similar team in Salzburg, Austria ceased operations this year on completion of the Austrian occupation. A second team of specialists has been assigned to similar duties with the Engineers in Tokyo, Japan.

In November 1955 a geologist was assigned to accompany the Navy on Operation Deepfreeze I. Limited observations were made on the rocks in widely separated parts of Antarctica.

Field studies during the year were continued in the western Pacific and Alaska. In the Pacific a field survey of Truk was completed and work on Miyako and Ishigaki was started and brought to near completion. Military geology reports on the Palaus, Truk, Okinawa, Tinian, Guam, Yap, and Saipan were in preparation for publication. The Far East Engineer Command requested numerous engineering geology consultations, primarily on the evaluation and discovery of water resources for military use in Korea.

The program of field survey of geologic and associated terrain conditions in Alaska continued for the tenth year. Field reconnaissance was conducted in the areas of the Big Delta Military Reservation, Northeast and Southeast Copper River Basin, the Arctic Slope, and Gerstle River. Comprehensive military reports were underway on 10 areas previously investigated.

In addition to furnishing advice and studies to the Corps of Engineers, the Survey also furnished similar guidance to the Air Force on problems in the Arctic. This expansion of effort increased considerably during the year.

Foreign Geologic Investigations

Scientific and technical geologic assistance was extended to 15 countries in Latin America, Asia, and Africa under the sponsorship of the International Cooperation Administration, Department of State. Assistance in the appraisal of mineral resources was continued in Mexico, Brazil, Peru, India, Philippines, Taiwan, Egypt, Cuba, Chile, Israel, and Libya. Cooperative minerals investigations were completed in Iran. Studies in engineering geology were completed in Bolivia. Technical assistance in the field of photogeology and photogrammetry was extended to British Guiana. Long-range assistance in minerals-potential evaluation was started in cooperation with the Government of Indonesia.

Thirty-six participants from 16 countries, under the sponsorship of International Cooperation Administration, received training in the Survey's domestic field program.

A reconnaissance of Brazil's uranium resources was continued under the joint sponsorship of that government and the U. S. Atomic Energy Commission.

Gravimetric geophysical surveys were made near Camaguey, Cuba, and the gravity anomalies were drilled in search of chromite. This work, done under sponsorship of the General Services Administration, was completed during the year.

Library

The Geological Survey Library, including the branches in Denver and Menlo Park, again reached new highs in circulation and reader activity. Accessions in Washington were 24,456 text items and 3,244 maps; 13,143 pieces in Denver, and 31,349 pieces in Menlo Park. In Washington 49,461 items were loaned to Survey members for use outside the Library, 5,240 were loaned to other libraries and 3,565 were borrowed from other libraries. An estimated 125,000 items

were used within the Library. About 33,000 reader visits were made, 5,000 of these by non-Survey people.

The Denver Branch had about 26,000 readers, made 11,620 loans, and borrowed 1,379 items from other libraries. The Menlo Park Branch had about 3,000 readers and loaned 3,267 items.

The 1951 volume of the Bibliography of North American Geology was published during the year. At the end of the year the 1952–53 volume was in page proof, the 1954 volume and the 1940–49 cumulative volumes were at the printer, and the 1955 volume was in preparation.

CONSERVATION DIVISION

The Conservation Division classifies Federal lands as to mineral and water resources and supervises mineral-recovery operations under leases, permits, and licenses on Federal, Indian, and naval petroleum reserve lands. A small headquarters staff and a field staff of competent geologists and engineers are employed. This force makes field surveys, prepares maps and reports dealing with waterpower, fuels, minerals, and chemicals essential to the mineral-resource economy of the United States, and conducts onsite supervision of mining and drilling operations necessary to assure the safe and economical production by private enterprise of coal, oil, gas, and other minerals.

Mineral Classification Branch

From field offices in Colorado, California, Montana, New Mexico, Oklahoma, Utah, and Wyoming, geologists made specific investigations which resulted in geologic reports and maps for official use. In the interest of conservation and wise use these maps were of considerable assistance to engineers in planning and recommending to Government lessees and others more efficient methods of recovery of the products involved. The Branch completed maps and reports on the geologic feasibility of seven power dam sites in Alaska; completed reconnaissance of phosphate deposits, northeastern Nevada; a mineral resources map of Washington; a structure contour map of the Fort Peck Indian Reservation, Montana; structure contour map of the Montana Plains; geology of dam sites, upper Columbia River, Idaho and Montana; a contour map of the Greenwood oil and gas field, Kansas; a revision of the contour map of the East Orlando oil field, Oklahoma; map of the Ragged Mountain coal district, Colorado; structure contour map of the Colorado plains; revision of the geology of the southeastern Powder River Basin, Wyoming; and a contour map on Yates sand, southeastern New Mexico.

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All phases of the services rendered were maintained at a continued rapid pace throughout fiscal year 1956. In all, 28,884 cases were acted upon during the year, involving outright disposal of Federal lands with no reservation of minerals, the disposal of such lands with reservation of one or more specified minerals, or the exercise under the Federal leasing laws of the Government's right to lease for exploration by private enterprise a mineral substance from lands under its jurisdiction. In addition the Branch: prepared initial or revised definitions of 31 producing oil and gas fields containing Federal lands; appraised geologically 208 unit-plan and participating-area proposals; drafted 11 determinations of the productive limits of producing oil and gas deposits as found to exist on August 8, 1946, with regard to the leaseholds involved; reported for appropriate action the fact and geologic significance of 106 new discoveries of oil or gas made on or affecting Federal-land leaseholds; recommended the competitive sale of oil and gas leases on 6 parcels of public land; reviewed and reported upon 20 appeals from decisions of the Bureau of Land Management affecting the disposal of Federal lands; and prepared 226 miscellaneous reports on the mineral potentialities of specific lands for various agencies of the Federal Government.

Water and Power Classification

Water and power classification includes investigations to determine potential waterpower possibilities. The Branch classifies public lands having value for development of waterpower projects and works closely with other bureaus and agencies in administration of the public lands so classified. These duties are carried out from a central office in Washington, D. C., and from field offices in Denver, Colo.; Sacramento, Calif.; Portland, Oreg.; and Tacoma, Wash. Investigatory work in Alaska is directed from Tacoma, Wash. Field work during 1956 was directed mainly toward obtaining basic information on the waterpower resources and storage possibilities of Federal lands in Alaska, California, Colorado, Idaho, Montana, New Mexico, Oregon, and Washington. Field projects completed during the year, some of which were continued from previous years, or were in progress on June 30, include surveys on Bradley Lake and Bradley River, Halibut Creek, Juneau Creek, Snow River, and Lost Lakes, Alaska; Kaweah, Kern, Klamath, and North Yuba Rivers, California; Arkansas and Navajo Rivers, Colorado; Lemhi River, Idaho; Clark Fork (of the Columbia River) and Rock Creek, Montana; Navajo River, New Mexico; Coos, Nestucca, Trask, Wilson, and Deschutes Rivers, Oregon; Wynoochee, South Fork Skyhomish, Wind, White, Salmon, and Klickitat Rivers, and Calligan, Dorothy, and Isabel Lakes, Washington.

The foregoing projects included almost 1,000 miles of stream channel surveys and 25 dam site surveys. These projects normally extend over a 3-year period from start to completion. For the current year the work completed would be the equivalent of about 350 miles of channel surveys and 10 dam site surveys.

As of June 30, maps resulting from the projects above outlined were in various stages of preparation for publication for 550 miles of stream channel and 18 dam sites. Maps published during the year covered 163 miles of stream channel and 11 dam sites. Maps awaiting publication cover 75 miles of stream channel and 6 dam sites.

During the year one report on waterpower resources was published as a water supply paper and four others were placed in open file. One report on the geology of waterpower sites was published as a bulletin and two were placed in open file. During the year a program was started of making systematic review and appraisal of the waterpower withdrawals. Material was assembled for use in the periodic reports on developed and potential waterpower of the world.

Classification activities resulted in the addition of 56,700 acres to power site reserves and elimination of 31,834 acres. The outstanding reserves in 23 States and Alaska show a net total of 7,128,615 acres. Reservoir site reserves were reduced to 134,823 acres by the elimination of 440 acres. Supervision of power projects under license with the Federal Power Commission was reduced to 129 by termination of 5 licenses. Supervision was increased to 908 such projects under permit or grant from the Department of the Interior, 82 having been added and 1 terminated. Supervision was increased to 189 in cooperation with the Bureau of Indian Affairs, 2 having been added. Action involving hydraulic determinations was taken on 5,719 cases received from departmental sources and the Federal Power Commission.

Supervision

Supervision is exercised over operations concerned with discovery, development, and production of coal, potassium, sodium, phosphate, and oil shale from public domain lands; of sulphur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order No. 5105; of gold, silver, and mercury on certain Spanish land grants; of all minerals, except oil and gas, on restricted allotted and tribal Indian lands, on "acquired lands" under the act of August 7, 1947, and provisions of section 402 of the President's Reorganization Plan No. III of 1946, on land in the California State Park under the act of March 3, 1933 (47 Stat. 1487) and on National Forest land in Minnesota under the act of

June 30, 1950 (64 Stat. 311). Outstanding mineral leases and permits on acquired and Indian lands and lands subject to the aforementioned acts involve the exploration for and production of bauxite, cobalt, copper, gold, iron, lead, manganese, silver, nickel, titanium, tungsten, uranium, vanadium, zinc, asbestos, bentonite, clay, coal, garnet, gravel, gypsum, feldspar, fluorspar, limestone, marble, mica, phosphate, pumice, quartzite, quartz crystal, sand, silica sand, sulphur, and vermiculite.

Responsibilities include investigating and reporting on applications for leases and prospecting permits; recommending lease terms, enforcing compliance with lease terms and regulations governing the conduct of prospecting, mining, and beneficiation; protecting and conserving the natural resources by preventing waste; determining royalty liability; preparing statements, receiving payment of royalties and rentals, acting in an advisory capacity to the Office of the Secretary, other bureaus of the Department, and other Government agencies.

As of June 30, 1956, under supervision were 2,536 properties involved in leases, permits, and licenses in 32 States and Alaska, of which 1,297 were on public lands, 439 on acquired lands, and 800 on Indian lands. Production from such lands under supervision during the fiscal year is estimated at 19,728,000 tons, valued at $135,274,000, with royalties amounting to $5,862,000. The production of coal from public domain land in the United States and Alaska aggregated 5,788,500 tons, valued at $31,093,600 with a royalty value of $709,248. Production of coal in Alaska amounted to 607,747 tons. Potash production amounted to 8,701,200 tons of crude and refined salts valued at $56,510,500 and having a royalty value of $2,336,750. The principal source of sodium was Searles Lake, Calif., accounting for 790,400 tons of the total of 964,460 tons of sodium and associated compounds produced from lands under supervision. Total value and royalty value of sodium were $25,189,750 and $827,084, respectively. Phosphate rock and shale production was 1,342,800 tons—931,896 tons from public domain, 4,304 from acquired lands, and 406,600 tons from Indian lands. Production of lead and zinc concentrates from Indian lands amounted to 35,050 tons valued at $4,112,874 and royalty value of $365,250. The output of uranium and vanadium ores from Indian lands was 516,697 tons valued at $10,692,607 and royalty value of $1,204,930. Phosphate, coal, and sand and gravel made up the major part of the remainder of the production from Indian lands totaling 2,744,868 tons valued at $16,759,000 and royalty value of $1,706,100. Coal, fluorspar, zinc, asbestos, bentonite, phosphate, mica, manganese, quartzite, quartz crystal, stone, and sand and gravel were produced from acquired lands in 13 States to an aggregate of 546,023 tons valued at $2,273,902 and royalty value of $92,167.

Oil and Gas Leasing

The oil and gas leasing supervision applies to operations for the discovery, development, and production of crude oil, natural gas, and products extracted from natural gas on Federal, Indian, and certain Naval petroleum reserve lands. These duties were carried out during the year through 6 area offices and 21 district offices at 21 separate locations in California, Colorado, Louisiana, Montana, New Mexico, Oklahoma, Utah, Wyoming, and Washington, D. C.

On the public lands 99,567 oil and gas properties were under supervision at the end of the fiscal year, aggregating 72,709,487 acres in 24 States and Alaska. Drilling on public lands during the year included the spudding of 1,768 wells and the completion of 1,640 wells, of which 1,138 were productive of oil and gas. In all, 23,461 public lands wells, including 13,515 capable of oil or gas production, were under supervision on June 30, 1956. Production in 1955, amounted to about 119,680,000 barrels of petroleum; 285,601 million cubic feet of natural gas; and 196 million gallons of gasoline and butane, with royalty returns to the United States of about $42,183,000.

There were 4,161 acquired land leases embracing 3,853,369 acres in 29 States under supervision at the close of the fiscal year. Drilling on acquired lands during the year included the spudding of 65 wells and the completion of 66 wells, 27 of which were productive of oil and gas. In all, 548 acquired land wells, including 223 capable of oil and gas production, were under supervision on June 30. Including compensatory royalty allocated to the Rio Vista gas field the production from acquired land was about 5,240,500 barrels of petroleum; 13,995,000,000 cubic feet of natural gas; and 67,831 gallons of gasoline and butane, with royalty returns of about $2,253,000.

Operations on 11,685 leaseholds were supervised, embracing 3,357,-821 acres on Indian lands in 15 States. Drilling on Indian lands during the year included the spudding of 698 wells and the completion of 602 wells, of which 416 were productive of oil and gas. In all, 8,924 Indian land wells, including 4,955 capable of oil and gas production, were under supervision on June 30. Indian land revenues from rentals, royalties, and bonuses amounted to $19,942,965.

Drilling on military lands during the year included the spudding of 8 wells and the completion of 7, all productice of oil and gas. In all, 54 military land wells, including 52 capable of oil and gas production, were under supervision on June 30.

On behalf of the Department of the Navy, supervision was continued over operations for the production of oil, gas, gasoline, butane, and propane from 17 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 296 active wells totaled 2,428,000 barrels of petroleum, 5,582,535,000 cubic feet of natural gas,

of which 2,288,100,000 were net sales the remainder being gas injected for pressure maintenance, shrinkage, or fuel used on leases, and 9,685,600 gallons of natural gasoline with an aggregate royalty value of $1,071,000.

Work on the outer Continental Shelf involved supervision of 367 section 6 leases, originally issued by the States of Louisiana and Texas, and over which jurisdiction was assumed by the Federal Government under provisions of the Outer Continental Shelf Lands Act, and 235 leases issued under section 8 of that Act, containing at the end of the year a total of 577 wells, 304 of which were productive of oil and gas. Drilling on the outer shelf involved the spudding of 239 wells, and the completion of 210, including 123 producers. The production of petroleum from outer shelf in 1956 was about 120 percent greater than during 1955, and the production of gas was about 40 percent greater. Revenues received during the year as royalties, rentals and bonuses totaled $119,718,000.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 38 new unit plans during the year and the termination of 53 previously approved unit plans, leaving 285 approved plans covering 4,844,136 acres outstanding. On the outer Continental Shelf, 8 such plans were approved during the year and the total now stands at 9, embracing 259,172 acres. About 50 percent of the petroleum, 28 percent of the natural gas and 62 percent of the gasoline and butane obtained from Federal lands during the year was produced under approved unit agreements. On Indian lands 17 new units were approved and none was terminated, the total number of plans in effect at the end of the year being 28, involving 76,496 acres. There were 99 drilling unit, or communitization, agreements approved during the year, making a total of 581 approved as of June 30. The only development contract approved during the year was in Alaska involving 1,200,000 acres. The total number of such approved contracts is now 7, 3 in Alaska and 4 in New Mexico, aggregating 3,378,000 acres.

TOPOGRAPHIC DIVISION

The preparation and maintenance of the quadrangle maps that make up the National Topographic Map Series is the major responsibility of the Topographic Division. Related activities include control surveys, research, preparation of special maps and supplying map information and aerial photography to the public.

During the year about 1,800 new maps were published and mapping projects were under way in every State of the Union, the Hawaiian Islands, Puerto Rico, the Virgin Islands, and Alaska. A total of

about 18,500 published topographic maps are now available for the United States, Alaska, Puerto Rico, and the Hawaiian Islands.

The topographic mapping program continued to be directed toward satisfying the most urgent needs as determined by analysis of requests received from Federal map-using agencies and the States. New and continuing high-priority defense requirements and additional requests for mapping needed in minerals and water resources investigations and development have continued to be dominant factors in guiding our mapping efforts. Cooperative programs have been continued with many of the States, enlarged in several, and started in a few.

Topographic maps produced by the Geological Survey are so designed as to content and accuracy in order to meet military requirements as well as a multitude of nonmilitary needs. Mapping accomplished primarily to meet national defense requirements included strategic areas along the perimeter of the United States, as well as areas surrounding nearly 100 military installations and many of the principal cities. New requirements received during the year included antiaircraft areas, the Fort Polk maneuver area in the south-central United States and Fort Huachuca, Ariz. Nonmilitary requirements were given added emphasis by the national minerals policy program, the recommendations of the President's Advisory Committee on Water Resources Policy, the expanded highway program and the needs of the Federal Civil Defense Administration.

Mapping Programs and Map Production

During the year ending June 30, 1956, 2,353 maps were transmitted to the Publications Office for printing and distribution. Of these, 1,289 represented new mapping by the Geological Survey; 175 were Geological Survey revisions of existing maps; 52 were new maps compiled by other agencies which, by interagency agreement, are published and distributed by the Geological Survey; 144 were civil editions of maps which had been compiled previously and published for military use of the Department of Defense; 105 were one-color advance editions; 6 were planimetrics; 3 State base maps, 45 index maps, and 17 were urban area maps; and 517 maps were transmitted for reprinting.

The program of preparing maps of selected metropolitan areas was accelerated to meet civil defense requirements. Maps of 16 cities were prepared and printed. Maps of 26 additional cities were placed in production.

There were significant increases in and new programs for cooperation in several states. Indiana started a 10-year program to complete the mapping of the Sate at 1:24,000 scale by increasing the annual State funds for this activity from $50,000 to $200,000. West

Virginia, which was completely mapped at 1:62,500 scale through cooperation from 1899 to 1931, started a new program to remap the State at 1:24,000 scale, contributing $200,000 for the current and fiscal year 1957. The Kansas State Geological Survey increased its funds from $14,000 to $23,000 for cooperative mapping in the first step of a planned gradual annual increase toward a completion program, and the State highway department provided $100,000 in additional funds for mapping specific quadrangles in connection with an expanded highway construction program. Wyoming started its first cooperative topographic mapping program. New programs were also started with the cities of Des Moines, Iowa, and Oklahoma City, Okla., and with De Kalb and Fulton Counties in Georgia.

The 7½-minute topographic quadrangle maps of Kentucky were completed and cooperation is continuing as an active map revision program. The largest cooperative program during the year was in the State of California with other major programs in Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Minnesota, Missouri, New York, Oklahoma, Tennessee, Virginia, West Virginia, and Wisconsin. Programs were also carried on in Arizona, Arkansas, Colorado, Connecticut, Georgia, Maine, Massachusetts, Michigan, Nevada, North Dakota, Pennsylvania, Texas, Vermont, Washington, Wyoming, and Puerto Rico.

In the continental United States 102,100 square miles of new mapping and 14,100 square miles of revision of existing maps was accomplished during the year. With these additions a total of about 40 percent of the area of the nation is now covered with good quality modern quadrangle maps of the National Topographic Series. (Details of mapping accomplished are shown in the table on page —).

Considerable progress was also made during the year on the 1:250,000 scale topographic map series of the United States being compiled by the Army Map Service. Published maps of the civilian edition are now available for about one-third of the United States (169 sheets) and compilation has been completed for an additional 200 sheets.

Mapping in Alaska continued in a large measure to be directed toward satisfying high priority requirements of the Department of Defense. In some areas equal attention was given to the mapping needed to support the development of the mineral, timber, and water resources of the Territory. The general objective of this program is to provide complete, accurate, coverage of Alaska at 1:250,000 scale and to map parts of the Territory at 1:63,360 scale where civil or defense needs justify the effort. The new 1:250,000 scale coverage will replace the existing provisional series.

A major achievement in Alaska was the acquisition of 83 percent of the aerial photography required to cover approximately 122,000

square miles of the Brooks Range area in northern Alaska. This accomplishment is made possible through use of the most advanced photogrammetric and field methods and equipment, thorough planning, and the use of helicopters and fixed-wing aircraft in field surveys.

Mapping on the inch-to-the-mile (1:63,360) scale was in some stage of progress on 606 Alaska quadrangles covering about 128,100 square miles. Actual accomplishment, in terms of stereocompilation was about 19,300 square miles. With 182 quadrangle maps published during the year, the total of published maps of this series is 519.

Mapping in the Territory of Hawaii was continued toward the ultimate goal of completely remapping the islands at 1:24,000 scale. Operations during the year were conducted on Oahu, Maui, and Hawaii, concentrating on requirements of the Department of Defense. With publication of the remaining 11 of 15 quadrangles covering the island the mapping of Oahu was completed. Four of the 17 quadrangles covering Maui were also published.

The 1:24,000 scale Virgin Islands mapping program was continued and three quadrangles covering St. Thomas Island have been published.

The program of continuous map maintenance or revision in Puerto Rico was continued under a cooperative agreement.

As a necessary framework to correlate the new mapping in correct elevation with respect to sea level, 12,300 miles of leveling were run. To correctly position the new maps on the surface of the earth, 5,600 miles of transit traverse were run and 49,300 square miles were controlled by triangulation. Computed results of the control surveys are available to the public upon request. During the year contracts were let for 61,500 square miles of precision aerial photography for topographic mapping purposes, of which approximately 30 percent was twin low-oblique coverage. The Air Force delivered 20,200 square miles of photography for use in the compilation of topographic maps of certain Air Force bases. Flying operations were resumed in northern Alaska to complete the project begun in 1955 of photographing 122,000 square miles of the Brooks Range area.

Activities of the Special Maps Branch were in large degree a continuation of the preparation of charts for the USAF Aeronautical Chart and Information Center. In assisting the Air Force program of maintaining worldwide coverage of aeronautical charts, an important contribution is made to the overall Defense program. In addition, many special maps were prepared for other Divisions of the Geological Survey and for other agencies of the Federal Government; these included photogrammetric and cartographic map compilation, map revision, preparation of shaded relief, color-separation drafting and photographic services. Among 185 foreign charts completed during the year for the Air Force were 9 color-separation

charts; photo-compilation of 79 charts covering 173,000 square miles; 12,350 square miles of map revision; and 97 radar prediction charts. A total of 136 Air Force charts are in various phases of compilation and will be completed in the new year.

By agreement with the Operations Coordinating Board and in cooperation with the Navy Hydrographic Office, the Survey began mapping operations in Antarctica from aerial photographs made available by previous expeditions. Completed mapping for the year amounted to 142,000 square miles compiled principally from trimetrogon and radar-scope photography. This mapped area is represented on eight 1 : 500,000 scale sheets of the series complete with shaded relief and color-separation drafting for lithographic reproduction.

During the year several projects were completed for the Army Map Service. These included 56 shaded relief plates representing 56 foreign maps and a 2-year program requiring the compilation and color-separation drafting of 15 1 : 1,000,000 scale maps.

An accomplishment worthy of mention is the completion of planetable mapping of beach and adjacent areas extending from Bay Shore to Montauk Point, on Long Island, N. Y. These areas are the subject of a detailed beach erosion and hurricane damage study authorized by Congress and conducted by the Corps of Engineers. Geological Survey maps with planimetry complied by stereomethods served as their base map. A substantial saving has accrued to the Corps of Engineers because of these maps and their timely completion.

New mapping and map revision during the year for publication as 7½- or 15-minute topographic quadrangle maps in the United States (excluding Alaska) for each of the major phases of mapping activity are as follows:

	New mapping (square miles)	Map revision (square miles)	Total (square miles)
Photography			91,000
Horizontal control	88,600		88,600
Vertical control	56,900		56,900
Supplemental control	80,200		80,200
Stereocompilation	75,400		75,400
Field compilation	104,800	14,500	119,300
Drafting and scribing			120,400
Transmitted for reproduction			137,600

In the fiscal year, work was in progress on 6,685 quadrangles. It usually requires about 3½ years to map a quadrangle and publish the result.

A detailed summary of map production covering new mapping, remapping, and revision, is shown in the following table:

Areas (in square miles) mapped during fiscal year 1956 for publication on standard scales

[Contour intervals, 5 to 100 feet]

State	Area mapped, scale			New mapping	Revised mapping	Total
	1:24,000	1:31,680	1:62,500			
Alabama	93			93		93
Arizona			2,970	2,970		2,970
Arkansas	61			61		61
California	6,210		13,100	16,357	2,953	19,310
Colorado	2,694		596	3,290		3,290
Connecticut		127			127	127
Delaware	538			176	362	538
District of Columbia						
Florida	4,210		645	3,484	1,371	4,855
Georgia	1,285		2,180	3,465		3,465
Idaho	594		258	797	55	852
Illinois	35		779	814		814
Indiana	2,657			2,628	29	2,657
Iowa	230		112	342		342
Kansas	2,204			634	1,570	2,204
Kentucky	373				373	373
Louisiana	334		1,325	1,153	506	1,659
Maine	44		3,990	2,096	1,938	4,034
Maryland	288			226	62	288
Massachusetts		176			176	176
Michigan	159		2,900	3,026	33	3,059
Minnesota	212		2,954	3,166		3,166
Mississippi						
Missouri	2,173		8	2,181		2,181
Montana	1,509		1,604	3,113		3,113
Nebraska	901			901		901
Nevada	95		5,215	5,310		5,310
New Hampshire	6		397	370	33	403
New Jersey	861			534	327	861
New Mexico	391		3,290	3,681		3,681
New York	2,637		1,294	2,361	1,570	3,931
North Carolina	553		738	1,286	5	1,291
North Dakota	1,222			1,222		1,222
Ohio	443			443		443
Oklahoma	1,228		1,205	2,312	121	2,433
Oregon	215		10,676	10,382	509	10,891
Pennslyvania	2,221		120	1,879	462	2,341
Rhode Island						
South Carolina	231			231		231
South Dakota	1,604			1,604		1,604
Tennessee	1,026			902	124	1,026
Texas	4,167		2,848	6,187	828	7,015
Utah	1,816		788	2,376	228	2,604
Vermont			207	207		207
Virginia	241		952	954	239	1,193
Washington	823		1,471	2,192	102	2,294
West Virginia						
Wisconsin	204		4,286	4,490		4,490
Wyoming	1,835		413	2,248		2,248
Total	48,623	303	67,321	102,144	14,103	116,247
Alaska			[1] 19,535	19,280	255	19,535
Hawaii	462			462		462
Puerto Rico		[2] 394			394	394
Virgin Islands						
Grand total	49,085	697	86,856	121,886	14,752	136,638

[1] 1:63,360. [2] 1:30,000.

Research and Development

The installation of new photogrammetric equipment, designed and developed by the Geological Survey, continued during the past year. The new items, which include ER–55 projectors, Twinplex plotters, aspheric-plate diapositive printers, and variable-ratio pantographs, are part of a more efficient system for topographic mapping that includes the use of twin photography, economical compilation scales,

and scribing techniques for the production of the map manuscript. A United States patent was issued on the ER–55 projector, dated March 13, 1956, with all rights assigned to the Government.

A prototype model of the Orthophotoscope was built and is currently undergoing operational tests. The Orthophotoscope is an instrument used to make orthographic photographs from stereoscopic pairs of standard perspective pictures. Results of early tests indicate that the instrument will be a success and applications are foreseen in the fields of geology, engineering, and the military, as well as in mapping.

The first model of a twin-camera mount, based on a center-of-gravity design developed in the Geological Survey, was built and tested during the year. Indications are that such a mount may open the way to better resolution in the aerial photograph. This would greatly enhance the use of aerial photography in all photogrammetric operations. The mount has been loaned to the Air Force for further, more rigorous flight tests.

Tests conducted during the year have shown that the technique of using stereotemplets for the extension of horizontal ground control is not only feasible, but desirable in many cases. Stereotemplets are a development of the Geological Survey. One of the four main offices is already using the technique almost exclusively for its horizontal-control extensions. Wider adoption of the system is expected as more information is gained.

As a result of research performed by the Geological Survey the applicability of the ER–55 projector as an efficient high-oblique stereoplotter was proven. It was concluded that new trimetrogon photography taken with the latest precision cameras, ER–55 projectors, stereotemplet triangulation and vertical control extension by photoalidade can be combined to form a photogrammetric system capable of producing more accurate small-scale large-contour interval maps under the most adverse conditions of flying and available ground control.

The scribing process which has now replaced drafting as a map finishing procedure is being extended to field surveys. Meanwhile, progress is being made in adapting it to stereocompilation work. The adoption of plotting scales that are the same as the reproduction scales, which is now underway, will represent further economies through elimination of conventional "final" rendering of certain plates. The efficiency of the process has been established and has increased considerably since its adoption. It will continue to improve as research and development provide new and improved instruments, register devices, scribe and strip coatings, sensitizers, and operation techniques.

In the continuing effort to improve the efficiency of control surveys, experiments were made in the determination of elevations for

supplemental control by altimetry. Efforts were directed toward refinement of the instruments themselves, improvement in the methods of using them, the application of corrections for atmospheric conditions, and better methods for computing the results. Accomplishments have been sufficiently encouraging to justify further research.

The tremendous advance in the uses of electronics offers tantalizing promise of potential savings to be gained in the execution and computation of control surveys. Continuing effort has been made to keep abreast of the latest developments in order that we may immediately put into use any practical device for electronic measurement or any more economical method of computation.

The program of converting telescopic alidades to optical reading auto-leveling instruments is continuing. All reports and tests of the converted alidades show improved accuracy and substantial operational savings in time.

An electronic line counter was developed and constructed which counts the line crossings on maps by sliding an electric microeye unit across the map sheet. The data are used in cost studies.

The rectoblique plotter has been redesigned to reduce time of operation and to improve its accuracy. Other research work included development of a small combination planetable board and light table for more expeditious field checking of scribed map manuscripts; tests of automatic levels and leveling rod graduations; studies and tests of stereotemplet materials.

Contour interval plans have been reviewed and approved for 36 of the 48 States. Plans have been received from the responsible Region offices for nine of the remaining twelve States, and considerable work has been done on review of those on hand. A summary plan for the United States, on a 1:5,000,000 base map, is being prepared.

Progress has continued in writing the new manual of Topographic Instructions. Of the proposed 138 chapters, 80 have been issued and 24 are in advanced stages of preparation. The parts of the manual concerning basic policies and field surveys are now virtually complete, and planning has begun for a sales edition.

Map Information Office

Expansion of business and industrial activity during the year was reflected in a general increase in the activities of the Map Information Office. Industrial concerns are showing more interest in the use of topographic maps in the conduct of various operations. Requests for topographic maps, aerial photographs, and geodetic control covered a wide variety of uses.

Maps and related information were sought for many different purposes—as aids to microwave station location; general planning for

highway, railroad, and airport sites; development of real estate subdivisions and factory sites; for compliance with Federal requests for geographic coordinates of hundreds of key industrial facilities; for oil and gas, and mineral exploration and prospecting especially in connection with uranium exploration; for detailed study of terrain in the vicinity of airplane accidents by the Civil Aeronautics Board and the Civil Aeronautics Administration; for base maps by city and town planning and zoning commissions; and for the determination of commercial franchise area boundaries.

The past year also was marked by large increases in the strictly nontechnical use of maps and requests for map information. Several national magazines advised the public that topographic maps were available from the Geological Survey and that additional information and advice about map uses and sources was available. The public response was indicated by the large volume of inquiries directly traceable to each of several news stories. Most requests were for data for recreational purposes—hunting, fishing, camping, touring, and the like. These requests evinced a newly aroused interest in maps by an increasing number of persons who were unfamiliar with topographic quadrangle maps.

There were notable increases in sales activities. Aerial photo sales amounted to $95,000, an increase of nearly $10,000 over the preceding year. The distribution of geodetic control lists in 15-minute quadrangle units increased considerably. More than 38,000 lists were sent out on request.

As the result of an agreement with the Army Map Service, the Geological Survey took over the sale and distribution of all advance materials of the 1:250,000 scale series of United States topographic maps. Orders for this copy received from the public, as well as from State and Federal agencies, have exceeded expectations.

Aerial film taken in connection with the preparation of the 1:250,000 scale series of United States topographic maps is also being released to the Geological Survey by agreement with the Army and the Air Force on an indefinite loan basis. Coverage for approximately 45 percent of the area of continental United States was received during the year. Arrangements were also made with the Department of the Navy to accept, as it becomes available, Navy aerial mapping film of Alaska on an indefinite loan basis. Reproductions from all unclassified film are available to domestic users.

WATER RESOURCES DIVISION

The work of the Water Resources Division is to determine and appraise the Nation's surface and underground water resources. During fiscal year 1956 there was a further increase in public interest

in water-resource investigations, owing partly to local and regional floods or droughts, partly to increased competition for existing supplies by municipalities, agriculture, and industry, and partly to broadened public awareness of the importance of having adequate hydrologic data on hand before designing and building such structures as municipal waterworks, reservoirs, dams and bridges.

Water-resources investigations include the systematic collection, analysis, and publication of hydrologic and related geologic data; appraisal of water resources of specific areas; determination of water requirements for industrial, domestic, and agricultural uses; and research and development to improve the scientific basis of investigations and techniques.

Water-resources investigations are financed from directly appropriated funds, funds transferred from other Federal agencies for work performed directly for them, and from funds provided by States and municipalities for cooperative investigations. From the beginning of Federal-State cooperative investigations in 1895, the partnership arrangement has grown to include work in all 48 States and in Hawaii and Guam.

Funds made available by States and municipalities in 1956 for cooperative studies were:

State	*Obligation*	*State*	*Obligation*
Alabama	$136,350	Nebraska	80,634
Arizona	130,706	Nevada	31,394
Arkansas	51,899	New Hampshire	18,348
California	351,052	New Jersey	76,560
Colorado	97,098	New Mexico	164,597
Connecticut	34,787	New York	219,813
Delaware	34,405	North Carolina	111,849
Florida	186,114	North Dakota	45,002
Georgia	88,030	Ohio	160,878
Guam	19,904	Oklahoma	101,815
Hawaii	88,899	Oregon	73,118
Idaho	61,615	Pennsylvania	147,315
Illinois	77,347	Rhode Island	26,583
Indiana	141,430	South Carolina	33,630
Iowa	86,686	South Dakota	22,007
Kansas	67,156	Tennessee	87,056
Kentucky	147,888	Texas	300,102
Louisiana	151,657	Utah	92,692
Maine	12,473	Vermont	8,535
Maryland	61,792	Virginia	84,776
Massachusetts	41,967	Washington	120,063
Michigan	80,166	West Virginia	27,547
Minnesota	102,988	Wisconsin	45,952
Mississippi	44,053	Wyoming	62,284
Missouri	36,543		
Montana	52,882	Total	4,528,437

Surface-Water Investigations

The measurement and publication of basic information on streams, lakes, and reservoirs were continued on a comprehensive scale, with special emphasis given to the timely publication and release of data. These records provide a sound basis of facts for the study and analysis of many hydrologic and engineering problems.

Surface-water records were obtained at more than 6,800 sites in the 48 States and in Alaska, Hawaii, and Guam during fiscal year 1956. Surface-water records include 4,800 records collected in cooperation with 187 agencies of States or their subdivisions and 2,000 records obtained for Federal agencies such as the Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority, State Department, Soil Conservation Service, Atomic Energy Commission, and permittees and licensees of the Federal Power Commission.

Compilation of all streamflow records in the United States for the period 1888–1950, a project which was started in 1951, is now 68 percent complete. During the year, compilation volumes were published for the lower Mississippi River Basin and for the Pacific slope basins in Washington and the lower Columbia River Basin. Users of these summary streamflow reports, water-supply and sanitary engineers; designers and operators of flood-control systems, irrigation projects, and powerplants; and many others concerned with historical and long-term streamflow data, now have records of monthly and annual discharge figures and other data for given basins in a single volume, rather than nearly 50 volumes of the annual report series of water-supply papers.

Flood-frequency reports for Nebraska, Connecticut, and Missouri, prepared cooperatively by the Geological Survey, were published. Flood studies were in progress in six other States at the end of the year. Data were also being collected and preliminary analyses made for a nationwide flood-frequency study. When completed, this will provide a means for computing flood frequencies on all streams in the United States. The unit for analyses which have been started for New England and the Colorado River area, is the river basin.

Additional cooperative programs with State highway departments were started and several existing programs were expanded in scope. Data obtained provide better definition of the flood-producing characteristics of small streams, knowledge of which is essential to the design of adequate and economical drainage and flood-control structures. Hydraulic data for about 90 stream sites were furnished to various highway departments. The program of collecting flood-flow data on small streams by means of crest-stage and continuous gaging stations was enlarged.

Considerable progress was made in developing techniques for relating single measurements of low flow in ungaged streams to correlative records of flow at stream-gaging stations, in order to deduce the characteristics of small streams during periods of low flow.

Devastating floods of August-October 1955, extending from New England to North Carolina, were documented by intensive field investigations and a preliminary report was published in USGS Circular 377. Similar investigations followed the floods of December and January in the west coast area, and a preliminary report is being published as USGS Circular 380. Final reports on the floods in both sections of the country will be prepared.

An intensive review was completed of the scope and adequacy of the stream-gaging network in the Colorado River Basin. The derived methods of review were sufficiently fruitful that a review of the nationwide stream-gaging network was begun in June 1956 and was scheduled to be completed within a year. A hydrologic network will be defined, setting up (1) "primary" stations, which will be operated indefinitely to give long-term trends, and (2) short-term "secondary" stations to give area coverage. This will aid planning of the program for collecting basic surface-water data.

Sixteen interstate compacts for apportionment and division of interstate waters are now in effect and seven are under negotiations. These compacts include provisions for the measurement of streamflow, commonly by the Geological Survey.

Water resources investigations were made along the Canadian boundary, as required by the Boundary Waters Treaty of January 11, 1909, between the United States and Canada, or by order of the International Joint Commission.

Ground-Water Investigations

The growing importance of ground water to the Nation caused a continued increase in demands for information on which to base plans for use and conservation of this critical natural resource. Mutual Federal and local interest was reflected in cooperative programs in 44 of the States, Hawaii, and Guam. Of 550 ground-water investigations underway during the year, about 80 percent were in the Federal State cooperative program.

About 100 of the projects concerned problems in which the primary interest is National, or in which Federal agencies are directly concerned. Departments of Defense, State, Agriculture, and Health, Education, and Welfare, several Bureaus in the Department of the Interior, and the Atomic Energy Commission are examples of agencies having direct or preponderant interest in specific water problems.

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The greater part of the effort was directed toward area investigations and reports on the geology and ground-water resources of geographic or hydrologic units, commonly of counties or ground-water basins. These studies contribute to the overall objective of a nationwide coverage and a national inventory of water resources. Supporting studies included research into the principles of occurrence and movement of water in various geologic and hydrologic environments, systematic inventories of the draft on ground water, and studies of water-level fluctuations. Research, besides adding directly to knowledge of hydrogeologic principles and processes, leads to improved techniques for the analysis and solution of water-supply problems. Inventories kept current, provide records of operating experience with ground-water reservoirs.

During the year 144 scientific reports and papers on investigations were published for public information, and 142 reports were released to the "open" file. The published reports include 16 water-supply papers, 1 professional paper, 5 circulars, 45 reports published by cooperating agencies, 2 contributions to The Yearbook of Agriculture, 44 papers in scientific journals, and 31 reports in duplicated form. About 40 additional reports were prepared for administrative release to Federal agencies.

The diversity of problems investigated throughout the country is illustrated by a few of the reports. One on ground-water resources of the San Luis Valley in Colorado shows that the shallow alluvial aquifer is overdeveloped in places, but that additional supplies can be obtained in large areas; also, that relatively large additional supplies can be obtained from artesian aquifers. In the Puget Sound area of Washington, Pleistocene deposits (those accumulated during the ice age), contain what may be that area's only large supplies of ground water of good quality for agricultural, industrial, and municipal use. On the east coast, ample ground-water resources were reported in the historic York-James Peninsula of Virginia.

In northeastern Arizona, a highly successful program for the location and development of adequate domestic and stock supplies by wells was in progress in the arid Navajo and Hopi Indian Reservations. In contrast, excessive recharge from the infiltration of irrigation water has caused drainage problems in the Riverton area and in the vicinity of Kaycee in the upper Powder River basin in Wyoming. Along the Ohio River, large quantities of water are available from the alluvium, whereas in the nearby Paducah area only small to moderate supplies can be obtained.

Research on artificial recharge was continued in Arkansas, and additional work was done in Texas, Oregon, and Alaska. Also, a comprehensive report on the Putah Creek area in Solano County,

Calif., discusses many of the complex elements that would affect use of the underground storage capacity for integrated operation of the Monticello Reservoir and the ground-water reservoirs.

A report on phreatophytes, which was completed and is in process of publication, revises and expands considerably the information in an earlier water-supply paper. These deep-rooted, water-loving plants take water directly from the zone of saturation and waste millions of acre-feet of water each year.

A paper entitled "The quantitative approach to ground water," by J. G. Ferris and A. N. Sayre, traces the history and development of the quantitative concepts and techniques now widely used in the appraisal and interpretation of ground-water resources.

Chemical-Quality Investigations

During 1956, notable progress was made in determinations of the quantity, type, source, and distribution of dissolved minerals in natural waters. About 65,000 samples from streams, lakes, springs, and wells were analyzed. The majority come from about 600 key locations, mostly on streams. About 8,500 samples were from wells and springs.

In addition to the nationwide program, more detailed chemical-quality investigations were made of streams in the basins of the Colorado, Missouri, Pecos, and Columbia Rivers; in New York and the New England States and in Alaska. Also, a sampling network was maintained on western streams to determine trends in mineral content that would affect successful continued operation of western irrigation projects. Investigations were made in cooperation with State and municipal agencies in 16 States, and special chemical-quality studies were made for the Department of Defense, Atomic Energy Commission, Bureau of Reclamation, Veterans Administration, Federal Housing Authority, and Public Health Service.

Reports on the chemical quality of natural waters, issued during 1956 and having special interest, included those on the Colorado River Basin for the period 1925–40; the quality of surface waters for irrigation in the Western United States in 1952; the chemical characteristics of surface waters in the Devils Lake Basin, North Dakota; and the quality of surface waters in the Wind River Basin, Wyoming. Reports describing chemical characteristics of surface waters of South Carolina, Texas, New York, Kentucky, North Carolina, and Oklahoma were prepared in cooperation with those States. Studies were continued of public water supplies of the larger cities of Alaska, Hawaii and Puerto Rico.

Temperature variations in time and place are of special importance to waterworks, industry, fish culture, and sediment-transport studies. Measurements were made also of water temperatures as a regular part

of the quality investigations. Daily observations or continuous recordings of temperature were obtained during 1956 at more than 400 sites on important streams. Periodic measurements were made at many additional river locations.

Sediment Investigations

Study was continued during 1956 of the sources, quantity, and movement of waterborne sediments and their effects on reservoir storage, navigable waterways, diversion works, and irrigation canals. Measurements were made regularly of sediment in suspension at about 200 locations. Comprehensive investigations were continued in the Missouri, Middle Rio Grande, and Colorado River Basins. These studies provided information about the sources of sediment, rates of discharge, and other pertinent factors in these areas to aid extensive Federal programs of water development.

The results of sediment investigations in the Wind River Basin were published in Water-Supply Paper 1373. The program of the U. S. Soil Conservation Service was assisted by studies of sediment yields and the trapping efficiency of reservoirs on small watersheds in North Carolina, West Virginia, Kentucky, Georgia, Nebraska, Oklahoma, and Texas. Special sediment studies were made for the Bureau of Reclamation in the Rio Grande and Colorado River Basins and in the watershed of Medicine Creek, Nebraska.

Investigations of sedimentation were continued in cooperation with Iowa, Wisconsin, Kentucky, Ohio, Pennsylvania, and Virginia. These included intensive studies of several small watersheds in Pennsylvania and Wisconsin to measure and explain changes in runoff and discharge of sediment induced by conservation practices.

Other Special Investigations

Comprehensive reports on the water resources of industrial-production areas were prepared in continuation of a series started in 1953. At that time the Business and Defense Services Administration requested an expanded program for the preparation of summary reports on the overall water resources and water situation in a number of important industrial centers. Manuscripts were prepared or reports published on the following areas during fiscal year 1956: Tacoma, Wash., New Orleans, La., Yadkin-Pee Dee River Basin, N. C., Neuse River Basin, N. C., Mobile, Ala., and Portland, Oreg.

Studies were continued of the water requirements for specific industries. A report on the water requirements of the carbon-black industry was published in 1956. Studies of the rayon, acetate-fiber, and aluminum industries were completed and manuscripts prepared.

The inventory of the occurrence and quality of saline water resources of the United States was continued. Activities were concentrated in New Mexico, for which a substantial amount of information is available. A study of the saline waters of North Dakota was completed.

Continued progress was made in the development of procedures and techniques for collection and appraisal of facts about radioactive substances dissolved in water. Special emphasis is being given to dissolved radio-elements in relation to geologic, chemical, and hydrologic factors. Studies of specific terranes were made in Texas, Colorado, Idaho, Nevada, and Arizona, and single-samples of water were collected from many sources throughout the United States. The work provides useful background data for studies of radioactive contamination of water, contributes to understanding of the occurrence of radioactive substances in water, and provides clues to the geologic environment through which the water has passed.

Research and Development

Active research in hydraulics and hydrology produced several significant results. A major improvement was achieved by purchasing an electronic computer that automatically tabulates daily discharges directly from the gage charts. Previously this work was done by time-consuming manual means. The device allows better use of time and manpower and saves many times its own cost. A step toward elimination of costly stilling wells at stream-gaging stations was taken by developing a bubbler-type sensing device to activate the stage recorder. Considerable progress was made in field studies of the factors that affect the artificial recharge of ground water, and of the principles that control the movement of water through unsaturated porous media. Further development was achieved of an electrical analog model for analyzing the hydraulic properties of nonhomogeneous aquifers. Rigorous field testing has demonstrated the ability of a new type of recorder to register continuously the electrical conductivity of water. This instrument promises a major advance toward economical collection of additional information about the load of dissolved solids in river waters. Studies completed during the year demonstrate that graphic plottings yield curves showing the relation between the sediment loads of rivers and the rate at which they discharge water. When the graphic relation is supplemented by occasional direct determinations of sediment load, the method can be used to compute the total load of sediments discharged during monthly and annual periods. This method is sufficiently accurate for many water-resource development problems.

A report on evaporation losses from Lake Mead, presenting the results of comparing extensive experimental techniques with records of actual water loss from the lake surface, was completed and placed in open file pending publication. Research in the theory of evaporation and in techniques for its measurement under a variety of conditions was continued.

Soil and Moisture Conservation

Investigations by the Geological Survey of various aspects of hydrologic and geologic conditions on public lands provide basic data necessary for the efficient use and management of those lands. The work is part of the soil-moisture-conservation program of the Department of the Interior and is dedicated to improvement and maintenance of the productive value of the 280 million acres of Federal land under the stewardship of the Department. Special attention was given to comprehensive investigations of water supplies in grazing areas in western Utah, southwestern Colorado, Nevada, and western Wyoming.

Technical Assistance Program

The overseas water-resource work by the Geological Survey was begun on a continuing basis in 1950, under terms of the United States technical assistance program. During 1956 agreements were in effect between the Geological Survey and the International Cooperation Administration. The investigations originated through requests for technical assistance from the various countries. Such requests were then relayed by the United States overseas missions.

Long-term projects were under way in eight countries at the end of fiscal year 1956. Six of these were primarily ground-water investigations and two were surface-water studies. The projects generally combine the training of a nucleus of foreign nationals in the methods and techniques of hydrologic investigations, with investigations of specific foreign areas in which water development has been proposed. At the end of the year, more than 100 nationals were receiving in-country training by Survey personnel on field projects in Afghanistan, Chile, Egypt, India, Iran, Libya, Pakistan and Peru. Compilation of the results of 5 years of geologic mapping and field reconnaissance in Saudi Arabia was continued in Washington with principal attention to preparation of a base map. A ground-water hydrologist was assigned to the Government of Jamaica for an initial period of 6 months, subject to extension, to advise on ground-water problems and to demonstrate methods and techniques for ground-water investiga-

tions. During the year, visiting citizens of the Belgian Congo, China, Egypt, Formosa, Iran, Iraq, Pakistan, and the Philippines received training in the United States.

Work on Publications

The primary purpose of the Geological Survey is to provide for the people and the agencies of Government, information necessary for the exploration, development, and conservation of our mineral and water resources. As this information becomes available through investigations, surveys, and research, fulfillment of this purpose is served by publication of a variety of reports, maps, and charts. The information is published in part by the Survey, in part by cooperating States, and in part by many scientific journals. These publications include maps of the topographic and geologic features of the Nation, studies of mining districts and mineral deposits, of the composition and structure of rocks and minerals, of fossils and the rocks in which they are found, of geophysics and geochemistry, and studies of streamflow, ground waters, and their chemical quality.

During fiscal 1956, 849 reports including geologic and hydrologic maps were submitted for publication. Of these 356 were for publication by the Geological Survey, 41 as professional papers, 92 as bulletins, 49 as water-supply papers, 15 as circulars, and 159 in the various map series, and the remainder for publication by cooperating agencies or scientific journals.

Preparation

In this period 180 new manuscripts were sent to the printer and 147 were published. Work on new manuscripts prepared in fiscal year 1956 included the editing of 24,120 pages; checking of 3,733 galley proofs and 12,817 page proofs. Printed reports delivered included 17 professional papers, 60 bulletins, 45 water-supply papers, 8 circulars, 14 chapters for the new edition of the topographic manual, and 3 hydrologic atlases.

Illustrations to accompany reports published by the Survey were prepared at an increased rate. Completed and transmitted for publication were illustrations for 105 reports, an increase of 13 over the preceding fiscal year. The 57 bulletins, 28 professional papers, 19 water-supply papers, and 1 hydrologic atlas included in this group, and an additional 8 circulars, required 2,677 drawings and photographs, of which 137 were for multicolor reproduction.

Final copy for 188 geologic maps for publication in the Geological Survey's map series and 2,353 topographic and related maps were transmitted for reproduction.

Map Reproduction

The production of maps increased about 13 percent over the past fiscal year. The following is a summary of map reproduction work:

	New	Reprinted
Topographic and related maps:		
Standard topographic	[1] 1,856	[2] 303
Standard topographic (Engineers)	2	249
Standard topographic (revisions)	[3] 100	
1:250,000 scale	[4] 20	[4] 12
Scale conversion	37	
Planimetric	11	21
State base	7	11
State topographic indexes	43	
Status index	1	3
Miscellaneous	5	100
Geologic maps:		
Geologic quadrangle	28	
Mineral investigation	25	3
Geologic indexes	2	2
Coal	12	
Oil and gas maps	25	5
Oil and gas charts	5	
State geologic	2	
Geophysical Investigation	1	2
Geologic status	1	
Miscellaneous	104	1
River Survey maps	17	
Water Resources maps	3	
Total	2,307	712

[1] Includes 10 printed by other Government agencies.
[2] Includes 18 printed by other Government agencies.
[3] Includes 20 printed by other Government agencies.
[4] Printed by other Government agencies.

These 3,019 new and reprinted map editions comprise 8,995,432 copies and 42,869,800 impressions, of which 8,798,962 copies and 41,733,800 impressions were printed in the Survey's plant. These maps range in size from 18 by 22 inches to 50 by 72 inches. They included the geologic State map of Montana and 13 city and vicinity maps, such as Cleveland, New Orleans, Salt Lake City, and San Diego.

In addition to the foregoing production, 1,328 jobs comprising miscellaneous maps and other preliminary map services were completed. This printing includes 324 maps amounting to 601,198 copies and 5,162,984 impressions of which 115 were illustrations comprising 443,700 copies and 1,633,000 impressions for the Government Printing Office. The rest of the miscellaneous printing and service was done for other units of Government. Also 2,023 type jobs (impressions on cellophane for map preparation) were delivered, and 587 maps were mounted on cloth.

The total cost of all production was $1,545,502. Of this amount $25,688 was received from other agencies for map sales, and $23,874 was received for printing or service work. The remainder of the cost, $1,495,940 was charged to Survey funds. These costs do not include $12,064 representing negotiated credit the value of maps received from Army Map Service on an exchange basis.

A summary of the work performed in the Survey's reproduction plant includes: reproduction and delivery of 9,400,160 map copies (46,896,784 impressions); preparation of 12,274 photolithographic printing plates, 1,121 printing plates, 10,406 photolithographic negatives, 8,932 photographic negatives ranging from 2 by 2½ inches to 30 by 40 inches, 15,054 prints ranging from 1½ by 2 inches to 40 by 72 inches; preparation of 606 lantern slides; developing and printing of 59,100 feet of 35 mm. aerial film; and the mounting of 814 prints.

Distribution

The warehousing of Geological Survey publications is handled through facilities at Washington, Denver, and Fairbanks, and distribution of maps, folios, and circulars from these points is aided by 11 other Survey field offices. Further distribution is carried out by 435 commercial agents who purchase maps for resale to the public.

In addition to approximately 29 million items on hand at the beginning of the year, 277,000 copies of 214 separate reports in book and pamphlet form (printed by the Government Printing Office and the Interior duplicating section) and 9 million copies of 3,019 new and reprinted maps printed by the Geological Survey were received.

The distribution of approximately 3,300,000 maps and 275,000 book reports and pamphlets during fiscal year 1956 was an increase of 62,000 copies over the preceding year and represented the largest annual volume of distribution by the Geological Survey to date. In addition, more than 100,000 copies of the Survey's monthly announcements of new publications were distributed through the Superintendent of Documents. This total distribution was accomplished through the receipt and processing of more than 200,000 individual requests and resulted in the receipt of $410,000 from the sale of maps, $26,000 of which was received from other Federal agencies. These receipts do not include $12,064 representing the negotiated credit value of maps supplied to Army Map Service on an exchange basis. The distribution of maps for official, educational, and congressional use continued to be approximately 33 percent of all maps distributed.

The total number of copies distributed by Geological Survey offices as compared with fiscal year 1955 is shown in the following table:

	Fiscal year 1955 maps, reports, and indexes	Fiscal year 1956 maps, reports, and indexes	Percent increase or decrease
Washington	[1] 2, 293, 300	2, 438, 250	+6
Denver	[1] 964, 600	878, 550	−9
Fairbanks	[1] 35, 850	44, 200	+23
Other field offices	[1] 203, 850	198, 950	−2
Total	3, 497, 600	3, 559, 950	+2

[1] Figures adjusted to revised reporting procedure.

Public Inquiries Offices

Establishment since June 1950 of five Public Inquiries Offices in Denver, Colo., Salt Lake City, Utah, San Francisco and Los Angeles, Calif., and Anchorage, Alaska, has resulted in a substantial improvement in the availability of the results of Survey investigations to the public. These offices carry stocks of Survey maps and reports concerning their respective areas, answer all types of inquiries, and direct specific questions on technical matters to appropriate Division technical officers. Maps and reports are sold "over the counter" but the offices are not equipped to handle mail orders.

FUNDS

During the fiscal year 1956, obligations were incurred under the direction of the Geological Survey totaling $49,269,237. Of this amount 57 percent was appropriated directly to the Geological Survey, 30 percent was made available by other Federal agencies, and 13 percent by States and their political subdivisions.

Source and use of funds in fiscal year 1956

Topographic surveys and mapping:		
Geological Survey appropriation		$11,808,861
Reimbursements from non-Federal sources:		
States, counties, and municipalities	$1,263,510	
Sale to the public of aerial photographs and photographic copies of records	90,278	
Sale of personal property	39,483	
		1,393,271
Reimbursements from other Federal agencies:		
Bureau of Reclamation	1,019,044	
Department of the Air Force	707,666	
Department of the Army	555,700	
Department of the Navy	209,000	
Miscellaneous	291,383	2,782,793
Total appropriation and reimbursements		15,984,925
Direct State payments		7,813
Total, topographic surveys and mapping		15,992,738
Geologic and mineral resource surveys and mapping:		
Geological Survey appropriation		5,718,441
Reimbursements from non-Federal sources:		
States, counties, and municipalities	$215,686	
Sale of personal property	20,898	
		236,584

Geological and mineral resource surveys and mapping—Continued		
Reimbursements from other Federal agencies:		
Bureau of Reclamation	$111,538	
Defense Minerals Exploration Administration	440,827	
Department of the Army	1,022,765	
Department of the Navy	338,507	
Atomic Energy Commission	5,579,244	
International Cooperation Administration	577,077	
General Services Administration	258,931	
Government Printing Office—map reproduction	96,259	
Miscellaneous	114,029	$8,539,177
Total, geologic and mineral resource surveys and mapping		14,494,202
Water resources investigations:		
Geological Survey appropriation		7,655,038
Reimbursements from non-Federal sources:		
States, counties, and municipalities	$3,592,863	
Permittees and licensees of the Federal Power Commission	123,182	
Sale of personal property	49,333	
		3,765,378
Reimbursements from other Federal agencies:		
Bureau of Reclamation	995,641	
Department of the Army	1,102,247	
Department of Agriculture	181,794	
Atomic Energy Commission	341,398	
International Cooperation Administration	479,684	
Miscellaneous	511,055	3,611,819
Total appropriation and reimbursements		15,032,235
Direct State payments		1,021,051
Total water resources investigations		16,053,286
Soil and moisture conservation: Geological Survey appropriation		104,010
Supervising mineral leases and classification of lands:		
Geological Survey appropriation		1,787,557
Reimbursements from non-Federal sources: Sale of personal property		1,387
Reimbursement from other Federal agencies: Miscellaneous		51,249
Total, supervising mineral leases and classification of lands		1,840,193
General administration: Geological Survey appropriation		784,808

Summary:		
Geological Survey appropriation		$27,858,715
Reimbursements from non-Federal sources:		
States, counties, and municipalities	$5,072,059	
Miscellaneous	324,561	
		5,396,620
Reimbursements from other Federal agencies		14,985,038
Total appropriation and reimbursements		48,240,373
Direct State payments		1,028,864
Grand total		49,269,237

BUREAU OF MINES

Thos. H. Miller, *Acting Director*[1]

FOREWORD

SOARING demands for minerals and fuels to feed the Nation's upsurging economy formed the background for endeavors and attainments by the Bureau of Mines in fiscal year 1956 in promoting conservation of resources and furthering safety in the mineral industries.

Efforts to broaden the Nation's resource base of metals and nonmetallic minerals were emphasized during the year and were encouraged by a 40-percent increase in funds to permit strengthening of much of this work in the coming fiscal year. More was learned about the extent and character of submarginal deposits, and advances were made in developing methods for utilizing them. New, superior alloys to meet more exacting requirements were developed, and progress was made in synthesizing strategic materials in which the Nation is deficient.

Two important factors affecting the Bureau's fuel programs were a dramatic upswing in the bituminous-coal industry and failure of the anthracite industry to share in this growth. Simultaneously there occurred stronger preference for liquid and gaseous fuels.

The Bureau's research on mining, preparation, carbonization, and combustion of coal continued, and, in cooperation with industry, a special study was made which outlined more than 200 possible fields of coal research. Work on anthracite was concentrated on finding new uses and on instituting a cooperative program with the Commonwealth of Pennsylvania for conserving reserves threatened by flooding.

Research designed to increase ultimate recovery of petroleum and to point the way to its more efficient refining, storage, and use progressed steadily with the aid and cooperation of industry. Important studies

[1] J. J. Forbes was Director of the Bureau of Mines until November 30, 1955. Thos. H. Miller was Acting Director throughout the remainder of the fiscal year.

in the transportation and storage of natural gas were completed. In addition, methods of obtaining liquid and gaseous fuels from coal and oil shale were studied in a continuing effort to assure this Nation an adequate supply of such fuels at some future time.

Production of the lightweight, inert gas helium reached a new high as demands from Government, industry, and research groups continued to soar. A temporary shortage early in the fiscal year was overcome, but limitations can be expected until expansion of the Bureau's helium plant at Exell, Tex., is completed in the spring of 1957.

Cooperating with the Public Health Service and industry's Coordinating Research Council in air-pollution studies, the Bureau began research on the role of automotive exhaust gases. An automobile engine and precision instruments were installed for this work, which will involve analysis of exhaust gases created under various operating conditions.

The Bureau strengthened its safety educational program, first instituted 46 years ago, and concentrated on research to lessen the roof-fall hazards in mines. As coal-mine inspection work under the Federal Coal Mine Safety Act became increasingly effective, there was a substantial decrease in safety violations.

Failure of coal-mine fatalities to decline, even though the year passed without a major disaster, showed the need for increased attention by management and labor to day-to-day occupational hazards.

Two important developments in the Bureau's program of testing equipment for safe use in coal mines were the adoption of standards for approving underground lighting systems and for testing the fire resistance of conveyor belts.

Major policy decisions in Government continued to lean heavily upon compilation and interpretation of facts regarding foreign and domestic mineral production, consumption, and reserves. Meanwhile, the Bureau helped friendly nations conserve and develop their own mineral resources and worked with the International Cooperation Administration by sending technologists abroad and by training foreign mineral and fuel technologists brought to America to observe and learn.

The Bureau and its employees were honored by representation on many technical, industrial, and Government committees and boards, including the American Gas Association, American Society for Testing Materials, the American Institute of Mining, Metallurgical, and Petroleum Engineers, the National Academy of Sciences, the American Petroleum Institute, the Interstate Oil Compact Commission, the American Chemical Society, and the American Standards Association.

Details of these and the many other developments of the year are described in the sections that follow.

MINERAL DEVELOPMENT

Mineral consumption continued upward in fiscal year 1956, taxing many mines and plants to capacity. Recognizing the growing pressure on our resources, Congress increased the Bureau of Mines appropriations for mineral research and related studies in the coming year.

In 1956 Bureau services to the Office of Minerals Mobilization were expanded, and a liaison office was established, staffed by 2 top members of the Bureau of Mines, serving on rotating assignment, 2 consultants, and a full-time secretary. Eighteen special reports were completed by the Bureau for OMM.

The Bureau continued participation, with the Geological Survey, in the Defense Minerals Exploration Administration program fostering discovery and development of new sources of strategic and critical minerals. Bureau-Survey field teams examined loan applicants' properties, recommended actions, and directed and reported on DMEA projects underway. The Bureau also continued to provide technical assistance for the General Services Administration at mines and plants holding Government contracts.

Base Metals

Marked improvement in ore recovery, which will mean substantial conservation of resources, is expected to result from applied physics studies which were underway by the Bureau at three of the Nation's largest underground copper mines. As with past research of this type, results will be made available to the entire industry.

Information on low-grade Red-Bed copper deposits in Colorado and New Mexico were compiled, and investigations of copper deposits in remote areas in Washington and Alaska still were in progress at year's end. In another phase of the investigation encouraging progress was noted in recovering more copper from oxide and oxide-sulfide ores. Further studies extending into the new fiscal year will cover beneficiation, hydrometallurgical, and pyrometallurgical problems.

Efforts to conserve lead and zinc included compilation of mineral atlases, helpful in exploration, and research to evaluate geophysics for discovering additional ore in the Tri-State mining district of Missouri, Kansas, and Oklahoma. Experiments were conducted for improving recovery of lead and zinc sulfides lost in present milling practices. Efforts to recover zinc from oxidized ores by caustic leaching and by chemical precipitation progressed, as did long-range work to improve zinc-base alloys.

An extensive program on secondary nonferrous metals gave encouraging results. Invention reports were filed on a vertical

amalgam electrode and a new chloride electrolyte for recovering pure metallic zinc from galvanizers' residue. An improved retort for use in vacuum-distillation furnace processes was developed to a semi-commercial stage, and progress was made in recovering tin from "hardhead," a tin-smelter waste, by selective oxidation of iron. Work also was continued on a process to recover a bulk sublimate of cadmium, germanium, and other valuable metals from zinc concentrates, and the Bureau successfully completed the first phase of a study on separating magnesium and cadmium from a magnesium-cadmium-aluminum alloy.

Mercury-resources studies were expanded in 1956. Methods for treating complex Alaskan mercury-antimony ores were developed and now are being adapted to continuous operation to facilitate their possible use by industry.

Ceramic and Fertilizer Materials

As part of its extended program for conserving western phosphate-rock resources, the Bureau continued to participate with industry in testing and redesigning its experimental pneumatic vibrating-blade planer for underground mining. These tests proved that certain phosphate rock can be planed and that some advantages are gained by long-face planer mining. Since no blasting is required, a cleaner product results. Furthermore, the need for supporting pillars may be reduced, permitting higher recovery and consequent extension of phosphate resources. By the end of the fiscal year enough operating facts had been obtained to permit design of an improved planer for testing under varied conditions.

Late in the year regional and headquarters representatives established new standards for selecting projects in the Bureau's long-range ceramic-materials programs. Clay resources, particularly in Washington, Idaho, Colorado, and Utah, were reconnoitered and evaluated.

Research went ahead on carbides, borides, silicides, and nitrides as substitutes for industrial diamonds and as possible high-temperature refractory materials.

With the major objective of developing substitutes for strategic muscovite block and film mica, the Bureau conducted research on factors affecting crystallization of fluorphlogopite mica, sought new compositions superior to those now used, and studied reconstitution of flake synthetic mica into sheets suitable for strategic and nonstrategic uses. Although much progress has been made in this field, the Bureau recognizes the need for deeper studies covering the properties of synthetic-mica compositions and factors affecting the growth of large crystals.

Construction and Chemical Materials

The Bureau conducted laboratory and pilot-plant research on methods for recovering fluorine from phosphate rock and low-grade phosphatic shales and plans to expand this work to cover low-grade fluorspar deposits. Studying the fluorspar situation intensively, it also prepared several special reports for the Office of Minerals Mobilization and other Federal agencies.

Bureau engineers examined California and Maine asbestos deposits, while metallurgists studied the possible byproduct value of small percentages of chromium and nickel observed in the Maine drill cores. Basic investigations of properties important to asbestos technology were emphasized, and further progress was made in synthesizing asbestos or asbestoslike fibers. At year's end research on fiber crystallization was in progress and the possibility of patenting a product combining synthetic fluoramphibole with synthetic mica was under consideration.

Entering a new and important field, Bureau engineers began studying water problems of the mineral industries. These projects concerned the quality of water required by processing plants and the mineral constituents of waterborne wastes.

Recognizing that the new national highway-construction program poses many materials problems, the Bureau completed a second survey of future cement production capacity and began studying the availability of concrete aggregate supplies.

Ferrous Metals and Ferroalloys

The year's major items in the Bureau's program to assure adequate domestic iron-ore output involved searches for improved production methods and satisfactory metallurgical classification of deposits. More than 800 bulk samples of Lake Superior taconite were classified, and extensive ore-dressing tests were made on low-grade iron ore from Texas, the Southeast, and the Pacific Northwest and on titaniferous iron ore from Alaska.

Seeking improved steelmaking techniques, the Bureau obtained new information on high-temperature reactions, studied the effects of boron and rare earths on mechanical properties of steel, and counted advances in resulfurizing and decarburizing molten steel by jet injection. It continued work on the portable top-fired scrap preheater it had developed to cut metal losses and melting time in steelmaking furnaces.

In research on utilizing submarginal domestic manganese resources, the Bureau obtained good recoveries by percolation leaching of wad ores with sulfur dioxide and by ammoniacal-ammonium carbonate

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leaching of reduced materials from Aroostock County, Maine. A report disclosed 59 million long tons of material averaging 4.9 percent manganese in 25 percent of the Batesville, Ark., district surveyed. Tests showed that a concentrate acceptable for the national stockpile can be prepared from it. Other research showed that within certain limits titanium can be substituted for manganese to overcome the harmful effects of sulfur in steel.

Studies in upgrading domestic chromite included producing chromium alloys experimentally by direct smelting of ore and concentrate and improving methods of creating and fabricating high-purity ductile chromium. Samples were given other Government agencies and industry for further study. Beneficiation of chromite-bearing laterites proved encouraging, and refractory properties of Oregon and Montana chromites were studied further.

Massive ductile molybdenum was produced experimentally by Bureau metallurgists, who also made progress in developing methods for treating low-grade, complex tungsten ores. Examination of tungsten deposits yielded more knowledge of potential domestic resources of this essential metal.

Another ferrous-metals study was aimed at lowering the cost of producing vanadium metal in an effort to encourage its wider use.

Metallurgical projects on nickel involved ways of treating ore at the United States Government-owned Nicaro, Cuba, plant under a 2-year agreement with the General Services Administration. Efforts were directed toward recovering byproduct cobalt, chromium, and iron.

Light Metals

Bureau research has shown that aluminum-silicon alloys can be obtained by electrically smelting offgrade domestic materials not now suitable for alumina production and that commercially pure aluminum can be obtained from them in the laboratory. Operating variables were studied, and the equipment was altered to improve quality and to increase yield.

Laboratory tests yielded basic information for improving methods of producing alumina from Wyoming anorthosite by the lime-soda sinter process. The effect on alumina recovery of varying feed composition and operating conditions was studied intensively.

As research progressed on developing new magnesium alloys, the Bureau also provided fundamental information which encouraged greater use of this lightest of structural metals in aircraft, other transportation equipment, and industrial machinery.

Electrolytic purification of titanium scrap and offgrade sponge indicated that titanium can be eletrorefined to remove virtually all

of the iron, oxygen, tin, nitrogen, molybdenum, and zirconium and most of the aluminum and chromium. The Bureau also continued to investigate the sodium reduction of titanium tetrachloride for producing high-purity metal.

Under a cooperative agreement with the Wah Chang Corp., extended to June 1957, the Bureau continued to improve titanium-sponge production techniques by the magnesium-reduction process. Innovations have created sponge of higher and more uniform quality.

After entering into a cooperative agreement with the General Services Administration for utilizing domestic ilmenites for titanium, the Bureau conducted smelting runs at the Albany, Oreg., station producing slag containing 70 to 98 percent equivalent titanium dioxide from Idaho, Florida, and South Carolina ilmenites. At the Boulder City, Nev., station, some of this was treated to produce titanium tetrachloride suitable for metal production.

Various factors in casting titanium were evaluated at Albany, Oreg., a 150-pound furnace being used to determine optimum mold materials, methods for utilizing scrap, and techniques for semicontinuous casting. Two small casting furnaces were designed and built for the Naval Research Laboratory and Army Ordnance.

Rare and Precious Metals

Idaho and South Carolina placer deposits identified during the Bureau's search for uranium and thorium for the Atomic Energy Commission were exploited by industry on a substantial scale. During the year the Bureau, under a contract with AEC, analyzed more than 24,000 mineral samples submitted by the public and believed possibly to contain fissionable elements.

By the end of the year the Bureau had turned over to industry the facilities for producing reactor-grade zirconium at the Bureau's Northwest Electrodevelopment Laboratory, Albany, Oreg., with the Bureau recovering hafnium metal from a chemical byproduct. Both metals were required by the AEC. In its own laboratories the Bureau continued efforts to improve zirconium-hafnium production techniques.

Under other agreements with the AEC, the Bureau conducted research on thorium-metal technology, the preparation and properties of rare-earth-metal alloys, and the beneficiation and hydrometallurgy of uranium ores, including uraniferous lignites.

On a laboratory scale the Bureau developed a flotation process that promises a commercial method for recovering beryl from pegmatite ores of Kings Mountain, N. C. Success of the Bureau in recovering columbium and tantalum from tin slags and domestic ores led a

private company to build a pilot plant for treating columbium-tantalum concentrates.

Cooperating with the General Services Administration, the Bureau stepped up its program on selenium, a scarce strategic metal, seeking ores intensively in many Western States. On a laboratory scale, seleniferous ores from Wyoming and the Colorado Plateau as well as various smelter byproducts were processed for selenium values.

Research on rare-earth metals at the Bureau's Reno, Nev., station, was expanded; accomplishments included development of new instrument-analysis techniques for rapid and reliable determination of the rare-earth elements and progress in developing extraction and refining processes for producing the rare earths in pure forms.

Miscellaneous Research on Minerals

Besides surveying mining methods and costs in cooperation with industry, the Bureau continued studies of the mathematical principles governing sampling of mineral deposits, drilling research, and laboratory analyses of the physical properties of mine rock to reduce the amount of work necessary to establish mineral reserves. Design, construction, and use of instruments to measure physical properties and reactions to stresses generated by mining continued. Field work intended to utilize fully developed instruments and to test and improve others included investigations of blasting, mining in various types of rock, and roof support.

Determination of thermodynamic constants needed by metallurgists and others engaged in applied research continued, as did other basic studies on theories and formulas governing thickening, sedimentation, flocculation, analysis, electrostatic separation, flotation, ultrasonics, and development of synthetic materials.

Work conducted in cooperation with universities included a continuing study of drilling and new investigations on hydraulically placed mine fill and the use of precast concrete members for underground support.

BITUMINOUS-COAL RESEARCH AND RELATED ACTIVITIES

The continuous rise in bituminous-coal production since 1954 and the expectation that increasing demands for energy will cause this trend to continue and even accelerate strongly influenced the Bureau's efforts to promote conservation of coal resources. Statistical and economic studies were continued along with evaluation of foreign and domestic research programs.

Technologic Research

An outstanding development was a survey of coal research possibilities, which was made in cooperation with Bituminous Coal Research, Inc. This widely publicized study, outlining more than 200 projects, will help in establishing a comprehensive research program for coal technology in which all interested agencies, public and private, can participate.

Additional knowledge of the structure and constitution of coal was accumulated through research involving degradation, analysis, and physical measurements. Methods of coal classification and moisture determination proposed by the International Standards Organization and the Economic Commission for Europe were evaluated. In Alaska, the Bureau's coal work included exploration of coal areas and the establishment of a permanent testing laboratory. In the United States, methods and equipment used in coal mining were appraised, including modified longwall mining with German planers, and the use of large augers in surface operations.

In associated fields, the Bureau continued search for more effective methods for cleaning, dewatering, transporting and utilizing coal, developing test equipment, instrumentation, and techniques as necessary. Basic principles of flotation and modern feldspar jig cleaning of fine coal were among processes studied.

Continuing studies in the mechanism and kinetics of coal carbonization included investigation of the effects of pretreatment. In the Bureau's pilot-scale retort carbonizer, 31 eastern coals or blends not now widely used for producing metallurgical coke were carbonized experimentally. Cooperative studies with western steel companies were aimed at improving coke made from locally available coals. Studies were also made of the effects of blending inerts such as anthracite fines and petroleum coke on the quality of coke produced.

Besides helping other Federal agencies solve combustion and boiler-water treatment problems, the Bureau began a new fluid dynamics research project; flow patterns of gases and dusts in combustion equipment and pneumatic transport of solids were the initial phases studied.

Several problems of incinerating radioactive wastes were undertaken and a special incinerator was designed. As part of an effort to prevent or extinguish refuse fires, the effect of composition on the rate of spontaneous heating of coal-mine refuse was examined.

Fluid Fuels From Coal

Coal-to-oil research included additional fundamental studies of the chemistry of coal. Bench-scale and pilot-plant experimentation continued in an effort to improve synthetic liquid fuels processes.

The hot-carbonate technique for purifying synthesis gas was found superior. Fundamentals of the Fischer-Tropsch synthesis were restudied and catalysts that give high-quality gasoline and high yields of gasoline were evaluated. Efforts to engineer a one-step coal hydrogenation process have shown that temperature-control will be a difficult problem. Dry coal hydrogenation through stepwise heating of the coal was examined and appears promising.

Both synthesis and pipeline gases were involved in the coal-to-gas research. Work on synthesis gas was directed toward lowering costs by devising processes that either do not require relatively pure oxygen or will permit cheaper separation of oxygen from air. Pilot-scale runs on a process for making synthesis or pipeline gas from producer gas and steam, using a form of iron as a catalyst, were started. Studies were made on costs and materials of construction for use of nuclear energy in coal gasification. Tests were run in two simulated (electrically heated) reactors, and these indicated possibilities of reducing costs.

Laboratory studies were made of gasification of water slurries of low-rank, highly reactive coals. Development continued on a pulverized coal-oxygen pressure gasifier, and several feeding systems were evaluated. Kinetics of gasification reactions and behavior of gas-solids systems likewise were investigated.

The study of underground gasification of coal progressed in cooperation with the Alabama Power Co. and the Standard Oil and Gas Co., and an industry advisory committee was established. Work during the year was concerned with preparing a satisfactory gasification zone in a hydraulically fractured coal bed.

Bituminous-coal Economics and Statistics

Bituminous-coal production rose steadily during the year in response to demands by electric utilities, coke plants, and the export market. Forecasts that the trend would continue upward to unprecedented heights in the next two decades naturally caused attention to focus on how the producing industry will prepare to meet these anticipated requirements.

As an economic guide to technologic research, estimates were made of future energy requirements by each major energy consumer group.

Statistical and economic research increased in volume and scope to determine the factors that will govern the amounts of solid fuels and methods of production, distribution, and consumption of coal, its exportation, and its relative position in competitive energy markets. Special analyses were made of solid fuels mobilization requirements, particularly in relation to production of steel and other strategic

commodities. Data on coal, coke, coal chemicals, foreign solid fuels, and energy trends were supplied to various members and committees of the Congress, to Federal and State agencies, and to others.

ANTHRACITE ACTIVITIES

Anthracite Research

Preliminary tests with a Bureau-designed pneumatic coal planer were completed in November 1955 after demonstrating that the hardest anthracite can be planed. Use of this device under production conditions is planned for the coming year.

Test data indicated the practical value in anthracite mining of backfilling chambers with a pneumatic machine preparatory to recovering pillars of coal. The packing rate that a fully mechanized operation would require for backfilling is within the range of the results obtained in the experiment.

In studies in the Bureau's experimental blast furnace at Pittsburgh, Pa., anthracite was substituted satisfactorily for up to 40 percent of the coke required for smelting untreated Mesabi iron ore and up to 60 percent for smelting prepared ore. When pellets were smelted, use of anthracite as part of the charge lowered fuel requirements and increased production at a constant blowing rate. The resulting metal was slightly lower in sulfur when anthracite was used, even though the anthracite was slightly higher in sulfur than the coke it replaced. Egg and Stove sizes of anthracite performed equally well.

Research on producing metallurgical fuel with anthracite as its principal ingredient indicated that after calcination (a form of heat treatment) a briquet made in the laboratory resists impact and abrasion as well as either furnace or foundry coke. Coal tar, petroleum pitches, and bituminous coal were studied as binders for anthracite and various briquetting devices and treatment temperatures were investigated.

Calcination studies of lump anthracite aimed at making it more suitable for metallurgical use indicated the possibility of improving its physical properties. Products containing less than 0.1 percent volatile matter were prepared readily in pilot-scale equipment.

Breakers in the Pennsylvania anthracite region were sampled, at the operators' request, and analyses of current production were made.

Anthracite Flood Control

A Branch of Mine Drainage was established at the Bureau's Anthracite Experiment Station, Schuylkill Haven, Pa., late in 1955. Its chief function is to review and evaluate mine-drainage projects

proposed by the Commonwealth of Pennsylvania under Public Law 162, 84th Congress, which authorized Federal contributions up to $8.5 million to match the State's expenditures for such projects.

Data on mine-water pools, barrier pillars, and surface-water seepage previously compiled by the Bureau were brought up to date. Several projects were evaluated jointly with engineers of the Pennsylvania Department of Mines and Mineral Industries and of anthracite operators.

Anthracite Economics and Statistics

Weekly, monthly, and annual reports on production and distribution of anthracite were issued, enabling operators and others to obtain clearer perspectives of the industry's many economic problems.

PETROLEUM AND NATURAL GAS RESEARCH

Petroleum and Natural-gas Production

During the year, one Bureau of Mines report supplied answers to reservoir appraisal problems that have troubled petroleum engineers for years. Another, covering a study of gas-storage operations in a depleted oil reservoir, pointed the way to efficient secondary-recovery methods for deep-seated reservoirs and provided valuable information on pressure-maintenance by use of natural gas.

In a new field of research, the Bureau successfully applied and extended paper chromotographic methods to separate and study porphyrin aggregates isolated from crude oil; these substances cause production difficulties.

Certain phases of research on clays in petroleum reservoirs were completed and substantial advances were made in identifying clays. Progress also was made on other engineering studies of selected Arkansas, California, Kansas, Kentucky, Louisiana, Oklahoma, and Texas oilfields.

Progress was satisfactory in laboratory experiments to determine relative permeability of selected core samples and the stability and adsorptive characteristics of complex compounds of iridium 192, used to trace underground flow in secondary-recovery work. A study of electrical and surface forces in fluid flow was expanded to include reactive reservoir solids, such as clay minerals. Promising results were obtained in exploratory studies of the effects of detergent solutions on the resistance and permeability of an aluminum-oxide plug during oil displacement. Work on the effects of wettability on the permeability of inert porous plugs to homogeneous liquids was completed.

Experimental use of a foam detergent in the water-flooding of prepared oil-formation specimens progressed to the point where enlarged equipment is being adapted to further trials by the Bureau. Tests were completed on surface properties of a series of nonionic detergents and on the use of propane in isolating asphalt fractions rich in nitrogenous and interfacially active materials. Final results of a large-scale field test of detergents for water flooding in Oklahoma were published.

Thirty reports were completed on scientific and engineering research related to primary and secondary petroleum-recovery operations, Missouri River Basin studies, and a special natural gas pipeline survey for the Governor of Alaska.

Present and proposed Bureau petroleum-research projects were re-evaluated in conjunction with a comprehensive survey of the industry's production-research program. A steering committee formed during the year suggested ways of using manpower and equipment more efficiently and closer coordination of Bureau research with that of industry.

Transportation and Storage

Field tests were conducted on 6 natural-gas underground reservoirs in studying the deliverability of gas from storage reservoirs. Investigation of the theory of transient pressure conditions within a natural-gas reservoir having been completed, the Bureau seeks to develop methods of predicting the productivity of natural-gas wells.

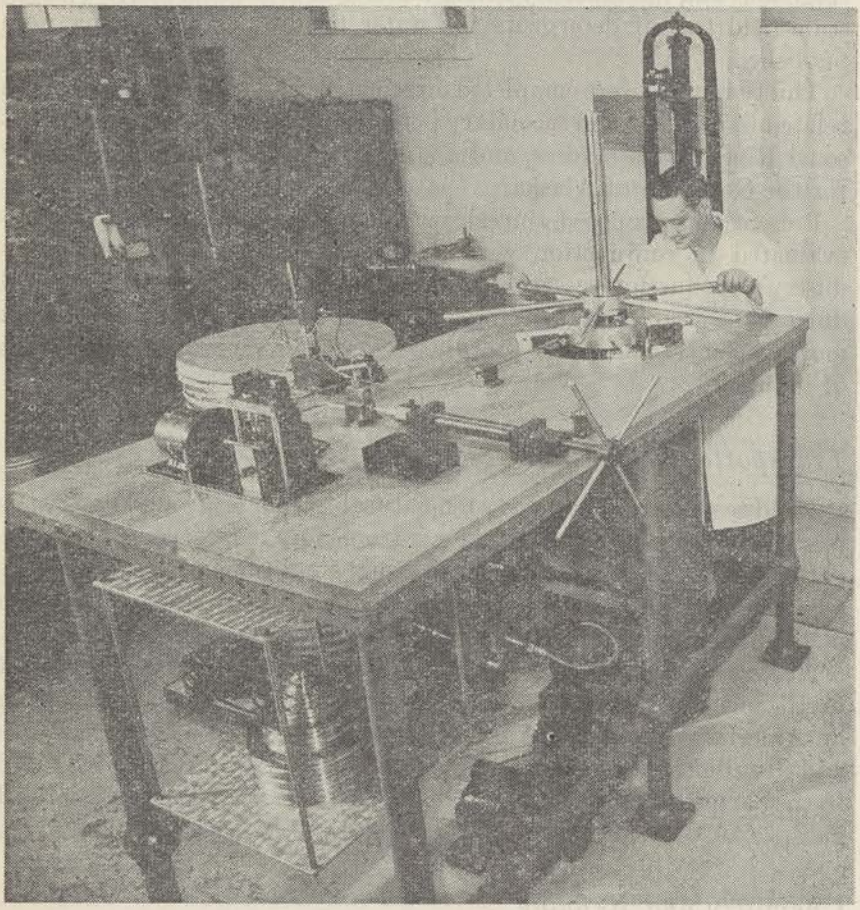
An engineering study of an underground natural-gas storage project in Illinois was reactivated, and staff members aided in formulating an American Standards Association safety code on gas-transmission and distribution systems and advised the United States Coast Guard in preparing standards for water transportation of liquefied natural gas.

Chemistry and Refining

As an aid to producers and consumers, the Bureau continued its research on autoignition characteristics of diesel fuels and pure hydrocarbons found in them. Based on analyses of heat transfer in the preignition phase of the diesel cycle, an equation was developed to define the rate of heat transfer in terms of combustion chamber conditions.

Analyses were made of 330 domestic and foreign crude oils, a gain of more than 50 percent over last year's total. A special report on the availability of specific fuels from various crudes was prepared for the Air Materiel Command.

A major development in the Bureau's survey of sulfur in petroleum was identification of thiophene in Wilmington, Calif., crude oil. In a related phase, adsorption techniques are being developed for concentrating and separating sulfur compounds from relatively high-boiling fractions of petroleum. Five standard reference samples of



Special compressibility apparatus in Bureau of Mines thermodynamics laboratory for determining pressure-volume-temperature relationships of petroleum components.

organic sulfur compounds were purified by Bureau technicians and prepared for distribution to other research groups.

Satisfactory progress was counted in developing techniques for concentrating and separating nitrogen compounds from crude oil and studies are under way to determine the effects of thermal decomposition of such compounds in petroleum fractions. Three purified organic nitrogen compounds were prepared as reference standards.

Emphasis in the Bureau's research on stability of distillate fuels shifted from study of storage characteristics to the basic causes of instability. As oxidation appears to be an important factor, the mechanisms involved are being studied. Samples were obtained for a stability research program on gasoline, and storage tests were begun.

Nationwide surveys were continued on the quality of domestic motor gasoline, aviation fuels and diesel fuels. In addition, burner fuels were included in the survey work for the first time.

Work in thermodynamics included precise measurement of such properties as heat capacity, heat of combustion, vapor pressure, and heat of vaporization for 19 organic sulfur, nitrogen, and fluorine compounds and for 9 hydrocarbons. Heats of combustion and formation were determined for tetraethyllead, solving a difficult problem of long standing. Complete thermodynamic functions were calculated for seven compounds for which measurements were completed. Distinctive recognition to the Bureau's petroleum research work came with the invitation to a staff member to present a paper, "Rotating Bomb Calorimetry," before the Faraday Society, Manchester, England.

In addition to many special reports to cooperators and supporting Government agencies, and several technical book chapters, 30 reports of the chemistry, refining and thermodynamics work were prepared for publication.

Petroleum and Natural Gas Economics

During the year the Bureau completely revised the old energy tables of mineral fuels covering production, and prepared new energy tables covering calculated consumption of all fossil fuels and waterpower.

In October the Bureau of the Budget requested a comprehensive study and review of all Bureau of Mines petroleum questionnaires to determine whether improvements might be made and if some forms could be eliminated. Several meetings were held; 14 agencies were represented at the first, members of the Statistical Committee of the American Petroleum Institute attended the second and agreed to establish regional committees to study the forms, and representatives of the American Gas Association attended another session.

Adoption of the following projects, recommended by representatives of other Government agencies and industry, will be contingent upon availability of funds:

1. Obtain better statistics on production with breakdowns by smaller areas than States, for instance counties.

2. Obtain more detailed data on interdistrict movement of crude oil and products.

3. Improve coverage of the report on refinery capacity and provide more data on miscellaneous petroleum products.

4. Explore the practicability of providing data, in future years, on petrochemicals and on exploration, discoveries, and development.

OIL SHALE STUDIES

Following the shutdown of retorting and refining experimental units, the Bureau's oil-shale program during the year was confined to mining investigations at Rifle, Colo., and research at the Petroleum and Oil-Shale Experiment Station at Laramie, Wyo. This work is described in detail in Bureau of Mines Report of Investigations 5237 (part II of the annual report of the Secretary of the Interior on operations under the Synthetic Liquid Fuels Act in 1955.)

Laboratory Research

Many samples of oil shale from the Tri-State region of Colorado, Utah, and New Mexico were analyzed by the Bureau and the results were used to extend known oil-shale reserves.

Chief emphasis in laboratory studies was on the fundamental constitution of kerogen, the organic material that yields the crude oil obtained by heating oil shale. Techniques used were solvent extraction, X-ray analysis, and spectroscopic examinations. Although additional evidence obtained by all these methods indicates that kerogen is extremely complex, the secret of its actual construction remains unsolved.

Studies on the composition of shale oil obtained at various temperatures in an entrained solids retort neared completion. Several autothermic runs of this retort were made during the year.

Mining

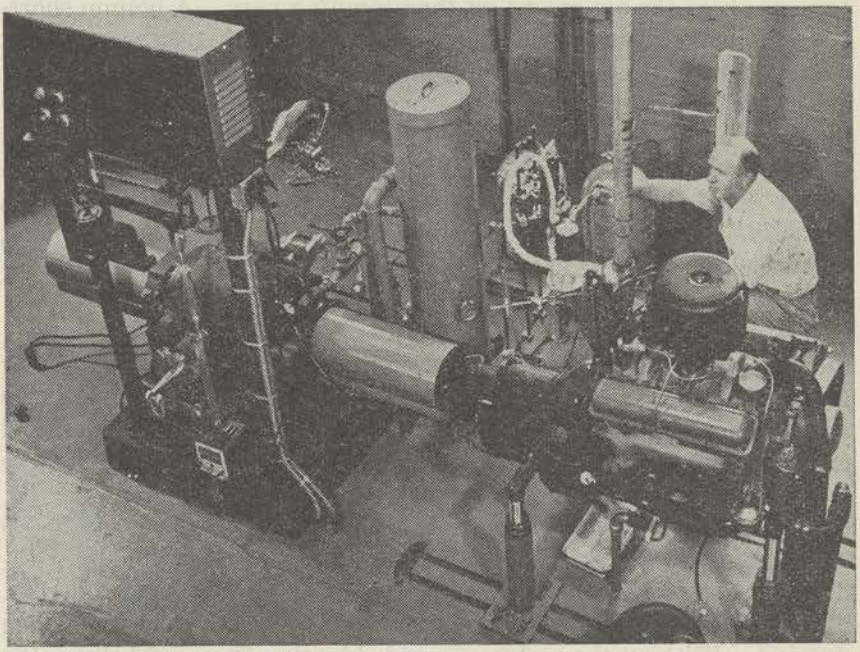
New mining equipment was received at Rifle, Colo., and additional miners were hired. Beginning in March, the mine was worked on a two-shift basis, but all such operations ended in June, since the Congress did not provide funds to continue operations.

Before work was halted, a new adit, known as No. 3, had advanced 343 feet with an estimated removal of 9,620 tons of shale. Another adit, No. 4, was enlarged for 532 feet with removal of 9,650 tons of material. In the mine portal and the two adits, 457 roof bolts and 782 feet of 4-inch channel iron were installed.

AIR AND STREAM POLLUTION STUDIES

The Public Health Service, United States Department of Health, Education, and Welfare, drew upon the Bureau's long experience and excellent laboratory facilities in connection with air-pollution activities authorized by the 84th Congress.

At the Petroleum Experiment Station, Bartlesville, Okla., research was begun on the role of internal combustion engine exhaust gases in air pollution. Exhaust gases produced under closely controlled con-



Equipment used by Bureau of Mines to study automobile exhaust gases in air-pollution research program.

ditions will be analyzed and the relationships of their components to fuel and lubricant composition and engine operation will be studied. Equipment for the first phase of this undertaking, including a V–8 automobile engine and a suitable dynamometer, was installed and tested.

In a complementary phase of the work, the Coordinating Research Council is supporting Bureau research to determine the applicability of gas chromatography to exhaust-gas analysis.

Other aspects of air pollution being studied under the cooperative agreement with the Public Health Service are incineration of refuse, removal of sulfur dioxide from stack gases, and determination of

effluents from stacks and vents of an industrial plant. Much of this work is being done at the Central Experiment Station, Pittsburgh, Pa.

Water pollution work during the year included surveys on losses of valuable minerals in industrial waste waters.

HELIUM ACTIVITIES

Helium production by the Bureau of Mines paced the Nation's rising industrial economy to reach a new peak of 243,790,000 cubic feet, 19 percent above the old record set the preceding year. A helium shortage that had developed near the end of fiscal year 1955 was largely overcome by September, enabling all essential demands to be met.

The largest single factor in the new production record was availability of helium-bearing gas from the Hogback field to supplement the supply at the Navajo plant, Shiprock, N. Mex. This additional source enabled the plant to produce at almost double its previous capacity. A smaller gain was achieved at the Otis, Kans., plant, where helium-bearing natural gas from the nearby Reichel pool became available.

Of great long-range importance were refinements in the helium production process, including newly designed heat exchangers and other equipment, and greater use of automatic valves and controls. These improvements were tested during the year and utilized to a limited extent to increase output. They will yield greater benefits in the future when they are installed throughout all plants.

Shipments during the year totalled 256,629,000 cubic feet, 12,839,000 cubic feet above production. The excess was made possible by withdrawal of stored helium from the Cliffside field, near Amarillo, Tex. This had been conserved in prior years when production had exceeded demand. Without the cushion provided by the conserved helium, the shortage early in the year could have become extremely critical, with adverse effects on the national defense and economy. Withdrawal continued only until the output of the plants increased.

Federal agencies received 73.5 percent of the helium shipped from the Bureau's plants, and private industry used an additional 14 percent on Government contracts, leaving 12.5 for private uses.

Plans to expand production facilities at the Exell, Tex., helium plant moved forward throughout the year. Congress previously had appropriated $6 million for the purpose. An architect-engineer contract was negotiated in August; plans and specifications suitable for use in requesting construction bids were approved at year's end. Meanwhile, the Bureau had ordered, through competitive bidding, an estimated $2 million in major equipment items for the expanded plant.

Transfer of the Navy's helium tank cars to the Bureau was effective July 1, 1955, whereupon the Bureau assumed full responsibility for

operating the Government's helium tank-car pool. Seventeen new cars were added during the year, bringing the total to 107. The Navy relinquished its rights to recall 30,431 standard-type cylinders that it had sold to the Bureau earlier on a contingency basis.

A comprehensive report submitted by the Bureau to the Secretary of the Interior in December disclosed that helium is more vital to the national defense and economy than previously supposed, and that this valuable nonflammable gas will be required in growing volume to meet the country's future needs. The latest findings indicate that decisive additional conservation steps should be taken soon to save for future generations more of the helium now wasted in the large volumes of helium-bearing natural gas that are sold for heating and other purposes without going through a helium-recovery phase.

EXPLOSIVES AND EXPLOSIONS RESEARCH AND TESTING

Work on Explosives

Tests of permissible and other explosives and hazardous chemicals during the year totaled 3,037. Consumption of permissible explosives—those tested and approved by the Bureau for safe use in underground coal mines—rose to 90,338,390 pounds, compared with 78,490,751 pounds the preceding year; 180 different permissibles were on the active list at year's end. Field samples of 21 permissible explosives were tested and 2 were declared nonpermissible because of failure to meet minimum safety standards. The manufacturer was authorized to make certain minor compositional changes designed to make the product again meet required safety standards.

Two new blasting devices were approved for use in underground coal mines. During tests of a compressed-air coalbreaker for safe use in gassy mines, flammability of natural-gas air mixtures was determined at pressures up to 10,000 pounds per square inch. Sensitivity of a "do-it-yourself" type of ammonium nitrate explosive was determined; use of such explosives is growing in large-scale strip mining. Experimental quarry blasting with a nitrogen-tetroxide hydrocarbon liquid explosive disclosed serious inherent hazards.

Detonation-front temperatures in high explosives were measured. A small-scale study showed that humidity affects the incendivity of firedamp only to the extent that water vapor dilutes the oxygen in the gallery atmosphere. Other research was begun to determine whether the oxygen-value test, developed to evaluate the relative incendivity of high explosives, can be used to determine the relative safety of permissibles. High-speed photography was used to observe gaseous detonations at low pressures.

Dust and Gas Investigations

Besides evaluating the flammability of 76 industrial and mining dusts, measuring velocities of dust-explosion flames, and improving methods of quench-venting dust flames, Bureau researchers devised techniques for neutralizing the explosion hazard of parked mine cars loaded with fine coal. They also demonstrated that two 300-pound piles of coal dust can propagate on explosion in an otherwise well rock-dusted entry, and showed that blanket rock dusting on the mine floor alone is ineffective in controlling an explosion.

Flammable gases and liquids investigated to determine their explosive characteristics included hydraulic fluids for high-speed airplanes, synthesis gases used at low temperatures and high pressures, hydrogen, hydrogen-steam mixtures, a monopropellant, and various organic compounds. A study of the effects of pressure and airflows on the stability of laminar flames can be applied in designing commercial gas burners. Research on the chemistry of flames rich in combustible components was initiated, with special attention to their noxious products of combustion. Turbulent flames of natural gas and liquefied petroleum gases were studied with an electronic probe and a newly developed flame radiation photometer. Continuing research led to better understanding of electric spark ignition hazards in hospitals, industrial plants, and other establishments.

Large-scale coal-mine explosion demonstrations were held to emphasize the consequences of carelessness, and the Bureau aided Government agencies, municipal authorities, and industry in investigating and preventing fires and explosions.

HEALTH AND SAFETY ACTIVITIES

Activities to promote safety and healthful working conditions in the mineral industries were strengthened in fiscal year 1956, the first full year of operation under the immediate supervision of an Assistant Director.

More staff members were assigned to safety education and training, time-tested programs receiving increased emphasis. Other programs—research, equipment testing, and coal-mine inspection—were reviewed and modified as necessary to meet fast-changing conditions.

Besides investigating hazards that actually caused accidents, the Bureau studied latent dangers and sought ways of coping with them.

Through inspection of coal mines and enforcement of the Federal Coal Mine Safety Act, it continued to strive for improved safety conditions, and the year was free of major coal-mine disasters.

Work on Primary Hazards

With roof falls causing 58 percent of last year's coal-mine fatalities compared with 55 percent the preceding year, failure of the national campaign to reduce this type of accident was acknowledged and new attacks on roof-fall hazards were considered. Underground noncoal mines, on the other hand, experienced a drop of 29 percent in such fatalities. The improvement resulted largely from rock-bolting.

Bolting also continued to prove effective in controlling coal-mine roof. Of 229 roof-fall fatalities in bituminous-coal mines, only 5 were attributed to failure of bolted roof. This was 3 more than in 1954, but meanwhile the number of bolts used had increased from 2 million a month to 3 million.

In the laboratory and in the field, studies were carried on to determine basic principles of mine roof support and increase the effectiveness of roof-bolting. Included were efforts to systematize the use of compression pads, tests of new types of bolts, and centrifugal studies of rock specimens.

Throughout the year Bureau engineers held roof-control conferences with mining-company officials, State mine inspectors, and engineers from various parts of the United States and from foreign countries.

Testing Equipment

Broadening its program of testing electrical-mechanical equipment to determine suitability for safe use in underground coal mines, the Bureau developed standards for fire-resistant conveyor belts and for mine lighting systems. At the request of the Atomic Energy Commission and the Industrial Safety Equipment Association, the Bureau explored the feasibility of setting up laboratory facilities, training personnel, and preparing standards for approving respiratory protective devices for use in atmospheres contaminated by radioactive materials.

Ninety-eight approvals and 137 extensions were issued, requiring 1,756 explosion tests on equipment submitted by 26 manufacturers. Approvals were granted mining machines, a rock-duster, cable-reel shuttle cars, conveyors, trucks, compressors, pumps, roof drills, distribution boxes, loaders, a storage-battery locomotive, electric lamps, a flame safety lamp, a gas detector, a blasting unit, and two diesel tractors. Flame-resisting qualities of 7 cables were determined.

The Bureau's second experimental coal mine at Bruceton, Pa., near Pittsburgh, was completed; it consists of two entries to be used for testing dust-collecting units. Track was laid and ballasted, water and

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air lines were installed, and power lines were laid to the face area in conduit. Coal and other material removed during underground tests on a new explosive and a blasting device will result in development of additional entries which will be used later for safety examinations of drill-dust collectors and for other dust studies related to health rather than explosion hazards.

During the year, 9 rotary roof drills with integral dust collectors were approved and 8 extensions of approval were granted; this equipment was submitted by 4 manufacturers.

Six new approvals of respiratory protective equipment and 51 extensions of approval were granted during the year, and preliminary examinations were made on 6 devices. These included gas masks, supplied-air respirators, dispersoid respirators, and nonemergency gas respirators. Apparatus and techniques being developed for testing paint-spray respirators were improved.

Bothersome noises encountered in supplied-air helmets and hoods have led the Bureau to consider adding limitations on sound levels and frequencies to its approval schedules for such devices.

Health

The Bureau accelerated efforts to promote more healthful working conditions in the mineral industries during the year, expanding earlier programs and initiating new ones to meet hazards introduced by modern methods and processes.

Fortified by information gained in conferences with medical and research specialists in England, Wales, and Australia, the Bureau cooperated with the United States Public Health Service in planning a study of pulmonary disability among American coal miners.

In all, 19,714 gas samples were analyzed, including 19,041 taken during Federal coal-mine inspections. Others came from metal mines, sealed fire areas or boreholes into underground fire areas in coal mines, or tunnels under construction; some were collected in connection with testing and underground use of diesel engines or during plastics and conveyor belting decomposition tests, and the rest during tests of breathing apparatus and other protective equipment or miscellaneous field and laboratory investigations.

The Bureau installed equipment for measuring carbon monoxide concentrations in the Liberty vehicular tunnels at Pittsburgh, Pa. The information was used to appraise present conditions and aid in planning future ventilation changes.

Studies of possible dust hazards included the use of X-ray diffraction equipment to analyze 55 samples from various sources for free silica content. The light-field microscopic technique was used for dust counts on 671 impinger samples collected during field and labora-

tory investigations, and 106 particle-size distribution determinations were completed.

During the year, 30 persons, mostly from foreign countries, were trained to sample and evaluate airborne dusts.

An investigation begun in April 1955 to ascertain the effectiveness of bleeder entries in keeping caved areas in coal mines free of explosive gas accumulations was completed.

A complete ventilation survey was made of one coal mine, and a pressure survey was made in one of the Nation's biggest coal mines. This information, along with that assembled by the company in quantity surveys, was used on the Bureau's electric analog computer to forecast the effect of proposed changes in a ventilating system. The analog was used, also, to evaluate data submitted by Bureau engineers and to predict the effect of proposed ventilating changes in two western mines.

Field investigations were conducted to determine the composition of diesel exhaust gases and their influence on the atmospheres in potash mines, a copper mine, a phosphate mine, and a trona mine.

Future programs will emphasize studies on controlling dust potentially harmful to mine workers' health. These investigations should be broad enough to be useful throughout the industry. Examples of desirable studies are determination of the type of airflow—whether turbulent or streamline—and resistance factors for typical stoppings, overcasts, and extensive gob areas, and evaluation of noise levels in mining operations.

Accident Analysis

Analysis and tabulation of injury and related employment records remained useful as a guide for developing better programs to prevent accidents in the mineral industries. Besides reports for the industries, State and Federal agencies, trade associations, labor unions, and others interested, special tabulations were prepared to help the Federal coal-mine inspectors work more efficiently.

Industries covered included coal mining, coke, quarrying, metal and nonmetallic mineral mining, metallurgical operations, and petroleum and natural gas production and refining. Use of a revised reporting form developed during the year will enable the Bureau for the first time to classify and tabulate causes of injuries in the metallic and nonmetallic mineral mining industries.

The 31st National Safety Competition and 4 other safety contests were conducted with approximately 1,500 mines, quarries, and plants participating. Some 2,000 Certificates of Accomplishment in Safety were presented workmen and supervisors at the winning plants.

Safety Education

Safety training was intensified by the Bureau last year, particularly in the coal-mining industry, and still further emphasis is planned. Experience has shown the value of this work in reducing accident rates, partly by promoting safety consciousness but even more by giving officials and workmen the advantage of research findings on hazards and means of guarding against them.

In round numbers, 25,000 persons completed the Bureau's 20-hour accident-prevention course for coal miners, bringing the number trained since 1947 to 150,000. Since experience has shown the greatest improvement in accident rates at mines where every official and workman has taken this course, emphasis on 100 percent participation was intensified.

Bureau personnel continued to give similar training at mines and plants in other branches of the mineral industries.

By the end of the year 1,876,000 persons had taken the Bureau's first-aid course, 107,400 had taken its mine rescue course, and 38,000 had taken both since July 1910. The Bureau stimulates interest in these activities by sponsoring and contributing judges and other officials to local, State, and national contests and by sponsoring the Holmes Safety Association, a national organization whose local councils and chapters provide excellent forums for discussing the causes of accidents and means of preventing recurrences.

Coal-mine Inspection

For the fourth full year, coal-mine inspection work was carried on under the Federal Coal Mine Safety Act. Besides title I, authorizing the Bureau to enter and inspect coal mines, report on hazards, and recommend (but not require) their correction, it includes in title II specific enforcement provisions designed to prevent explosions, fires, inundations, and man-trip or man-hoist accidents, in mines regularly employing 15 or more men underground.

The Nation had approximately 8,510 active coal mines in 1955, including 1,474 title II mines, 5,735 small title I underground mines, and 1,310 strip mines. At the end of fiscal year 1956, Bureau personnel assigned to coal-mine inspection and related duties included 245 coal-mine inspectors, 43 engineers, and 10 coal-mine electrical inspectors.

During the year 3,627 routine inspections were made of coal mines subject to title II, 43 of them jointly with State inspectors under State-Bureau cooperative agreements provided for in the act. In addition, 1,604 special inspections were made to determine whether previously cited violations of mandatory provisions had been abated.

Federal inspectors observed 9,147 violations of the mandatory provisions, many of which were corrected immediately and thus required no formal action. They issued 1,576 notices setting a reasonable time for abating dangers, 287 granting time extensions, and 1,550 certifying that dangers had been totally abated.

During the year 112 orders were issued requiring withdrawal of men from all or part of 63 mines, 57 orders at 38 mines because of imminent danger, and 55 at 25 mines because of failure to abate violations within a reasonable time; the Federal Coal Mine Safety Board of Review, an independent agency, annulled one of the 55. By comparison, 155 withdrawal orders were issued at 100 mines during the previous year.

Orders were issued classing as gassy 12 mines previously considered nongassy. The Director later annulled one and revised another to apply to only part of a mine. The Board of Review denied one appeal and issued an interlocutory order on another granting the operator time to meet certain conditions pending reconsideration of the appeal.

Federal inspectors and engineers also made 6,686 routine inspections of smaller title I mines (including 767 strip mines), 1,209 electrical, ventilation, dust, blasting, and related surveys, and 759 investigations of fatal and serious nonfatal accidents, mine fires, gas and dust ignitions, and miscellaneous conditions.

No major coal-mine disaster (one causing 5 or more deaths) occurred during the fiscal year. Preliminary reports showed 417 coal-mine fatalities in calendar year 1955 compared with 395 in 1954, but the fatality-frequency rate of 1.04 per million man-hours was unchanged. The preliminary fatality-frequency rate for the first 6 months of 1956 was 1.10.

Control of Fires in Inactive Coal Deposits

At the end of the fiscal year the Bureau had controlled or was combating 55 of the 192 known fires in coal deposits not now being mined, 32 on the public domain and 23 on private property. Coal reserves conserved under this program since the Congress first appropriated funds for it in fiscal year 1949 now total an estimated 250 million tons.

Four fire-control projects were completed, 3 on the public domain and 1 on private property, and work proceeded on 8 others.

Future plans include necessary maintenance work on completed projects and initiation of new ones in order of urgency and to the extent appropriations permit. The Government pays the full cost of controlling fires on Federal land and requires local contributions of half the cost of controlling those on private property.

FOREIGN ACTIVITIES

Throughout the year the Bureau centered its foreign activities on projects designed to assure a continued inflow of strategic and critical minerals to counteract domestic deficiencies. It collected and evaluated technical and economic information on mineral deposits abroad, their development, and their metallurgical problems, then made the facts widely available. In addition, it gave technical aid to underdeveloped countries and trained foreign specialists in its laboratories. These activities have helped increase investment by private American capital in developing foreign mineral resources.

Services to Government and Industry

Requests for information and advice on foreign mineral matters from Government agencies, numerous foreign governments, and industry kept increasing. Private requests came from industries planning investments in foreign mineral deposits, machinery and equipment manufacturers seeking new markets, and consulting firms alert to new opportunities.

American investment in development of mineral industries abroad has been expanding rapidly, notably in bauxite, copper, manganese, nickel, iron ore, rutile, and petroleum.

Technical Assistance

Under a continuing agreement with the International Cooperation Administration, Bureau engineers were assigned last year to 15 technical assistance projects in 13 countries—Afghanistan, Brazil, Colombia, Cuba, Egypt, India, Israel, Liberia, Mexico, Nepal, Pakistan, Peru, and the Republic of the Philippines. Among these were 3 in coal mining and technology, 5 in metal and nonmetal mining, 1 each in chemistry and chemical engineering, and 5 combination projects.

A new educational program utilizing Bureau motion pictures was begun, with films depicting safety practices and various mining and metallurgical operations being shown by Bureau engineers in 9 different countries. The films were screened 60 times before approximately 5,000 persons and were received enthusiastically.

Foreign Trainees

Training of mineral technologists from abroad continued in Bureau laboratories. Sixteen trainees from 9 foreign countries completed their assignments, and 11 others remained at year's end. Brazil, Colombia, Formosa, India, Indonesia, Mexico, Peru, Thailand, and the

Republic of the Philippines were represented. About 20 trainees are expected during the coming fiscal year. Subjects emphasized are fuel production and utilization, metallurgy, and health and safety practices, these being of major importance in the countries represented.

Direct Contracts With Foreign Governments

At times, contracting independently of the International Cooperation Administration, the Bureau provides foreign governments, companies, or institutions with services not available from private research or consulting organizations.

Under one such agreement last year, two Bureau engineers presented a safety demonstration program at a Safety Congress in Monterrey, Mexico. All costs were paid by the Instituto Technologico y de Estudio Superiores de Monterrey.

Under a similar contract, the North Central Experiment Station, Minneapolis, Minn., performed reducibility tests on iron ore from El Romeral mine, Chile, for and at the expense of Compania de Acero del Pacifico S. A. of Talcahuano, Chile.

An arrangement of this nature has been in effect with Petrobras (formerly the Brazilian National Petroleum Council) since 1950, under which the Bureau has applied experience gained in its domestic oil-shale program to development of Brazilian oil-shale reserves. This agreement, now dormant, runs until July 1, 1957.

RIVER BASIN ACTIVITIES

The increasing importance of water to the Nation's growth and development has accelerated activity and cooperation among Federal and State agencies in water conservation and development. Problems of the mineral industries relating to inundation, water supply, pollution, and water development are of increasing concern to the Bureau.

Special reports were prepared concerning the mineral industry in proposed Federal and non-Federal water development project areas. Three River Basin Compacts were studied as another cooperative service by the Bureau; they involved mineral engineering consultation and review while States and the Federal representatives were negotiating.

During the year, investigations and reviews of reports made for other Federal agencies included 30 for the Corps of Engineers, 34 for the Federal Power Commission, 2 for the Bureau of Indian Affairs, 2 for the Fish and Wildlife Service, 8 for the Bureau of Reclamation, and 30 for the Department of Agriculture.

Missouri Basin Project

Special funds are appropriated annually for the Missouri Basin program. The Bureau of Mines prepared seven technical reports for the Federal and State agencies involved, covering all phases of the mineral industry—in the fields of lignite, petroleum, natural gas, metals, and metallic and nonmetallic minerals. Five special mineral industry studies for areas where reservoirs are planned were made for the Bureau of Reclamation.

Research on lignite was pointed toward producing a tar with high byproduct values to make the remaining char cheap enough for use as fuel for electric power generation. Such power could be integrated with a basin's hydropower to make more firm energy available. Progress has been made in solving the problem of adequate, safe storage of lignite mined from the Garrison Dam site.

Metallic and nonmetallic mineral studies were primarily on industry feasibility, source investigation, and utilization. Of special concern to the Missouri Basin was work on aluminous shales, phosphates, raw materials for the chemical industry, limestone, gypsum, and light-weight aggregates. Mineral development of the Basin is an important element in the Basin's growing economy and Bureau of Mines research provides specific and urgently needed information on new mineral discoveries and new technologic development.

MINERAL ECONOMICS

Seeking a sound economic basis for the Federal Government's policy and actions in meeting mobilization requirements and fostering a healthy minerals industry, analyses of supplies and requirements of the strategic metals and minerals were made under both peacetime and wartime assumptions. Response of demand and supply to price changes over different periods was analyzed for each strategic commodity. The effects of such factors as gross national product, industrial production, substitution, and technologic developments were also considered in estimating supply and demand responses to possible, probable, or proposed price changes.

Proposed and potential assistance programs were evaluated and estimates made of their cost to taxpayers and consuming segments, together with their probable benefits to the mining industry, other mineral industries, and service industries. Their potential effects on the price and cost structure and on consumption patterns of each mineral were analyzed.

Studies of the strategic minerals, besides aiding the Department's mineral mobilization program, substantially increased information

on economic relationships influencing the long-term welfare of the industries producing them. In addition, numerous quantitative studies were made of fuels supply, use, substitution, and competition.

Factors affecting the foreign supply and use of minerals were analyzed from both a mobilization and a long-run viewpoint. Trends of imports and exports, effects of tariffs on the flow of imports, and varied Government actions relating to international trade in minerals were under continuing analysis and review. Analyses were made of the role of foreign supply in both short-run and long-run resource base planning for individual minerals. Trade and tariff analyses were undertaken in connection with negotiations under the General Agreement on Trade and Tariffs and numerous tariff change proposals.

Interindustry research studies covering columbium-tantalum, zinc, and chromite were completed.

Continued studies of the effects of Federal and State taxation of minerals on the operation of the industry covered treatment of expenditures in various stages of the development of mineral properties, financial relationships between percentage depletion and loss carryover, the estimated impact of different percentages of depletion allowance on mineral production, exploration, and development. Accelerated tax amortization, as it affected the mineral industries, was analyzed as a guide for proposed changes in this Government program.

Special Statistical Surveys

By an agreement reached in December 1954, the Bureau of Mines and the Bureau of the Census jointly conducted the Census of Mineral Industries for 1954. The Bureau of Mines collected and reviewed census reports received from mineral producers. The Bureau obtained from Census reports for 1954 covering information on production, stocks, and so forth of many minerals ordinarily collected by Mines in its own surveys. This minimized duplication of reporting by industry and is expected to make statistics published by the two agencies more nearly comparable. By the end of the fiscal year, collection and review had been completed except for reconciliation of final results.

At the request of the Office of Minerals Mobilization, the Bureau of Mines surveyed most of the domestic mining and minerals processing industries (other than fuels) to determine their steel, copper, and aluminum requirements for maintenance, repairs, and operating supplies. The survey, based on actual use of these materials during the first half of 1955, revealed substantial changes in requirements,

particularly an increased use of alloy steels and aluminum, since the last similar survey during the Korean War.

PUBLIC REPORTS

Three of the many reports issued during the year to fulfill the Bureau's obligation to make its findings available to industry, research workers, educators, and others were particularly significant.

The authoritative Minerals Yearbook was issued in 3 volumes instead of 1, an innovation that permits better coverage. Principal emphasis was on area presentation and reviews of technologic progress. Volume I includes commodity reviews other than fuels, volume II fuels reports, and volume III area reports.

Bulletin 556, Mineral Facts and Problems, which provides basic information on 85 mineral commodities, was designed as a reference work for engineers, scientists, and administrators; revision at 5-year intervals is planned. It has been popularly labeled as a "One-Volume Encyclopedia of Minerals."

Information Circular 7754, Outlook and Research Possibilities for Bituminous Coal, prepared in cooperation with Bituminous Coal Research, reviews the current status of research in this field here and abroad, and lists 209 possible projects for consideration.

In all, 622 publications were prepared for printing or processing; they included 8 bulletins, 142 Minerals Yearbook chapters, 5 miners' circulars, 3 handbooks, 14 lists of publications or motion pictures, 119 reports of investigations, 36 information circulars, 263 journal articles and speeches, and 32 miscellaneous reports (including 2 cooperative monographs). Their preparation involved editing 24,750 pages of text and examining 2,425 illustrations. Many lengthy technical indexes were prepared.

Demand for films from the Bureau's free loan library of industry-sponsored technical-educational motion pictures continued to grow, particularly from schools in the 48 States, Alaska, and Hawaii. Showings totaled 214,847 and the films were seen by more than 66 million persons at group presentations or on noncommercial television programs, compared with approximately 57 million the previous year.

"Arizona and Its Natural Resources," one of the most popular films in the Bureau's library, was revised during the year. Two new films, "Idaho and Its Natural Resources" and "The Petrified River—the Story of Uranium," were nearing completion at year's end.

Although central distributing and maintenance facilities for the more than 6,000 film prints are maintained at Pittsburgh, Pa., some 200 educational institutions, public libraries, Armed Forces installations and school districts participate in the circulation of the motion pictures on a free, long-term loan agreement.

ADMINISTRATION SUMMARY

The Division of Solid Fuels was separated during fiscal year 1956 into a Division of Anthracite and a Division of Bituminous Coal to improve administration and provide better control of research programs.

An Office of Management Analysis was established in the Office of the Deputy Director. One of its responsibilities is to complete the Bureau manual of instruction. The Bureau of Mines has adopted the departmental manual numbering system and format to facilitate integration of departmental manual releases with subject material in the Bureau of Mines Manual. Information published in the Bureau Manual supplements that published in the Departmental Manual. Thirty-six releases have been issued within the organization, delegation, and administration series following adoption of the departmental manual system.

A program of training in research management was established under the Assistant Director—Programs. Four qualified technically trained men have completed the course.

Property

A significant accomplishment in property management was adoption of the machine records property accounting system by Region V, Pittsburgh, Pa. The new system contemplates establishing immediate responsibility for and positive control of all property within the region.

Continued efforts to reduce the Bureau motor-vehicle fleet resulted in a 7-percent decrease. Continuing reviews of nonexpendable property needs resulted in transfer of property with an acquisition cost of $129,400 to other agencies. Scrap sales totaled $44,740.

Property records of the Bureau of Mines as of June 30, 1956, showed accounts as follows:

Automotive equipment	$4,053,699.47
Canvas, composition, leather and rubber goods	21,535.47
Drafting and precision engineering instruments	122,933.70
Electrical equipment	541,573.15
Hardware	511,143.65
Household furnishings	136,461.76
Laboratory apparatus and appliances	7,925,958.04
Medical and surgical appliances	61,187.25
Office furniture, appliances and floor coverings	3,003,097.17
Photographic and projection apparatus	369,110.01
Power plant and general shop equipment	4,101,217.46
Real estate	30,521,326.75
Specialized equipment	6,389,004.58
Total	57,758,248.46

The Bureau expedited disposal of obsolete records and the transfer to Federal Records Centers of records that are to be preserved or stored. During the year, reference cards for the Washington general correspondence files dating from 1910, when the Bureau was organized, through 1946, were transferred to the National Archives and Records Service and the Federal Records Center, making 736 square feet of former storage space available for office uses. The Records Control Schedule requires breaking the general correspondence files of the Washington office annually and transferring them to the Federal Records Center in yearly blocks after 5 years, 1 year's files being transferred annually. Results of records retirement throughout the Bureau are reflected in savings of floor space and in the release of many filing cabinets and card cases for reuse.

Finance

During fiscal year 1956 two surveys were undertaken which, upon completion, will benefit the Bureau's financial operations.

One group made a survey of the accounting system to determine its efficiency relative to the Bureau's budgeting and programing process and to determine the need for redesigning the reporting processes for effective management.

Under the direction of the Deputy Director, a bureauwide study was made of practices at field installations in the use and cost of common services, such as shops, and the methods employed in distributing such expenses as well as administrative overhead.

The information gained should result in more uniform operations throughout the Bureau. This will assist in developing cost standards which will, in turn, permit better evaluation of research operations.

Funds available to the Bureau of Mines for the year, including direct appropriations, prior balances available, reimbursements, advances and transfers from other Government agencies, proceeds from helium operations, and contributions from non-Government sources, totaled $49,895,064. Of this, $31,942,256 was obligated, leaving an unobligated balance of $17,952,808. Approximately half this was represented by available-until-spent funds approved by Congress for the anthracite mine-drainage program. A recapitulation at the end of the following tabulation shows the approximate amounts and sources of the unobligated balances.

Funds available to the Bureau of Mines for fiscal year 1956, by source of funds

Direct appropriation	$29,578,000
Prior year balances available	8,938,410
Less transfers and returns	—1,568,586
Reimbursements from other Government agencies	245,681
Advances and transfers from other Government agencies	6,803,838
Proceeds from helium operations	4,938,307
Contributions to trust funds from non-Government sources	959,414
Total	49,895,064

Obligations incurred by the Bureau of Mines in the fiscal year 1956, by appropriation

Conservation and development of mineral resources	$14,541,794
Health and safety	5,251,214
Construction	2,497,901
General administrative expenses	1,024,622
Working funds (including consolidated and allocated)	4,615,876
Economic and technical assistance, defense support, Asia and Pacific, other than Formosa and associated States of Cambodia, Laos, and Vietnam, executive (transfer to Interior)	[1]—5,783
Economic and technical assistance, Near East and Africa, executive (transfer to Interior)	4,458
Mutual defense financing, defense support, finance and technical assistance, Europe, executive (transfer to Interior) April 4, 1948–54	30,000
Mutual defense financing, defense support, economic and technical assistance, Formosa and the associated States of Cambodia, Laos, and Vietnam, executive (transfer to Interior), April 3, 1948–54	[1]—247
Technical assistance to American Republics and non-self-governing territories of Western Hemisphere, executive (transfer to Interior)	461
Technical cooperation, general, executive (transfer to Interior)	57,197
Administrative expenses, section 411, Mutual Security Act, executive (transfer to Interior)	29,945
Technical Cooperation, general, executive (transfer to Interior)	318,890
Defense support, Asia (transfer to Interior), 1956	27,403
Southeast Asia and western Pacific, executive (transfer to Interior), 1955	700
Defense support, Near East, Africa, and South Asia, executive (transfer to Interior), 1955	17,116
Development and operation of helium properties	2,685,903
Contributed funds	844,806
Total obligations incurred	31,942,256

RECAPITULATION

Total funds available to Bureau of Mines	49,895,064
Obligations incurred	31,942,256
Unobligated balance of funds	17,952,808
Anthracite mine drainage	8,500,000
Construction under 14X0954	3,668,660
Construction for Army	2,040,746
Helium balance	2,252,404
Balances available in fiscal year 1957	950,000
Balances under fiscal year funds not available	540,998
	17,952,808

[1] Disbursement less than carryover obligation.

Personnel

Delegation of Authority.—Field appointment authorities of assistant directors and regional directors were increased to grade GS–13. Field classification authorities also were increased. Previously, these authorities were limited to grade GS–11 or lower.

Employee Safety.—Bureau motor vehicle regulations and instructions were developed and distributed. Assistance was given to the field in conducting safety programs through inspections, recommendations for improving procedures, and safety messages. The Bureau received the Department's Green Cross award for the greatest improvement in safety for the month of February.

Staffing.—Recruitment of professional and scientific personnel, student trainees, and student assistants was emphasized. Virtually all Bureau offices participated. A speech for delivery to high school students by professional and scientific employees was prepared to stimulate interest in science as a career. Descriptive material covering the major professional positions in the Bureau was written for use in a departmental recruiting pamphlet. To strengthen the Bureau's recruitment and placement program, policies and procedures were adopted which assure better planning of anticipated recruitments or reductions and likewise improve methods for considering employees for promotion and transfer.

Employee Relations.—The personnel office cooperated with the Office of the Secretary in drafting employee handbook material applicable to the Department as a whole. In addition, much of the preliminary work was completed for revising the Bureau Employees' Handbook. Exit interview instructions were rewritten. Field visits were made for evaluation and assistance in connection with employee awards and the employee relations program in general.

Employee Development.—Three employees from the field participated in the Department's management training program. On-the-job training, including student training, continued to be emphasized. Work was begun on a manual chapter on training and employee development.

Classification.—Desk audits, field surveys, and conferences and discussion with employees were continued to assure compliance with classification requirements. On-the-spot studies were conducted at seven field stations and assistance in connection with inspections and classification audits conducted by the Civil Service Commission was provided three regions and another field activity.

The reorganization involving the abolition of the Division of Solid Fuels and the establishment of the Divisions of Anthracite and Bituminous Coal required revision of job sheets, classification of new positions, and advisory and instructional services. A classification

study was conducted in the Division of Minerals to delineate the professional from the nonprofessional technical work. This study and realignment of classifications will continue through part of next year. A study was made of the safety representative positions in the Bureau and an analysis of the classification characteristics of such positions was prepared as a basis, or standard, for future classification actions.

Program Evaluation.—A Bureau of Mines Program Evaluation Guide was developed and distributed.

Schedule and number of paid employees

	GS	Ungraded	Total
Departmental	594		594
Field	2,712	983	3,695
Total	3,306	983	4,289

Incentive Awards.—Increased activity and employee participation in the incentive awards program were reflected by the following:

Suggestions received during the year	497
Suggestions receiving awards	157
Total of cash awards granted for suggestions	$5,040
Suggestions resulting in estimated annual savings	56
Suggestions resulting in intangible savings	101
Total of estimated annual savings	$32,949
Awards based on superior performance	44
Total cash awards granted for superior performance	$9,015
Special acts or service awards	2
Total of cash awards granted for special acts or service	$400
Total honorary awards granted	45

OFFICE OF OIL AND GAS

Hugh A. Stewart, *Director*

ADVICE and assistance given to the executive and legislative branches of Government during the year contributed to Federal coordination of petroleum and gas policy and served to keep Government officials and the public apprised of the petroleum and gas situation. Administration of the Connally Act, liaison with industry, discharge of responsibilities under the Defense Production Act, Federal Civil Defense Act, and the Internal Revenue Code were also carried on during the fiscal year. Office of Oil and Gas activities and accomplishments follow:

SERVICE TO CONGRESS

Congressmen, representing 22 States, received information regarding petroleum, gas, and related matters. Testimony and voluminous data were presented to 14 different congressional committees for use in conduct of various investigations. The Office of Oil and Gas supplied the basis for the Department's position in reports to Congress on proposed legislation related to petroleum and gas.

COOPERATION FROM STATES

A noteworthy contribution was made by the Interstate Oil Compact Commission at the request of Government. IOCC completed a report on underground storage of liquid petroleum hydrocarbons in the United States. The Director of the Office of Oil and Gas officially represented the Department of the Interior at IOCC meetings, and the Federal Petroleum Board received cooperation from the State oil and gas regulatory agencies in daily contacts in administration of the Connally Act.

INDUSTRY COOPERATION

The Secretary of the Interior continued to maintain direct channels of communication with the petroleum and gas industries to obtain advice and information as needed and requested on national oil and gas matters and mobilization planning. The Military Petroleum Advisory Board, National Petroleum Council, Foreign Petroleum Supply Committee, and Gas Industry Advisory Council were used for this purpose. In participation at meetings of these industry advisory groups and direct contact with representatives in industry, the secretariat and Office of Oil and Gas officials kept the industries informed on oil and gas policies and developments affecting those industries.

VOLUNTARY AGREEMENT RELATING TO FOREIGN PETROLEUM SUPPLY

On May 8, 1956, the voluntary agreement relating to foreign petroleum supply was amended to incorporate changes with respect to operations of the Foreign Petroleum Supply Committee. The amendments were requested by the Attorney General to eliminate possible anticompetitive dangers following a review of all of the voluntary agreements in effect pursuant to requirements of the Congress incorporated in the Defense Production Act. The changes prescribe that the Foreign Petroleum Supply Committee and subcommittees be under Government chairmanship, that its staff be Government employees, and that the foreign petroleum information be gathered by Government. Heretofore there had been industry chairmanship, staffing, and collection of information. As a result of the changes in functioning of FPSC, the Office of Oil and Gas took over the work of completing two revised reports on pipeline systems, and terminal and storage facilities at deep-water ports of foreign countries.

PETROLEUM AND GAS IN CIVIL DEFENSE PLANNING

Petroleum and gas responsibilities delegated to the Secretary of the Interior by Federal Civil Defense Administration Delegation No. 3, dated August 13, 1955, were assigned to the Office of Oil and Gas. Under this authority OOG plans and directs Federal activities designed to procure, store, transport, and distribute adequate petroleum and gas supply to attacked areas and reception centers, consistent with the national emergency fuel program.

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As the fiscal year ended, OOG had in final stages of completion a sampling of how the States were organizing to cope with emergency problems under nuclear attack conditions. The partial survey indicated that the Government needs to provide information as to Federal planning for guidance at the regional and local levels. The Office of Oil and Gas expects to disseminate information for that purpose.

NATIONAL DEFENSE EXECUTIVE RESERVE

Inasmuch as the Office of Oil and Gas has major petroleum and gas defense responsibilities, it has commenced planning for recruitment of an executive reserve of personnel to be trained to occupy full-time executive positions in the Federal Government in event of national emergency. Authority for this executive reserve program is section 710 (e) of the Defense Production Act, implemented by Executive Order 10660 of February 15, 1956, and Defense Mobilization Order I–21, dated February 23, 1956.

Technical staff members of the Office of Oil and Gas will be key personnel in the petroleum and gas executive reserve. The Secretary of the Interior, upon recommendation of the Director of the Office of Oil and Gas, will enlarge the reserve by appointment of competent and outstanding oil and gas experts selected through industry sources, such as the Military Petroleum Advisory Board, National Petroleum Council, Foreign Petroleum Supply Committee, and Gas Industry Advisory Council, and from the former Petroleum Administration for Defense and Petroleum Administration for War.

NATO PETROLEUM PLANNING COMMITTEE

Important discussions on petroleum mobilization readiness planning of NATO countries made it desirable for the Director of the Office of Oil and Gas to head the United States delegation to the meetings of the North Atlantic Treaty Organization Petroleum Planning Committee held at Paris, France, in June, and to take an active part in the proceedings. An assistant director of OOG participated in the committee's meetings in Europe during October 1955, March and June 1956.

INTERNATIONAL LABOR ORGANIZATION PETROLEUM COMMITTEE

Two Government officials were members of the United States delegation to the reconvened fifth session of the ILO Petroleum Commit-

tee, at Geneva, Switzerland. One of the delegates was the Director of the Office of Oil and Gas, who participated in plenary sittings held April 3–14, 1956.

INDUSTRIAL EXPANSION GOALS

Office of Oil and Gas reexamination of its programs and progress of industrial expansion in the petroleum and gas industries to meet mobilization objectives resulted in the Office of Defense Mobilization closing certain goals. This was done by issuance of Defense Mobilization Order VII–6, Supplement 3, dated September 29, 1955. The closed goals included No. 65c, natural gas liquids capacity; 65d, oil pipelines; 65e, oil storage facilities; and 171, expansion of pipeline capacity in the gas utilities industry.

At the same time, a new goal, No. 226, was established for oil and gas pipelines and petroleum storage facilities. It applies to oil and gas pipelines running directly to military or Atomic Energy Commission projects, and petroleum storage erected solely for military use.

Of two petroleum goals still open after September 1955, the Office of Oil and Gas studies indicated that the petroleum industry would attain an established goal of 9 million barrels a day domestic refining capacity by January 1, 1957. In view of industry's progress toward reaching this goal, upon recommendation of the Office of Oil and Gas, ODM closed goal 65b covering United States refining capacity on April 20, 1956.

When the fiscal year ended, studies were underway to determine whether the alkylate goal should be increased or closed because it appeared that sufficient applications for accelerated tax amortization had been received to oversubscribe alkylate goal 207.

Acting as technical adviser to the Business and Defense Services Administration of the Department of Commerce, advice was given with respect to approval or denial of accelerated tax amortization for goal 206 covering research and development laboratories related to the petroleum and gas industries.

USE OF INCENTIVE OF ACCELERATED TAX AMORTIZATION

During the fiscal year 1956, over two hundred applications for accelerated tax amortization were processed by the Office of Oil and Gas. The applications had been referred by the Office of Defense Mobilization for reports and recommendations as to whether projects should be granted or denied accelerated tax amortization under the

petroleum and gas expansion goals. OOG analyzed and submitted numerous recommendations to ODM covering applications for time extensions and scope amendments.

ADVICE AND ASSISTANCE TO FEDERAL AGENCIES

Under the leadership of the Assistant Secretary (Mineral Resources) and the Director of the Office of Oil and Gas, almost every agency having responsibilities or interested in Federal oil and gas policy, operations, and matters related thereto were given advice and assistance as requested. A brief résumé of important items follows:

The Presidential Advisory Committee on Energy Supplies and Resources Policy made a report in February 1955, aimed at strengthening national defense, providing for orderly industrial growth, and assuring energy supplies for our expanding national economy and for any future emergency. The report provided that oil imports should not exceed significantly the relationship that these imports bore to United States crude oil production in 1954. The Assistant Secretary participated in Presidential Advisory Committee reviews and outlook regarding crude oil and residual fuel oil imports and sanctioned action of the Defense Mobilizer in the effort to secure voluntary reduction of oil imports to the prescribed formula. Voluntary compliance by the oil industry to reduce imports in accordance with the formula would obviate Government action by the Defense Mobilizer under Public Law 86 which requires that he report to the President when he finds that an article is being imported into the country in quantities that threaten to impair the national security. The Government's position regarding the oil imports situation was supported by facts developed by the Office of Oil and Gas.

Oil specialists of OOG have represented the Department of the Interior on various Department of Commerce committees engaged in fixing controls and quotas on exports of minerals, metals, and their products as necessary to our national security.

As the agency delegated petroleum and gas defense responsibilities under the Defense Production Act, the Office of Oil and Gas developed and evaluated voluminous data requisite to planning for partial and full mobilization, rendering advice to the Office of Defense Mobilization, Department of Defense, and other agencies having need for such information. This assignment included analyses and evaluations of the worldwide petroleum and gas supply and demand situation and forecasting of potential supply and demand under various emergency conditions and situations.

The Office of Oil and Gas participated in the interagency project of developing the President's report to the Congress concerning the Nation's rubber requirements and resources and the need, if any, for further research by the Government.

CONNALLY ACT ADMINISTRATION

The Office of Oil and Gas supervises the activities of the Federal Petroleum Board in the administration of the Connally Act, an act prohibiting interstate shipment of oil produced in violation of certain State oil and gas conservation laws and orders issued thereunder. The Board initiates and conducts investigations and holds hearings with respect to production and interstate shipment of such contraband oil with the view of supporting the oil and gas conservation policies of the respective States.

The Federal Petroleum Board is composed of a Chairman and two members, with headquarters office at Kilgore, Tex., and suboffices at Midland and Victoria, Tex., and Lafayette, La.

While the Connally Act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling of oil, its chief application is in the States of Texas, Louisiana, and New Mexico, whose regulations prescribed under the act are actively enforced by the Board. So far as possible with the resources at its command, the Board also enforces the provisions of the act in other oil-producing States, particularly in Mississippi, Oklahoma, Arkansas, and Kansas. The State of Colorado duly adopted and passed article 6, Oil and Gas Conservation Act, as amended by 1955 legislation, which brings this State within the provisions of the Connally Act and subject to its applicable regulations.

Producers, refiners, transporters, and others handling oil products in a designated area are required to keep prescribed operating records and file monthly reports with the Board on approved forms. The designated area consists of 106 counties in the State of Texas, the counties of Lea and Eddy in the State of New Mexico, and the entire State of Louisiana.

From the designated area the Board regularly receives and processes each month approximately 8,205 monthly producer's reports, about 483 monthly pipeline reports, and 67 reports from processors and refiners. These reports cover operations in 2,998 separate oilfields and account for approximately 65.84 percent of the entire production in the States of Texas, Louisiana, and New Mexico, which is approximately 4,096,000 barrels daily.

During fiscal year 1956, nearly 3,000 leases were inspected, some 2,500 leases were visited, and 9 pipelines were checked. To ac-

complish this, 659 oilfields were visited and 808 investigations were conducted.

At the beginning of the fiscal year, 9 cases dealing with violations of the act were pending, 5 in investigative status, 1 pending review by the Board, 1 pending disposition by the United States attorneys, and 2 were under review by the Solicitor's office.

Six new investigations were started during the fiscal year. Nine cases were on the Board's docket at the close of the fiscal year, of which 3 were in the investigative stage, 2 under review in the Department of Justice, and 4 were pending disposition by the United States attorneys.

During the fiscal year, six cases were closed, all by successful prosecution in the Federal courts. As a result, $14,400 in fines were imposed and paid.

DEFENSE MINERALS EXPLORATION ADMINISTRATION

C. O. Mittendorf, *Administrator*

DURING the fiscal year 1956, the Defense Minerals Exploration Administration continued to conduct a program to encourage exploration for deposits of strategic and critical minerals in the United States, its Territories and possessions.

Pursuant to a delegation of authority from the Office of Defense Mobilization to the Secretary of the Interior, the Government provides assistance to private industry, through the DMEA participating in the costs of exploring for indicated or undeveloped sources of strategic and critical minerals. The extent of the Government's participation is 50 to 75 percent of the cost of exploration, depending upon the mineral or minerals being sought. Funds for the Government's share of the exploration costs are allocated from the borrowing authority under the Defense Production Act of 1950, as amended. In the opinion of the Government, if the exploration work has been successful in finding ore, a certification of discovery or development is issued, and the contribution made by the Government to the cost of the exploration work is repayable at a rate of 1½ to not more than 5 percent of the sales receipts for any ore produced until the amount of the Government's contribution is repaid, without interest, or until a specified time, usually 10 years has elapsed from the date of the contract.

Exploration projects are established under contracts between the Government and mine operators. These contracts are based upon sound engineering and geological principles, and require specified work to be performed within specified costs and during a fixed period of time.

The program is administered by the DMEA with a small Washington staff and five field auditors. Technical field services are provided through the cooperation of the Geological Survey and the Bureau of Mines. Participation in the program by private industry is wide-

spread and includes individuals, partnerships, and corporate enterprises. The program is especially appealing to small business as evidenced by the large number of small mine operators participating.

The DMEA received 486 applications for aid in an exploration project during the fiscal year 1956, bringing the total number of applications received since the inception of the program in mid-1951 to 3,179. This total includes requests for aid on projects located in 43 States and Alaska. In the 12 month period ending June 30, 1956, 144 new contracts were executed, making a total of 911 contracts executed since the beginning of the program. These contracts are for projects in 32 States and Alaska, and as a group include a search for 28 different minerals and metals. At the start of the fiscal year 1956, 208 contracts were in force but this figure dropped to 198 at the end of the fiscal year. From the beginning of the program to date, 62 contracts have been canceled without any work having been performed on them, but only 2 of these 62 contracts were canceled in the past fiscal year. During the past 12 months, Government commitments on contracts amounted to $3,724,087. The total Government commitments during the life of the program now amount to $26,179,002. The total estimated cost of the work approved under the 144 new contracts executed during the fiscal year 1956, including industry participation, is $5,702,376, and for the 911 contracts executed to date, aggregates $42,597,236.

During the fiscal year 1956, 112 contracts under which actual work was performed, were terminated without certification of discovery or development. The cost of these 112 projects was originally estimated at $3,782,368, with the Government's participation set at $2,063,360, but the actual cost to the Government was only $1,164,375. At the end of the fiscal year, 651 contracts having a total project cost of $20,856,745 had been terminated without certification. The Government's share in the cost of these contracts was estimated at $13,137,618, of which only $9,021,969 was expended. Although a few of these terminated projects have found small quantities of ore, the amounts were not sufficient to justify their being certified. However, valuable geological information was obtained from all of these terminated projects.

The DMEA issued 45 certifications of discovery or development during the fiscal year 1956. The total project cost for these certifications was $3,992,756. The Government was committed to participate up to $2,432,214 on these projects, but only $1,813,603 was actually expended by the Government. As of June 30, 1956, the DMEA had certified 246 projects having an aggregate project cost of $13,131,462. Government participation in these contracts was set at $8,135,331, however, only $6,207,662 has been contributed by the Government to

date since work on some of the terminated projects was completed at less cost than anticipated and the work on several of the other projects is still in progress. At the end of the fiscal year 1956, the Government had received repayments amounting to $1,347,434 in the form of royalties from 267 operators. This sum included repayments from 22 operators for the full amounts of the Government's participation in their projects, totaling $365,006.

The 246 certifications were on projects involving a search for antimony, asbestos, beryl, chromium, cobalt, columbium, copper, corundum, fluorspar, iron, lead, manganese, mercury, mica, monazite, nickel, rare earths, rutile, sulphur, talc, tantalum, tin, thorium, tungsten, uranium, and zinc. Forty-seven of the certified projects were in North Carolina; 35 in Colorado; 26 in Utah; 23 in Idaho; 14 in Arizona; 12 each in California, Montana, and Nevada; 10 in Washington; 9 in Wisconsin; 7 in South Dakota; 5 each in Alaska and Georgia; 3 each in Alabama, Illinois, New Mexico, Missouri, and Wyoming; 2 each in Arkansas, Vermont, and Virginia; and 1 each in Florida, Iowa, Maine, New Hampshire, New Jersey, Oregon, South Carolina, and Texas. Twenty of the 246 certified projects had not been completed by June 30, 1956. On a conservative basis, at prices in effect at the end of the fiscal year, the recoverable minerals and metals in the ores found on the 246 certified projects is estimated to have a gross value of approximately $275 million. Subsequent ore-showings on 44 other projects may lead to their eventual certification.

All applications for exploration projects are studied by technical experts. In the majority of cases a field examination of the property involved is made by a DMEA field team, comprising personnel of the Geological Survey and the Bureau of Mines. Based upon a study of all available information, including the results of the field examination, either a project is approved and a contract made or the application denied. As of June 30, 1956, 1,423 applications have been denied, 267 of them during the past fiscal year. A total of 563 applications have been withdrawn, but only 86 in the past 12 months.

During the fiscal year 1956, applications were received at a steady rate with a slight increase over the number received during the previous fiscal year. The largest number of applications received were for uranium projects, the second largest number were for mica projects, and the third largest number were for tungsten projects. A substantial increase in applications for zinc took place, principally for projects in the Appalachian area.

Auditing of contract expenditures and ore production royalties continued at a steady rate during the fiscal year 1956. As of June 30, 1956, the Contract Administration and Audit Division of the

DMEA had made a total of 828 audits covering Government disbursements of $12,375,576, on 706 projects. Of these, 178 audits covering Government disbursements of $2,572,084 were made on 152 projects during the past 12 months. Approximately 79 percent of the exploration program disbursements have been audited. In addition, 86 audits have been made on 74 projects for production purposes during the fiscal year 1956. These 86 audits covered sales of production totaling $7,229,791, on which royalties payable to the Government amounted to $351,121. To date, 178 production audits on 146 projects have been made involving ore shipments of $15,479,354 and royalties payable to the Government totaling $739,393.

In July 1955, the DMEA issued a revised booklet of questions and answers about the exploration program. In order to expedite the processing of uranium applications, the DMEA established a field office at Grand Junction, Colo., in August 1955. Royalty auditing procedures were issued in January 1956, and a new delegation of authority to the executive officers of the DMEA in the field was also issued in that month. In April 1956, the short form contract of the DMEA was revised and forms for the Field Teams' semiannual reports on certified projects were also revised. On May 29, 1956, the DMEA issued Amendment No. 3 to DMEA Order–1, amended. This amendment added the mineral selenium to the list of strategic and critical minerals eligible for 75 percent Government participation in an exploration project, pursuant to request from the Office of Defense Mobilization.

The cooperation of the Geological Survey and Bureau of Mines with the extensive participation of mine operators has resulted in making the program a success. Participation in the program by the large number of small operators is particularly significant. Approximately two-thirds of the contracts executed have been with individuals and partnerships. About one-half of all contracts call for total expenditures of $24,000 or less, and about one-third provide for expenditure of less than $3,000 of the operator's own funds. Under the program substantial quantities of strategic and critical minerals have been found. Although current production is small, the ultimate production from successful projects will be important to the Nation's economy and defense. Some ore deposits are being found that are uneconomic to mine at present market prices, but these deposits will be available if needed in times of emergency. The ore deposits found under the DMEA program are an important element of the Nation's mobilization base.

OFFICE OF MINERALS MOBILIZATION

Spencer S. Shannon, *Director*

THE Office of Minerals Mobilization was established in January 1955 to carry out the Secretary's responsibilities for national defense preparedness in metals, minerals and solid fuels. These responsibilities had been delegated to the Secretary by the Director of the Office of Defense Mobilization. As of July 1, 1955 the Office of Minerals Mobilization commenced operations on funds appropriated to it.

The principal activities of the Office during the year consisted of estimating the adequacy of supply of minerals and solid fuels in periods of national defense emergencies, recommending programs to assure adequate defense supply, and establishing standby and readiness programs that could be activated quickly in the event of a defense emergency.

With the technical assistance of the Bureau of Mines and Geological Survey, 19 comprehensive mobilization base evaluations, together with recommendations for establishing and maintaining an adequate national defense supply position for various metals and minerals were completed and submitted to the Office of Defense Mobilization. Some represented revisions of previous mobilization base evaluations and recommendations required by changed conditions. As of June 30, 1956, comprehensive evaluations and reviews of 25 materials were in progress. About 50 reports and program recommendations were prepared on various expansion goals and their relation to essential production bases. In addition, at the request of the ODM, numerous appraisals were supplied concerning the effects on these bases of new factors, such as technological developments and proposed changes in tariff rates. The adequacy of industrial capacity to produce coal and coke under mobilization conditions was maintained under constant review.

In the case of solid fuels the Office had the responsibility of evaluating and recommending on applications for certificates of necessity for accelerated tax amortization under the Internal Revenue Code and for loans under the Defense Production Act. Through June 1956 a total of 175 necessity certificates had been certified and 28 canceled with 147 still outstanding at a total value of $698,401,000. Of these 83 were for coke, 59 for metallurgical coal, 2 for coal in Alaska and 3 miscellaneous.

In carrying out its minerals mobilization responsibilities the Office established and maintained coordination with other Government agencies which plan and carry out programs directly or indirectly affecting minerals mobilization. Of particular note was the establishment of arrangements for cooperation with the Office of Defense Mobilization and the Department of Agriculture in connection with the surplus agricultural barter program. The Office also represents the Department of the Interior on the Interdepartmental Materials Advisory Committee which deals with stockpiling and related materials supply matters.

Activities with respect to readiness were designed to insure continuity of government and the production of basic metals, minerals and solid fuels under emergency conditions. As part of this programing, recruitment was started for the executive reserve with a view to having trained key personnel available for service immediately in the event of a national defense emergency.

A complete study was made of requirements of mines, mills, and smelters and the solid fuels industry for controlled materials (steel, copper, aluminum and nickel) for maintenance, repair and operating supplies. To obtain the basic data for these estimates for the minerals industry, a survey was undertaken and approximately 25,000 questionnaires were returned and tabulated. From these data estimates were prepared in accordance with overall economic and strategic criteria so that they could be consolidated by ODM with estimates of other industries under the defense materials system. Specific plans for Government and industry action under emergency conditions were developed. Drafts of the regulations and orders necessary to put the recommendations into effect were in preparation. Work was commenced on plans and programs for plant security and plant protection.

Under the delegation from the Federal Civil Defense Administration, the Office began programing to assure an adequate supply of solid fuels for attacked areas and reception centers. In connection with this responsibility, the Office selected personnel to be utilized in controlling production and distribution of solid fuels in an emergency. Steps were taken in collaboration with the regional headquarters of the FCDA to establish local solid fuels advisory committees in po-

tential target areas to assist the State directors of Civil Defense in obtaining adequate quantities of solid fuels in an emergency. Personnel of the Office of Minerals Mobilization received indoctrination at the National Headquarters of the Federal Civil Defense Administration at Battle Creek, Mich.

During the year, 15 Industry Advisory Committees were appointed to facilitate cooperation between the Government and minerals producers to assure that the special conditions and requirements in each industry would be taken into account in mobilization supply programing and to facilitate common understanding and action by industry and Government with respect to readiness.

OFFICE OF GEOGRAPHY

Meredith F. Burrill, *Director*

THE Office of Geography was established to carry out the responsibilities of the Secretary of the Interior under the act of July 25, 1947, conjointly with the Board on Geographic Names. The Office performs the research and other staff functions relating to the standardization of geographic names for use by the Federal Government.

The work of the Office in 1956 was chiefly concerned with names in areas outside the continental United States, with special emphasis on Latin America, Antarctica, and Africa. Geographic and linguistic research led to the standardization of over 140,000 names, bringing the total of such names and variant cross-references to about 1,500,000. Over 400,000 names were edited on maps and in textual materials for correctness of form and spelling and accuracy of application, and more than 300,000 names were issued in gazetteers. (See the report of the Board on Geographic Names.) In addition over 16,000 telephone and mail inquiries were answered.

Substantial files of standardized names are now maintained for nearly all areas except the continental United States. New source materials and changing political and linguistic conditions make necessary a continuing review of policy and the addition of new information to the name files of many areas. This and the supplementation of files continues to utilize increasing proportions of the research effort of the Office.

BOARD ON GEOGRAPHIC NAMES

The Board on Geographic Names is an interdepartmental organization established by the act of July 25, 1947, for the purpose of standardizing geographic nomenclature for use by the Federal Government.

Its members represent the Departments of State, Army, Navy, Post Office, Interior, Agriculture, Commerce, and Air Force, and the Government Printing Office, the Library of Congress, and the Central Intelligence Agency. Dr. H. Thompson Straw, Department of the Air Force, was Chairman during the fiscal year 1956.

The Board and its committees met frequently to act on nomenclature policies, to approve names and to perform related functions. New policies were formulated and previous ones revised and extended.

A uniform system for the transliteration of Arabic, the BGN/PCGN system, was adopted jointly by the Board and the Permanent Committee on Geographical Names for British Official Use.

The Board's series of gazetteers of standard names for public sale by the Superintendent of Documents was extended as follows: No. 5, Hong Kong, Macao, Sinkiang, Taiwan, and Tibet; No. 6, Chile; No. 7, British West Indies and Bermuda; No. 8, Albania; No. 9, Burma; No. 10, British Borneo, Singapore, and Malaya; No. 11, Greece; No. 12, Japan; No. 13, Indonesia, Netherlands New Guinea, and Portuguese Timor; No. 14, Geographic Names of Antarctica; No. 15, Mexico; No. 16, British Honduras; No. 17, Rhodesia and Nyasaland; No. 18, Costa Rica; No. 19, Iran; No. 20, Angola; No. 21, Uruguay; and No. 22, China.

The volume of additional activity is reflected in the report of the Office of Geography.

Office of the Assistant Secretary
Public Land Management

Wesley A. D'Ewart, *Assistant Secretary*

THE Assistant Secretary for Public Land Management is responsible for the direction and supervision of the Bureau of Land Management, the Bureau of Indian Affairs, the National Park Service, the Fish and Wildlife Service, and the Office of Territories.

Significant achievements have been attained in each of the bureaus during the past year in a continued effort to provide the best service to the public.

The technology and skills developed by the Bureau of Land Management in evaluating various land uses and applying the principles of multiple land use, assure a well conceived and balanced program for the proper management and orderly lease or disposal of the public domain lands in the United States. Fundamental to these programs is completion of a project for modernizing the basic land records. With the aid of modern technology, wornout documents are being permanently preserved on microfilm and electronic tabulating cards to permit easy reference. Adequate cadastral surveys are essential to the successful management and conservation of the natural resources of the public lands. Surveys have been extended over areas valuable for minerals, including oil and gas in the Western States and in Alaska. Areas found suitable for homesites have been subdivided to accommodate demands of increasing populations. In the Pacific Coastal States, surveys have aided in the harvesting of timber, reforestation and other timber management activities.

A marked acceleration in the Bureau's activities in both the public domain and acquired lands of the United States, particularly with respect to uranium, contributed to the national economy and to national defense through the discovery and exploration of new sources of fissionable materials.

Under recently enacted Public Law 359, some 7,250,000 acres of public land which were withdrawn from mineral location under Federal power site reservations were opened to location. Adequate safeguards are provided for the protection of surface values which could be destroyed by unrestricted mining operations.

During fiscal year 1956, the Bureau of Indian Affairs placed increasing emphasis on educational and economical opportunities. Development of reservation resources was pressed forward through continued extension of Indian irrigation projects, further expansion of soil and moisture conservation work, and similar activities. During calendar year 1955, sales of Indian timber were sharply stepped up and produced about a third more income to the Indian owners than in the preceding year.

The Bureau also took steps to increase the opportunities for industrial employment of Indians in the vicinity of reservations. A program to foster and encourage the establishment of manufacturing or processing plants in these areas was set up, and numerous contracts were made with industrial firms throughout the country.

The most outstanding feature of the National Park System and the National Park Service during fiscal year 1956, was launching of the Mission 66 program, a 10 year conservation program of development and improvement to provide facilities for 80 million visitors by 1966—the golden anniversary of the establishment of the service.

In the past, National Park Service programs have been on a year-to-year basis. The Service now hopes to be able to proceed with development on a full scale, rather than a piecemeal basis. Not only will this make possible much more economical expenditure of construction funds but it will shorten the period of disruption, for each area being developed, with construction activities.

Much thought and effort is being given to better accommodations and facilities in a number of our national parks, as for example the recently launched new Canyon Village in Yellowstone National Park, and the extensive cabin development, with appurtenant facilities, which will serve campers and day visitors as well, at Colter Bay, in Grand Teton National Park.

A major accomplishment for the Office of Territories during fiscal year 1956 was the enactment of the Alaska Mental Health Enabling Act, as a result of which the mental health program in Alaska will now become a territorial responsibility.

Also due to the passage of the Federal Aid Highway Act of 1956, Alaska's road program, heretofore operated by the Office of Territories, is being transferred to the Bureau of Public Roads of the Department of Commerce. Henceforth, the Territory of Alaska, with respect to highway developments, will be treated far more as though it were a State than has been true in the past.

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Advancements of considerable importance in local government, public health, and education have developed in the Trust Territory of the Pacific Islands and in American Samoa.

In American Samoa the most significant change has been a tripling of exports through the operation by private enterprise, with Government encouragement, of a large fish cannery.

During fiscal year 1956, the first commercial air service began operation to American Samoa and plans for a large airport were progressed which will make American Samoa an essential stop on major Pacific air routes.

Extensive construction for the improvement of highways, schools, telephone system and fresh water supply were undertaken during 1956 in the Virgin Islands. Also contract has been made to study the airport needs of the islands.

For the first time in the history of the Virgin Islands Corporation, a corporation responsible for aid in developing the economy of the islands, a profit in the production of sugarcane was attained. The production per acre was 36.52 tons—the highest on record. Under this Corporation, power operations have improved both in efficiency of service and income.

Agriculture progress on the islands include land clearance, improved livestock production, and forestation, all of which have contributed to the overall development of this territory.

The Fish and Wildlife Act of 1956 (Public Law 1024, 84th Cong.) provides for an Assistant Secretary for Fish and Wildlife, with the Service becoming the United States Fish and Wildlife Service, under a Commissioner of Fish and Wildlife, and consisting of two bureaus, the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. Under this act, the new Service will provide the opportunity for added conservation of our fish and wildlife resources through expanded research and improved management of fish and wildlife resources.

During fiscal year 1956, the Service made substantial progress in its promotion of utilization and conservation, and operations were further decentralized to bring them closer to the particular areas they affect.

Considerable success was obtained in developing markets for the plentiful and underutilized fish of the Great Lakes, and a nationwide survey of the shrimp industry aimed at improving production, processing, and distribution of shrimp products was completed.

During the year the first U. S. standard of grade and condition for fishery products was established through the joint efforts of the fishing industry and the Government. The first standard has been applied to fish sticks. Development of standards for frozen fish blocks and for raw breaded shrimp is well advanced.

BUREAU OF INDIAN AFFAIRS

Glenn L. Emmons, *Commissioner*

WITH the responsibility for Indian health activities transferred to the United States Public Health Service, the Bureau of Indian Affairs in the fiscal year 1956 placed increasing emphasis on the other two phases of the program originally announced by Commissioner Emmons in December 1953—education and economic opportunity.

The most striking progress in the educational field was achieved on the Navajo Reservation where enrollment of children in school increased nearly 7 percent over the preceding year and reached a record level of 25,287 students. This total included not only children enrolled in schools on the reservation but those in mission schools, public schools of the peripheral communities, and Federal boarding schools located throughout the Western States.

Another significant step in education was the initiation of a "pilot" program of adult education in five tribal areas. Under the readjustment or "termination" laws enacted in 1954, members of tribes such as the Menominee of Wisconsin and the Klamath of Oregon were afforded an opportunity for adult education and vocational training to prepare them for the assumption of full citizenship responsibilities which would come with the ending of Federal trusteeship. The new program, however, went beyond this and affected tribes not covered by such legislation. Its principal purpose was to provide English language skills for Indians who enjoyed little or no formal schooling in their youth.

On the economic side the progress was at least equally impressive. Development of reservation resources was pressed forward through continued extension of Indian irrigation projects, further expansion of soil and moisture conservation work, and other similar activities. Sales of Indian timber were sharply stepped up in the calendar year 1955 and produced about a third more income to the Indian owners than in the preceding year. Combined Indian income from oil, gas, and other minerals reached an all-time high of more than $41 million.

In addition to this heightened activity in the resource field, the Bureau also took steps to increase the opportunities for industrial employment of Indians in the vicinity of reservations. A program to foster and encourage the establishment of manufacturing of processing plants in these areas was set up under the direction of an assistant to the Commissioner and numerous contacts were made with industrial firms throughout the country. By the end of the fiscal year, plants of this type were either established or definitely in process at Kingman, Ariz., near the Hualapai Reservation; at Cherokee, N. C., near the Cherokee Reservation; and at Gallup, N. Mex., near the Navajo Reservation.

Meanwhile the Bureau continued its voluntary relocation program of financial help and community adjustment service for the benefit of Indians seeking employment opportunities away from the reservations. The number of individuals receiving such assistance increased to 5,316 as compared with 3,461 the preceding year. This included 1,051 family groups, 732 unattached men, and 373 unattached women. For the fiscal year beginning July 1, 1956, funds available for relocation assistance were more than tripled to a level of approximately $3,500,000 and plans were made for a substantial expansion in the range of community adjustment services and in the staff both on the reservations and in the city offices.

At the five tribal areas covered by "termination" or readjustment laws enacted in 1954—Menominee of Wisconsin, Klamath of Oregon, Uintah-Ouray of Utah, western Oregon, and the four Paiute bands of Utah—steady progress was made throughout the year in preparing for the "termination date" when the Indians will take over full responsibility for their own property without further Federal trusteeship. In the case of the western Oregon and Paiute groups, this date was scheduled for the late summer of 1956 and the preparations were well advanced at the end of the fiscal year.

At Klamath a contract was signed for a complete appraisal of the tribal property which is scheduled for completion in the spring of 1957. For both the Klamath and Menominee the termination is set for 1958. For the "mixed blood" people at Uintah-Ouray it is scheduled for 1961. Similar readjustment legislation affecting three tribal groups in northeastern Oklahoma—the Peoria, Wyandotte, and Ottawa—was introduced in the second session of the 84th Congress, with the approval of the tribes, and appeared most likely to be enacted before the end of the session.

NAVAJO-HOPI REHABILITATION

In fiscal 1956 the 10-year program authorized by the Navajo-Hopi Rehabilitation Act of 1950 passed beyond the halfway point and con-

tinued to produce benefits of fundamental value for members of the two tribal groups.

Education

The Long Range Act authorized a total of $25 million for the construction of schools and for other educational purposes. The allocation of $3,287,000 for education in fiscal year 1956 brought the total of long range funds provided in this category through the sixth year of the program to $24,200,800.

The new boarding school at Kayenta was completed and ready for use in the fall of 1955, built at a cost of $1,507,000, and accommodating 400 boarding and 80 day pupils.

In addition, the construction program for fiscal 1956 included the near completion of work on two dormitories in peripheral communities, the awarding of contracts on two others and the awarding of contracts on three school expansion projects. On the Hopi Reservation the program included good progress on a boarding school dormitory at Keams Canyon and several other school construction projects.

Cooperation between the Federal and State Governments has made possible the construction of 11 public schools on or near the Navajo Reservation with funds appropriated under Public Law 815, and serving approximately 2,500 Navajo students. Two large public-school facilities will open at Tuba City, Ariz., and Crownpoint, N. Mex., in the fall of 1956, serving 350 and 450 pupils respectively.

The past year has been marked by close cooperation in the planning and execution of the Navajo education program by the Navajo Tribe, the Bureau of Indian Affairs, the State department of public instruction, and the local county and municipal governments. The cooperative approach has borne fruit in the form of better understanding on the part of Navajo and surrounding non-Navajo people, and has resulted in the formulation of a basic Navajo education policy. The latter provides that:

1. School facilities will be provided on the reservation for beginners through age 12—or through grade 6.
2. Educational opportunities will be developed in public schools for children in grades 7 to 12.
3. Vocational education in off-reservation Federal boarding schools will continue for retarded Navajo children in the 13- to 18-year age group, as long as required.
4. Provision will continue to be made through the States for the education of mentally and physically handicapped Navajo children.
5. Navajo high-school graduates will be encouraged to pursue advanced training in keeping with their interests and capabilities.

As one aspect of the objective of providing schools for beginners through the sixth grade on the reservation, trailer schools will be con-

verted to permanent day schools when, after a 2-year trial period, such conversion is proven to be feasible and desirable. However, it is not intended that permanent expansion on the reservation will exceed 12,000 spaces. If additional space is required beyond that maximum, it will be provided in the form of temporary facilities.

At the close of the school year in June 1956, the total enrollment was placed at 25,287 pupils in all types of schools, representing an increase of 1,608 over the 23,679 enrolled in the preceding school year. Of these, 1,302 were enrolled in public schools in 6 peripheral towns in the Bordertown Dormitory program.

Completion of the dormitory construction and school expansion summarized above will be reflected in an increase in school enrollment in the bordertowns to an anticipated 1,460 in the 1956–57 school year.

Hospital and Health Facilities

On July 1, 1955, the Public Health Service of the Department of Health, Education, and Welfare assumed the responsibility for Indian health. The Long Range Act authorized a total of $4,750,000 for implementation of the needed Reservation health program, of which $2,712,300 had been allocated in long-range funds prior to July 1, 1955. In 1956, a total of $5 million was made available to the Public Health Service for the construction of Indian health facilities, of which $2,037,700 was charged to the long-range program, thus completing the appropriation originally authorized in this category.

Irrigation Projects

Of the $9 million authorized for irrigation construction by the Long Range Act, a total of $3,332,275 has been appropriated thus far, of which $636,500 was allocated in fiscal year 1956.

A 1,200-acre tract on the south side of the San Juan River, known as the "Helium Unit" of the Hogback project has been completed. Construction of the main canal and laterals and subjugation of the land was carried out under contract and finished on October 12, 1955, at a cost of $206,149.32. The Navajo Tribe will participate with the Bureau in the operation of this tract as a training unit over the course of the next nine years, bearing the greater portion of the actual cost from annual tribal appropriations.

The Red Lake project, involving 949 acres of land, was completed in November 1955.

The feasibility report on the proposed Shiprock division of the Navajo project was completed in January 1955, and submitted to the Secretary of the Interior by joint memorandum of the Indian and Reclamation Bureaus on February 20, 1956.

The Navajo project was included as a participating project in Senate bill 500, authorizing the construction, operation, and maintenance of the Colorado River storage project and participating projects.

Roads and Trails

A total of $8,405,000 has been allocated thus far against the Long Range authorization of $20 million for road construction. Of the total made available to date, $1,700,913 was provided for road construction on the Navajo, and $320,000 for construction on the Hopi Reservation in fiscal year 1956.

The 1956 appropriation is being used to finance additional construction work on Route 3, including the surfacing of a 19.5 mile segment of road between Ganado and Sawmill Junction, and for the surfacing and grading of the Window Rock streets. Contract work on Route 1 between Shiprock and Tuba City consisted of 11.5 miles of gravel surface and 10.3 miles of grade from Shiprock west. Four bridges were constructed, 2 on Route 1 and 2 on Route 3. Four airstrips were constructed located at Tuba City, Crownpoint, Kayenta, and Chinle.

Soil and Moisture Conservation

Long-range allocations for soil and moisture conservation and range improvement work to date have totaled $3,263,430, of which $686,850 was provided in fiscal year 1956. The total authorization is $10,000,000.

The soil conservation program receives the close cooperation of the Navajo Tribe which, in fiscal year 1956, contributed $70,000 in tribally appropriated funds plus approximately $1 million worth of labor and materials contributed by individuals. During the same period $203,600 was contributed in the form of agricultural conservation and stabilization program funds, and $685,003, in federally appropriated money.

During the past year emphasis has been placed on the eradication of sagebrush and juniper as a major range improvement project. In the Jeddito area 7,660 acres were cleared during fiscal year 1956, bringing the total acreage cleared to 15,703 acres. The cleared rangeland showed a gain of 160 pounds of usable forage per acre over adjoining uncleared areas on the basis of random clippings made in the fall of 1955.

Range Water Development

The total allocation of long-range funds for range water development in fiscal year 1956 was $146,280, to which there was added $244,634 in regular funds.

Of the total, $134,634 was used for construction and $110,000 for operation and maintenance. Twenty-two wells were initially programed for construction in fiscal year 1956; however, due to total well depths involved, it was necessary to reduce the number of wells contracted to 18. The completion date of the fiscal year 1956 program will be September 1956, or sooner.

Of the $250,000 Tribal appropriation for the fiscal year 1956 well drilling program, $10,000 was transferred to the U. S. Geological Survey for feasibility studies and $10,000 was withdrawn for administrative expense. The remaining $230,000 was programed for the drilling of 18 wells, more or less. Contracts have been let for the drilling of 10 tribal wells and the contracts for 8 additional tribal wells are pending. The completion of the fiscal year 1956 tribal well-drilling program will probably fall in the first half of fiscal year 1957.

On the Hopi Reservation excellent progress was made on the long-range water development program. Five wells were drilled and four of these were equipped with windmills and are now in operation. Two charcos were also built as an integral part of that program. This water development program was approved by the council and all developments are in accordance with that program.

Development of Industrial and Business Enterprises

The Long Range Act authorized the appropriation of $1 million for the purpose in reference, of which $228,000 has been allocated thus far. In fiscal year 1956, $10,000 was provided to the Hopi but no funds in this category have been allocated to the Navajo in fiscal years 1955–56.

Having passed through a period when the major emphasis was placed on the development of small, local tribal enterprises or "home industries," the Navajo Tribe is presently interested in a program designed to attract established industries, capable of employing Navajo labor, to the reservation area. The tribal council has formally endorsed such a program and, on December 8, 1955, adopted a resolution appropriating $300,000 for implementation of the program. The money in reference may be used for the provision of plant facilities to industrial operators, for the training of Navajo workers, and for allied purposes.

The tribe has established a tribal office for industrial development and operations and has hired an industrial manager to carry forward the industrialization program as rapidly as possible.

PROGRAM DEVELOPMENT

Programing on a broad scale to accelerate the carrying out of Bureau objectives was initiated on April 12 in a memorandum to area directors and agency superintendents entitled, "Programing for Indian Social and Economic Improvement." This memorandum stressed the need to come to grips with the basic long-range problems in each tribal situation which presently impede the betterment of the Indians' economic status and living standards, hamper the provision of full educational opportunities for their children, and obstruct the improvement of their health conditions. Another objective that was stressed is the need to reach a common understanding and mutual agreement with Indian people upon the means and methods for their achieving the stage where they will have developed the self-reliance necessary to conduct their personal affairs with the same degree of independence as other American citizens.

More specifically, in cooperation with Indian people, local and State governmental units, the Bureau is seeking (1) to make a careful analysis of reservation populations, their probable increase, their needs, and their potentialities; (2) to accurately inventory physical resources and possibilities for their improvement for the purpose of determining the number of people for whom these resources can provide a decent living; (3) with the cooperation of the Public Health Service, to secure adequate health coverage to reduce wasted human resources; (4) to provide through local and State educational systems, as well as directly through Bureau-operated programs, adequate education opportunities in basic and vocational fields benefiting beginners through adults; (5) specific training and guidance programs to develop greater self-reliance and to equip Indians to adjust to a competitive economic society; (6) improvement and conservation of physical resources; (7) development of supplementary sources of income through establishment of payrolls on or near reservations; (8) to advise Indians of the economic opportunities available to them and to give adequate assistance within the limits of available appropriations to all desiring to seek these opportunities; (9) gradual assumption of functions performed by the Bureau either by the Indians themselves or, as appropriate, by agencies of the local, State, or Federal Government.

Primary responsibility for programing is placed upon agency superintendents but assistance is to be given when possible by Bureau personnel from area and central offices.

PROGRESS UNDER READJUSTMENT LAWS

Alabama and Coushatta Indians of Texas

Fiscal year 1956 was the first in which the Alabama and Coushatta Tribes of Texas functioned wholly without Federal supervision. Although Federal trusteeship terminated on July 1, 1955, pursuant to Public Law 627, 83d Congress, approved August 23, 1954, these Indian people, if they desire, continue to be eligible to be admitted to hospitals and schools maintained by the United States on the same terms applicable to other Indians. During this year, five Alabama and Coushatta Indian students continued or completed their courses in Bureau educational institutions. Only seven members of the tribes found it necessary to call upon the Bureau hospitals for medical services, thus indicating self-reliance in all instances other than major or emergency illnesses. State officials report smooth and satisfactory transition to local auspices in the conduct of Alabama and Coushatta Indian affairs.

Menominee

The Menominee Act terminating the special Federal trusteeship (Public Law 399, 83d Cong.; 68 Stat. 250) was the first adopted but provided for the second longest transition period of the six laws removing restrictions enacted by the 83d Congress. During the first year of the transitional program (fiscal 1955), steps were taken to (1) determine entitlement to inclusion of members on a final roll of the tribe, (2) distribute $4,885,500 per capita to the Menominees as directed by the termination act, (3) arrange with the State of Wisconsin for a special adult education and vocational training program, (4) and carry out a far-reaching administrative and services reorganization resulting in the separation of the Agency and tribal governmental activities from the lumber milling and other commercial enterprises.

The many service functions heretofore administered by Agency personnel, and sometimes performed by Mill personnel, now devolve upon an enlarged tribal organization if it wishes to continue these services as tribal enterprises. The tribe has employed its own bonded treasurer, who, with the tribal chairman, supervises tribal business accounts and many of the activities formerly administered by the Agency under a new simplified plan of operations. Similarly, the Menominee Garment Factory, long a troublesome and losing operation as a tribal enterprise, has been leased to private operators in the textile field, with a prospect of guaranteed income to the tribe and continued employment for Menominee workers. The Bureau com-

pleted a management analysis of the Agency administration in July 1955, in which the Menominee Advisory Council concurred in the main, and the resultant adjustments find a very small Agency staff largely devoted to advisory and trust management activities, with the functional service-providing activities under the management of tribal government. For the balance of the transitional period it will be a "learn-by-doing" process for the Menominees, with counseling and general trust supervision as the role for the Bureau of Indian Affairs.

Klamath

Cooperatively, the Klamath Indians, and the Federal and State agencies concerned are directing their efforts toward accomplishing the various provisions of the act leading to termination on August 16, 1958. The proposed roll has been published and appeals, of which there are now approximately 50, are being considered by the Secretary. Management specialists under contract with the Secretary have (1) started a survey designed to develop guidelines for selecting economic units and to determine an equitable way of apportioning tribal assets among tribal members; (2) assisted in formulation of a plan to stimulate the tribal economy; (3) considered appropriate methods of managing the assets that would remain with the tribe; and (4) submitted a contract for appraisal and inventory of the reservation's resources that was approved by the Secretary February 17, 1956. Indians are reported to be showing a great deal of interest in an educational program under a contract with the Oregon State Department of Education for (1) off-reservation training which includes any regular college or training school chosen by the student applicant; and (2) on-reservation training centered around social, economic, and vocational training such as business management, insurance, and homemaking.

Western Oregon

The western Oregon Indians, under Public Law 588 progressed on schedule toward the termination date of August 13, 1956. For the Grand Ronde group, the final roll was completed and published, the tribe elected to dispose of all tribal lands excepting a small tract on which the community building is located, and land sales are moving forward to completion. For the Siletz Tribe, the tribal roll has been completed, 37 acres of federally owned land are in process of being transferred to the city of Siletz, the cemetery is being transferred to an Indian organization, work is underway to transfer 6 acres of federally owned land to the city of Empire, and the balance of the land is to be used as a park-monument to Siletz Indians. Preparation is also under-

way to process a per capita distribution of $500,000 to tribal members of which over $400,000 was derived from the sale of tribal lands.

Utes of Uintah and Ouray

Termination of Federal trusteeship for the mixed-blood group under Public Law 671 is scheduled for September 1, 1961. Final rolls have been published for both groups consisting of 1,314 full bloods and 490 mixed bloods. Both groups jointly are completing special purchase of heirship lands.

The mixed bloods adopted a plan for the distribution and management of assets, adopted a constitution and bylaws under the name of "Affiliated Ute Citizens of Utah" and elected a board of directors. The full bloods are processing a long-range program which is to include a family plan, resources development, credit, health and education—all designed for improving self-support and the management of their own affairs. Bills were introduced in the 84th Congress to permit future enrollment on the full-blood rolls prohibited by Public Law 671, and to exempt mixed-blood corporations organized to handle the distribution of assets from corporate income tax.

Paiute Bands of Utah

Federal trusteeship for the Paiute Bands of Utah under Public Law 762 is scheduled for termination September 1, 1956. Final rolls have been published for the four bands; Indian Peaks 26, Kanosh 42, Koosharem 34, and Shivwits 130. The Kanosh Band has elected to partition its land. The Indian Peaks and Koosharem Bands have tentatively elected to sell their lands. The Shivwits Band has indicated it will apply to the Secretary for his approval to sell 26,680 acres of its reservation and will retain 840 acres in trusteeship for a period of 10 years as homesites. Special recontact work is being carried out with these groups to advise them of the opportunities available to them under the vocational training and relocation programs which, if not begun by individuals, will expire on September 1, 1956.

INDUSTRIAL DEVELOPMENT

The Bureau's industrial development program was initiated early in the fiscal year 1956. Contacts were made by the Commissioner's assistant with numerous industries from New York to Los Angeles in the fields of electronics, textiles, metal fabrication, woodworking, and many others.

One tangible result of the program during the fiscal year was the establishment of a metal fabricating plant at Kingman, Ariz., in

January by the Kingman Industries, Inc. It is expected to employ at least 50 Indians, mainly from the Hualapai Reservation, by the end of the first year's operation.

Another development was the action of Saddlecraft, Inc., of Knoxville, Tenn., in setting up a plant for the manufacture of leather moccasins and other leather goods near the Cherokee Reservation in North Carolina. It is currently providing steady employment for 21 Cherokee workers.

Under the Navajo Tribe's program for attracting industry, a contract was consummated June 25, 1956, by the tribe with the Baby Line Furniture Corp. of Los Angeles, Calif., manufacturers of juvenile furniture, house shutters, play yards, and similar products. The contract provides for establishment of a branch plant at Gallup, N. Mex., which is scheduled to begin operations around October 1, 1956, and is expected to employ about 100 Navajo workers by the end of the first year. Further expansion of operations in the future is anticipated.

At the close of the period, additional negotiations were being actively carried forward by the Bureau with a number of industrial companies, looking toward the establishment of plants near Indian population centers in Oklahoma, Minnesota, North Dakota, South Dakota, Montana, and Wyoming, as well as Arizona and New Mexico.

EDUCATION

Approximately 122,900 Indian children of school age, 6 to 18 years, attended public, Federal, mission, and other schools in the United States and Alaska in the fiscal year 1956. Nearly 60 (58.6) percent were in public schools, more than 30 (32.3) percent in Federal schools, and 9 (9.1) percent in mission and other schools. Enrollment in public schools increased substantially while it remained stationary in Federal schools, due to the policy of transferring classes and schools from Federal to public school jurisdiction where feasible.

Contracts with States and local school districts were negotiated in 19 States and the Territory of Alaska, providing Federal financial assistance for public school education for approximately 39,600 Indian children, as authorized by the act of April 16, 1934 (48 Stat. 596), as amended, commonly known as the Johnson-O'Malley Act. The public schools absorbed an additional (estimated) 3,400 Indian students in the fiscal year 1956.

The State of Texas has assumed full responsibility for the education of Indian children within the State.

In accordance with the recommendations of the House Committee on Appropriations, dated March 15, 1955, H. Rept. 207, a survey was

completed of the administration of the Bureau's program of financial assistance to public school districts as authorized by the Johnson-O'Malley Act. While the report pointed to certain shortcomings, which are now being corrected, it generally endorsed the policy and procedure of the Bureau in administration of this activity.

In cooperation with the Department of Health, Education, and Welfare and the local school districts in the States of Arizona, Colorado, Montana, and New Mexico, the Bureau has recommended the construction of new schools under the provisions of Title IV, Public Law 815, as amended. These projects will make it possible for additional Indian children to attend local public schools.

The Bureau of Indian Affairs operated 83 boarding and 234 day schools in the fiscal year 1956. Many of the reservation boarding schools accommodate large enrollments of day pupils. The day schools include 13 instructional aid schools in Alaska, and 29 trailer, 4 hogan, and 4 literacy units on the Navajo Reservation. Classes were also conducted for Indian children who are patients in four hospitals (sanatoria) and Indian students were housed in Federal dormitories at 11 locations to attend public schools.

Approximately 83 percent of students enrolled in Federal schools are full-blood Indians and only about 3 percent are less than half-blood.

A total of 25,287 Navajo students, all ages, were enrolled in all types of schools during the 1955–56 school year. This represents an increase of 6.8 percent over the previous year's enrollment. Due to an increased school population, the number of Navajo children out of school decreased only slightly despite the provision of additional school spaces.

Emphasis, the past year, has been placed on the review of standards now in effect and the development of new ones for the guidance of schools operated by the Bureau. The main objective of such a study was to develop a standard guide for school operation. The standards reviewed include (1) the curriculum and the techniques employed in developing it; (2) the vocational guidance program; (3) the staffing pattern necessary to operate a school at maximum efficiency; and (4) equipment and supplies needed for daily operation.

Professional growth has been an important part of the Bureau's summer education program; 38 workshops, on local and area level, have been held with approximately 3,000 persons participating. Themes for the workshops were developed around the needs of special groups. Some of the themes were: orientation and special training for new employees, curriculum study for both academic and vocational teachers, guidance for advisory personnel, preventative maintenance for custodial personnel, and better feeding program for cooks. Principals and principal-teachers of the Juneau area met for 2 weeks to

discuss the educational program needed in Alaska to meet the rapid changes taking place in the cultural and economic lives of the natives and to clarify their responsibilities to the school and to the adults in the villages. Representatives from other Bureau branches, United States Public Health Service; and Territorial health, welfare, and education departments participated. Bureau education personnel planned and led these workshops and many people outside the Bureau participated. Several public school teachers facing the same problems enrolled. Representatives from State departments of education and health, and from universities and colleges participated.

Vocational training courses in printing were continued by the printing departments operated at five large boarding schools. In the 1955–56 school year 114 boys received training in these shops with 14 graduating. Of those graduating, 12 have received permanent placement in commercial printing establishments, 17 others are working in print shops for the summer.

The schools operated for the Choctaw Indians in Mississippi, for the first time, will have access to good library facilities through the Bureau's purchase of a mobile library unit to be ready for operation in the late fall of 1956. The unit will be equipped with approximately 4,000 books and with some visual aids equipment and supplies suitable for use with school age children. The initial evaluation of such a service was obtained through the excellent cooperation of the Mississippi State Library Association. It has been determined through use of the State library unit that a bookmobile library will be enthusiastically received and will be of great educational value to the Choctaw people.

During the year the Bureau initiated a pilot program in adult education. This program originated in the expressed need of individual adult Indians in many tribal groups to acquire the basic skills of speaking, reading, and writing the English language and doing simple arithmetic or to increase these skills. There are hundreds of adult Indians on reservations today who do not possess such skills, either because educational opportunity was not available to them when they were children or because they did not fully avail themselves of such opportunity as existed. In either case, many adults now feel a need for literacy skills to aid them in employment, buying and selling, maintaining good health, rearing a family, and assuming responsibilities of citizenship.

Operations of the program have been begun at five tribal jurisdictions where the need was especially acute: the Seminole of Florida, the Papago of Arizona, the Turtle Mountain Chippewa of North Dakota, the Rosebud Sioux of South Dakota, and the Shoshone-Bannock at Fort Hall in Idaho. Teachers have been employed at

these jurisdictions and are surveying the educational needs and interests of the adults. Instruction based on this survey has begun at most of the jurisdictions.

A continuing search has been made for published learning materials which might be usable in the program. However, because of the peculiar needs of the learners involved, it has been and will continue to be necessary to prepare much of the instructional material specially by gearing it to the specific needs, interests, and levels of literacy of the learners. A good start has been made on preparing such materials.

A plan for evaluating the program has been devised. This involves complete documentation of the adults' needs and interests and the methods, techniques, materials, and equipment employed in teaching.

The Bureau's program of assistance to Indian young people in obtaining education beyond the high school level was accelerated by a larger appropriation in education grant funds for this purpose in 1956; 202 students were aided by the grant funds. A number of tribal groups have established scholarship grant programs from their own funds. The Jicarilla Apache Tribe of New Mexico will use the income from a $1 million trust fund, created in 1956, to provide higher education for its young people. The Bureau is continuing its work to increase the number of Indian scholarships now available through public and private sources and is using to the fullest extent the higher education benefits made possible through Federal grants, loans, working scholarships, and post high school vocational training courses.

WELFARE

In the field of welfare the Bureau continued its emphasis on providing social services to assist Indian families to manage their own affairs and cope with their personal problems, as well as maintaining an assistance program for needy Indians. Child welfare services have been provided for dependent or neglected Indian children either in their own homes or in foster homes when placement away from home has been indicated. There is increasing recognition of the need for such assistance. Some progress was made in finding, and referring for appropriate institutional care, Indian children with handicaps such as mental retardation, deafness, blindness, or cerebral palsy who require training which is not available in Bureau schools. Considerable unmet needs were uncovered in this connection, particularly in the Southwest.

Relief needs in Alaska and on the Navajo Reservation increased, while remaining fairly stable in the rest of the country. In Alaska the increase was considerable because of the poor fishing season, which resulted in a heavy caseload in areas where fishing is the chief means

of support. The Public Health Service increased case-finding operations particularly with respect to tuberculosis in Alaska and on the Navajo Reservation, and it was necessary to provide assistance to a number of additional families either in the family home or with foster care of the children when the parents were hospitalized.

During the fiscal year the average general assistance monthly caseload averaged 2,883 families with 7,842 persons. The average monthly grant was approximately $57.82 per family. Increased use was made of surplus commodities particularly in the Aberdeen area.

Emphasis has continued on planning for younger children to remain in their own homes so that they may attend public school, whereever possible, rather than enroll in Federal boarding schools. Social workers reviewed the situation of a number of children already in school and applications for enrollment, based on social rather than educational reasons, to determine whether the children could be assisted to remain with their families or interested relatives. Some children were enabled to remain with their families through provision of aid to dependent children or other assistance, and others to live with relatives. Advice and counsel were given to children in school and their families and school staff in regard to personal problems and summer plans for the childrn.

Contracts were renewed with 4 mission day schools for school lunches and incidental costs, and with 3 mission boarding schools for boarding care. These contracts provided for up to 1,005 Indian children for whom public or Federal school facilities were not available.

The aid to dependent children program became effective in Nevada July 1, 1955. This has made it possible to transfer to this program all eligible Indian families of children who were previously carried under the Bureau's general assistance program or in foster homes. Under the State program, Indian families will receive needed social services and assistance from the same agency and on the same basis as other citizens of the State.

The Senate Subcommittee on Juvenile Delinquency paid special attention to the delinquency situation among Indians. A welfare representative attended hearings of the committee, and a staff member is assigned to the Subcommitee on Juvenile Delinquency of the Interdepartmental Committee on Children and Youth.

In compliance with legislation providing for termination of Federal supervision of trust property belonging to certain tribes and bands of Indians in Oregon, measures have been taken to protect the interests of those members of these tribes who are minors, non compos mentis, or in need of assistance in conducting their affairs. Policies and procedures have also been developed and appropriate activities

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are in progress for protection of minors and other persons in need of assistance who are members of the Klamath Tribe and the mixed-blood group of Ute Indians in Utah who are also covered by termination legislation.

RELOCATION SERVICES

During fiscal year 1956, of the Indian people who applied for relocation services, 5,316 were assisted to relocate in the four cities where the Bureau had field relocation offices—Chicago, Denver, Los Angeles, and San Francisco. Of this group, 4,211 were included in 1,051 family units, 732 were unattached men, and 373 were unattached women.

A total of 4,402 persons were granted financial assistance to cover all or a portion of the cost of relocation and 914 persons availed themselves of the employment and community adjustment services but were not granted financial assistance.

These services were accomplished by approximately the same numbers of personnel who the previous year gave assistance to 3,461 Indian people. This naturally placed a severe strain on the staff and there was some reduction in quality and quantity of services and assistance provided. However, increased effectiveness of effort, based on previous experiences, offset this to some extent. An increased range of services is planned for fiscal year 1957, with the anticipation that increasing numbers of Indian people will apply for relocation services and plans have been made for a considerable increase in relocation staff.

Continuing efforts were made to acquaint community agencies with the fact that the Bureau is not requesting these agencies to perform special services for Indian people, but only to make their regular services available on the same basis as they do for all other people.

Among Indian people at the reservations interest in relocation opportunities continued to grow. At most agencies there was a constant backlog of applicants awaiting services. Tribal councils, in general, agreed that the relocation services program performs a necessary function and provides a needed kind of assistance for some members of their tribes. The program is being accepted as one of the necessary tools with which each tribal group can work in planning a long-range program to help Indian people to establish themselves as self-sufficient citizens.

At the field relocation office level many new employers hired Indian people, and those with whom the Bureau had previous contact continued to employ workers referred by Relocation Services. Wage rates are increasing gradually, and through experience, field reloca-

tion office workers are able to make job placement in more desirable positions year by year. Each year more Indian workers progress to skilled and supervisory positions and their success leads to more and better job openings for newcomers.

More effective job placement and improved counseling in the use of financial assistance funds has resulted in allowing more time for orientation counseling and community adjustment of new arrivals. The average length of time between arrival and the first day on the job during the past year was approximately 7 days. This allows time for more adequate orientation within the limits of time during which financial assistance can be provided. Again, additional staff will add greatly to the effectiveness of this counseling.

LAW AND ORDER

Only one State, Nevada, acted during the last fiscal year to assume jurisdiction in Indian areas under authority of Public Law 280, 83d Congress. The Nevada law became effective 90 days after July 1, 1955, and contained provisions whereby any county which did not wish to assume jurisdiction could be relieved of that responsibility by proclamation of the Governor. About two-thirds of the Indian country in Nevada was, by proclamation of the governor, taken out of State jurisdiction, leaving about one-third of the Indian country in the State subject to State jurisdiction.

All amendments proposed in the Congress to amend Public Law 280 to require either Indian consent or consultation failed of enactment, although the Senate enacted S. 51, after it was amended to delete sections 6 and 7 from Public Law 280.

The Attorney General of Washington rendered an opinion holding that the so-called disclaimer of jurisdiction in the State's constitution was not a bar to assumption of jurisdiction under Public Law 280 or an appropriate act of Congress transferring jurisdiction. At the close of the year, the Portland area office was considering appropriate legislation to recommend to the Washington State Legislature in accordance with the State attorney general's opinion.

During the year two Indian tribes adopted resolutions pursuant to the act of August 15, 1953 (Public Law 277, 83d Cong.), for the purpose of legalizing intoxicants on the reservation. This brings to 30 the number of Indian tribal groups which acted to exercise the local option afforded Indian groups by the provisions of the statute. Although the Indians have generally welcomed the removal of the discriminatory legislation outside of Indian country, they have shown a tendency to act very slowly in the legalization of intoxicants within their reservations.

With the small increase of funds appropriated for law enforcement by the Congress, it was possible to make marked improvement in law enforcement in the Aberdeen area, particularly in North Dakota. The small increase was devoted primarily to operating expenses and care and feeding of prisoners, thus permitting the Indian courts to operate much more efficiently.

REALTY TRANSACTIONS

During the fiscal year 1956 the Bureau carried out a reexamination and reappraisal of realty policies and activities, together with a reorganization and staffing of the realty functions in both the field and Central offices. This was a start toward rebuilding the realty program of the Bureau on a sound and realistic foundation primarily to effectuate an orderly removal of lands from the jurisdiction of the Bureau and to achieve the efficient and economical management of those lands which remain under trusteeship. This has involved the establishment of new policies and legal interpretations, the accomplishment of research work, promulgation of regulations, development of procedural manuals, and the recruitment of a limited number of trained technical personnel and realty specialists. Regulations and manual procedures have been developed to facilitate the expeditious processing of cases to afford better control over individual realty transactions and to insure equities to the landowners.

With an increase in available funds for the fiscal year 1956, the realty staffs in both the field and the central offices have been expanded to an extent that enabled the consummation of a total of 47,128 realty transactions requested by Indian owners as compared with some 26,000 cases reported for the previous year. This is an increase of 81 percent in the number of cases acted upon.

During the year the mechanics were developed and initial steps taken to effectuate the withdrawal of Federal supervision over the lands of those Indians for which Congress passed terminal legislation. In carrying out this terminal legislation, and in response to requests of the Indian owners for sales, patents in fee, certificates of competency and removal of restrictions, 2,526 transactions were closed which resulted in the removal of 265,033 acres of land from the jurisdiction of the Bureau.

On the management side, 14,822 of the 47,128 realty cases acted upon this year were surface leases and permits and 4,615 involved the leasing of oil and gas and other minerals. Also included were some 25,165 transactions which had no material effect on the overall acreage of land under the jurisdiction of the Bureau. These included sales to individual Indians, exchanges between individuals, and individuals

and tribes, gifts to members of immediate families and other miscellaneous items.

The nucleus of an appraisal staff was formed during 1956. Professionally accepted appraisal techniques have been adopted with the objective of insuring equity in each transaction involving interests in Indian lands. Guide lines by manual release and other field instructions have been made available to appraisal personnel, and appraisal reports are being prepared in accordance with rules of admissible evidence as set down by the courts. Active recruiting for professionally trained appraisers has been impeded by the urgent national demand, and recruitment is progressing slowly. To relieve this situation, six Bureau employees engaged in this work have been selected to attend appraisal instruction courses sponsored by the American Institute of Real Estate Appraisers. In some instances, where unusual or time-limit valuation problems exist and it is impracticable to perform appraisal work with staff appraisers, contracts have been entered into with qualified appraisal firms and individuals.

The act of August 9, 1955 (Public Law 255, 84th Congress, 69 Stat. 539), referred to as the long-term leasing act, provides a means for better and more profitable utilization of Indian-owned trust and restricted real property. Prior to the enactment of this legislation, most Indian-owned lands, excepting those in the State of Washington and on a few Indian reservations, could be leased for periods not exceeding 5 years. Statutory limitations on the length of tenure prevented the proper development of land of high potential productive value, where the Indian was financially unable to develop such lands and lessees could not afford to make the necessary improvements because the short-term tenure was insufficient to amortize the capital investment required. Many valuable business sites have also remained idle and undeveloped over the years for the same reason.

In addition to the basic work accomplished toward rebuilding and realigning the realty program and organization, many old and difficult land cases that required policy decisions and much research work to resolve have been completed, which has generally resulted in the improvement of the overall status of the realty program.

MINERAL LEASING

Three trends of major importance in the Indian minerals field stood out in fiscal 1956: (1) the phenomenal renewed interest in Osage Reservation oil and gas leasing; (2) the stepped-up search for oil and gas on Navajo lands in the Four Corners area of Arizona, New Mexico, Utah, and Colorado; and (3) the potential expansion of gas development on Indian lands in the San Juan Basin of the Southwest.

The total oil and gas income from all reservations for the year amounted to $41,007,075. Altogether, 3,990 oil and gas leases covering 943,199 acres were approved as compared to 2,931 leases for the prior year covering 716,763 acres. At the end of the 1956 year 17,627 leases were in force covering 5,422,920 acres. A total of 2,115 wells were drilled as compared to 1,193 wells during the prior year.

A total bonus of $9,714,450 was paid for Osage leases compared to a total bonus of $6,604,582 for the prior 5 years combined. A total of 1,422 wells were completed on the Osage Reservation during the past year—almost double the number completed during the prior year. Of these 70.07 percent were commercial oil wells. The primary reasons for the renewed interest in the Osage Reservation may be attributed to the discovery of new pay formations in the old partially developed areas, shallow drilling depth to production and favorable results obtained from water flood projects. In addition, there is available a considerable accumulation of reliable geological data.

On the wildcat lands of the Four Corners area, 6 producing wells were brought in on Navajo tribal land and 2 producing wells were completed on an allotted Navajo tract. The allotted tract brought a bonus of $116,310 to the Indian owner. These strikes are no doubt responsible for an increasing interest in oil and gas development on the Navajo Reservation. The completion of the pipeline from the San Juan Basin to the Pacific Northwest and the construction of additional gas pipelines to California industrial centers offer an opportunity for early gas development and a substantial market for gas production on the Navajo, Jicarilla, Southern Ute, and Ute Mountain Reservations.

The interest in leasing for oil and gas on the Blackfeet and Crow Reservations, Montana, has been steady. In the same State leases were sold this past year for the first time on the Fort Belknap and Northern Cheyenne Reservations. Royalty payments slightly in excess of $1,800,000 were collected from oil and gas leases on the Wind River Reservation, Wyoming.

A total income of $2,881,532 was received for minerals other than oil and gas. Following the general trend, the uranium development has been very active and successful in production and expansion. The "boom" is being replaced with a study of the problems and possibilities of obtaining production profits on the deposits. Both individual operators and corporations are expending large sums in drilling and exploration work. At an advertised sale of Navajo tribal drilling and exploration permits, $253,709 were received for 15,176 acres. It is hoped that this is a foreruner of other sales. As a result of discoveries in the Abrosia Lake area, there is a strong interest in developing Navajo allotments in McKinley County, New Mexico. In addition

to the uranium mills being operated at Shiprock and Bluewater, N. Mex., an additional mill is operating at Tuba City, Ariz. A new ore-buying station has been installed at Grants, N. Mex. These will provide an expanded market for ores in the area. As a result of discoveries on the Spokane Reservation, Washington, a bonus of $317,500 was received for uranium mining leases on three allotted tracts comprising 459 acres. There is considerable exploratory work being performed on this reservation. It is expected that a mill will be erected to serve the area. Considerable interest has also developed on the Crow Reservation, Montana.

There is a small but steady production from the lead and zinc mining leases, Quapaw Reservation, Oklahoma, and phosphate from the Fort Hall Reservation, Idaho.

IRRIGATION

Indian irrigation projects vary in size from tracts of a few acres such as subsistence garden tracts to projects of over 100,000 acres and are often the only means of obtaining a livelihood for resident reservation Indian families. Crops produced on these projects during the calendar year 1955 were valued at $47,077,048.

During the fiscal year 1956 a considerable amount of the construction work involved the rehabilitation, repair and betterment of existing facilities. The lands and the landowners of the various projects benefited materially through the improved facilities provided by rehabilitation.

Approximately 7,762 acres of additional lands on the various projects were served during 1956. This involved the extension and rehabilitation of 113 miles of canals and laterals; enlargement of 20 miles of canals; construction, repair and rehabilitation of some 710 various types of water control structures, drilling and rehabilitation of 13 deep wells; and the construction of storage dams to provide additional storage of 18,035 acre-feet.

Power facilities on the Colorado River (Arizona), Flathead (Montana) and San Carlos (Arizona) projects were extended to serve an additional 267 customers. This involved the construction and extension of approximately 16 miles of transmission and distribution lines and the conversion of transmission lines to larger capacities. These power systems provide electrical energy for project use and serve the adjacent surrounding communities, and, in most instances, are the only source of power available to the customer.

During the months of December, January, and February of the fiscal year 1956, severe flood damage occurred to irrigation facilities on the Wapato (Washington), Klamath (Oregon), Warm Springs

(Oregon), San Carlos, Miscellaneous Pueblo (New Mexico), Miscellaneous California, and Nevada Agency projects. As a result of the emergencies caused by these floods a major part of irrigation activities for these projects during the entire fiscal year was concerned with replacement and repair.

The most important Indian irrigation development work other than flood repair work during the year was on the following projects:

Colorado River Project, Arizona

Emphasis was placed on drainage work during the year and intensive studies were conducted in order that final drainage plans will be completely adquate. Other drainage work consisted of the installation of 1,450 piezometers on 40,000 acres of cultivated land; the cleaning and deepening of 26 miles of drains; the excavation of 4.5 miles of new drains; and the rehabilitation of 4 drainage pumps. In addition to the drainage work, 2.5 miles of a large irrigation canal were lined with gunite.

Navajo Hogback Project, New Mexico

The main canal of this project was extended for a distance of 2 miles with necessary structures including installation of a 72-inch steel pipe siphon 1,200 feet in length and the construction of a reinforced concrete check, wasteway, and chute, 355 feet in length.

San Carlos Project, Arizona

The rehabilitation and enlargement of the Picacho Reservoir was completed in May adding 18,000 acre-feet of storage to the project.

Flathead Project, Montana

The construction work on this project consisted of the concrete lining of 6,070 feet of the Dry Creek Canal and 1,975 feet of the Polson pump canal. Power improvements for the year consisted of the modernization of the Roman substation, installation of a new transformer bank at the Ravalli substation and the installation of a 34.5-kilovolt switching structure at Kerr substation.

Engineering Plans and Surveys

Investigations and field studies were carried on in the Kohatk area of the Chui Chui project (Arizona) to determine the availability of groundwater; reconnaissance soil surveys were made on 1,200 acres

of land near Towaoc, Colo.; preliminary surveys were conducted on 5,000 acres of Southern Ute (Colorado) lands in connection with the proposed Animas LaPlata project, and detailed soil surveys were completed on 4,500 arcres of land on the proposed Mancos project.

In addition to the usual, regular preliminary and preconstruction surveys, extensive field examinations and studies and the collection, preparation and assembling of data for the protection of Indian water rights were continued during the year for use in connection with the water suits entitled *Arizona* v. *California*, and *Texas* v. *New Mexico*. Indian water rights were also involved in connection with the Columbia River Compact, Klamath River Compact, and the Ahtanum suit on the Yakima Indian Reservation.

FORESTRY

During the calendar year 1955, nearly 662 million board-feet of Indian timber was cut under contract or used by Indian tribal sawmills. In addition to this commercial type of operation, about 116 million board-feet of timber was cut by Indians and non-Indians for local use. Cash receipts from the stumpage cut under contract and used by tribal sawmills exceeded $11,250,000. Cash sales for local use yielded an additional $104,000, and the timber cut by Indians under free use had an estimated stumpage value of $330,000. The total harvest during the year, therefore, amounted to 778 million board-feet, which had a stumpage value approaching $11,750,000.

The combined contract sales and Indian sawmill use in 1955 exceeded corresponding operations in 1954 by 28 percent in volume and 32 percent in value. As in past years, the Pacific Northwest led all other sections of the timber-producing areas, and accounted for 71 percent of the volume of sales and 75 percent of the receipts.

Considerable progress was made during the year in field work to obtain timber inventories for use in revising the estimates of allowable annual cut. The assembling and interpreting of these basic data was in progress or was completed, in 1955, on several Indian reservations, including the Fort Apache and San Carlos Reservations in Arizona, the Hoopa Valley and Tule River Reservations in California, the Southern Ute in Colorado, the Red Lake in Minnesota, the Northern Cheyenne in Montana, and the Jicarilla in New Mexico, the Klamath in Oregon, and the Menominee in Wisconsin.

In most instances, this newly acquired knowledge regarding total volume and allowable cut has revealed that the annual rate of cutting can be safely increased without violating the objective of sustained yield management. This knowledge would have been of little practical value, however, if the appropriations for forest management

and timber sale administration had not been substantially increased. The combined effect of improved knowledge and increased appropriations is reflected in the increased volume and value of timber sold during the past year.

Although most tribes prefer to sell their timber to private loggers, an exception to this practice occurs on the Red Lake Reservation in Minnesota, the Menominee Reservation in Wisconsin, and the Navajo Reservation in Arizona. A tribal sawmill operates at each of these reservations. These mills used 45 million feet of the 662 million feet reported above as sold under commercial type of operations; and accounted for $786,000 of the cash income from such sales. In addition to this cash return to the tribes for the value of stumpage used, the mills returned an operating profit of $477,000 during the fiscal year 1955; and paid more than $1,750,000 in wages, a very large portion of which was paid to Indians and those married to Indians.

During the calendar year 1955 the combined Indian Reservations experienced a total of 845 fires, which burned 64,797 acres of land. Only 10.5 percent of this area was forest land, however, the remainder being grass or brushlands. About two-thirds of the burned forest area occurred on two reservations, the Hoopa Valley in California and the Fort Apache in Arizona, when disastrous fires originating in adjacent areas swept over their borders before being brought under control. Lightning was responsible for approximately 50 percent of the fires. Total damage to Indian-owned land and resources was estimated at $314,000. The total suppression cost amounted to $268,000.

Direct insect control work continued during the year on the Cherokee Reservation, to eradicate an attack of the southern pine beetle, which had suddenly become epidemic in that region. Control work was also initiated on the Menominee and Navajo Reservations to combat destructive attacks by the walking-stick insect and the Black Hills beetle, respectively. In addition to these direct attacks, salvage sales of timber were made on the Warm Springs and Yakima Reservations. These sales included timber either killed or exposed to attack by destructive pine-bark beetles.

The only forest disease against which effective action was taken was the white pine blister rust in the Lake States. Some 2,440 acres of control area were worked over, to eradicate ribes, on five reservations. On the 11 Indian reservations in the Lake States, where blister rust control work has been undertaken, 77 percent of the control area is now on a maintenance status, and requires only occasional checks to determine whether the alternate host plants for the disease are becoming reestablished.

RANGE MANAGEMENT

The 44 million acres of Indian rangeland has a rated grazing capacity of approximately 880,000 cow units. More than 33 million acres having a grazing capacity of 550,000 cow units were used by Indians largely for the grazing of family subsistence herds. Cash receipts for the use of the Indian rangelands during the fiscal year were approximately $2,865,000. Free use privileges granted to Indians were valued at $3,500,000.

These lands are divided into range units and permits are granted thereon proscribing maximum stocking, proper season of use and other conservation stipulations to obtain optimum use consistent with sustained forage production. Range not required for Indian use is offered to the public for competitive bidding.

Difficulty is still being experienced in obtaining proper use of large areas of tribally owned range in New Mexico and Arizona. The prolonged drought and the heavy demand by the Indians for forage for their livestock has created an overgrazed condition that will require careful management over a long period of time to correct.

The estimated value of the take of fish and wildlife resources in 1956 was over $2,200,000.

SOIL AND MOISTURE CONSERVATION

Soil and moisture conservation activities and practices applied on Indian lands during fiscal 1956 reached an all-time high. Indian farmers and ranchers joined with other community leaders in actively engaging in conservation planning and development. This is evidenced by the fact that 90 percent of all Indian lands in established soil conservation districts are covered by working agreements with them. Involved in this are 27,663,000 acres of land located in 231 districts. Local conservation associations or enterprises are operating on much of the Indian land not included in such districts.

To serve as a guide in the proper use of this land, 11,069 individual farm and ranch plans were developed with the operators on 3,010,687 acres of Indian land. Basic inventory and utilization surveys were carried out on 17,169,678 acres in the formulation of the plans and the servicing of plans previously made. As a direct result of cooperation in carrying out farm and ranch plans, approved cropping systems were carried out on 2,082,739 acres of Indian lands. Cultural practices—including cover crops, deep plowing, residue management, rough tillage, strip cropping, and weed control—were initiated on 2,028,889 of the some 3,500,000 acres of dry and irrigation Indian

farm land. On the basis of recommendations of soil technicians and engineers especially assigned to study problems relating to the improvement of water-logged, alkali, or otherwise unsuitable lands; 6,974 acres were leveled, 7,146 acres were drained, and 9,855 acres treated for alkali or similar conditions. Thus, 23,975 acres of land were brought into a high state of production.

Revegetation of range lands through artificial and natural means has resulted in the reseeding of 95,558 acres of range land, the elimination of undersirable brush and woody plants from 73,134 acres and the construction of 1,348 miles of fence for the protection and management of these related land areas. In addition, 1,173 ponds were constructed for livestock water, 185 minor detention structures for flood and erosion control, and 39,220 acres of water spreading developed primarily for increased forage production. These measures, to which thea Indians have contributed more than the Government, are developing and stabilizing their land base, controlling erosion, reducing flash floods and utilizing floodwaters for the production of forage and water for livestock. Indian farm and range lands as well as management techniques are being improved; human and livestock carrying capacities increased, and the use of the land facilitated by these works.

When affected, Indian lands are participating in the planning and development of the Small Watershed program authorized under Public Law 566. Two such programs are presently underway.

EXTENSION

The Bureau of Indian Affairs has continued the process of turning extension work to the States and the Department of Agriculture. At the close of fiscal 1956, the Bureau had entered into contracts with 16 of the 18 States where extension work with Indians was formerly carried on directly by the Bureau; this includes roughly two thirds of the total extension program with Indians. The States not covered by contract are Arizona, Mississippi, and part of New Mexico. Negotiations with the Department of Agriculture resulted in an agreement, effective July 1, 1956, under which that Department took over most of the supervisory responsibility for Indian extension work formerly exercised by the Bureau.

State extension workers and the remaining Bureau extension workers were able to assist through the various educational extension programs an estimated total of 17,051 Indian families with practices designed to improve farm, home, and community living. The 4–H Club programs among young Indian boys and girls continued to receive emphasis.

ROADS

In 1956, the Indian road program authorized in the Federal-Aid Highway Act of 1954 at the rate of $10 million a year for 1955, 1956, and 1957, got into full swing. The transition of construction operations from a force-account basis to a contract basis was completed. The utilization of private engineering firms and the services of the Bureau of Public Roads enabled the Bureau to complete the increased survey and plan work with no significant increase in engineering personnel.

Severe floods in Arizona, California, and Oregon made it necessary to postpone construction projects totaling $500,000 and to transfer the funds to maintenance so that the damage could be repaired.

A $1 million program for improving Klamath Reservation roads and turning the entire 750-mile reservation road system over to Klamath County, Oreg., on the termination date (August 13, 1958) was in full operation at the close of the fiscal year.

The Bureau road maintenance program, in addition to the $500,000 flood damage repair item, provided $2,270,000 for the routine maintenance of 18,660 miles of roads, including blading, graveling, ditching, and snow removal.

During the year $9,461,080 was available for the construction of roads. This enabled the Bureau to contract for grading and draining of 581 miles, for surfacing of 569 miles, and for 1,200 feet of bridges. This work will result in turning over 500 miles of roads to county governments, thus relieving the Federal Government of future maintenance expense.

CREDIT ACTIVITIES

Indians require financing to develop and utilize their resources, both physical and human. More sources of financing are now available to Indians, and their economic activities are probably now more adequately financed than at any time in their history.

The Bureau's credit program consists of two main phases. First, Indians are encouraged and assisted in obtaining financing from the same credit institutions that serve other citizens. Second, Indians who are unable to obtain financing through customary channels are assisted with loans administered through the Bureau.

Financing Through Credit Institutions Serving Other Citizens

The same institutions that finance other citizens now supply the major part of the Indians' credit requirements. The enactment of

Public Law 450 approved March 29, 1956, authorizing the execution of mortgages and deeds of trust on individually owned Indian trust or restricted land, should be of assistance in enabling more Indians to obtain financing through customary sources.

Because many Indians now deal with lenders on the same basis as other citizens, complete information is not available on the amount of financing received by them. The data which are available are not entirely comparable. Incomplete reports, however, show a continual upward trend as follows:

Calendar year:	*Amount*
1952	$22,315,000
1953	27,665,000
1954	33,960,000
1955	55,725,000

Bureau's Credit Operations

Financing through the Bureau involves two main funds; (1) tribal moneys, and (2) a revolving loan fund. Two old programs—"reimbursable" loans which were made many years ago, and loans of livestock repayable "in kind"—are in process of liquidation. The unpaid balance on "reimbursable" loans has been reduced from $1,078,805 at the close of 1952 to $498,299 at the close of 1955. The unpaid balance on loans of livestock repayable "in kind" has been reduced from 37,083 head at the close of 1952 to 26,065 head at the close of 1955. A total of $1,691,166 had been accepted in settlement of "in kind" loans at the close of the fiscal year which was deposited in the revolving loan fund. These moneys are available for cash loans to Indians and Indian organizations.

The following shows the amount involved in the Bureau's credit program at the close of the last 4 years:

	1952	1953	1954	1955
Tribal funds	$8,537,445	$9,704,611	$9,669,468	$17,300,578
Revolving loan fund	11,335,261	10,173,745	9,505,193	8,311,374
Livestock loans [1]	3,661,498	2,126,969	1,655,160	1,133,940
Reimbursable [1]	1,189,364	1,024,488	841,568	498,299
	24,673,568	23,029,813	21,671,389	27,244,191

[1] In process of liquidation. Value of livestock estimated.

Use of Funds by Tribal Organizations

Tribal funds and revolving loan funds are used by the Indian organizations for two purposes; (1) to finance enterprises which are operated for the benefit of all members of the particular tribe in-

volved, and (2) for relending to members and associations of members. The following shows the balances outstanding at the close of the last 4 fiscal years:

	1952	1953	1954	1955
Enterprises	$9,327,886	$9,026,322	$8,913,728	$14,232,917
Individuals	8,420,418	8,861,220	8,562,825	7,521,799
Cooperatives	273,767	149,974	136,650	161,177
	18,022,071	18,037,516	17,613,203	21,915,893

Payments totaling $255,760 were delinquent at the close of the fiscal year on the financing of enterprises. The enterprises involve activities of various types. They include 5 salmon canneries and 54 trading posts in Alaska native villages, and livestock, leasing, soil conservation, stores, motels, lodges, oyster farming, and arts and crafts enterprises in various sections of the Indian country. The collectibility of some of the loans to enterprises is questionable. Four villages in southeast Alaska which are indebted to the United States for loans totaling $3,311,943 which were received for the acquisition and operation of salmon canneries, experienced poor fishing seasons the last 3 years. The 1955 operations of the canneries were fairly successful, however, and the loans are now in better condition than they were at the close of 1954.

In addition to cash loans made to individuals as shown above, there was an estimated $2,288,328 outstanding at the close of 1955 in loans made by Indian organizations repayable "in kind."

The decline in the amount loaned to individuals during 1955 was due mainly to the cessation or curtailment of credit operations for three tribes for which terminal legislation was enacted—Klamath, Menominee, and Northern Ute. The repayment record on individual loans at the close of 1955 was not satisfactory. In fact, the rate of delinquency increased from 16.94 percent of the unpaid balance at the end of 1954 to 19.69 percent at the close of 1955.

The repayment record on loans to cooperatives was also unsatisfactory. Considerable loss may be suffered on such loans. A total of $51,033 was either delinquent or owing on loans in process of liquidation. Although corrective measures are being instituted, it should be emphasized that on loans and investments totaling $54,852,096 since the revolving fund was first established, a total of $428,121 or less than 1 percent has been canceled. At the close of 1955 slightly more than 8 percent of all amounts owing by enterprises, individuals and cooperatives was either delinquent or owing on loans in process of liquidation.

Indian organizations and enterprises were carrying $5,962,346 of available cash at the close of the fiscal year.

BUILDING AND UTILITIES

Bureau activities involving buildings and utilities during the 1956 fiscal year were primarily concerned with improving sanitary conditions, providing additional school facilities, and performing work for the Indian Health Division of the U. S. Public Health Service.

An important phase of the work was the improvement of sanitary conditions, expanding water supplies, and water storage facilities, and the abatement of stream pollution. Twelve projects of this type located in seven States were completed at a cost of approximately $556,000.

A second important phase of the work was providing additional school facilities to permit enrollment of children not now in school, and improving substandard school facilities which already existed. Twenty-four projects of this type have either been completed, or are substantially complete. Ten projects reprogramed under the Navajo emergency education program and located at 18 different stations in Arizona and New Mexico were completed at a cost of approximately $780,000. New domitories, costing approximately $500,000 each, which will provide kitchen and dining room facilities and accommodate 304 children each, are scheduled for completion at Winslow and Holbrook, Ariz., in time for the opening of school in September.

A complete new day school costing approximately $323,000, which will provide classroom, kitchen and dining facilities for 180 pupils, is substantially complete at Polacca, Ariz., on the Hopi Reservation. A project at Keams Canyon, Arizona, is nearing completion, which will provide dormitory, kitchen, and dining facilities for 320 pupils, quarters for 20 school employees, and major improvements to the sanitary facilities, at a cost of approximately $1,024,000 for the project.

In accordance with Bureau policy of contracting with private architects and engineers to design and prepare plans and specifications, for all major projects requiring new plans, contracts have been negotiated for and awards made to private architects and engineers for 15 projects at a cost of approximately $177,000 for architectural-engineering services.

ARTS AND CRAFTS

The Indian Arts and Crafts Board continued to promote the economic welfare of Indian artists and craftsmen by supplying technical assistance to individuals and groups in the production and marketing of their work. The basic program of the board is threefold: (1) to foster high quality Indian arts and crafts, (2) to educate the Indian craftsmen in modern commercial methods, and (3) to protect both the consumer and Indian producer from cheaply imitated wares.

In fiscal 1956, major emphasis was placed on assisting previously organized groups. In addition, however, the board responded to requests for assistance in setting up new craft organizations at Tama, Iowa; Pipestone, Minn.; Mescalero, N. Mex.; Fort Hall, Idaho; and on the Standing Rock Reservation in South Dakota. A major development is in the making for the whole Northwest area in cooperation with the Northern Plains Crafts Association.

In Alaska the sales of the Alaska Native Arts and Crafts Association were affected by the influx of pseudo-Indian manufactured merchandise and foreign imports. The association met the challenge by reemphasizing its trademark "Genuine Indian-Eskimo Arts and Crafts." With the cooperation of the Army post exchanges, the sales program has already begun an upward trend.

The jade projects at Shungnak and Norvik, Alaska (both above the Arctic Circle) continued to make progress. New members are constantly being added. Of great interest to the project is the return of Ronald Senungetuk, a young Eskimo craftsman, to work with the Indian Arts and Crafts Board representative in Alaska, as his assistant. Ronald was the recipient of the board's scholarship for study at the American School for Craftsmen in Rochester, N. Y.

In the Seminole program, a new cooperative procedure is being developed. The Florida State Extension Service allows Mrs. Edith Boehmer, formerly with the Indian Service but now employed by the State agency, to continue her work with the Seminole crafts people. The Seminole Guild has employed a young tribesman to work as Mrs. Boehmer's understudy in the management and marketing of their products. The sale of their merchandise maintained its high peak of 1955.

In the spring of 1956 the Qualla Arts and Crafts Mutual, Cherokee, N. C., celebrated its tenth anniversary. The net worth of the organization stands at $34,061.21. Five percent dividends paid semiannually to its membership amount to a total of $5,708.53 being paid to them since its beginning. There are now 176 members and the organization has been debt-free for 3 years. During the 10 years the organization has bought a total of $199,742.29 worth of items from the Cherokee craftsmen. These figures tell only a part of the service this organization has rendered to the people of the Cherokee Reservation. The purpose of this organization is to give the craftsman the highest possible price for his crafts and this policy has caused all other shops to pay the same prices in order to buy the quality crafts these members make. The result of better prices paid to the worker is reflected in the improvement in the standard of living for the Cherokee people.

At Rapid City, S. Dak., the Sioux Indian Exhibit and Craft Center is proving an effective instrument in serving the community and the

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Indian citizens of the area. Attendance increased 7,037 over the previous year. The mayor proclaimed a week as "Museum Week." The South Dakota State magazine ran an article on the museum. Many newspapers and other magazine articles were written and several programs were given on radio and television. The director also gave constant assistance to the craft organizations at Rosebud, Tama, Pipestone, Sisseton, and Cheyenne River.

For some time a need has existed for practical business information slanted toward the needs of the Indian artist and craftsman. To fill this need, a publication "Business Booklet for Indian Artists and Craftsmen" has been written and will soon be ready for publication and distribution.

PROPERTY AND SUPPLY

In line with overall Federal policy, business-type activities conducted by the Bureau have been curtailed to eliminate production or service in competition with private enterprise. One example is the dairy farm at the Albuquerque school which was closed in fiscal 1956. In addition, 11 telephone systems (3 in Oregon, 2 in Montana, and the others in Arizona, California, Nebraska, South Dakota, Washington, and Wisconsin) as well as 3 power lines (in Arizona, Oregon, and Washington) were sold to commercial enterprise.

The Bureau also continued to take steps toward the disposal of excess real and personal property. The Pipestone School plant in Minnesota was declared to the General Services Administration for disposal. Surveys and other necessary information have been furnished that agency. Approximately 150 acres of the 740-acre tract has been added to the Pipestone National Monument. The General Services Administration is now in the process of disposing of the remainder of the acreage including the school plant.

Finally the Bureau proposed legislation to convey surplus government-owned buildings and improvements on tribal or reserved lands to the tribes. Such legislation was passed shortly after the close of the fiscal year.

BUDGET AND FINANCE

Continued progress was made during 1956 in revising and improving the accounting system installed in Bureau accounting offices in fiscal 1953, particularly in the revision of certain operating and other accounts to better meet budgetary and program needs.

A periodic inspection program was inaugurated to cover the processing of collections and other accounting matters to be performed by

personnel of the Bureau's accounting offices and by other qualified staff. Instructions were issued for the merging of separate area general ledger accounts at the accounting office level in order to facilitate reconciliation of accounts and to reduce nonessential record maintenance and reporting. Studies are continuing to further improve, strengthen, and simplify budgetary and accounting requirements (including studies for further mechanization of the accounting work in the area offices) as well as to simplify the reporting requirements.

INTERNAL AUDIT

During 1956 the Bureau established two audit field offices—1 at Albuquerque, N. Mex., and 1 at Billings, Mont. Auditors using these offices as headquarters will give more effective and economical audit coverage of the Bureau's activities. Neither office has been fully staffed because of difficulty in recruiting traveling auditors. Four of the Bureau's 10 areas were audited during 1956, and at 2 of the remaining 6 areas an audit was underway at the close of the year.

MANAGEMENT COORDINATION

Organizational Changes

As the fiscal year drew to a close, the topside structure of the Bureau was altered in acordance with shifts in program emphasis. A new Division of Tribal Programs and Relocation Services was created under an Assistant Commissioner to provide coordinated executive direction to the rapidly developing relocation and Indian social and economic development programs. Also incorporated in the new division were all responsibilities in regard to tribal government, including advising tribes on their governmental and corporate functions, and correlating tribal activities with related Bureau programs. Another important change was the establishment of the Deputy Commissioner to serve as an overall line assistant for the Commissioner. In the field, the most significant organizational change was the division of the huge Navajo Agency into five subagencies, each having jurisdiction over a specified geographical area. The main objective of this reorganization was to bring the administration of Navajo affairs closer to the Navajo people.

Reports and Forms Management Program

Midway in the fiscal year the Bureau inaugurated a reports and forms management program. Some results have been: (1) design of new and revised operating and report forms, particularly those

operating forms providing basic data for reports; (2) outlining and charting new procedures; and (3) rewriting policies, definitions, and procedures for Indian Affairs Manual and other instructions.

A survey of Bureau forms in the Departmental stockroom was practically complete by the end of the year. Each branch was asked to review the forms that it had initiated. Forty-two percent of Bureau forms in stock were declared obsolete and approximately 650 square feet of storage space will be released.

Administrative Issuance Review

In October the Bureau began a long-term review of its administrative issuance including the Code of Federal Regulations, the Indian Affairs Manual, delegations of authority and other instructions. The purpose of this review is to:

(1) Provide a clear set of coordinated instructions on policies, procedures, and standards for the administration of the Bureau.

(2) Eliminate obsolete material that tends to hinder the effective use of the instructions.

By June 30, substantial progress had been made toward the completion of the review and it was anticipated that it would be completed during fiscal year 1957.

Pilot Census Project

The Bureau completed development of forms and procedures to be used in an experimental census of the Indians in the Aberdeen area. This pilot census will have considerable scope in that it will provide certain information on Indian income, family status, occupations and residences never before made available on an organized basis.

Management Reviews

The technique of management review was inaugurated during the fiscal year, and reviews were made in the Gallup and Aberdeen areas. The reviews consisted of cooperative studies of organization and methods by teams consisting of Central Office, Area Office, and Indian Agency officials. The technique was unique in that it brought together representatives from the three levels of Bureau administration for a concentrated appraisal of management practices and procedures in a specific organizational jurisdiction.

PERSONNEL

A program to evaluate the effectiveness of the personnel functions of the Bureau on a continuing basis was initiated for application at both the Central Office and field office levels. Two additional training programs were approved for the Bureau by the Civil Service Commission. One permits the employment during vacation of students as trainees in soil conservation activities. The second is entitled "The Junior Internship Program" and utilizes the newly established Federal Service entrance examination to bring new employees into the Bureau at the GS–5 and GS–7 level. The junior internship training has been combined with the departmental management and executive development training program to constitute the Bureau's overall career-development program. Two boards of civil-service examiners have been established, one in the Central Office for social workers and one in Denver, Colo. for relocation officers. The Bureau also participates in the joint departmental board that was established in Juneau, Alaska, in conjunction with bringing the positions in Alaska into the competitive service.

BUREAU OF LAND MANAGEMENT

Edward Woozley, *Director*

PUBLIC LANDS

THE Bureau of Land Management was established as the Department's chief custodian of the public domain on July 16, 1946, when the General Land Office (established in 1812) was consolidated with the Grazing Service (created in 1934) in accordance with the provisions of the President's Reorganization Plan 3 of 1946.

The Bureau exclusively administers approximately 468 million acres of public domain lands, about 290 million acres of which are in Alaska. Most of this land is unappropriated and unreserved.

BLM also manages the publicly owned mineral resources in about 58 million acres of privately owned lands.

In addition, the Bureau participates in the disposal of natural resources in another 242 million acres of federally owned lands reserved for national forests, national parks, national monuments, wildlife refuges, historic sites, irrigation projects, military or atomic energy use, power sites, and other public purposes.

Still another responsibility of BLM is what is known as acquired lands, some 58 million acres that came into Federal ownership through purchase, exchange, transfer, condemnation, or donation.

Functionally, the Bureau of Land Management manages, conserves, and, under a policy of development through wise use, disposes of the land and its natural resources, including the range grasses and other forage, the minerals (including oil and gas), and approximately 472 billion board-feet of commercial and woodland timber.

These activities fall principally into six categories—Lands, Minerals, Range, Forestry, Cadastral Engineering, Records.

Principal accomplishments for the fiscal year ending June 30, 1956, in these activities are summarized in the following pages.

LANDS

The Bureau of Land Management conducts studies and classifies public lands for proper use; processes withdrawals of land for use by the public or governmental agencies; restores lands from such withdrawals for use or for disposal under public land laws; acts on applications and claims for the use of or title to public lands; issues leases, licenses, or permits for land use; grants instruments of patent or other title conveyance in fulfillment of the public land laws.

Lands Legislation

Both the Congress and the Department of the Interior during the year gave intensive consideration to legislation needed to perfect and modernize existing land laws, and to make legislative provisions for new and changed conditions. Sparking this effort was the continuing intensification of the demand for lands and their resources, necessitating legislation of two general classes: (1) Laws to meet the needs of specific situations, and (2) General laws to provide the basis for administrative actions to meet recurring problems and needs.

The second session of the 84th Congress and the Department considered many proposals of both classes during the year.

Several laws were enacted to meet specific situations. One of far-reaching effect was Public Law 830, the Alaska Mental Health Act, which among other things, granted the Territory of Alaska the right to select 1 million acres of public lands to aid in the support of the mental health program and other Territorial activities. Public Law 522 authorized the sale of certain public lands to the city of Henderson, Nevada, for its future development. Other measures were: Public Law 525, transferring certain lands in Arizona to the Yavapai Tribe; Public Law 696 transferring a small acreage in Utah to the Kanosh Band of Indians; Public Law 722, restoring to tribal ownership the remaining ceded lands of the Colville Tribe, Washington; and Public Law 926, transferring certain lands in New Mexico to the Pueblos of Zia and Jemez; Public Laws 846 and 891, abolishing two national monuments, Verendrye, N. Dak., and Fossil Cycad, S. Dak. (found not to be of national interest) with special provisions for their future use and disposition; Public Law 456, permitting the sale of certain lands to a Lake County, Oreg., school district; and Public Law 589, authorizing the sale of certain recreational lands in Montana to an American Legion Post.

By Public Law 892, Congress paved the way for the solution of the problems which have prevented the lifting of the highway and other right-of-way withdrawals in Alaska. This law permits the Department to grant preference rights on restored lands to the owners and

claimants of lands abutting present withdrawals. Revocation of the withdrawals without such authority would have done grave injustice to settlers and developers along the highways.

By another act, Public Law 834, the Congress recognized the difficulties being experienced by many homestead and desert-land entrymen in the States owing to the current farm surplus situation. The law grants such homesteaders leaves of absence and permission to suspend development operations until March 1, 1959. It contains several provisions to prevent speculation in such entries and also to permit use of the lands by Federal permittees, licensees, and lessees during the period of suspension.

In addition to the above, several public and private laws were passed to quiet title to certain specified tracts of land or to grant equitable relief to individual claimants whose claims could not be recognized under the public land laws. The records on these laws reflect careful scrutiny by the Department and the Congress of the equities involved.

Laws enacted of a more general nature included Public Law 698, eliminating the necessity for two final proofs from homesteaders on unsurveyed lands in Alaska; Public Laws 699 and 932, clarifying the rights of the States and Alaska to their school sections in order to eliminate inequities in existing law; and Public Law 931, improving the law respecting allotments to Indians, Aleuts, and Eskimos in Alaska.

Although the Congress did not take final action on the proposals, the Congress and the Department devoted much time and energy during the year to several significant legislative suggestions. Among these were the management and disposal of tidelands, submerged lands, and inland navigable waters in the Territory of Alaska. The tideland question is of particular importance because many communities in Alaska are dependent upon the tidelands for further growth and expansion.

Other important fields considered but not finally acted upon included legislative policy for the disposition of the Bankhead-Jones lands purchased by the Government during the 1930's; congressional control over the reservation of public lands and outer Continental Shelf waters for military purposes; clarification of the surplus property acts as they apply to public domain lands and minerals; congressional policy as to the recreational use of the public domain; land grants to the Territory of Alaska; entries on coal and oil or gas lands in the Territory; amendment of the public sale laws to facilitate disposals of unneeded Federal lands; and allowance of desert-land entries on noncontiguous public lands. Although the bills were not enacted, departmental research and congressional hearings have established valuable background material for their further consideration.

Considerable progress was also made during the year in the program for consolidation and modernization of the public-land laws. Among the more important items in this program were drafts of proposals for authority to dispose of public lands for commercial and industrial purposes, consolidation and revision of the rights-of-way laws, a uniform measure of damages for trespass on the public lands, and consolidation and revision of the townsite laws. Several other items were added to the vast body of public-land laws.

Regulations and Procedures

During the year the Director's staff continued to give high priority to the issuance of policy statements, manual procedures, and regulations, basic guides for the management of the public lands and for informing the public of its opportunities, rights, and privileges under the public-land laws.

A major problem which was attacked vigorously during the year was the administration of the Small Tract Act. Private promoters, recognizing the basic desire of the people for a tract of land of their own, seized upon the provisions of the Small Tract Act and regulations to promote applications for small tracts through widespread advertising in all media. As a result, the Bureau was inundated with thousands of small-tract applications from all over the country from people who did not know the character of the lands selected and the terms and conditions of the small-tract regulations. Many applicants, of course, expressed disappointment when they were informed of the actual requirements.

Besides calling the attention of the Department of Justice, the Federal Trade Commission, Post Office Department, local authorities, chambers of commerce, and the Better Business Bureaus to the problem, the Department approved regulations prepared by the Bureau to meet this unwholesome development. These regulations, together with governing policy and procedure directives under the Small Tract Act, brought a sharp decrease in promotional filings, freeing the Bureau to process applications from people who had bona fide intention of acquiring and developing small tracts. The Bureau directives introduced fundamental policy statements and procedural steps on many aspects of the Small Tract Act, including criteria permitting classification under the act, policies concerning renewals and improvement requirements, and procedures for public sale of small tracts.

Another outstanding field of activity was the whole question of withdrawals and revocations. Directives were issued establishing standard procedures for this subject, including such critical matters as adequate publicity for proposed withdrawals, coordination with State officials and other interested parties in both withdrawals and

revocations, and adequate review and negotiation of proposed withdrawals. Intensive demand for lands and resources required a thorough consideration of multiple values involved in wise land management.

Basic land appraisal procedures for Bureau operations were established. This was consistent with the departmental desire to insure satisfactory appraisals of property under its administration and to protect the public interest in securing full value for lease, use, or disposal of lands and resources.

Other administrative clarifications covered homesteads in Alaska, principles for extensions of time to desert land entrymen under permanent legislation, issuance of temporary road rights-of-way, land classification for range rehabilitation projects—all designed to specify procedures and policies in matters which the changing times and economy require for effective and fair administration of the public lands. Emerging problems are thus being met through the Bureau's attention to this important phase of its activities.

Regulations were issued by the Department during the year for small tracts, temporary road rights-of-way, preference rights under the public sale laws, assignment of desert land entries, shore-space restrictions in Alaska, administration of the Choctaw-Chickasaw lands in Oklahoma, and the townsite laws.

Proposals were submitted for departmental review on trustee townsites in Alaska, fees and charges for services rendered to applicants and claimants, utilization of rights-of-way reserved on small-tract areas, and exchanges.

This brief recitation of activity in the field of procedures and regulations shows clearly not only the wide variety of lands matters which the Bureau must consider but also the close relation of the administration of the public lands with the economy of the country. Use of the public lands, for the most part, is private use and regulations and procedures must keep abreast of the changing conditions of the American economy—a primary objective of the Bureau.

Lands Adjudication

Total applications for the use or acquisition of public lands dropped from 43,000 cases in the record postwar year 1955 to 23,000 cases in fiscal year 1956. Small tract lease applications accounted for nearly all of this decrease, shared in part with small declines in applications for homesteads, desert-land entries, and State selections. Principal increases were noted in applications for public sale, exchanges, and in small tract sales applications by lessees exercising the option to

purchase clause of their leases. Concerted effort was pointed toward the reduction of case backlog during the year, with the result that unclosed cases were down nearly 3,000 from 1955.

The large reduction in small tract lease applications during 1956 resulted directly from the tightening of controls over mass filings by promotional land locators, particularly in Nevada and California. In 1955 intensely active land locating promoters, through extensive advertising media, induced thousands of persons from all parts of the country to file, for a fee, small tract applications through their agencies. This surge of filing activity resulted in hundreds of duplicated or "top" filings for the same tracts of land, for which only one person could be a successful lessee.

New regulations which became effective July 5, 1955, required personal inspection of the tract applied for, or lands within one mile of the tract. This new control, together with others, effectively dampened land locator activities, and tended to confine applications to bona fide filings by persons with sincere desire to acquire and develop the lands.

As an outgrowth and extension of Department Opinion M–36263 of February 23, 1955, which held that desert land applications cannot be allowed and that desert land entries cannot be patented where the alleged source of water is percolating ground water in Arizona, some 1,500 desert land applications in California were similarly held for rejection by Bureau of Land Management decision in 1956.

As in Arizona, California State law specifically precludes percolating ground waters from the doctrine of prior appropriation, and therefore cannot be used to qualify for entry or patent under the Desert Land Act. The April 2, 1956, Bureau decision (*Sidney Lee Smith* v. *Mary F. Kershner et al.*), was subsequently appealed to the Department. Final proofs on allowed desert land entries involving the use of percolating ground waters in California were being temporarily suspended as they were received. Approximately 600 allowed desert land entries in California in various stages of development may be potentially involved. Legislation was enacted on August 4, 1955 (69 Stat. 491; 43 U. S. C. 321) so as to provide a waiver in the case of desert land entries theretofore allowed in Arizona of the requirement that the right to use of water for purposes of final proof and patent depends upon prior appropriation.

Withdrawals and Restorations

Withdrawals of public lands in the United States and Alaska during the year aggregated 498,000 acres. In contrast, approximately 1,203,000 acres were released from withdrawal.

The decrease in public land withdrawals during the past year resulted largely from the suspension after October 27, 1955, at the request of Congress, of all pending withdrawal applications for Defense purposes of the Department of Defense for large areas of public lands. At the close of the year the Department of the Interior had pending before it applications for such withdrawals involving a total of about 9,400,000 acres of public lands in the United States and 100,000 acres in Alaska.

Public concern over the withdrawal and reservation of public lands was aroused particularly in regard to the rapid extension of the land holdings of the various agencies of the Department of Defense which totaled 25.4 million acres on June 30, 1955. Increasing concern, particularly throughout the public lands States, was also evinced over the continued expansion of single purpose reservations of public land areas. Both public and private interests began actively to seek means to obtain fuller utilization and development of all of the resources of the public domain—the soil, mineral, timber, grazing, and other material resources; the fish, wildlife, power, and water resources; the scenic, wilderness, and recreational resources; as well as greater use of various site values of the land itself.

The Bureau of Land Management initiated action to obtain a full review of all present withdrawals or reservations of public domain lands as well as pending or future requests of various governmental agencies for withdrawals and reservations of such lands. The objective of this review is to (1) keep all withdrawals to the minimum required to serve the public interest, (2) maximize the use of withdrawals consistent with their primary purpose, and (3) eliminate all withdrawals that are no longer needed to serve a public purpose.

Classification and Investigations

Land classification is used by the Bureau of Land Management to achieve the most effective use and development of the Nation's public land resources. The Bureau is authorized by law to classify for use and disposal under suitable laws the unreserved public domain lands under its jurisdiction in the United States. In Alaska it is authorized to classify lands only for home, business, recreational, commercial, industrial, and public purposes. Investigations conducted in 1956, however, raise the question whether there is need to broaden this authority in Alaska.

Settlement on the public domain on small tracts for home, business or recreation sites continued to be highly popular in both the United States and Alaska. During the year the Bureau of Land Management leased or sold over 50,000 acres which had been classified and subdivided into 11,469 small tracts in a great many localities in the United

States and Alaska. The most concentrated interest in the acquisition of a small tract is centered in areas adjacent to cities and communities in southern California and Nevada and in Alaska.

In the United States, 97,000 acres were classified for disposition under the Homestead and Desert Land Acts compared to 226,000 acres found suitable the year previous. In recognition of the increasing financial difficulties being experienced by many of the homestead and desert-land entrymen owing to farm surpluses, however, support was given to Public Law 834 which granted 3-year leaves of absence to homesteaders and a 3-year moratorium on cultivation and improvement requirements to both homesteaders and desert-land entrymen.

A major change in land classification for desert-land entry was necessitated by disapproval of percolating ground water as sources of supply for irrigation water in Arizona and California. The Desert Land Act requires an assured water supply based on the doctrine of prior appropriation in order to comply with the requirement of reclamation of all irrigable lands in an entry.

High priority was given to the classification of land for satisfaction of State indemnity selection rights and for consolidation of land holdings through State exchanges. Nearly 500 applications involving 380,000 acres were subjected to examination and classification in order to serve these public interests in 1956.

Most of the land classification work of the Bureau of Land Management is done in response to individual applications for land. The applications are recognized as a public expression both as to land use requirements and land use suitabilities. Insofar as possible, however, land classification was carried forward in advance of demand in order to have lands designated for specific uses and so facilitate the processing of various kinds of applications for land as they are filed. Small area classifications were completed on 24,162 acres in a great many places in the United States and Alaska. But for the high rate of filing of individual applications, 22,372 in 1956, greater emphasis would be placed on this kind of classification work.

Area classifications were completed in various places in the United States where there was particularly intensive interest in the acquisition of lands for various purposes. All lands in these areas were examined and classified whether embraced in pending applications for homestead or desert land entry, small-tract or recreation-area lease or purchase, State selection or State exchange, or for some other form of use or disposal as well as vacant lands potentially suitable for use and disposal under the public-land laws. The following examples indicate the kind of conflicting interests that were involved in typical area classification projects.

Because of fragmentation, isolation, and other problems of administration, small areas of public lands in seven of the Eastern

States were the object of immediate disposal in fiscal year 1956. In these States, 56 separate public sale classifications were made and a total of 54,600 acres were sold under the public-sale law, and the Small Tract Act. Thirty-nine such sales were held in Arkansas, where 47,600 acres of public lands were disposed of. The additional 7,000 acres sold were located in Alabama, Florida, Indiana, Michigan, Minnesota, and Wisconsin.

The classification of lands for irrigated agricultural development under the Desert Land Act received considerable attention in Idaho in 1956. Nearly 9,500 acres of desert lands were examined for suitability for agricultural development under this law, of which 7,300 acres were classified favorably, and 2,200 acres classified unfavorably (until a satisfactory showing of a source of irrigation water is made by the applicants). Idaho also classified 87,000 acres of public domain range land as suitable for reseeding, in effect precluding the operation of the disposal land laws for these lands unless satisfactory showing could be made for land uses higher than for grazing purposes.

In Alaska, where nearly 80 percent of the total land area of the Territory is under the jurisdiction of the Department of the Interior, it is of primary importance that suitable public lands be made available for residential, industrial, commercial, and recreational use. The Bureau in 1956 classified a total of 2,660 acres of public lands for these purposes under the recreation and public purposes law, the Alaska Public Sale Act, and the Small Tract Act. There is no classification law governing agricultural entry on public lands in Alaska

The States of Arizona and New Mexico classified a combined total of 5,800 acres of public lands into 1,300 tracts under the Small Tract Act in 1956. Essentially all of the tracts were filed upon by the public and leases issued.

Nevada initiated investigations of 32,000 acres of public lands for disposal under the Small Tract Act during the year, as well as 103,500 acres of desert lands for possible disposal under the Desert Land Act. The reports of the findings of these investigations will show the suitability for classification and disposal of these lands under the two laws cited.

The Bureau of Land Management continued its cooperation with other Department of Interior agencies in a public land inventory and classification program in the Missouri River Basin. A total of 13 million acres of public domain has been classified through fiscal year 1956 of which 1.6 million acres have been determined to be suitable for disposition to private individuals or to other public agencies. Of this total 104,664 acres were classified during the current fiscal year.

MINERALS

The Bureau of Land Management administers the mining and mineral leasing laws, carrying out a program of development, conservation, and utilization of mineral resources. This is accomplished (1) through the leasing of minerals on public domain lands, privately owned lands in which the mineral rights are reserved to the United States, and certain acquired lands; (2) through the issuance of mineral patents and other instruments relating to mineral resource development; and (3) through studies relative to mineral and other resource development and use.

General

In keeping with the policy of multiple use expressed by Congress and the Department, constant effort was directed toward expediting development of public domain mineral resources in accordance with laws which make the Bureau of Land Management responsible for carrying out a program of development, conservation and utilization of mineral resources. Under the Mineral Leasing Act, the Bureau administers the leasing of minerals in approximately 700 million acres of federally owned lands, including those withdrawn and reserved for national forests, national parks and other purposes; about 58 million acres of privately owned lands in which the United States owns the mineral rights; and another 58 million acres of lands acquired through purchase or otherwise by other Federal agencies.

The other broad minerals function of BLM is the encouragement of free enterprise and individual initiative under the United States Mining Act of May 10, 1872, as amended, for the discovery and development of nonleasable or "locatable" minerals.

A third and comparatively new but growing mineral leasing function of BLM is that of administering submerged lands of the outer Continental Shelf for development of oil, gas, and other mineral resources.

Accomplishment

The volume of mineral activities on all types of land under BLM jurisdiction continued at an even higher level throughout the past fiscal year than in fiscal year 1955, attaining new record highs with exception of the outer Continental Shelf.

BLM's total earnings from the management and disposal of mineral resources of federally owned or controlled lands totaled $179,831,467 for the past fiscal year—far exceeding revenues collected by the Bureau in all its other fields of operation. Due to decreased bonus monies

totaling $108,528,724 received from competitive leasing in the outer Continental Shelf, as compared to $139,736,404 in fiscal year 1955, grand total receipts were lower than the record $207,775,033 of 1955. The 1956 total royalities, rentals, and filing fees (including OCS rentals) plus bonuses for competitive oil and gas and other mineral leasing by states other than the OCS, reached an alltime high of $71,302,743 as compared to $68,038,629 in 1955. Most of the $71,-302,743 consisted of $69,889,972.81 received from royalities, rentals, and filing fees as compared with $66,790,519.76 in 1955.

These earnings were not achieved to the detriment of good conservation practices. No legal or other safeguards against abuses or misuse of lands under the guise of mineral developments were overlooked.

At the same time, multiple-use policy was carried out to the fullest as one of the Bureau's primary objectives in the fulfillment and performance of the obligations imposed upon the Department by law and delegated to BLM.

Close contacts were maintained with the mining industry and the oil and gas, petroleum industry and their representatives and associations, resulting in greater mutual understanding and contributing to the solving of many complex problems inevitable in this tremendous field of activity.

Legislation

New legislation enacted during the past fiscal year had the effect of encouraging expansion of mineral activities both through anticipation and as result of actual passage, particularly through furtherance of multiple use. The principal new laws affecting minerals activity passed during fiscal year 1956 were Public Law 167, Public Law 357 and Public Law 359. Promulgation of new or amended regulations to implement these laws was commenced and partially accomplished during the year.

In addition to drafting regulations, considerable accomplishment was realized in carrying out the new measures.

Under Public Law 167, which provides for multiple use of surface resources on public land, the Bureau made substantial progress during fiscal year 1956 on the 10-year program envisioned for the initiation and completion of the work required under this most important change in the mining laws since the Mineral Leasing Act of 1920. A considerable number of areas were designated and identified as having serious conflicts between surface management and mining operations. Specifically, 79 areas involving more than 3 million acres were designated for examination during fiscal year 1957. It was estimated that some 54,000 mining claims and 24,000 verified statements would

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be filed, necessitating between 2,000 and 3,000 hearings. Priority was given to selection of areas on which there existed the greatest interference with good land management. Public Law 167 regulations were prepared during fiscal year 1956 but due to their complexity publication was not expected until the second quarter of fiscal year 1957.

Under Public Law 357, progress consisted principally of setting up organization and procedural requirements for acceptance and recording of mining claims filed under this act which provides for the entry, location and mining of uranium and other valuable source materials in public lands known to be valuable for lignite coal. As of June 30, 1956, more than 2,000 mining claims had been filed and recorded with the Bureau, mainly on uraniferous lignite deposits in Montana, South Dakota, and North Dakota. It was anticipated that regulations for administering Public Law 357 would be published early in fiscal year 1957.

Under Public Law 359, the Bureau's major accomplishments for fiscal year 1956 consisted of setting up organizational and procedural methods for the acceptance, recording, and adjudication of claims filed under this act which opened to the staking of mining claims some 7.2 million acres of public lands set aside as power and water sites in 23 States and Alaska more than 40 years ago. As of June 30, 1956, nearly 3,000 claims were filed under a provision of the law which permits interested parties to protest against placer claims. The Secretary has delegated to the Bureau the responsibility of ordering hearings in such claims to determine the facts presented. Protests on hand warranted the expectation that numerous hearings and subsequent decisions would be forthcoming during fiscal year 1957. Public Law 359 regulations were prepared during fiscal year 1956, with publication expected during the first half of fiscal year 1957.

New regulations and regulation changes were also proposed and finally adopted, following waiting periods to allow public comment, for numerous other phases of mineral operations.

Adjudication of Mineral Cases

On June 30, 1956, there were outstanding approximately 100, 922 oil and gas leases on public domain covering 75,436,767 acres, including the Outer Continental Shelf. There were also 4,166 outstanding oil and gas leases on acquired lands of the United States covering 3,852,672 acres. A total of 1,738 permits, leases and licenses for other minerals covering 2,235,825 acres were likewise issued on public domain and acquired lands.

During fiscal year 1956, new and reactivated noncompetitive oil and gas lease offers and applications for lease totaled 45,514 cases, and a total of 46,012 were closed during that period. Approximately 22,776 oil and gas lease assignments were handled during the period. During that same period the new and reactivated mineral patent applications amounted to 221, of which 273 cases were closed during the year. In addition, there were 255 miscellaneous applications in connection with mineral locations and 263 of such cases were closed. In all, 77,815 cases were closed as against 71,988 received, reducing the backlog of cases pending from 30,214 to 24,387.

Table No. 1 discloses the number of mineral cases adjudicated in the continental United States and Alaska during fiscal year 1956.

TABLE NO. 1.—*Mineral adjudication operations in continental United States and Alaska, fiscal year 1956*

Type of case	Unclosed cases, July 1, 1955	New and reactivated cases, during year	Cases closed during year	Unclosed cases, June 30, 1956
Public-domain lands:				
Oil and gas leases (noncompetitive)	9,959	42,582	41,579	10,962
Oil and gas leases (competitive)	72	380	604	[1] 1,133
Mineral leases	205	429	316	318
Mineral permits	1,809	1,165	1,460	1,514
Acquired lands:				
Oil and gas leases (noncompetitive)	4,136	2,932	4,433	2,635
Oil and gas leases (competitive)	108	15	123	
Mineral leases	5,643	803	928	[2] 678
Mineral permits	873	551	4,873	[2] 1,391
Mineral locations (patent applications)	706	221	273	654
Mineral locations (miscellaneous)	28	255	263	20
Oil and gas assignments (record title)	6,583	22,495	22,776	[1] 5,017
Resource sales	47	32	53	26
Outer Continental Shelf leases (sec. 6)	45	128	134	39
Total	30,214	71,988	77,815	24,387

[1] Adjusted to reflect 1,285 cases transferred from oil and gas assignments to oil and gas leases (public domain, comp.).
[2] Adjusted to reflect 4,840 cases transferred from mineral leases (acquired) to mineral permits (acquired).

Revenues

The chief source of revenue derived by the United States from the use and disposal of the resources on the public lands is from the lease or sale of mineral resources. The revenues realized in fiscal year 1956 from royalties, rentals and filing fees under the mineral leasing acts was $69,889,972.81, compared with $66,790,519.76 in fiscal year 1955. In addition to the foregoing, a major source of receipts is also derived from bonuses offered for the issuance of oil and gas leases. A summary of the bonuses received from mineral leasing by States, as well as on the outer Continental Shelf, is set forth in the following table No. 2.

TABLE 2.—*Competitive leases—fiscal year 1956*

Mineral and State	Total		Acquired lands		Public-domain lands	
	Acres	Bonus	Acres	Bonus	Acres	Bonus
Oil and gas:						
California	40.00	$12,062.40			40.00	$12,062.40
Colorado	7,542.92	87,946.97			7,542.92	87,946.97
Louisiana	382.25	19,628.14			382.25	19,628.14
Montana	1,915.17	7,934.17			1,915.17	7,934.17
New Mexico	6,840.37	180,035.15			6,840.37	180,035.15
North Dakota	292.03	10,702.98			292.03	10,702.98
Oklahoma	129.90	4,180.71			129.90	4,180.71
Texas	1,603.20	611,749.84	1,603.20	$611,749.84		
Utah	228.46	47,291.22			228.46	47,291.22
Wyoming	2,522.67	259,947.25			2,522.67	259,947.25
Outer Continental Shelf:						
Louisiana	252,806.92	[a] 100,091,262.93				
Taxes	149,760.00	8,437,461.60				
Total oil and gas	424,063.89	109,770,203.36	1,603.20	611,749.84	19,893.77	629,728.99
Other minerals:						
Coal:						
Utah	1,762.39	1,763.00			1,762.39	1,763.00
Wyoming	2,553.41	2,554.00			2,553.41	2,554.00
Phosphate: Idaho	3,292.32	165,975.59			3,292.32	165,975.59
Total, other minerals	7,608.12	170,292.59			7,608.12	170,292.59
Grand total	431,672.01	109,940,495.95	1,603.20	611,749.84	27,501.89	800,021.58

[a] As of August 1956, approximately $57,470,303.00 of this amount was held in escrow pending litigation by the State.

Outer Continental Shelf

The Department of the Interior's third "sale" of oil and gas leases on the outer Continental Shelf off the States of Louisiana and Texas was held on July 12, 1955, in New Orleans, La., with 94 tracts covering 252,807 acres off Louisiana and 27 tracts covering 149,760 acres off Texas being leased at that time. There was realized in bonus bids $108,528,724.53, which, together with the first year's rental of $1,207,722 brought into the Federal Treasury almost $110,000,000. This sale, together with the previous two sales held in 1954, have brought thus far more than $252 million in income to the Federal Government.

RANGE

The Bureau of Land Management administers grazing and range activities on some 170 million acres of the public domain, principally through the granting of grazing permits in grazing districts as established by the Taylor Grazing Act of 1934, and grazing leases outside of grazing districts. These activities are managed by the Bureau for maximum productivity of the lands, the highest use of forage, and minimum erosion of the soil. Programs for the rehabilitation of deteriorated range lands and more effective use through more effective distribution of livestock are corollary activities.

The activities in range management for the past fiscal year were directed primarily toward completing the adjudication of Federal range privileges in grazing districts, stepping up the program of range studies and investigations, striving for improved range use supervision, and carrying out a comprehensive range conservation and improvement program.

Range Administration and Management

Special effort was made bureauwide to arrive at a final adjudication of grazing privileges—meaning legal determination of the extent of authorized use of Federal range lands for the grazing of livestock. This program was emphasized in all States, and a reduction in grazing use in some cases amounted to as much as 60 percent of the total grazing privileges previously allocated to the range users. As a prerequisite to adjudication, efforts were renewed to obtain dependent property surveys. In some States this work is practically 100 percent completed. In others, much is left to be done in local areas. Considerable effort was made in every case to increase the number of operations covered by these reports. Development of range management plans and the programming of activities were initiated in most cases as a necessary part of orderly range administration.

Long-term grazing permits were offered to Federal range users as soon as the requirements could be met. Special rules for administering grazing districts were approved for one district in Montana and one district in New Mexico to provide for a more equitable apportionment of Federal range privileges and better resource management.

Without exception the States have pointed out that a lack of sufficient personnel has seriously handicapped the range trespass aspect of overall administration. Oftentimes suspected trespass or other illegal use cannot be proved with the numbers of range management personnel now authorized for the district offices. An encouraging note was the cooperation received from Federal range users in almost all areas. However, both individuals and livestock associations have been insistent that the Bureau give increased attention to the problem of range use supervision.

Top priority will continue to be given to adjudication of range privileges especially in those areas where past overuse has resulted in a critical condition today. In conjunction with adjudication, range line agreements and allotment divisions are being established to provide for better regulated use of the range and a reduction in trespass.

Wildlife Management, Recreation and Protection

The Federal range plays a very important part in the overall picture of wildlife management. In some States the public-domain lands support up to one-third or more of the total game population at one time or another during the year. Their importance to wildlife is generally well recognized and Bureau employees have been taking an increasing part in wildlife management activities, including census taking, game range studies and other related programs.

It is now the usual thing for district, State, and area personnel to attend annual cooperative meetings on game problems with other Federal and State agencies and individual landowners. From these meetings come recommendations on the seasons and amount of hunting desirable, range rehabilitation work needed, and similar matters.

In some States deer are becoming more and more of a problem since improved range conditions, coupled with more intensive predator control work during the past decade, have increased the deer herds in many areas. This matter is receiving the attention of all interested groups and agencies and in most instances proper remedial measures have been initiated.

It is reported that a range use problem of long standing on the Sheldon Game Range in Nevada has recently been settled by joint action of the Bureau, the Fish and Wildlife Service and the Forest Service, illustrating the manner in which the cooperative approach to game management is being undertaken throughout the Western States. Another example is an agreement between the Arizona Fish and Game Commission and the Arizona State Supervisor which provides a foundation for close cooperation between the two agencies in all matters relating to the field of wildlife and lays the groundwork for joint study of the effects of the Bureau's range rehabilitation programs upon various wildlife species.

The whole field of wildlife management is dependent upon proper public relations. Progress in effective management is retarded by adverse public opinion. California has had such a situation and only through the combined efforts of State officials, Federal agencies, and individuals has the game department finally been able to secure public approval for either-sex deer hunting in that State. The harvesting of does is necessary to maintain control of deer numbers but it has taken a considerable number of years to overcome public opposition to this practice. Overall relations between Bureau personnel and other groups interested in wildlife management are excellent and there is every expectation that cooperative management of wildlife will continue to improve in future years.

Condition of Range and Livestock

The past fiscal year has produced a wide variety of climatic conditions in the western range States. In several States moisture and forage conditions were good to excellent last fall but have since deteriorated considerably, with extreme cases being Montana and Arizona where drought emergency relief programs are now planned or in operation. In contrast, California experienced severe drought conditions during the summer and fall of 1955 which were followed by extremely heavy winter precipitation, and now forage conditions are reported to be the best in years.

Generally the condition of livestock is reported to be good to excellent, excepting the several areas where prolonged drought has led to a reduction in numbers and in some cases complete nonuse of the range.

Range Studies

Since the Bureau implemented a concerted range condition and trend study program several years ago, an increased effort has been made to expand and improve the methods for obtaining and recording basic data.

Training sessions have been held in all States to instruct key district and State personnel in the latest methods of obtaining the required information. Our efforts have been pointed toward a balanced program to include detailed studies of representative areas in support of large-scale and less intensive studies.

As an integral part of this program, an estimate of trend of overall range condition has been made. These estimates will later be supplemented by comparative data as soon as it can be obtained from cumulative records. In spite of the effects of current drought in parts of the West, a good portion of the public range is believed to be stabilized or improved in condition. Those areas which appear to be deteriorating are receiving very careful attention in order that necessary corrective measures may be taken and the downward trend reversed.

In support of the range adjudication program, range surveys are being conducted in most States and some fairly substantial progress has been made in obtaining grazing capacity information during the past year. New Mexico and Arizona have full coverage by range surveys and now require only occasional rechecks of existing range conditions. In Idaho, where range surveys previously covered only a small part of the Federal range area, excellent progress has been made with approximately 1½ million acres completed during the past fiscal year.

The program for obtaining range utilization measurements has suffered somewhat from a lack of personnel available to do the work. However, most States are making as many utilization checks of the range as possible. In some areas special cooperative studies are being carried out as exemplified by Montana, in which hydrological and ecological studies are being made of the Willow Creek waterspreading system by the Geological Survey and Montana State College in cooperation with the Bureau.

Hearings and Appeals

The situation with respect to the conduct of hearings and issuance of decisions on grazing appeal cases remains unfavorable but is somewhat improved since last year. Well over 100 appeal cases were awaiting a hearing at the end of the fiscal year. In some cases the delay in the processing of appeals has seriously handicapped the overall range adjudication program. Idaho and Montana appear to be in the worst shape in this respect, with 17 cases pending in Montana and 74 pending in Idaho at the close of the fiscal year. In the latter instance it is estimated that 59 of the 74 can be disposed of with only two hearings, since they involve similar issues.

Section 15 Lease Administration

Little change has occurred in the overall aspects of administering lands under section 15 of the Taylor Grazing Act (lands leased for grazing outside of Taylor grazing districts). In most States 95 percent or more of the total leasable acreage is now under lease and efforts are being continued to reach 100 percent. While a few States reported that no attention could be paid to section 15 lease areas due to limitations in personnel, most States were able to provide at least some range-use supervision and inspection. Although trespass is recognized to be a serious problem in many lease areas, for the most part the section 15 lands are reported to be in fair to good condition or better. In one State, a small percentage of lease land was rated as to condition and trend, but in other States this type of work has not been possible.

Soil and Moisture Conservation

All States have reported a complete changeover to community watershed programing of project work and this approach to soil and moisture conservation is unquestionably working out very well. Cooperative pilot projects have been approved in many areas in which the Bureau participates with other Government and State agencies

and soil conservation district supervisors in providing a comprehensive management and soil and moisture conservation program for the pilot area.

Arizona reports that the magnitude and effectiveness of the Bureau program for reducing the erosion of soil and increasing the production of range forage in that State has attracted much favorable attention. It is believed that this is similarly the case in many other States.

In California one of the important conservation practices is the seeding of wild fire burns immediately after the fire has been extinguished. This has been a very effective measure in restoring vegetative cover in that State.

Utah has made excellent progress in the community watershed program. Fifteen watershed plans have been approved at the State level and several others are in the process of completion. One of the latter covers the Paria River drainage where a joint program is being set up with the Tropic Soil conservation district, the Soil Conservation Service, the Forest Service in the Department of Agriculture and the National Park Service, Bureau of Reclamation and the Bureau of Land Management in the Department of the Interior, all working in close harmony in development of the plan. This drainage is one of the heavy silt contributors to the Colorado River. Since the Glen Canyon and Marble Canyon Dam sites are below the Paria drainage early action on this pilot project was timely.

Emphasis has been placed on range revegetation measures, water development and control structures, land treatment measures which will retain the soil and water in place and provide an increased amount of native or introduced vegetation, and protection fencing to control livestock and preserve treated areas. Cooperation from private landowners and range users is reported to be very good from the standpoint of both monetary contributions and aid in construction and maintenance of projects. In one instance a contribution of $22,000 for these purposes was made by a Utah livestock company, which seems to indicate considerable confidence in the Bureau's overall conservation program.

Halogeton

Significant results were obtained from the Bureau's halogeton work program in controlling the detrimental effects of the plant on the range and in reducing livestock losses. Although the plant continues to spread, its adverse influence has been reduced in areas where control work is complete.

Of an estimated infested area of almost 11¼ million acres, approximately 8¼ million acres is Bureau-administered land. This is nearly 2 million acres more than the infested acreage reported a year ago,

due in part to the discovery of new locations and to spreading of the plant within and along the perimeter of general infestations.

During the past year, intensive and extensive surveys were conducted on 11 million acres of rangeland from which halogeton infestation information was acquired. Only a part of this surveyed area is included in the area of infestation, but most of it presents potentialities for such invasion.

Livestock losses from halogeton poisoning still occur quite frequently among sheep herds using the more heavily infested areas, and to a lesser degree in cattle herds grazing such ranges. In Nevada, Utah, and Idaho, numerous cases of poisoning have been well confirmed, while in other States losses due to halogeton lack substantiation and an apathetic attitude toward control measures is prevalent among stockmen.

Halogeton Control

In the past fiscal year, 32,367 acres of Bureau land were reseeded to perennial grasses, mainly crested wheatgrass, for the control of halogeton. These operations included the necessary brush removal and seedbed preparation. Such seedings, when successful, have the effect of suppressing any existing halogeton stand and of providing an additional supply of livestock forage. The added forage makes possible a lighter degree of use on other infested ranges in the vicinity, thereby hastening vegetative recovery to a condition commensurate with effective control of livestock poisoning. Sufficient palatable forage minimizes or eliminates the grazing of halogeton by livestock.

Last year 260 miles of fence were constructed to limit the use of livestock on reseeded and other halogeton infested ranges. These were aimed at the protection of new seedings and seasonal ranges, and the proper distribution of livestock on use areas. Such use control must be correlated with the range management functions of the Bureau such as the perfection of proper stocking of different areas and the apportionment and allotting of the range. Also, another grazing-use distribution device of the range improvement program, water developing, must also be considered and used in any effort to adequately ease excessive grazing burdens on infested areas.

Other means used to increase the palatable forage supply and suppress halogeton on some infested areas include waterspreading systems and contour furrowing. About 900 acres were included in waterspreading projects during the year. Quite often reseeding is done in connection with these projects to hasten desired results.

A great deal of work has been expended in acquainting range users with management requirements to minimize halogeton losses. This public relations effort has likewise been effective in acquiring a con-

siderable contribution from range users in cash, labor, materials, and equipment operation toward the completion of the annual project work program.

Chemical and Mechanical Treatment

Direct eradication of halogeton has been accomplished principally by chemical treatment with spray solutions of low volatile esters of 2,4–D. Only minor acreages have been treated by grubbing or other mechanical removal.

These treatments are directed toward isolated spot infestations, particularly those removed some distance from other populations of the plant. Also, peripheral treatment of general infestations where rapid spread was expected has inhibited the invasion of new areas. In numerous cases, road rights-of-way and gravel pits have been sprayed for removal of seed sources from these rapid-spread areas.

During the past year, 32,731 acres were chemically treated. It is believed that the rate of spread in most areas so treated has been considerably reduced by eliminating seed sources, and a number of small spot infestations have been eradicated. Generally, chemical spraying has resulted in a thinning of halogeton stands, at least during the year immediately succeeding that in which the spraying is accomplished.

Under cooperative agreements, the Bureau has made location surveys on a considerable acreage of reclamation withdrawn land, and applied chemical treatment on infested areas.

Halogeton Research

The Bureau is continuing cooperation in halogeton research directly with the Agricultural Research Service and State agricultural experiment stations. These research agencies are conducting experiments aimed at determining the growth habits and ecological requirements of the plant, and at formulating effective means of controlling it. The studies cover such items as seed-producing characteristics of the plant, soil requirements, plant associations and competition, reseeding evaluation, ground and aerial spraying with 2,4-D, evaluation of various herbicidal compounds including selective herbicides, and grazing intensity trials.

Cooperation of the Bureau in research projects is usually limited to aid in planning, construction of facilities, and application of treatments. Some time is spent in helping to collect data which are ultimately analyzed by the research agncies.

Other Noxious Weeds

Most of the States report that a variety of other noxious and poisonous weeds such as larkspur, death camas, camel thorn, white top,

loco, and many others have caused limited livestock losses were a minor threat to maintenance of good range forage conditions. However, in only a few cases has any control activity taken place and this has usually been on a very limited scale in conjunction with local county or State agencies. The need for a stepped-up program of other-than-halogeton weed control is recognized but it will have to await additional funds and personnel before much can be accomplished.

Range Improvements

In keeping with general policy, range improvement funds have been used primarily for maintaining existing projects and range facilities. Considerable maintenance work is also being done by Federal range users under cooperative agreement with the Bureau. In addition, the districts have been able to carry out a limited program of water development, range allotment and drift fencing, and other small-scale range improvement activities. Some reseeding of range lands has also been accomplished although this work has been carried on principally under the halogeton and soil and moisture program.

We are pleased to report that the range improvement program has been materially aided by the fish and game departments in several States. For example, in Colorado substantial contributions have been made to the access road development program and the State has shown a willingness to cooperate in water development projects, range surveys, reseeding, research projects and similar matters.

FORESTRY

All timbered lands under the jurisdiction of BLM—an area approximating 161 million acres in the United States and Alaska—are managed by the Bureau on a sustained yield basis for the purpose of insuring continuous timber production at the highest possible level. This in turn assures economic stability of communities which depend upon the timber resources. The Bureau integrates managemnt of watershed, recreational, and other resources with timber management for the greatest total public benefit. Vital to this end is the Bureau's program for protection from fire, insects, and disease.

Timber Sales

Based on the concept of sound forest management, which prescribes cutting of the mature trees in an amount not to exceed the annual sustained yield growth, the Bureau of Land Management conducts public timber sales that yield substantial monetary return to Federal,

State, and county treasuries. The volume and value of timber sold from Bureau forest lands in fiscal year 1956 were the greatest in the history of the Bureau, the volume 834,416,650 board-feet bringing $27,801,486.45, compared to 763,243,000 board-feet of timber valued at $19,903,301.45 sold in fiscal year 1955, the previous high year. These figures include timber involved in trespass settlements.

Timber from the Oregon and California Railroad and Coos Bay Wagon Road grant lands accounted for 664,835,000 board-feet of the total sold and $25,024,063.97 of the total value. Public domain timber sales and other types of disposal accounted for the remainder. It should be noted that during the last 5 years the volume of timber sold on the O. and C. lands has been equal to 95 percent of the allowable annual cut.

During this period, the Bureau was alloted $2,818,455 for the management and protection of these lands. This represents a ratio of income to expenditures of approximately 10 to 1 or $10 earned for every dollar spent. Even after distributing substantial shares to the various public land states and counties, the Federal Treasury realized a net $4,100,000 income for fiscal year 1956.

In addition, the Bureau expended $3,600,000 from receipts payable to the counties on the construction of timber access roads on O. and C. lands in western Oregon. These roads are designed to tap a tremendous volume of salvage timber in inaccessible areas which would be lost entirely if not salvaged soon. This expenditure is in the nature of a capital investment, using funds which normally would have been distributed to the O. and C. counties in Oregon. This investment will be repaid in full with net gains both to the counties and the Federal Treasury through higher sales revenue resulting from wider, more efficient harvesting. From its inception in fiscal year 1951 approximately $10,312,000 has been spent on this program as of May 1, 1956. As a result approximately 146 miles of heavy-duty logging roads have been built or are under construction, representing about one-half of the total program.

Scope of BLM Forestry

The Bureau of Land Management forestry program is one of sustained-yield forest management giving due weight to the relative importance of soil conservation, wildlife, watershed protection, grazing, and recreational values of the forest.

The Bureau manages approximately 161,500,000 acres of forest and woodland—all outside of national forests—in the United States and Alaska. Of this, approximately 36,496,000 acres are in the continental United States, 6,376,000 acres being commercial forest land and

30,120,000 acres, noncommercial or forest woodland. The 125 million acres in Alaska contain 40 million acres of commercial forest land and 85 million acres of woodland.

This tremendous acreage is estimated to embrace almost 260 billion board-feet of timber on the commercial forest lands alone with another 212.5 billion board-feet standing on the less productive woodlands. Although no accurate inventory has been made of a large portion of this area, Bureau foresters estimate that the productive capacity of these forest and woodlands approximates 4 billion board-feet per year, or enough lumber and equivalent wood products to construct more than 350,000 five-room homes each year in perpetuity. The drain of forest products from this great reservoir was 834 million board-feet in fiscal year 1956.

Forest Land Inventory

An elementary component of any land-management program is inventory. Forest-land management is no exception. On the O. and C. and C. B. W. R. grant lands, where forest management has been developed to a high degree, forest inventories likewise have been developed to a high degree, particularly during the past year.

Shortly after the close of World War II, plans for an intensive up-to-date inventory of the grant lands were made. The time-honored method of ground cruising for making the inventory was discarded in favor of the then new method based on the use of aerial photographs.

In the use of photographs for forest inventory purposes, each photograph is studied individually with stereoscopic equipment, and the various forest type classifications are delineated thereon. Any questionable photo interpretation is checked in the field. Upon the completion of the classification of forest types, the volume of the merchantable sawtimber in the stand is determined by random sampling.

The results of the inventory have been noteworthy. The volume of merchantable timber found in the areas where recent inventories have been made has been 20 to 40 percent greater than the estimates provided by the older inventory surveys. The allowable cut, based on the productivity of the forest soils as well as the volume of mature timber and the acreage of immature forest stands, has also been found to be higher than previously computed. This increase averages about 25 percent overall. If the same upward trend of volume and allowable cut holds throughout the entire inventory, the total volume of timber on the O. and C. and C. B. W. R. grant lands may well be found to be upwards of 50 billion board-feet and the allowable cut more than 750 million board-feet per year.

Progress in Forest Management

In June of 1956 an order was signed which provided for an administrative exchange of 241,137 acres of national-forest lands for 242,734 acres of revested Oregon and California Railroad grant lands located in 13 counties of western Oregon. The original land pattern consisted of alternate sections of land administered by the two agencies and the exchange remedies this interlocking jurisdiction by blocking up the lands, making the numerous areas affected either all BLM or all national forest. Administration and management of these lands will be improved by both the consolidated land pattern and a reduction in the public confusion over management rules and practices of the two agencies operating in the same area.

During the past fiscal year an important addition to the mining laws was enacted by Congress which permits multiple-use of surface resources on public lands included within unpatented mining claims. This act, known as Public Law 167, provides for, among other things, government control of surface resources not needed in actual mining operations on public lands covered by unpatented mining claims located after July 23, 1955. The Government retains the right, prior to the issuance of a patent, to manage the surface resources of mining claims, including the cutting and sale of timber, grazing of livestock, and use of the surface of claims for access to adjacent public land and timber. These provisions of the new law will have a marked effect by improving the management and administration of the public lands, and allowing for expanded multiple use.

No sustained yield forest management plan is complete unless provisions are made for the reforestation of cutover and burned lands. While many forest areas naturally regenerate themselves after the removal of the forest cover, other tracts must be planted or seeded to insure a new crop of trees. During the past year over 5,000 such acres were planted bringing the total acreage planted since 1951 to more than 21,500. In addition, some 650 acres were seeded within the past year, bringing the total seeded acreage to slightly in excess of 12,000. Approximately 33,500 acres have been reforested using 13 million seedlings and 3½ tons of seed since the initiation of the reforestation program. Reforestation plays a dual role in the management of forest lands since it both assures future forest resources and also reduces the period required for natural regeneration. Reforestation is an essential of good management.

Protection

Successful management of renewable natural resources requires adequate protection from fire, insects and disease. To this end the

Bureau has been placing increased emphasis on fire protection. In an effort to reduce annual burned area to an acceptable minimum on the 180 million acres of forest, brush, and tundra under BLM jurisdiction in Alaska, cooperation with other agencies has been stressed. Through assistance in organizing and use of fire equipment from our fire-control organization in Alaska, several communities surrounded by public domain lands have assumed full responsibility of their fire control problem. The number and quality of fire training conferences have been increased. This has resulted in the development of better fire plans and has made possible more efficient use of manpower and equipment.

Very high frequency (VHF) radio has been installed in the grazing districts of Idaho and Oregon, and in one or more grazing districts in Montana, Nevada, Colorado, and Arizona. Tests are being conducted in all other districts and plans are being prepared for extension of VHF communications to all grazing districts. Radio telephone has been used successfully in two grazing districts in Nevada and one in Utah. VHF radio and radio telephone permit noise-free reception during periods of high electrical activity common during storms and other periods of high-fire occurrence when good communications are most essential in reducing the elapsed time between detection and initial action on a fire. In Alaska because of the long-haul requirements over numerous mountains medium frequency radio gives acceptable service. All base stations in Alaska have been rebuilt from equipment declared surplus by the military.

Use of three amphibian aircraft transferred from the Navy and three 4-place wheel planes all equipped with radio, have greatly improved the efficiency of the fire organization in Alaska. The amphibian craft has been used very effectively to transport fire fighters and equipment to lakes and airstrips near fires and to airdrop tools, equipment, and food to men on the fire line. The wheel planes here are used for patrol, scouting fires, air-to-ground radio contact with men on the fire line, and for moving fire fighters' equipment and supplies to airstrips as near to fires as possible.

High pressure pumper units mounted on multiple driver trucks are standard equipment on grazing districts for suppressing grass and brush fires. Nearly all districts are equipped with one or more such units. In Alaska the Pacific marine-type pumpers are better suited for fighting timber fires, although in accessible places the high pressure pumpers have proved to be equally effective. Development of a swampbuggy type vehicle for use in Alaska for off-the-road use is underway. If successful this will add to the efficiency of the fire control organization.

Contract protection on nearly 4 million acres of public domain forest and woodlands in the States of California, Idaho, Oregon,

Montana, Washington, Arkansas, and Minnesota was continued. An additional 2¼ million acres of BLM administered O. and C. lands in western Oregon bearing high-value Douglas-fir timber are also protected by contract. These lands are scattered and intermingled with ownerships of other agencies having protection organizations. For this Bureau to protect these lands under force account would be a duplication of effort.

While far less spectacular than fire, annual damage by insects often exceeds that of fire and the ravages are much more difficult to control. Insect infestations are difficult to detect and may reach epidemic proportions before adequate control measures can be effected.

A Douglas-fir bark beetle infestation in the Douglas-fir region of western Oregon, California, and Washington which followed heavy windthrow in these areas reached its peak toward the close of 1954. To prevent further outbreaks and the loss of some 13½ billion board-feet of timber, extensive salvage operations got under way. Over half of the estimated 3 billion board-feet on the 1.4 million acres of O. and C. lands have been salvaged to date from existing road systems. At present there is no effective means of control other than removal of infested trees to minimize the spread.

Before salvage could be accomplished on the remainder of the blowdown and beetle-killed timber, a system of access roads requiring several years had to be built.

Seventy-six thousand acres of Bureau of Land Management timber lands adjacent to or intermingled with the national forests and lands of other ownerships in Montana were treated for a spruce budworm infestation during the past year.

As high demands on timber continue, it becomes more important that prevention and control of disease should be given increased protection. The only known epidemic tree disease affecting BLM timber is white pine blister rust, a disease common to the five-needle pines. A blister rust control program was started in 1942 on 150,000 acres of commercial sugar pine near Medford, Oreg. The present project area is approximately 98,000 acres. During the last field season 568 acres were treated with initial eradication and 1,401 acres with reeradication.

CADASTRAL SURVEYS

As the official engineering service for the survey and resurvey necessary to the identification and description of public lands, the Bureau conducts cadastral surveys and prepares plats and field notes which graphically and narratively portray these surveys. The Bureau also prepares maps necessary to administer mineral leasing of the sub-

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merged lands of the outer Continental Shelf, and approves and plats mineral surveys executed by United States mineral surveyors.

The 1956 Program

Cadastral surveys are prerequisite to any comprehensive program of land management or development and the conservation of the natural resources. It is fundamental that the boundaries of the lands being administered must be known definitely before funds are expended for their improvement or the development of the resources of such areas. The cadastral surveys create and establish land boundaries, identify the parcels of land and afford descriptions and areas for the various subdivisions for title purposes. The boundaries are actually marked on the ground by permanent monuments. The Bureau of Land Management is not only the official agency for conducting the cadastral survey of the public lands under its own jurisdiction, but also conducts surveys for other Federal agencies on a reimbursable basis.

The cadastral survey program of the Bureau of Land Management for fiscal year 1956 was based primarily upon the needs of management and to aid in the development and conservation of the natural resources vital to the economy of the Western States and Alaska. Surveys were extended over areas valuable for minerals, including oil and gas in the western States and in Alaska. Areas found suitable for homesites were subdivided, thus affording lands to accommodate the demand of the increasing population of continental United States and Alaska. Surveys made in the Pacific Coastal States aided in timber management activities. The location, by cadastral survey, of the boundaries for administration rangelands and the construction of range improvements constituted a necessary part of the program. Of major importance, especially to the States of Arizona, California, and Utah, was the survey of school sections so that those states could obtain title to the lands granted to them at statehood and thus manage and utilize the resources of those lands.

Surveys in the States

In the past fiscal year, 1,361,041 acres of land were surveyed or resurveyed. The accomplished program included the resurvey of forest areas, principally in Oregon and California, to define the boundaries of timber management units, to settle trespass cases, and to provide a basis for timber sales; the survey of small tracts to provide home and business sites; the identification of the sections granted to the States for school purposes; the survey and resurvey of mineral lands for leasing purposes and development; and the survey and resurvey of grazing lands for range management.

Work for other Federal agencies to aid them in the management of the lands under their jurisdiction consisted of the resurvey of 466,200 acres for the Bureau of Reclamation in the Missouri River Basin; the survey and resurvey of 33,280 acres for the National Forest Service in Colorado and New Mexico; the resurvey of 8,080 acres in Idaho at the request of the Geological Survey to determine locations of phosphate deposits; the identification of extant corners of the Rainbow Bridge National Monument in Utah and the subdivision of six sections in the Rocky Mountain National Park, Colo., for the National Park Service; the determination of a portion of the boundary of the Zia Pueblo Indian Reservation in New Maxico for the Bureau of Indian Affairs; the investigation of river bed areas within the Garrison Reservoir, North Dakota, for the Corps of Engineers, War Department; the reestablishment of the boundary of the hospital area at Fort Stanton, N. Mex., for the Department of Health, Education, and Welfare; and the identification of lands reserved for the United States Coast Guard in the vicinity of Port Angeles, Wash.

Also accomplished were miscellaneous surveys and investigations such as the survey of islands and omitted lands in the Eastern States and in Idaho and Montana; a mineral segregation survey for the county of Mohave, Ariz.; the restoration and remonumentation of the Initial Point for the New Mexico Principal Meredian which governs the rectangular system of surveys in New Mexico and the southwestern portion of Colorado.

The survey of school sections made available 103,080 acres of land in Utah, 24,320 acres to Arizona and 28,800 acres to California—a total of 156,200 acres. In general, the program of work was based on the desires of the States to cover the areas of greatest value and interest. In order to make the maximum quantity of school lands available the Bureau adopted the plan of surveying and monumenting only township boundaries and only the boundaries of school sections in each township instead of making a complete subdivisional survey. Since there are 36 sections in each township, not more than 4 of which are designated school sections, this method made it possible to survey nearly 3 times more school sections than could have been surveyed where completely subdivided. By this procedure the Bureau also is able to manage the remaining unsurveyed areas in the townships, as there is sufficient control on the ground to determine the boundaries of any project initiated in the unsurveyed areas.

Alaska Surveys

The program in Alaska was designated primarily to provide for the survey of suitable units of land areas for homesites, settlement, and business sites. In addition to 65,280 acres surveyed under the

rectangular system, the accomplishment included the survey of 578 small tracts, 28 homesites, 8 homesteads, 7 headquarter sites, 1 mission site, 7 trade and manufacturing sites, 7 Alaska public-sale sites, 1 Indian allotment, 1 Territorial airport, 1 recreation site, and 23 miles of highway tracts.

RECORDS

Fundamental to the whole real property structure of the public land states and essential to the effective administration of the public domain and its vast resources are the Nation's land records.

These records are the source of such basic information as Federal ownership of public-domain lands; lands which have been conveyed to private ownership; mineral and other rights retained by the Federal Government in patented lands; vacant public lands withdrawn or reserved for special uses; leases, licenses, permits for use of the lands or resources, or both, granted by the United States.

The keeping of the vast official history of such detailed transactions is a responsibility of the Bureau of Land Management that amounts practically to a separate function. The patents alone number more than 6 million and occupy nearly 12,000 volumes.

Until the past 2 years there has not been a major change in the manner of preserving, making entries in, or providing access to these records since 1812. But, with the aid of new techniques, the wornout land records for the Western States, where most of the remaining public lands lie, are being completely modernized. They have been transformed and permanently preserved on microfilm images mounted in key-punched tabulating cards to provide a ready-reference index that will eliminate unwieldiness, slowness, and inaccuracies found in the old system.

Groundwork for the second phase of a two-part program to accomplish the records modernization was laid during the past year. A contract was awarded in October 1955 for the key-punching of nearly 4 million tabulated cards with apertures for mounting 35 mm microfilm images of patents and control documents for completion of what is known as the control document index.

The control document provides the basis for conversion of the old records to all-inclusive new master title plats, accompanying use plats, and historical indexes for each township in the Western States. This work will be accomplished progressively on a State-by-State basis, commencing in fiscal year 1957, and the Salt Lake City Land Office became the site of the first installation for the 2,550 townships in Utah.

Major advantages of the new records system will be the facility with which the public as well as Federal, State, county, and municipal

agencies can get information from or obtain copies of the plats and indexes. Duplicate copies of the 20 x 25½-inch plats can be made in a matter of minutes, simply by running sensitized linen sheets and matte film through a reproduction machine, thus saving hours of copying and handling of tract books.

OUTER CONTINENTAL SHELF

The Eastern States' outer Continental Shelf Office of the Bureau of Land Management was established to take action on mineral leasing under the Continental Shelf Act of August 7, 1953.

Interest in the leasing of submerged lands in the outer Continental Shelf was outstanding during the fiscal year 1956. As of June 30, 1956, an aggregate 230 section 8 leases were outstanding covering 839,437 acres of OCS lands. The United States Treasury has received a total of $252,141,077 in bonus bids and first-year rentals as result of those leases. Approximately 372 section 6 leases (those taken over from the State of Louisiana) covering approximately 1,450,942 acres are also outstanding.

A third sale of mineral leases in the Gulf of Mexico off Louisiana and Texas was held at New Orleans, La., on July 12, 1955, resulting in the issuance of 121 leases covering 402,567 acres of oil and gas lands. Total bonuses and rentals of $109,736,447 were covered into the Treasury. This third sale favorably compares with the two prior lease sales of October 13 and November 9, 1954, when a total of $140,969,005 in bonuses was received and $1,435,625 in first year's rental.

New regulations for right-of-way for pipelines were approved during fiscal year and additional authority to act was delegated to the manager of the New Orleans office in order to expedite the handling of pipeline work.

On June 11, 1956, the United States Supreme Court issued an order prohibiting the drilling of new wells or the issuance of new leases in the Gulf of Mexico off Louisiana except by agreement between the State of Louisiana and the United States to be filed with the Court. The area affected by the order was specified as extending from a line 3 marine miles from shore to a line 3 marine leagues seaward from a line recognized by the Coast Guard as delimiting the navigation rules applicable to inland waters and the open sea. No agreement had been reached between the parties as of June 30, 1956.

EASTERN STATES

The Eastern States office, in carrying out its 1956 program in the Southern States for Florida, Alabama, Louisiana, Mississippi, and

Arkansas, and in the Lake States for Michigan, Minnesota, and Wisconsin, disposed of 61,975.77 acres of land for $620,668.28 through the medium of 151 area and individual public sales and small-tract auctions.

The Russellville, Ark., office completed about 60 percent of its sales program, and it is expected that the total area, originally covering about 112,000 acres, will be disposed of by July 1, 1957. A follow up sales program planning disposal of remaining public domain in the State of Florida, as well as in the State of Minnesota, had now been completed.

FOREIGN ACTIVITIES

The Bureau of Land Management, in cooperation with the International Cooperation Administration and other specialized international agencies continued active cooperation with some 20 countries in all regions of the world on land use and conservation problems.

The Bureau's facilities were utilized by approximately 50 representatives of other countries and experienced BLM officials were made available for technical assistance assignments as requested.

Support on technical problems, international conferences and training centers was continually provided. Activities varied and ranged from forest and grazing land improvement and conservation practices, including small water facilities, in Jordan to collaboration with officials of the Philippine Government on land settlement and mineral leasing.

The homesteading days of the United States are being repeated by the low-cost homestead program of the Philippine Bureau of Lands under which 50,000 individuals annually are obtaining security through land ownership.

Increasing interest is being shown by governments in the management improvements recently adopted by the Bureau of Land Management for more effective handling of land disposal, conservation, land use and resource management activities.

STAFFING

Expanded programs in many Bureau activities necessitated recourse to active recruitment to meet manpower needs. The major colleges in the United States graduating foresters, mining engineers, and other professional categories were apprised of the Bureau's programs and employment opportunities. Recruiters visited some of these colleges. Publicity releases were distributed to technical and professional pub-

lications. These techniques resulted in an increase in permanent personnel of approximately 20 percent over last year.

Employment in the Bureau on June 30, 1956, totaled 2,267, distributed as follows: Area 1, 580; Area 2, 647; Area 3, 600; Area 4, 163; Eastern States office, 46; and Director's office, 231.

The Bureau launched upon a vigorous and formalized program to obtain more effective results from training. Special emphasis was given to development of technical and professional employees to provide for maximum utilization in these shortage categories. Formal training schedules were developed to improve planning and to insure a comprehensive program.

Four management development conferences were held in October and November 1955, attended by approximately 160 top level supervisory personnel. Appraisal of these conferences by the questionnaire method shows conclusively they were effective in achieving a better understanding of supervisory responsibilities and in pointing up new techniques of management for adoption in the Bureau.

Six management trainees, representing each area and the Washington office, participated in the Department's seventh management training program in Washington.

FINANCE

Revenue from the management of public lands in fiscal year 1956 amounted to $212,216,522. This amount included $111.22 million from the sale of oil and gas leases on the outer Continental Shelf and $100.99 million from public land receipts—a decrease of $27.3 million over the prior fiscal year, due to cancellation of a scheduled May 15, 1955, outer Continental Shelf lease sale as the result of litigation brought by the State of Louisiana in the State courts. The receipts of $100.99 from long-established operations of the Bureau were an all-time high, the previous high being $97 million in fiscal year 1955. Of the total amount, $36.7 million was distributed to States and counties. The receipts were from varied sources, principally from oil and gas leasing, timber and land sales, and grazing permits and licenses.

The Bureau's appropriation for expenditure in fiscal year 1956 amounted to $19,558,245.

FISH AND WILDLIFE SERVICE

John L. Farley, *Director*

EVENTS at the end of the fiscal year 1956 are of particular significance in fish and wildlife conservation. On June 30 the Fish and Wildlife Service completed 16 years of conservation of the birds, fishes, and mammals that are part of the Nation's renewable natural resources. Establishment of the Service on June 30, 1940, was another step in a constant advance of recognition of the importance of these resources. This advance began in 1871 with the appointment of a Commissioner of Fish and Fisheries to investigate the problems of conservation of the country's fishery resources—that appointment led to the Bureau of Fisheries. In 1885 an economic ornithologist was appointed to investigate the economic importance and conservation of birds, and that appointment led to the Bureau of Biological Survey, concerned with problems of wildlife conservation. In 1940 those two bureaus became the Fish and Wildlife Service of the Department of the Interior.

As the fiscal year ended, the Service was preparing for another step in its conservation advance, under proposals in the Congress for greater recognition of the importance of fish and wildlife conservation. These proposals were carried out just after the close of the fiscal year, by the Fish and Wildlife Act of 1956, signed by the President on August 8, providing for an Assistant Secretary for Fish and Wildlife, with the Service becoming the United States Fish and Wildlife Service, under a Commissioner of Fish and Wildlife, and comprising two bureaus, the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. Under this act, the new Service will be able to improve the conservation of our fish and wildlife resources, through greater efforts to assure wise use, through expanded research necessary for efficient management, and through direct management of certain resources.

During the fiscal year the Service made substantial progress in its promotion of utilization and conservation. Operations were further

decentralized to bring them closer to the particular areas they affect, with a strengthening of the five Fish and Wildlife Service regions embracing the northwestern, southwestern, central, southeastern, and northeastern parts of the country. Alaskan operations were under the Administrator, Alaska Commercial Fisheries, and the Administrator, Alaska Wildlife Resources. The Pacific Oceanic Fishery Investigations continued work from Hawaii.

In the brevity of this report, the many accomplishments in the several regions are incorporated in the overall accounts of the various phases of the Service's activities.

ASSISTANCE TO THE COMMERCIAL FISHERIES

The Fish and Wildlife Service's commercial fisheries activities included exploration, technology, market development and education, statistics, market news, and economics. The Saltonstall-Kennedy Act made funds available again to strengthen the nation's commercial-fishing industry, with special emphasis on research and marketing activities by the Service.

The new vessel *George M. Bowers*, completed during the year, is now being used on the fishing gear research program and has aided in the development of midwater trawls and the successful trawl depth electronic telemeter. Explorations of the *Pelican*, one of two recently chartered trawlers, now indicate that a sizable red-shrimp resource exists in the deep waters of the South Atlantic. The trawler *Metacomet* is assisting the Maine sardine program. Explorations by the trawler *Delaware* off New England for deepwater lobster uncovered a much larger resource potential than thought possible. Deepwater trawling by the *Delaware* has uncovered new fishing grounds with commercial concentrations of ocean perch.

The exploratory fishing vessel *Oregon* produced excellent catches of yellowfin tuna in the Campeche area of the Gulf of Mexico during the spring. This development in addition to earlier discoveries of tuna in the Gulf of Mexico indicates that commercial production of tuna may be possible the year around in these waters. Recent explorations by the *John N. Cobb* off the Washington coast added to the knowledge of the extent of the ocean-shrimp resource.

Expectations last year that establishment of the first voluntary U. S. standard of grade and condition for fishery products would soon be a reality have come to pass through joint efforts of the industry and the Government. The first standard has been applied to fish sticks. One major producer of fish sticks has already contracted for continuous inplant inspection based on this voluntary standard. Development of standards for frozen fish blocks and for raw breaded shrimp is well advanced.

The well-balanced research program on the development of new uses for fish oils has made substantial progress. As the elucidation of the complex chemical structure of fish oils, not heretofore accurately known, continues, new chemical derivatives based on these unique fish-oil characteristics are being developed by other workers in this fruitful field of organic chemistry. Fish oils may eventually be valuable in chemical-industry applications just as coal and petroleum now are.

A total of 280 fish-cookery demonstrations, including the distribution of fish-recipe booklets, were conducted by Service home economists for school-lunch and other insitutional food supervisors.

Special market-promotion campaigns were conducted on a national basis to assist the tuna and shrimp industries.

Three fishery educational motion pictures were produced during the year, and two others were in preparation. Of the completed films, one was financed by segments of the outboard motor industry, another by an equipment manufacturer. A third film yet to be completed is being financed by the Maine sardine industry. The Service-sponsored films dealt with the nutritive value of fishery products and fishery-product standards. The outboard and shrimp pictures were chosen for display in international film contests.

Considerable success has been obtained in developing markets for the plentiful and underutilized fish of the Great Lakes.

General statistical surveys for 1954 were completed for all sections of the United States. Similar surveys for 1955 were undertaken.

The Service continued to release monthly bulletins on landings of fishery products in 11 coastal States, and similar bulletins for Ohio and Georgia were begun. Monthly bulletins were released on domestic freezings and holdings of fishery products and on production of fish meal and oil. Quarterly reports on the yield of fish sticks and annual bulletins on the production of canned fishery products, byproducts, and packaged fish also were released.

Completion of a study to improve the collection and publication of statistics on freezings and cold-storage holdings of fishery products materially increased the value of the Service's cold-storage report.

Publication of detailed data on the important Gulf of Mexico shrimp industry was begun, and tabulation of detailed shrimp-catch statistics was undertaken as a basis for biological programs.

To aid in the orderly marketing of fishery products and byproducts, marketing specialists in fishing, distribution, and consumption centers collect daily production and marketing information. This information is disseminated, while it is timely and current, through daily reports by the seven Fishery Market News Service field offices, in Boston, New York City, Hampton (Va.), New Orleans, San Pedro, Seattle, and Chicago. Market News "Fishery Products Reports" provide an 18-year daily record of fishery production, marketing, and

price. These reports are used extensively in the fishery industry, in conservation work, in granting loans, in supplying background data for governmental actions, in research, and in determining the economic importance of the fisheries. The field work was completed on the studies of marketing of fishery products in eight key consumption centers other than those now covered.

The monthly periodical Commercial Fisheries Review continued to feature articles and news of trends and developments in the fishery industries of the United States and foreign countries.

Regulatory activities and reports on fishery cooperative-marketing associations were continuel in accordance with the authority vested in the Department by the Fishery Cooperative Marketing Act of 1934. On June 30, 1956, there were 84 active fishery cooperative-marketing associations in the United States and Alaska, the same as in 1955.

Studies were continued on transportation problems, including the effect of higher rates and charges for freight and express service. The problem of imports of groundfish fillets and tuna was kept under constant surveillance. A study of the economics of distribution of Pacific-coast fish was continued to determine marketing processes and the market potential for Pacific-coast fish in the Pacific Coast States. Progress was made on a survey of the fishing industry's hull-insurance and protection and indemnity insurance problems.

A nationwide survey of the shrimp industry aimed at improving production, processing, and distribution of shrimp products was concluded, and the results are being analyzed.

CONSERVATION OF ALASKA COMMERCIAL FISHERIES

The commercial fisheries of Alaska are its most valuable industry. Regulation of the fisheries is the responsibility of the Secretary of the Interior and is administered through the Fish and Wildlife Service. While about 25 species of fish and shellfish are taken, by far the most valuable are the salmon fisheries, which accounted for 86 percent of the total value of products as prepared for market in 1955.

Because of the depletion of the pink-salmon runs in southeastern Alaska and Prince William Sound, a vigorous restoration program, begun in 1954, was continued in 1955. This consisted of complete closure of the pink-salmon fishery in Prince William Sound, and a reduction in trap fishing by 50 percent in southeastern Alaska, coupled with large increases in closed areas in various bays to reduce purse-seine catches. These restrictions were accompanied by a stepped-up streamguard program to ensure that the increased numbers of spawn-

ing fish should not be lost to poachers. This program of reserving a larger proportion of the runs for spawning stock resulted again in generally satisfactory escapements of pink salmon from which larger future runs can be expected. Because of this restoration program, and because the record runs of chum salmon of 1954 were not repeated, the pack was but 2,385,163 cases in 1955, the smallest since 1910.

Research on the application of inorganic fertilizers to Bare Lake on Kodiak Island has produced some interesting results. The production of downstream red salmon migrants has been increased with a higher percentage leaving the lake at a larger size and a year younger in age than prior to the start of the experiment. This indicates a possible method of obtaining greater production from Alaska waters.

Continued research on herring showed an increase in catch per unit of effort, spawning area, and the appearance of a young dominant year class. Based on this, an increase in herring population size was predicted and a larger catch quota allowed for 1956. A tremendous increase in herring spawning in the spring of 1956 substantiated the prediction of a larger population.

With a few notable exceptions such as in Bristol Bay, the curtailment of fishing in 1955 resulted in a general improvement in spawning escapement.

From a conservation standpoint it is encouraging to note that the great majority of the operators and fishermen recognized the necessity of the program and supported it. This cooperation will do much to assure successful rehabilitation of the salmon runs.

Pribilof Islands Fur-Seal Industry

Fur-sealing operations on the Pribilof Islands during 1955 produced 65,638 fur-seal skins, 1,756 more than were taken in 1954. Of the production, 20 percent was delivered to the Canadian Government in accordance with the Provisional Fur-Seal Agreement of 1942, between the United States and Canada. Also produced on the islands were 321.4 tons of fur-seal meal and 42,591.4 gallons of oil; these products were sold later in the year by competitive bidding for a gross total of $53,898.

During the fiscal year, two public auctions of United States Government-owned skins were held in St. Louis, Mo. On October 10, 1955, 25,940 skins were sold for $2,354,816. In the second sale, on April 16, 1956, 27,017 skins were sold for $2,494,794.

RESEARCH IN FISHERY BIOLOGY

Coastal Fisheries

During the 1956 fishing season, shad investigations centered on the New Jersey coast, where 2,960 shad were tagged to determine racial composition and fishing mortality by the pound-net fishery. On the basis of previous years' escapements, the Service has predicted for the 1956 season a run of 234,000 shad in the Connecticut River and 5 million pounds of shad in the Hudson River. A 3-year program of research on the striped bass of the Roanoke River was begun in 1955, with particular emphasis on the populations of Albemarle Sound. The Sheepscot River, stocked annually with 20,000 to 30,000 young salmon, has been selected for studies of the Atlantic salmon. The investigational work consists in salmon tagging, ecological studies of the Sheepscot estuary and river, and construction and operation of a salmon-counting weir in the Sheepscot River.

In the Pacific Northwest, laboratory research in electrical fish guiding concentrated on measuring the effectiveness of electrical arrays in flowing water. Field efforts were devoted to studies of the barrierlike fields created by horizontally suspended electrodes. One experiment resulted in diversion of 97 percent of fingerling salmon into the bypass channel. In the Columbia River, where adult squawfish feed on young salmon released from hatcheries, electrical devices are being used to block the movement of squawfish and to remove squawfish from release areas. Efforts are being made to develop a portable electrical device to trap squawfish in areas of heavy predation. Also studied as a possible method of guiding salmon, different intensities of study and flashing lights successfully diverted over 95 percent of a natural run of blueback salmon.

Two instruments for identifying and counting migrant fish have been produced and placed in commercial production; the first records the passage of fish in underwater orifices, and the second indicates the direction of passage. Individual fish behavior can now be observed by attaching a sonic tag to the fish. Additional research and development are necessary to increase efficiency of the tag, reduce its size, and increase the range of the receiving equipment. The Fisheries-Engineering Research Facility, established in cooperation with the Corps of Engineers at Bonneville Dam, provides for study of migrating fish under controlled conditions.

An investigation is being made on the effects of water use on the physical and chemical qualities of the Columbia River system to correlate changes with migration and survival of fishes. Because blueback-salmon spawning is now limited to three major areas, research on fresh-water survival is in progress in Washington and Idaho. Substantial losses in fresh water prior to spawning are attrib-

uted mainly to disease aggravated by high water temperatures. A new upstream-downstream weir on Redfish Lake Creek has been installed to collect information on productivity and factors influencing survival and migration.

The most widespread collection of salmon racial data ever attempted in salmon research was completed in 1955, in accordance with a program outlined by the International North Pacific Fisheries Commission. Chartered fishing vessels and shore crews collected specimens and morphological and physiological data from all major red, chum, and pink salmon populations throughout their range in the North Pacific.

Samples of chum, pink, and red salmon from coastal and ocean areas from the Okhotsk Sea to the American coast have shown differences in parasites which appear to be related to differences in oceanographic features. An attempt is being made to discover genetically controlled serological properties characteristic of species and geographic races of salmon.

The stocks of king crab of Bristol Bay and the Aleutians are being investigated as a part of the studies under the International North Pacific Commission. Relative abundance of crabs in the Eastern Bering Sea in 1955 was about 10 percent greater than in 1950 and 1951.

Oyster studies in Long Island Sound have made it possible to issue bulletins which advise oyster growers of the time and area where cultch should be planted. This has resulted in heavy sets. Extensive studies are being undertaken on the control of oyster predators. The joint survey by the Service and the State of Maryland of the Maryland oyster resources included examination of 95 areas. Comparison of this season's figures with those of the 1954 survey indicates fewer marketable oysters and a smaller spatfall. A survey was made of approximately half a million acres of estuarine waters in Mississippi and northwest Florida; of 135,000 acres in northwest Florida, 4,600 acres of nonproducing bottom suitable for oyster culture were located.

Under the direction of the Service, oystermen at West Chatham, Mass., are experimenting with oyster raft culture. By raising the oysters above the bottom and keeping them suspended from rafts, the inroads of drills and whelks, which destroy young oysters, can be materially reduced. Further experiments will begin in July 1956, after spawning. In investigating means of controlling oyster drills, Service biologists discovered that these pests would not cross a barrier of metallic copper. Special fences for oyster beds, utilizing the copper discovery, are being developed.

Studies are being made to determine the causes of the decline in production of soft clams in New England and to find ways of increasing production. Research has shown that increase in green crabs

was largely responsible for decrease in soft clams north of Cape Cod. The present program is designed to determine why green crabs have increased and to find methods for control. A study to develop management of the hard-clam fishery and to find ways of collecting juveniles for private farming of hard clams is being pursued.

Progress is being made in understanding the role of chemical elements in the metabolism of marine organisms. Fission products, when added to marine environments, are accumulated by marine organisms and eventually may reach man through utilization of marine species of fish and shellfish. These studies attempt to ascertain the mode of entry, the amounts of radioactivity accumulated in different organs and tissues, and the passage of radioactive containments to other species.

Inland Fisheries

The outlook for a more effective and stable program on the Great Lakes was much improved by the appointment of the International Great Lakes Fishery Commission.

Major effort in lamprey control centered on Lake Superior, the only one of the Great Lakes which still contains sufficient lake trout to support commercial operations. Electromechanical barriers blocked all known spawning streams on the United States shore, and Canadian officials have been extending controls rapidly in the Ontario streams. As a result, lamprey control on Lake Superior is attaining a high level of effectiveness. Control activities on Lake Michigan are still limited to the streams of the northwestern area. Plans call for blocking all Lake Michigan spawning streams by the start of the 1958 run. Only one barrier has been operated in Lake Huron, and no expansion will be undertaken there until installations have been completed on Lake Michigan.

The search for substances that will destroy larval sea lampreys in streams without injuring fishes has neared the field-testing stage. Among the 4,600 compounds in the original screening tests, 8 exhibited strong selective toxicity toward larval lampreys and 2 gave particular promise.

The research vessel *Cisco* completed her second season of work on Lake Michigan, in research on the chub (deep-water cisco). Disappearance of the lake trout resulted in grievous deterioration of chub stocks in Lake Michigan. In the absence of lake trout. sea lampreys turned to chubs as food, and fishermen who formerly took trout changed to chub fishing.

Research in Green Bay centers on yellow perch, the principal commercial species in the southern area and important throughout the bay. Studies of the population since 1952 reveal no significant

changes in size, age, or rate of growth but found a more than twofold increase of production.

The *Cisco* is making a limnological-fishery survey of Saginaw Bay and adjacent waters of Lake Huron. Aside from this survey, investigations in Saginaw Bay are limited to studies of fluctuations in growth and abundance of walleyes and yellow perch.

In hatchery production, sporadic disease outbreaks occurred in 1955–56, but no catastrophic losses akin to those of previous years. This season is the second year without an outbreak of sockeye "virus" disease. Experiments at the Leetown, W. Va., laboratory found that products of metabolism excreted by hatching eggs are a factor in the blue-sac disease which sometimes causes loss of more than 50 percent of the affected sac fry. A field method of determination of drug-resistant strains of the furunculosis pathogen has been developed.

There are indications that the management regulations inaugurated for Yellowstone Lake in 1953 are showing desirable results. The numbers of spawners entering the tributaries to the lake are increasing. Fishing success in the 1955 season was the highest since 1949, the catch-per-hour figure amounting to 0.671. Fishing pressure was high, with 520,898 hours of fishing, and the catch of 349,757 fish was the largest yet counted.

Limnological work on Yellowstone Lake in 1955 indicated that the central and northern parts of the lake contain the greatest amounts of fish food. Mapping of the bottom of the lake is being continued as part of the program to relate physical and chemical features to the distribution of fish foods and fish. In the Great Smoky National Park, surveys of 17 streams produced estimates of populations of trout ranging from 5.6 to 83.9 pounds per acre, with most waters showing small gains over 1954 figures. The 1955 year class of rainbow trout was generally small in comparison with that of 1954. Surveys in the fall of 1956 will include other important streams not yet studied. Surveys of 7 streams in the Shenandoah National Park indicated populations of trout ranging from 3.8 to 133.1 pounds per acre.

Marine Fisheries

A new research unit, Ocean Research, located at Stanford University, was begun in September 1955. It will make a broad-scale study of relations between climatic and ocean conditions and the sudden fluctuations of commercial fish stocks—such as the recent failure of the California sardine fishery—with the ultimate purpose of discovering natural laws governing such fluctuations.

In 1955 a coastwide investigation was undertaken to determine the

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cause and predictability of violent fluctuations in the catch of Atlantic menhaden.

Census estimates of anchovy larvae in the area between Point Conception and Point San Juanico, Baja California, in 1954 and 1955 were twice the estimate for 1951.

The land census of the California gray whale taken from Point Loma, as the whales passed southward to Baja California lagoons to calve and breed, resulted in a count of 903 whales. Air census estimates totaled 826 adults and 138 calves. No explanation can be given for the low count, although fog undoubtedly contributed to a poor land count.

Deep-swimming and surface yellowfin tuna were generally scarce during the year in the Line Islands area. Unfished albacore resources 200–500 miles off the coast of Oregon were discovered. Evidence was found that suggests that the albacore, unlike the yellowfin, may be of one large population with its primary source in the western central Pacific.

As in past years, much of the research in the North Atlantic was in collaboration with the International Commission for the Northwest Atlantic Fisheries. Some results of the 4½-inch mesh regulation for haddock are appearing. The 1952 year class, an unusually large one, was the first year class to come fully under the regulation. Landings of the 1952 year class show an average increase in weight per fish of 16 percent, owing to the selective effect of the large mesh.

An outbreak of "red tide" occurred this year in south Texas and Mexican waters. Research has shown the red-tide organism to be most sensitive to certain metals, of which copper is the most promising as a control.

MAINTAINING THE INLAND FISHERIES

Fishing pressure greatly increased during the year on recreational areas throughout the country and on waters near areas of heavy population. More legal-sized trout were required for restocking waters in these areas, the demand for warm-water species was heavy, and the problem of maintaining the salmon runs continued to be of major importance. To meet these requirements, the Fish and Wildlife Service operated 91 hatcheries and propagated 22 species of fish for distribution to inland waters.

Expanded fish-rearing facilities at a number of hatcheries and improvement in fish-cultural techniques were largely responsible for a 31-percent increase in total weight of fish produced for stocking purposes. A large percentage of the production was distributed to waters on Federal land, near military installations and veterans' hospitals, and on State-Federal management areas.

Congress provided funds for improvement programs at the Springville (Utah), Welaka (Florida), and Pittsford (Vermont) stations. Funds were provided for construction of a new trout hatchery below the Norfork Dam (Arkansas) and for continuing construction of new hatcheries at Millen (Georgia) and North Attleboro (Massachusetts).

The eighth year of work under the lower Columbia River fisheries development program, designed to mitigate damage to the salmon fisheries caused by Federal and other dams, has provided increasing evidence of the soundness of the program. Construction has been nearly completed at the Service's Carson (Washington) and Eagle Creek (Oregon) hatcheries and at the Skamania hatchery of the Washington Department of Game. Eleven hatcheries have been completed under the program since its inception. Major fishway construction has been confined largely to the falls on the Kalama River and Salmon Falls on the Washougal River in Washington. Approximately three-fourths of the diversions in the John Day Basin (Oregon) have been screened. Service biologists, in cooperation with personnel of the Bureau of Reclamation, have developed a new louver-type fish deflector at the Tracy (California) pumping plant.

Studies on trout nutrition and the training program for trout-culturists were continued at the Cortland (New York) fish-cultural station, in cooperation with the State of New York and Cornell University. These activities, and the expansion of rearing facilities at a number of hatcheries, were important factors in the increased production of trout. Production of trout in ponds at several of the warm-water fish-cultural stations during the off-season in winter has been inaugurated. Trout stocked in the fall as fingerlings and removed in the spring as legal-size fish makes efficient use of facilities otherwise idle at that time of year.

Under the Columbia River Fishery Development Program, construction of the Service's Carson and Eagle Creek hatcheries has been nearly completed.

Drought in several parts of the country drew more attention to the need for water conservation, with the result that construction of farm ponds and reservoirs continued to increase. These new waters, new techniques in removing undesirable fish from large bodies of water, and a severe winterkill of fish in the Northern Plains States, all combined to increase the requirements for fish for stocking. Production of walleye and northern pike is receiving more attention as the importance of these predators in the management of large bodies of water is recognized. The training of warm-water fish culturists continued at the Marion (Alabama) station; use of improved techniques in control of Pondweeds, fertilization, and management of rearing ponds formed part of the training program.

The Branch of Game-Fish and Hatcheries employs a small number of fishery-management biologists, primarily to conduct studies of fish-management areas on lands under Federal control, to improve hatchery operations and fish-distribution programs, and to assist other Federal agencies and the States in fishery management. Assistance in the management of fishing waters on or near Defense installations, Veterans' Administration hospitals, national forests, Indian reservations, and wildlife refuges has been especially well received. Although more fish are being produced, as rearing facilities at hatcheries in certain areas are expanded, and improvement programs are being conducted at other hatcheries, these increases in fish production are not keeping pace with the demand for fish for restocking heavily fished waters. In part, this growing need must be, and is being, met by more efficient use of hatchery-produced fish and by better management of fish populations.

The accompanying table summarizes production and distribution from Federal hatcheries in the calendar year 1955.

Fishes and fish eggs distributed—calendar year 1955

Species	Eggs (number)	Fry (number)	Fingerlings		Fish 6 inches or larger		Total weight fingerlings and larger	Total number fish and fish eggs
			Number	Weight	Number	Weight		
				Pounds		*Pounds*	*Pounds*	
Largemouth bass		407,300	12,292,590	27,738	10,380	767	28,505	12,710,270
Smallmouth bass		315,000	89,480	388	80	114	502	404,560
Bluegill			51,328,070	72,176	4,490	1,150	73,326	51,332,560
Redear sunfish			1,281,120	4,135	560	72	4,207	1,281,680
Channel catfish			770,100	9,101	20,480	2,946	12,047	790,580
Bullhead			13,790	152			152	13,790
Walleye		1,936,000	553,810	384	100	5	389	2,489,910
Northern pike	1,300,000	12,147,000	1,370,570	1,506	520	34	1,540	14,818,090
Cutthroat trout	1,403,090	150,000	592,790	7,009	41,880	7,320	14,329	2,187,760
Rainbow trout	4,835,090		9,431,640	93,194	3,035,450	728,616	821,810	17,302,180
Kamloops trout			43,150	173			173	43,150
Steelhead trout			19,560	660	270,380	27,498	28,158	289,940
Lake trout			626,090	6,205	3,530	733	6,938	629,620
Brook trout	6,424,840	890,000	2,028,900	31,732	805,610	191,256	222,988	10,149,350
Brown trout	647,990	76,680	585,250	9,996	426,640	99,063	109,059	1,736,560
Grayling	500,840	370,000	73,000	192			192	943,840
Chum salmon		8,491,310	302,190	2,194			2,194	8,793,500
Coho salmon	447,890		622,150	10,515			10,515	1,070,040
Sockeye salmon	364,000		3,958,420	50,117			50,117	4,322,420
Kokanee		6,012,580	404,950	228			228	6,417,530
Chinook salmon	5,093,070	22,740	51,768,390	415,642			415,642	56,884,200
Atlantic salmon	200,080	62,620	239,000	2,248	3,460	452	2,700	505,160
Total	21,216,890	30,881,230	138,395,010	745,685	4,623,560	1,060,026	1,805,711	195,116,690

Acreage acquired or in process of acquisition for fish-cultural stations

State and station	Acquired in fiscal year 1956			Pending title conveyance
	By other than purchase	By purchase	Total	
New York: Cortland FCS		8	8	0
Washington:				
Bonneville (FBS)	3		3	0
Spring Creek (FCS)		6	6	0
Total	3	14	17	0

MANAGEMENT OF NATIONAL WILDLIFE REFUGES

Throughout the history of the refuge program, there has been a constant battle between the conservationists who would perpetuate our wildlife resource through the management of existing wetland areas and a persistent commercial group who would drain and bring into agricultural production such waterfowl habitat. This contest has been made the more difficult for conservationists by the expansion of our population and a general desire for additional agricultural acreage in a period of rapidly increasing land values. As wetlands continued to be lost through drainage, some of it ill-advised, the responsibility of our national wildlife refuges in providing for the needs of waterfowl and other wildlife increased proportionately. The loss of lakes and marshes has been unfortunate, not only in removing available habitat for nesting, feeding, and resting waterfowl, but indirectly in increasing the dependence of waterfowl on agricultural crops with resulting depredations of considrable economic importance.

While the primary emphasis in refuge managment is the production of aquatic and marsh foods, since these frequently have high yields and require no cultivation, it is necessary to supplement such food supplies with field crops. Where unusually heavy concentrations of ducks and geese occur, refuge personnel must farm the land in order that the entire production shall be available for wildlife use. In 1955, this type of cropping was done on 66 refuges, utilizing nearly 25,000 acres. Over 500,000 bushels of grain were produced. Almost three-fourths of this total was on refuges in Oregon and California, where Malheur, Lower Klamath, Tule Lake, Sacramento, Colusa, Sutter, Merced, and Salton Sea refuges each grew at least 15,000 bushels of grain.

On refuges in the Mississippi, Central, and Atlantic flyways, crop production was principally by local cooperators or permittees. In 1955, over 600 cooperators on 86 refuges farmed more than 75,000 acres. Most of the Government's share, amounting to 622,000 bushels, remained in the fields for the birds to harvest, while some was used to prevent crop depredations.

Grazing, haying, timber cutting, and fur trapping are encouraged as management tools to improve habitat for wildlife. These operations are conducted annually by several thousand permittees. Grazing was allowed on 79 refuges, where more than 925 permittees used over 2½ million acres. Over 15,000 tons of hay were cut from 48,350 acres by 326 farmers on 40 refuges. Timber cutting, while not an extensive operation, was engaged in by 300 permittees on 22 refuges. About 14 million board-feet of lumber, ties, posts, poles, Christmas trees, and pulpwood were harvested. Muskrats represent 90 percent of the fur

taken; populations of these animals, when kept in proper balance, maintain open areas in the marsh attractive to waterfowl.

In addition to the waterfowl that use refuges, many other species of wildlife are found there. Songbirds, upland game, big game, fish, alligators—all find a place. On most areas, more than 200 kinds of birds have been recorded over a period of several years. Some kinds of quail, pheasant, or grouse are found on practically all refuges. White-tailed and mule deer are widespread. Four fenced preservation areas have herds of American bison. The rare Florida key deer, bighorn sheep, antelope, elk, and moose are among the other big game protected.

National wildlife refuges have a great recreational value in allowing visitors to see undisturbed wildlife in its natural surroundings. Public visitation is encouraged where it will not conflict seriously with the general objectives of refuge management. Roads and trails are charted through many refuges for the convenience of visitors. Various bird lists, pamphlets, and bulletins are provided for those interested in observing or studying natural history on these managed areas.

Public use of the national wildlife refuges has greatly increased in recent years. There were nearly 7 million visitors in 1955 as compared with slightly over 4½ million only 2 years ago. More than a third, or 2,677,452, used the refuges for fishing. Public hunting accounted for 406,219 visitor-days, primarily through the Mississippi River Valley. Opportunities were afforded for picnicking, swimming, and wildlife observation, and these, together with business and official use, amounted to 3,890,776 visitor-days.

Public demands on Congress and on the Fish and Wildlife Service to purchase more land for national wildlife refuges have increased sharply during the past year. Funds for the acquisition of new refuges have been inadequate. No special appropriations for this purpose have been made recently by the Congress. As drainage and other competition for marshes has increased, land prices for refuges have climbed steadily. It is now possible to purchase and develop the equivalent of but one new Federal refuge a year.

Two new refuge areas were placed under administration by this Service the past year. This was made possible by the secondary use of two flood-control reservoirs, secured by agreements from the Corps of Engineers, Department of the Army. The McNary Wildlife Management Area is on the Columbia River in Washington; the Snake Creek National Wildlife Refuge is on the Garrison Reservoir in North Dakota. Nearly 1,500 acres were purchased this year for the Quivira National Wildlife Refuge in Kansas. The refuge, the second in Kansas, was established last year because of the need for a waterfowl wintering area in that part of the Great Plains.

A total of 12½ million acres of land managed primarily for waterfowl is considered the minimum acreage that will carry the present waterfowl population and permit its reasonable increase to a point where the waterfowl hunters of the future can be accommodated on a practical basis. The Federal Government has already acquired about 200 waterfowl refuges containing over 3,370,000 acres. It is estimated that an additional 4 million acres, the Federal Government's share, will cost an average of $40 an acre, or a total of $160 million for the entire Federal program. This includes averaging in the use of Federal reservoir lands where they are suitable and available, as well as future gifts and State lands at a nominal lease or on a cooperative basis. In view of past experience, the future development will cost $20 an acre, or a total of $80 million.

Acreage acquired or in process of acquisition by Fish and Wildlife Service for wildlife-conservation purposes

State and refuge	Acquired in fiscal year 1956			Pending title conveyance
	By other than purchase	By purchase	Total	
California:				
Salton Sea				3
Sutter		118	118	
Colorado: Monte Vista		954	954	440
Florida:				
National Key Deer Refuge	71		71	
St. Marks				5
Idaho: Deer Flat		80	80	
Kansas: Quivira		1,200	1,200	2,339
Kentucky: Reelfoot		261	261	
Louisiana: Catahoula				5,199
Maine: Moosehorn				1
Michigan: Shiawassee		93	93	125
Minnesota:				
Rice Lake		210	210	
Upper Mississippi River Wild Life and Fish Refuge		11	11	393
Mississippi: Noxubee		601	601	563
New Jersey: Brigantine				48
New Mexico: Bitter Lake				322
New York: Wertheim				8
North Dakota:				
Long Lake				160
Lower Souris	3		3	
Snake Creek	24,430		24,430	
Tewaukon		1,336	1,336	
Oregon: Malheur		1,990	1,990	3,164
South Carolina:				
Carolina Sandhills		51	51	
Santee		72	72	202
Savannah		5	5	
Texas: Laguna Atascosa				970
Vermont: Missisquoi		834	834	311
Virginia: Chincoteague		25	25	
Washington:				
Columbia		5,942	5,942	757
Marrowstone Wildlife Management Area	16		16	
McNary	2,849		2,849	
Willapa				410
Total	27,369	13,783	41,152	15,420

[1] Name includes "National Wildlife Refuge" except as indicated.

Acres of public domain reserved for wildlife conservation purposes and administered by the States

State and unit	Acres
Arkansas: St. Francis Sunken Land and Marked Tree Floodway	3,990
California: Topaz Lake Public Fishing Area	200
Montana:	
Fox Lake Waterfowl Project	160
Bull Mountain Game Range	1,599
Nebraska: Statewide No. 1 Game Management Area	743
Oregon: Ochoco Reservoir	40
Washington:	
Sherman Creek Game Range	560
Sunnyside Waterfowl Management Area	320
Total	7,612

WILDLIFE RESEARCH

If any one activity in the United States can be said to characterize the times, it is research. Billions of dollars are being poured from both public and private sources into the search for new materials, devices, and compounds to improve and protect the American standard of living. New uses for old materials, and new materials and methods for solving old problems are appearing with startling frequency. Industrial research facilitating an expanded economy has had great impact on wildlife and its habitat, and has thus created need for increased wildlife research. A case in point concerns the widespread use of chemicals.

Chemical treatments hold promise for the farmer, forester, and rancher, of providing the cheapest and most effective methods of crop protection. An outstanding example is chemical protection of tree seeds for direct seeding of forest areas. Experimental plots planted with chemically treated seeds have succeeded better than plots planted with untreated seeds; one chemical in particular shows promise of being effective against birds, forest rodents, and rabbits. Success of this program is attested by the planting in Louisiana in 1955 of more than 10,000 acres with repellent-treated longleaf, loblolly, and shortleaf pine seeds. Chemicals are used to protect both seeds and seedlings. In field studies in Washington, the first-year damage by rabbits to Douglas-fir seedlings was reduced by more than 75 per cent, at a cost for the repellent of less than 50 cents a thousand. Repellent treatments of young hardwoods and conifers in other regions have been similarly effective.

Chemicals are also important in control of rodents, especially house mice and rats, which cause annual losses of millions of dollars to food supplies, packaged materials, and electrical installations, and constitute an ever-present health hazard. Thousands of chemicals have been tested at the Service's Patuxent and Denver laboratories, and several promising materials have been isolated for use as roden-

ticides or repellents that should contribute significantly to better use of natural resources.

Insecticides have experienced outstanding development within the past few years. DDT, which was viewed with alarm by wildlife biologists a decade ago, has now been largely replaced by more effective insecticides, much more toxic to warm-blooded animals. Use of these materials must be evaluated and field-tested to enable recommendation of applications safe for wildlife. Studies are made on penned game birds to determine lethal doses. It has been found, also, that sublethal amounts affect reproduction of game birds and survival of their young.

Research on pelagic fur seals during the year indicated that the seal is not a significant salmon predator. There was only one occurrence of salmon in 205 seal stomachs collected between the Unimak Pass area and the Pribilof Islands. The problem of hookworm infection on fur-seal pups was studied also. Control of the infection by treatment of the soil has been generally unsuccessful. However, it has been demonstrated that the hookworm is only one of a number of mortality factors on seal pups. Fur studies in Louisiana have concentrated on the nutria, introduced into Louisiana in 1937. This animal has extended its range all along the Gulf Coast and is competing with the native muskrat. It causes some damage to farm crops and to aquatic vegetation in reservoirs. Its value for fur is not sufficient to encourage control by trappers. The Fish and Wildlife Service is cooperating with the Louisiana Wild Life and Fisheries Commission and the Southwestern Louisiana Institute to learn more of the ecological relations of fur animals living in the tidal marshes.

Waterfowl-habitat research follows four general lines. One is the inventory of marsh resources of the United States and evaluation of the rate at which they are being lost. The second involves improvement of existing waterfowl marshes by weed control and manipulation of water levels. Cooperative studies with States along the Atlantic seaboard have resulted in outstanding improvement of several important waterfowl areas. A third approach involves creating new marshes in areas of low economic value, such as abandoned quarries, gravel pits, swampy areas, and sewage-disposal lagoons. The fourth is the development of mosquito-control methods consistent with preserving waterfowl habitat. Concentrated effort along these lines may make it possible to compensate for the ever-increasing loss of waterfowl areas by agricultural drainage and other advances of civilization.

The year 1955 marked the 20th anniversary of the Cooperative Wildlife Research Unit program. During this period 2,373 fish and wildlife students were graduated from the Unit schools, including 677 with advanced degrees. Included in this total are 186 students

who were graduated during the 1954–55 year. More than three-fourths of those graduates who did not go into military service or go ahead for further training obtained jobs with State, Federal, or private conservation agencies, or as college instructors. Research was done on 275 projects by the Cooperative Wildlife Research Units during the past year.

Investigations by the section of distribution of birds and mammals are essential to provide basic data for the management of migratory species. Approximately 520,000 birds were banded during the past year, and 35,679 banded birds were reported as recovered. An analysis of banding and recovery methods is being made to improve techniques and to make banding data more useful for management.

A major function of the Fish and Wildlife Service is that of wildlife research for other Federal agencies, chief among which are the Forest Service, the National Park Service, and the Soil Conservation Service. During the fiscal year, public-lands biologists of the Service, cooperating with public land management agencies and private industry, devoted a major share of their time to studies of wildlife in forests of various types. One problem of major concern is the establishment of guidelines for timber-stand improvement. Recent research has shown that hardwoods contribute substantially to the supply of game food through mast production; thus, timber-stand improvement aimed at eliminating hardwoods in pine forests may work hardships on wildlife resources. This is but one of the problems faced by wildlife research in cooperation with the U. S. Forest Service.

GAME MANAGEMENT

Cooperators in the extensive waterfowl breeding ground surveys and banding program this year included 11 State game departments, 5 Provincial game departments, Ducks Unlimited, the Wildlife Management Institute, and the Canadian Wildlife Service. Other projects included the midwinter waterfowl population survey, the Post Office hunter kill survey, and winter banding; in varying degrees, the same cooperators took part.

Further cooperative endeavors were carried out with the individual flyway councils, and the National Flyway Council. Service representatives and representatives of flyway councils began preparation of long-term waterfowl-management plans for each flyway. This is the initial step toward continental management plans.

Again this year, meetings were held in May and June with flyway councils to review the regulatory program of the Service. These meetings are helpful in developing public understanding of the Service's functions as they relate to regulations.

In 1954 the Fish and Wildlife Service instituted two separate undercover programs, one in Texas, the other in Maryland. A third program manned and financed jointly by the Federal Government and the State of Tennessee was instituted in 1955. All three were brought to a successful conclusion in 1956.

The Tennessee operation resulted in apprehension of 28 market hunters, who had been commercializing in waterfowl in the vicinity of Reelfoot Lake. Fines and sentences imposed were $3,458.50 and 922 days in jail. The Texas program culminated in the greatest roundup of market hunters in the history of game-law enforcement in this country, when United States game-management agents assisted by United States marshals and State wardens arrested 44 market hunters; subsequently, warrants were issued for the arrest of 10 more. Shortly after the Texas roundup, 6 Maryland residents were arrested and charged with market hunting as the result of evidence obtained by a Service undercover operative.

During the year, 209 cases involving violations of the Alaska Game Law were concluded, with 153 convictions, 2 dismissals, 4 acquittals, and 50 cases concluded by seizure of contraband articles without further action. Five cases were pending at the end of the fiscal year. In addition to the Alaska Game Law violations, 6 Alaskan cases (5 convictions and 1 acquittal) involved violations of the Migratory Bird Treaty Act, and 4 (all convictions) involved violations of the Migratory Bird Hunting Stamp Act. Fines aggregated $14,566 (of which $3,468 were suspended); jail sentences totaled 1,445 days (of which 1,260 were suspended). Seizures included 49 firearms, 31 traps and snares, 4 game birds, 56 fishes, 66 game animals, 43 skins of fur-bearing animals, 1 shotgun, 6 bear hides, 1 mountain-sheep head, and 84 hunting and fishing licenses.

Game-management agents of the Service continued to assist law-enforcement officers of other Federal agencies and State agencies responsible for fish and game conservation. Game-management agents (acting as deputy State game wardens) individually, or in cooperation with State game law enforcement officers, assisted in the apprehension and conviction in State courts of 4,444 persons charged with violations of State game and fish laws, resulting in the imposition of fines and costs aggregating $146,847.54 (of which $3,703 were suspended). Jail sentences aggregated 3,795 days (of which 3,110 days were suspended), while probationary sentences were imposed aggregating 227,820 days. Of these cases, 2,368 involved unlawful taking of migratory birds and interstate shipment of game animals and fish, which were subject to prosecution in Federal courts.

Assistance by Service agents to other agencies responsible for management and protection of wildlife resources frequently involves them

in unusual situations. Such a situation arose this year, when a Service agent provided evidence to convict an individual who was fined $80 by the Yakima Indian Tribal Council for killing two deer on the Yakima Indian Reservation, Wash., during closed season. In international cooperation, game-management agents of the Service furnished evidence seized in the State of Washington which led to the conviction of a United States citizen in Canada for unlawfully killing and exporting a Rocky Mountain sheep; he was fined $550.

Under regulations pursuant to paragraph 1518 of the Tariff Act of 1930, as amended by the act of July 17, 1952 (66 Stat. 755; 19 U. S. C. sec. 1001, par. 1518), 18 permits were issued to authorize the entry, under quota, of skins bearing feathers of certain species of foreign wild birds. Imports consisted of 2,141 pheasant skins and 1,704 grey jungle fowl skins. The skins of the grey jungle fowl were for use in the manufacture of artifical flies for fishing, while the pheasant plumage lawfully may be used for millinery as well as for fishing flies.

Table of cases disposed of in Federal courts (exclusive of Alaska) involving violations of wildlife-conservation laws administered by the Fish and Wildlife Service, fiscal year 1956

	Pending July 1, 1955	New cases	Pending June 30, 1956	Terminated	Fines and costs	Jail sentences (days)	Probation (days)
Migratory Bird Treaty Act	[1] 381	1,076	218	1,239	$65,536	4,784	20,584
Migratory Bird Conservation Act	[1] 41	41	9	73	1,190	----------	144
Migratory Bird Hunting Stamp Act	[1] 18	76	16	78	1,832	----------	----------
Lacey Act	1	1	----------	2	100	----------	----------
Assault Act	5	6	2	9	350	690	2,190
Black Bass Act	----------	1	1	----------	----------	----------	----------
Northwest Atlantic Fisheries Act	5	----------	----------	[2] 5	----------	----------	----------
Bald Eagle Act	----------	2	1	1	25	----------	----------
Total	451	1,203	247	1,407	[3] 69,033	[4] 5,474	22,918

[1] The disparity between the number of cases shown in last year's annual report as pending June 30, 1955, and that shown as pending this fiscal year results from differences noted between records maintained in the Central Office and the regional offices of the Service. Future tabulations will be based upon data obtained from regional offices which possess more current information and hereafter will have sole responsibility for maintaining statistical records of this nature.

[2] These cases were dismissed because of insufficient evidence.

[3] Includes $12,775 suspended.

[4] Includes 2,917 days suspended.

CONSERVATION OF ALASKA WILDLIFE RESOURCES

A big problem in Alaska game and fish management is to find ways of distributing hunting and fishing pressure to avoid depletion in accessible areas and achieve proper utilization elsewhere. Inadequate harvesting can result in economic loss of fish and game resources and in long-term reduction in the carrying capacity of a range. Regulations are aimed at encouragement of hunting and

fishing pressure where greater utilization is desirable. While curtailments have been required in populated and readily accessible areas, regulations in most of the Territory have been liberalized as a result of a better understanding of population dynamics. Research is paying off in a way that hunters and fishermen can appreciate.

Sport fishing, as measured by recent economic surveys by the University of Alaska, is already a multimillion-dollar annual business in the Territory. The Service is attempting to gear game-fish management in Alaska to natural production rather than depend on artificial propagation. Lake and stream surveys have preceded stocking and transplanting operations in an effort to match habitat with species. It is recognized that maintenance stocking may be required to support heavy local fishing pressures, but emphasis has been on stocking areas capable of natural reproduction. Studies are underway to determine feasibility of fish food and environment manipulations to increase natural production.

An increased waterfowl-investigation program is providing much information on Alaska's contribution to the various flyways of the United States. Breeding-pair surveys, brood counts, winter inventories, habitat studies, and banding programs are developing needed information on migratory-bird production. Absence of droughts or other unusual conditions makes Alaska a prime and dependable producer of waterfowl. Key nesting and concentration areas are being selected for inclusion in the Nation's waterfowl network. Protection of habitat is of prime importance; industrial developments, particularly oil production, must be accomplished in a manner designed to safeguard vital nesting and feeding areas. With proper planning, this appears to be entirely possible.

Improvement of winter feeding grounds on the Kenai National Moose Range is receiving priority attention. Once an economically sound method is found to replace evergreens with willows, winter habitat manipulation may be extended to other critical areas. Work in this field has been so restricted by lack of funds that we are in danger of losing a portion of the tremendously valuable Susitna Valley and Kenai Peninsula moose herds. Present populations cannot be maintained unless we are able to make up for habitat losses due to settlement and replacement of willows by succession of spruce forests. These lands are chiefly valuable for moose production.

Modern tools and techniques are available to continue and possibly improve wildlife production in Alaska. The future of these resources may well hinge on our ability to help guide multiple land use practices in the next few years.

RIVER BASIN DEVELOPMENT AND WILDLIFE NEEDS

Of 344 reports this year by the Service on water developments planned by Federal agencies or by other interests under Federal permits, 131 were on Corps of Engineers projects, 58 on Bureau of Reclamation, 100 on Department of Agriculture, 39 on power projects requiring license from the Federal Power Commission, and 16 were special and miscellaneous studies.

Outstanding among fishery accomplishments relating to water developments was the completion of a fish hatchery at the Bureau of Reclamation's Nimbus Dam on the American River in California, to compensate for the loss of salmon-spawning areas. A fishway was constructed at Prosser Dam and two new fish screens were placed in operation in the Chandler Canal as part of the fish and wildlife developments planned for the Kennewick division of the Yakima project in Washington. Another fishway at Prosser Dam and a wildlife-protective fence along the main canal will be constructed in the near future.

Service technicians worked on problems pertaining to passage of salmon and other anadromous fish at Mayfield Dam on the Cowlitz River in Washington, at Pelton Dam on the Deschutes River and North Fork Dam on the Clackamas River in Oregon, at Rocky Reach, Priest Rapids, and The Dalles Dams on the Columbia River, and at Ice Harbor, Mountain Sheep, Pleasant Valley, Brownlee, Oxbow, and Hells Canyon Dams on the Snake River.

A Conservation Service award of the Department of the Interior was presented to the Holyoke Water Power Co. of Massachusetts for its mechanical-hoist fishway at South Hadley Falls Dam on the Connecticut River. This facility aided the passage of approximately 7,700 shad in the spring of 1956, the largest number to reach the upper river since the dam's construction in 1849.

The nationwide economic survey of hunting and sport-fishing activities, initiated last year, was completed with the exception of final analysis and review. The Service expects to release the findings of the survey in September 1956. This survey was selected by the Bureau of the Budget as one of two surveys by the United States Government recommended for inclusion in a publication of the United Nations on sample surveys of current interest conducted by various governments.

In line with the Coordination Act of 1946, plans were completed for use of six water-development areas for wildlife management. These are Albeni Falls Reservoir in Idaho, Old Hickory Reservoir in Tennessee, Clark Hill Reservoir in South Carolina, Fort Randall Reservoir in South Dakota, Alcova Reservoir in Wyoming, and the Humboldt Project in Nevada. Agreements between the Departments of the Army and Interior were completed for the McNary lock and dam

project in Oregon and Washington and the Snake Creek Arm of Garrison Reservoir in North Dakota, to make lands available for wildlife purposes.

Construction of six large Federally financed impoundments on the Missouri River mainstem, one of which will be larger than all the TVA reservoirs combined, is creating new fishery-management opportunities and responsibilities. Federal-State cooperative studies should be activated promptly if the enormous recreational and commercial fishing potential of these waters is to be realized.

The huge Upper Mississippi River navigation pool system, 900 miles long, has created many fishery problems, solution of which is considered very important by the five States on its border. In response to their request, the Service has designated a fisheries-survey director to coordinate a cooperative program of fish-management studies on the river.

Soil-bank program committees were established in the central office and in each of the regional offices to consider Service responsibilities, and means for implementing fish and wildlife conservation measures, in the program.

Results of a 4-year study of the relation between duck production and drainage in the pothole regions of North Dakota, South Dakota, and Minnesota were published as Special Scientific Report—Wildlife No. 32, Duck Production Studies on the Prairie Potholes of South Dakota. The inventory of marshes, swamps, and seasonally flooded lands has been summarized nationally and will be released in July as Circular 39, Wetlands of the United States. The followup inventory of permanent lakes, streams, and reservoirs of importance to waterfowl is nearing completion. These three studies provide long-needed information for planning a program to preserve and develop waterfowl habitat.

In connection with the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress), the Service has investigated and written reconnaissance reports on 80 small-watershed projects sponsored by the Soil Conservation Service. Of these, four projects were expected to be harmful to fish and wildlife resources, and detailed studies were made to recommend measures that would mitigate the detrimental effects.

Fish and wildlife development plans were prepared for specific areas as part of the Department's Garrison Diversion Project in North Dakota, and an area was tentatively selected to replace the portion of the Lower Souris National Wildlife Refuge which will be affected by this project.

A special report on the Upper Klamath Basin was prepared to show the importance of this area to waterfowl and to help resolve conflicts in the status of lands and waters.

Studies of the fish and wildlife resources of the Rogue River Basin were completed and a report was written showing the great importance of these resources.

In Alaska, studies continued on the Copper, Susitna, and rivers of the Kenai Penninsula in connection with proposed dams; and studies were inaugurated on the Yukon River. Several power projects on smaller streams were also investigated.

FEDERAL AID

Fish Restoration

This marks the completion of the first 5 years of the Dingell-Johnson fish-restoration program. In this short time, major contributions have been made to the Nation's sport-fish resource. Many new lakes have been built, access to lakes and streams has been provided, poor fishing lakes have been rehabilitated, and investigations have shown the way to better management.

Investigations during the fifth year of the program placed increasing emphasis on experimental management, evaluation and development of techniques, and studies of specific problems. Benefits of fish-population manipulation in certain streams have been determined, and the development of the most effective stocking methods continued. Other experimental management projects included habitat alteration, introduction of game and forage fish, commercial-fishing studies, and evaluation of fishing regulations.

In recognition of the need for selective control of rough fish, investigations were conducted to determine the effect of various poisons and to develop practical means for application. Studies were carried on to develop new selective fishing equipment and means for destroying undesirable fish spawn.

Sampling of inland and marine fish populations, life-history studies, selective breeding of hatchery stock, disease and nutrition studies, pollution investigations, as well as migration and harvest studies, are typical of the studies carried on in the past year.

Creation of new fishing waters was emphasized by 17 States in which 23 lakes, with a total of 1,850 acres, were being constructed. Located near population centers, these new lakes will help fill an urgent need for places to fish. Activities designed to improve stream habitat were undertaken on 8 streams in 5 States. These included streambank protection, gully control, tree and shrub planting, fencing, channel improvements, and barrier removals.

Twelve States undertook to remedy stunted game and overpopulations of trash fish by chemical treatment of lakes totaling over 14,000 acres. In Alaska and 14 States, public-use facilities such as roads,

parking lots, and boat ramps were installed to improve accessibility to lakes and streams and to increase utilization of resources.

Other program-financed activities included construction of fishways over stream obstructions, making accessible many miles of spawning grounds, and rotary and stationary screens, some to prevent fish from leaving lakes, others to prevent reinfestation by trash fish. Over 6,300 acres were acquired and nearly 57,000 acres leased by 19 States for lake sites, for fisherman access, and for spawning areas. In addition, over 10,600 acres were purchased for combination fish and wildlife areas.

Wildlife Restoration

Of special significance during this year was the amendment of August 12, 1955, to the Pittman-Robertson Wildlife Restoration Act. This provided for the apportionment, in five equal annual installments, of unappropriated $13,500,000 of sporting arms and ammunition excise tax collections that had accumulated prior to 1947. It also broadened the base of authorized restoration operations to include wildlife-management activities.

Program work followed the general pattern of other years, with greater emphasis on restoration of wildlife habitat. Waterfowl-management activities again received a large share of the States' developmental budget. Forty-four had over 150 projects approved which were designed to create new habitat for ducks and geese and to carry on the annual operations necessary to keep previously developed areas at a high level of production. A number of States built water-control structures to create marsh and shallow-water areas ranging in size from a few to many hundreds of acres. Maintenance of dams, manipulation of water levels to increase natural waterfowl foods, and farming operations to supplement the wildfowl diet required substantial effort. Muskrats, pheasants, and rabbits also benefited from these improvements.

Habitat manipulation for upland game on State owned or leased areas increased the food supply and provided sorely needed winter range for elk, antelope, deer, and other big game in the West, and whitetailed deer and turkeys in the East. Dividends accrued to many other species from these activities.

Thirty-four States expended over $2,500,000 on the improvement of farm-game habitat by tree, shrub, and herbaceous plantings on lands of cooperating farmers.

Trapping and transplanting antelope, deer, bighorn sheep, mountain goat, moose, wild turkey, snoweshoe hare, and marten into suitable but vacant range was conducted by 16 States and Alaska.

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As a result of legislation permitting expenditures for management, greater provision was made for public use of game-management areas. The newly authorized work included access roads, parking areas, and sanitary facilities which made it possible to more adequately handle hunter-use problems.

Lands bought for big-game ranges and waterfowl and upland-game management areas nearly doubled in acreage during the year. Over 135,000 acres were approved for purchase and an additional 114,000 acres were leased by 32 States.

Forty-four States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands sought answers to their wildlife problems through investigational projects. Prominent in these studies was the gathering of population data, reproductive success, and harvest information. These data provide important guidelines in setting seasons and bag limits and in determining hunter success.

Cooperative interest in the continental waterfowl situation was exemplified when 15 States sent 24 biologists to the Canadian breeding grounds to study production and band waterfowl to learn more of their migratory movements. The advantages of cooperative effort were demonstrated by joint efforts of various State groups in solving common waterfowl, dove, woodcock, deer, antelope, and bighorn-sheep problems.

A total of 541 exotic game birds from the Far East were imported by 4 States.

Publication of project findings is the most effective method of disseminating important results to other workers with similar problems. The results of Pittman-Robertson investigations were circulated in more than 400 published articles, bulletins, and books during the year.

PREDATOR AND RODENT CONTROL ACTIVITIES

Profitable conduct of agriculture, forestry, and other activities sometimes requires removal of animals that would otherwise interfere with resource utilization. Elimination of rats from grain elevators, reduction of coyotes on antelope fawning grounds, and protection of livestock from predators on national forests are examples.

Preventing damage and destruction of domestic foods and animal feeds by rats and mice has been greatly aided in recent years by anticoagulant poisons. Three of these, warfarin, pival, and fumarin, are licensed for commercial sale, and three others are being investigated by the Service. Despite great progress in rat and mouse control, there is still much to be done, particularly in guarding surplus grain stores from rodents; for example, at one point in Texas, 28 million bushels of wheat are currently stored in the open under canvas, which does not exclude damage and contamination by both rodents and birds.

Although excess numbers of most field rodents have not generally occurred for several years, there are signs of an upward trend. Jackrabbits are reported increasing in all the Western States except Arizona, Washington, and Oregon, and kangaroo rats have required control in New Mexico. New methods of controlling or repelling rabbits have been given field trials, particularly in Oregon and Washington, where the Service is working with foresters on methods of protecting tree farms. Two commercial products were tested and adopted for regular use in spraying nursery stock, and there are promising results from tests of new materials to control white-footed mice which prevent successful reforestation by direct seeding.

The recent upward trend in rodents is paralleled by increases in predators in the Western States, except Oregon and California, which reported no increases in coyotes but some in other predators, particularly bobcats. Alaska has reported a decided increase in wolves. These increases have occurred in spite of modern methods in predator control and reflect difficulties in extending limited Service facilities to cover widespread losses. Only through such techniques as airplane hunting, coyote getters, and compound 1080, has protection of game and livestock from predator attack been done as well as it has. Many sections are becoming so nearly urban that all hunting is prohibited, and species formerly classed as game or fur animals are now regarded as nuisance animals. Even in deserts and other relatively unoccupied places the current interest in uranium prospecting has greatly interfered with efficient control of predators, and in some instances has resulted in increased predation on game herds. Areas in Oregon and Nevada, formerly noted as among the best producers of antelope, have reported such great killing of fawns by coyotes as to keep the herds in a nearly static condition this year. On the other hand, in certain areas where control has been unhampered by competitive land use, antelope and other game have profited greatly by predator control. In Wyoming, the 1955 antelope harvest was 33,090 animals, about 3,000 larger than the average for 1951, 1952, and 1953. Taken as a whole, however, the Western United States has experienced increased damage to livestock and game from predators during the past year.

An unusual aspect of animal control has attracted attention in the Pacific Northwest where surplus numbers of bears have destroyed young timber. Another unusual situation is the control of coyotes preying on "weeder" geese in California. In the cotton-growing section over half a million geese are kept to weed the cotton fields. Protection of these birds from coyote depredations has become one of the newer Service responsibilities in resource conservation.

An activity directly related to human welfare is rabies control in wildlife, particularly in foxes. The Service has continued to work

closely with States and counties throughout the East where fox populations have been high for a number of years. The Service has also cooperated with the Public Health Service in studies of rabies among bats in Texas and other States as far north as Montana. As yet, there is little evidence of transmission of rabies from bats to man, although transmission to warm-blooded animals has been demonstrated in the laboratory. For the country as a whole, there was a slight decrease in the amount of rabies among wildlife, but trouble spots continually appear, and certain areas in New York, Georgia, and Texas continue chronic despite preventive efforts.

Cooperative predator and rodent control operations during the year entailed expenditures of $968,185 from regular departmental appropriations, supplemented by $1,474,143 from cooperating States and $3,374,520 from cooperating counties, livestock associations, and others. The recorded catch of predatory animals by Service and cooperative personnel was 55,402 coyotes, 2,036 wolves, 19,495 bobcats and lynx, 984 stock-killing bears, and 285 mountain lions. In rodent control operations, 10,546,930 acres of land were treated for elimination of prairie dogs, ground squirrels, pocket gophers, jackrabbits, field mice, cotton rats, kangaroo rats, porcupines, woodchucks, and moles. In addition, 344,702 premises were treated in cooperative campaigns for the control of rats. Special equipment and supplies used in both predator and rodent control, and 229,820 pounds of rodent-bait materials, were distributed by the Service's supply depot at Pocatello, Idaho.

INTERNATIONAL COOPERATION IN CONSERVATION

International Technical Cooperation

The Fish and Wildlife Service continued to assist the International Cooperation Administration in providing technical aid to friendly nations. Fishery-development projects were carried out in El Salvador, Peru, Bolivia, Liberia, Pakistan, India, Thailand, Viet-Nam, and Indonesia. The Service provides technical information, helps recruit competent technicians, and supervises instruction of foreign students in the United States.

An excellent example of success in developing a natural resource is the marine project in Liberia, where, it appears, the annual landings in 1954 and 1955 were at least 10 times greater than in prior years. The increase resulted primarily from the operation of large trawlers brought in from Europe. Facilities for better handling and distribution were put into operation, making it possible for inland areas to obtain marine products with their high content of proteins, minerals, and vitamins.

The training of foreign students in the United States is an important part of the assistance program, producing competent technicians who can continue developmental projects. This year, 12 students from 7 countries received valuable instruction. In addition, many visitors from abroad were given opportunities to visit persons and places of interest in connection with fish and wildlife resources.

International Conservation Agreements

The Service participated in the activities of a number of international fishery organizations and in several international conferences of importance.

The work of the International Pacific Halibut Commission and the International Pacific Salmon Fisheries Commission continued, with gratifying results. Good catches of halibut and Fraser River sockeye salmon once again demonstrate the excellence of these two fishery-management programs. As the result of expanded investigations, the Inter-American Tropical Tuna Commission has found tentatively that the stocks of yellow-fin and skipjack tunas which support the United States tuna industry have been fished during the past year at a level below the maximum sustainable yield and that at present there is no danger to these stocks from overfishing.

The International Whaling Commission and the Indo-Pacific Regional Fisheries Council both met during the year. Encouraging progress has been made in the development of techniques for the study of distribution and migration of salmons, by Canada, Japan, and the United States under the auspices of the International North Pacific Fisheries Commission.

The highlight of the activities of the International Commission for the Northwest Atlantic Fisheries was a meeting of scientists from the 10 member nations, in Biarritz in March 1956. This meeting contributed significantly to the solution of the complex problem of coordinating the research efforts of 10 governments. The Commission itself held its sixth meeting in Halifax in June 1956.

In April 1956, representatives of Canada and the United States met for the organization meeting of the Great Lakes Fishery Commission, established in accordance with a Convention signed by Canada and the United States in September 1955. The Commission will concern itself with the solution of important fishery problems in the Great Lakes, including control of the sea lamprey.

Representatives of the Department participated in the Santiago Negotiations on Fishery Conservation Problems, September 1955, in the Specialized Conference of the Organization of the American States on the Conservation of Natural Resources at Ciudad Trujillo,

Dominican Republic, in March 1956, and in the North Pacific Fur Seal Conference, which convened in November 1955 and was still in session at the end of the year.

CONSERVATION INFORMATION AND EDUCATION

In activities directed at conservation of the public's natural resources, nothing is more important than public understanding and cooperation. To gather and disseminate information was a basic function of each of the predecessors of the Fish and Wildlife Service and has continued as a vital function of the Service. The Fish and Wildlife Act of 1956 includes provisions that place added emphasis on "investigations, information, reports."

During the year, the Service publicized the findings of research and other information on fish and wildlife through 12 publication series and 6 periodicals. Publications included technical reports of scientific investigations, compilations of fish and wildlife statistics, public announcements concerning regulations, informational pamphlets on wildlife refuges, fish hatcheries, and other Service establishments, and popular informational and advisory booklets on fish and wildlife conservation.

From the 10 million young people in organized youth programs, as well as from many of the rest of the 35 million school-age children, there is a steadily increasing demand for informational materials and advice on the conservation of natural resources, including wildlife. The Service was able to contribute substantially to cooperative conservation-education programs for youth, and particularly to the national conservation program of the Boy Scouts, even though only about half the time of one member of the Division of Information could be given to this important phase of conservation.

Although there is no general public distribution of Service publications, approximately 75,000 specific inquiries were answered by the publications-distribution unit. There was an increase of more than 50 percent in the supplying of current information about fish and wildlife utilization and conservation to newspapers and other informational media. In visual information, 11,000 photographic prints were supplied in the last calendar year in answer to requests from publishers and conservation agencies. About 6,250 requests were received for the loan of Service motion pictures; 450 of these could not be filled because all available prints were in use. The Service produced several television shorts promoting the conservation of fish and wildlife, such as the "Save the Whoopers" short, of which 86 copies were distributed to midwestern television stations.

Tentative specifications were drawn up for information and education organizations for each of the Regional Offices of the Service.

THE NATIONAL PARK SERVICE

Conrad L. Wirth, *Director*

THE most important facts of the 1956 fiscal year, from the standpoint of the National Park System and the National Park Service were the completion of the Mission 66 report, its hearty endorsement by the President and by the Congress, and the launching of the Mission 66 program with an increase of $19,153,700 in the Service's appropriation for the 1957 fiscal year. This annual report offers a welcome opportunity to express appreciation of the warm support and backing extended to Mission 66 by former Secretary of the Interior Douglas McKay, by his successor, Secretary Fred A. Seaton, and by officials throughout the Department.

Particularly heartening was the instant favorable response of President Eisenhower when the Department and the Service had the extraordinary experience of presenting the essence of Mission 66 to the President and his cabinet. Tremendously encouraging, too, was the interest in this project displayed, even long before the report was finished, by members of the House and Senate, without regard to party affiliation, and the eagerness of the Congress to provide such funds as could be effectively used to launch the Mission 66 program.

It cannot be stressed too often that Mission 66 is a 10-year conservation program for the National Park System. Its whole purpose is to make possible the best and wisest use of America's scenic and historic heritage. That means maximum enjoyment with maximum protection of those features and those qualities which make it, as Time Magazine recently expressed it, "the U. S.'s unmatched National Park System." True, accomplishment of the program requires large amounts of construction, but these are simply the necessary means by which to accomplish its conservation objective. Equally a part of the program is the provision of services, adequate in kind and quality to meet the legitimate requirements of 80 million or more visitors in 1966. The maintenance of an enlarged physical plant, the provision of services for constantly increasing numbers of visitors, and protection both

of parks and people are the reasons why estimates for management and protection, and for maintenance and rehabilitation, show proposed increases in these items from the $11,562,000 and $10,158,000 allowed for 1957 up to $19,990,000 and $14,000,000 for 1966.

National Park Service programs in the past have been year-to-year programs. It is hoped that there will be such Congressional and public acceptance of Mission 66 as a 10-year program which must be carried through to completion as will permit the Service to operate, and to go forward with construction, in a manner predicated on its long-range character. It is particularly important that it be accepted in terms of specific things to be accomplished rather than in terms of estimates of cost.

Specifically, the Service hopes now to be able to proceed with development on a full-scale, rather than a piecemeal, basis. Not only will this make possible much more economical expenditure of construction funds but it will shorten, for each area being developed, the period of disruption which always comes with construction activities.

The preparation of designs for the greater amount of construction ahead, and proper supervision of construction, combine to pose a serious problem. It has been particularly difficult to recruit fully the professional staffs needed for the expanded 1956 construction programs and for the surveys and planning required for the more comprehensive program of Mission 66. The various steps taken to solve the employment problem include contracting with private engineering and architectural firms for the preparation of plans and for the supervision of construction. The Service is deeply grateful to the Public Health Service for the increased engineering services which it has made available.

Eager as the National Park Service is to obligate the increased construction funds made available to it, its first responsibility is to make certain that overall developments are soundly planned, that design for structures is fully acceptable, and that it gets, in return for its construction dollars, 100 percent of what it pays for.

Concessioner Developments

The past year has been marked by a major change and a long step forward in the direction of concessioner provision of overnight lodging and other facilities needed in a number of national parks. On June 25, brief ground-breaking ceremonies officially launched the construction of the new Canyon Village, in Yellowstone National Park. This project, situated comfortably back from the rim of the Grand Canyon of the Yellowstone, will replace the older and outmoded facilities which encroached on the rim, and will provide more and better facilities to meet the demands of increased travel.

Last year's opening of Jackson Lake Lodge, at Grand Teton National Park, is being followed by an extensive cabin development, with appurtenant facilities, which will serve campers and day visitors as well, at Colter Bay, all undertaken with funds supplied by Jackson Hole Preserve, Inc.

The million-dollar Yosemite Lodge project at Yosemite National Park; extensive capital improvements by Fred Harvey on the South Rim, at Grand Canyon National Park, with more in prospect; the near-completion of the Marine Service building at Flamingo, in Everglades National Park; and improvements by concessioners at Glacier and Shenandoah National Parks are all noteworthy steps toward the provision of more nearly adequate facilities in areas where they are needed and justified.

The Director decided against the provision of overnight facilities at Flamingo, convinced that space there was too limited to make them desirable and that they can be satisfactorily provided by private enterprise outside the boundaries of Everglades. Decision on relocation of overnight facilities at Mesa Verde National Park and Mount Rainier National Park awaits further study.

JAMESTOWN, WILLIAMSBURG, AND YORKTOWN

Next year is the 350th anniversary of the establishment of Jamestown; approximately halfway between 1607 and the present, the victory of French and American forces at Yorktown assured American Independence; and Williamsburg, lying between the two sites which are both parts of Colonial National Historical Park, witnessed the ripening of the culture of the colonial and early national period. For the celebration scheduled there next year, the Service will have anticipated mission 66 by completing the Colonial Parkway, extending from Jamestown through Williamsburg to Yorktown; by the construction of new visitor centers at Jamestown and Yorktown; and by other developments which should add greatly to visitor enjoyment and to appreciation of the Nation's historic past. Nearly all these developments were under contract before the past fiscal year ended. In addition, the glassworks at Jamestown, restored through the generosity of Jamestown Glasshouse Foundation, Inc., was nearly completed, and will be in actual operation during the 1957 celebration and thereafter.

Marks of Progress

Of the many events and developments of the past year described hereafter in more detail, brief notice is directed to some of the most noteworthy:

The donation, for the second successive year, by Jackson Hole Preserve, Inc., of $500,000 to match an equal amount of appropriated money for land acquisition;

Increasing stress on more, and more effective, training for Service personnel;

Extension of self-guidance activities, advances in the use of audio-visual facilities, and other extensions and improvements in the Service's interpretive program;

Reestablishment of the position of Associate Director of the National Park Service, and appointment to it of a career employee of long experience.

Public Relations

That there is a vast reservoir both of interest in and good will toward the National Park Service and the National Park System was abundantly shown in the response, by individuals, organizations, newspapers and magazines, to mission 66. Without doubt, nothing has contributed more to that public attitude than the courteous and conscientious performance of their duties by the men and women who represent the Service in the field. Nor is anything more essential to the successful accomplishment of mission 66 than the continuance of such service, and the maintenance of friendly and understanding relationships with the communities which, because they are neighbors, have a legitimate degree of special concern with the welfare of individual units of the System.

In order to promote this valuable relationship with area neighbors, the Service has suggested and urged all field areas to "invite the neighbors in" for three anniversary observances annually, these being Founders' Day (August 25), the date on which the law establishing the National Park Service was approved; Campfire Day (September 19), the day of the famous Yellowstone Campfire of 1870 at which Judge Cornelius Hedges urged establishment of the world's first national park; and Establishment Day, the anniversary date of the establishment of the area holding the observance. Though newly instituted, this procedure has already proved highly valuable, not only in cementing important local relationships, but also in bringing certain fundamental facts and concepts to large numbers of visitors in an effective way.

Heightened public interest in the National Park System during the past year has had a number of noteworthy results. At the end of the year both Time and Newsweek had under preparation feature presentations dealing with the System and with those problems toward the solution of which Mission 66 is directed. Probably the outstanding journalistic contribution to public understanding of the

parks was the 30-article series (to appear, with some modification, in book form) which appeared during the winter and spring in the Christian Science Monitor. These were written by Max Gilstrap, a former National Park Service employee, who brought to his task the understanding, the detachment, and the independence of judgment and opinion needed to make the series exceptionally thought provoking.

In connection with these projects, with the Sinclair Oil Corp. series of advertisements which have continued to feature many areas administered by the National Park Service, and with numerous other similar undertakings, it has been the pleasant privilege of the Service to serve as a source of information and, in some cases, as a checking point for factual accuracy.

Through representation on both its Advisory Council and its Steering Committee, the Service has worked closely throughout the year with Keep America Beautiful, Inc., the organization which is supported by those industries whose products tend ultimately to contribute to the litter along the Nation's highways, as well as along park roads and trails and at parking areas and observation points. With strong promotion by KAB and numerous other organizations associated with it, the use of the litterbag, first distributed at Mount Rainier National Park in 1951, has become tremendously widespread. Since litter is one of the major maintenance problems of the Service, participation in this well-organized effort to reduce it is considered both good public relations and good economy.

Changes in Advisory Board

With the expiration of the 6-year terms of Alfred A. Knopf and Charles G. Woodbury as members of the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments, their places were filled by the appointment of Frank E. Masland, Jr., of Carlisle, Pa., and Fred Smith of New York City. Mr. Masland, head of the rug manufacturing firm of C. H. Masland & Sons, Inc., has long been a student of the national parks and their problems. Mr. Smith is president of Fred Smith & Co., Inc., public relations counselors, and is a member of the executive committee of the Council of Conservationists. Both new members have a broad business background.

The two retiring members have given devoted and intelligent service. Mr. Knopf was for 2 years chairman of the Board and provided exceptional and courageous leadership.

At its spring meeting, the Board chose Walter L. Huber of San Francisco to succeed Mr. Knopf as chairman.

In July 1955, John B. Oakes, of the editorial board of the New York Times, was appointed to the Board to succeed the late Bernard

De Voto. Mr. Oakes has written extensively and effectively about national parks and conservation in general.

National Park Service Conference

"Public Services" was the theme of the servicewide conference at Great Smoky Mountains National Park last September. It was attended by nearly all superintendents and by numerous representatives of the Washington, Regional, and Design and Construction offices. Delayed from 1954, it was considered one of the most successful in the Service's history.

Former Secretary Douglas McKay was the principal speaker at the banquet which wound up the conference. His address was directed chiefly to superintendents and dealt largely with their responsibilities for the training and advancement of their subordinates.

Region Five Established

Effective on July 1, 1955, the 4 regions which had existed since 1937 became 5 when Region Five was established with headquarters in Philadelphia. Daniel J. Tobin became its first regional director. Tobin's career began as a clerk at Sequoia National Park in 1921. It encompasses a wide range of steadily increasing responsibilities in various field positions.

The new region includes 16 States in the Northeast and Middle West, extending west to include Isle Royale National Park in Michigan. Most of the area was formerly part of Region One, though Isle Royale was subtracted from Region Two. At the same time Arkansas, containing Hot Springs National Park, was transferred from Region Three to Region One.

The new regional director entered on duty on July 1. By September 1 enough key personnel had reported for duty so that the new office fully was able to assume its responsibilities.

Big Bend National Park Dedication

Originally planned at least four years earlier, the long awaited dedication of Big Bend National Park took place on November 21, 1955.

After the disappointments and postponements of previous years the Big Bend National Park development committee, headed by Paul Forchheiner of Alpine, resolved there would be a dedication in the fall of 1955. In August plans were still indefinite and it was not until October 24 that a date was established and a commitment received

from Secretary of the Interior Douglas McKay that he would make the dedicatory address.

Eleven hundred persons attended the dedication ceremonies which were held in The Basin. Among the distinguished persons who participated were Assistant Secretary D'Ewart, Governor Allan Shivers of Texas, and Representative J. T. Rutherford. The Director of the National Park Service was also present and was one of the speakers. An international touch was lent by the presence of the Governor of Chihuahua, Mexico, Sr. Lozoya Solis, and the Consul General of Mexico, Sr. Enrique Ballesteros, on the speakers' stand, with the flag of Mexico flying alongside the Stars and Stripes.

Special Commissions

The Director concluded his services as Executive Officer of the John Marshall Bicentennial Commission, which held its national celebration honoring the 200th anniversary of the birth of Chief Justice Marshall and also published a final report on its activities. The Woodrow Wilson Centennial Commission, of which the Director was also Executive Director, sponsored a series of nationwide observances commemorating the birth of President Wilson. In September 1955 the Boston National Historic Sites Commission, of which the Director is a member, undertook its studies of Colonial and Revolutionary period properties in Boston and vicinity. The New York City National Shrines Advisory Board began its program to promote public cooperation and support in rehabilitating and preserving Federal Hall National Memorial and Castle Clinton and Statue of Liberty National Monuments.

Antiquities Act Anniversary

June 8, 1956, was the 50th anniversary of the passage of the act for the Protection of American Antiquities, more generally known as the Antiquities Act of 1906. Section 2 of that act authorized the President of the United States to establish national monuments on lands owned or controlled by the Federal Government, by Presidential proclamation. The first national monument established under authority of the act was Devils Tower, in northeastern Wyoming, proclaimed on September 24, 1906. The anniversaries of the passage of the act and of the establishment of this monument have been celebrated in Wyoming in a series of events which started in June and which will extend through September 24. Early in June the Postmaster General announced that a commemorative stamp would be issued for Devils Tower.

Jamestown, Williamsburg, Yorktown Celebration

As an ex officio member of the Federal commission which is cooperating with a similar Commonwealth of Virginia commission in making preparations for the Jamestown, Williamsburg, Yorktown celebration in 1957, it has been necessary for the Director to attend numerous meetings of the commission in the area in which the celebration will take place. Anniversary observances are scheduled to begin on April 1 and to carry through November as planned by the Commonwealth and the United States Commission.

Mountain Climbing

Safety in mountain climbing continued to received attention with climbing and hiking organizations exerting considerable voluntary control over their members. The one fatality of the report year resulted from poor judgment and inexperience. Other accidents were infrequent. Contributing to the safety trend were the increased use of mountain climbing schools by visitors and an expanded mountaineering training program for National Park Service personnel.

Winter Use

As a result of important decisions made by the Secretary last year respecting winter use, new facilities were installed at Hidden Valley in Rocky Mountain and plans were completed for improvement of facilities for winter use of Paradise in Mount Rainier. The eight national parks open for winter sports received the heaviest winter use in their history—361,760 visitors as compared with 332,770 last year. About 40 percent entered the parks to participate in informal snow sports while 60 percent came to enjoy the winter scenery.

General Grant Tree Designated as National Shrine

After years of effort on the part of the people of Sanger, Calif., and particularly the American Legion post of Sanger, the act designating the General Grant Tree in Kings Canyon National Park as a National Shrine was approved by the President March 29.

Plans are underway for the dedication of the tree as a national shrine at ceremonies to be held at the site on Veterans' Day, November 11, 1956.

Flood at Hot Springs

The second most disastrous flood ever to hit the downtown section of the city of Hot Springs and Hot Springs National Park occurred

on February 15, 1956, following a rain storm in which 5.54 inches of rainfall were recorded during a 2-hour period. Basements of the bathhouses on Bathhouse Row and the Rockafellow Bathhouse were flooded, extinguishing the boilers and doing heavy damage to supplies which were stored in the basements. The bathhouses were unable to operate during 3 days. The floodwater receded and the litter was cleaned out in most of the houses within 24 to 36 hours. However, there was danger that floodwater had entered the central collecting reservoir from the three open springs in basements of bathhouses, so the reservoir had to be emptied and tests run for potability.

MISSION 66

The report for the fiscal year 1955 described the beginnings of Mission 66; the guidelines established for the studies on which its findings and recommendations were to be based; the invitation to all employees of the National Park Service to participate in it; the start made on correlation of their recommendations and of the prospectuses in which the needs of each field area were to be set forth fully.

The Mission 66 report was in approximately final form by the end of the calendar year; included in it, and derived from the prospectuses, of which the recommendations had been given a preliminary evaluation, was an estimate of the probable cost of so equipping and staffing the National Park System as to meet the needs of the 80 million visits expected in the year 1966, so that the 50th anniversary of the establishment of the Service might be fittingly celebrated.

On January 27, the Mission 66 program was presented, in word and picture, to President Eisenhower and his Cabinet, and was repeated immediately thereafter to the members of the White House staff. It was presented to the Congress on February 2, and was announced publicly at the Pioneer Dinner on February 8, jointly sponsored by the Secretary of the Interior and the American Automobile Association Congress appropriated the necessary funds to carry out the first year of the Mission 66 program.

The Service was fortunate in being able to present the Mission 66 story to the public through a handsome and colorful popular edition of the report, entitled "Our Heritage," which has been widely distributed. By this and other means, travel, conservation, recreation, scientific, and historical organizations and the press have been provided with information about the program as rapidly as it has become available. Much effort has been made to inform the press of the details of the program as rapidly as they could be made available. Public reaction from these groups and from many individuals and a great volume of editorial comment in newspapers and periodicals has been exceptionally favorable.

Only two significant areas of conflict have developed since the program was announced. These concern the location of accommodations in two of the national parks. It is fully expected that both of these will be resolved satisfactorily.

Park concessioners have been consulted about their participation in the Mission 66 program; notable improvements in and additions to accommodations are already underway and are planned in others in order to fulfill the purposes of the program. Several of those underway or completed are noted elsewhere in this report. While these projects started in advance of Mission 66, they are integrally a part of it, as will be those of the future.

Mission 66 has been widely characterized as the most significant undertaking of the National Park Service since its establishment in 1916. It seeks to provide for the most satisfactory enjoyment of the significant resources of the National Park System. The program calls for increased field staffs and increased annual operating funds, as well as a considerable amount of new development. Development is based on the assumption that when facilities are adequate in number, and properly designed and located, large numbers of visitors can be handled readily and without damage to the areas. Good development saves the landscape from ruin, protecting it for its intended recreational and inspirational values. It is the purpose of Mission 66 to locate developed areas where they will not invade the wilderness, impair fragile areas or features, or encroach upon significant exhibits. All development is based upon a well-thought-out plan for the protection and interpretation of the national and historic features of the areas. When these principles are followed, the development of a park contributes in essential ways to park conservation, while assuring the people of America, today and in the future, the opportunity to gain the fullest enjoyment of them.

A permanent staff has been established in the Washington Office of the Service to coordinate and continue the Mission 66 program.

Specific planning for individual areas, embodied in prospectuses defining the purpose, objectives, and plans for their management, development, protection and use, is almost complete. In accordance with the broad formulas defined in the prospectuses, detailed plans and construction drawings for those areas and projects to be programed in 1957, 1958, and 1959 are far enough advanced to insure prompt scheduling of the work.

Mission 66 Legislation

Three bills introduced in the 84th Congress—1 in the Senate and 2 in the House of Representatives—but not acted on before adjournment would have provided contract authorization, over a 10-year

period, amounting to $160 million for roads and trails, the same amount for parkways, and a like amount for buildings and utilities and the acquisition of lands and water rights. In reporting on this legislation, the Department and the Bureau of the Budget recommended that it be changed to authorize appropriations in these overall amounts during the 10-year period, as well as $2 million for the construction of airports on lands in close proximity to areas administered by the Service. It was also recommended that the Secretary be authorized to obtain expert or consulting services without regard to limitations imposed by the civil-service and classification laws. The Subcommittee on Public Lands of the Senate Interior and Insular Affairs Committee held hearings on the Senate bill on June 8.

INTERPRETATION AND INFORMATION

Every area administered by the Service is the common property of every American, who has a right to know what he possesses, how his property is managed, and what use is made of it. When he himself becomes a user of it, it is natural and desirable that, his curiosity roused, he should seek to obtain some understanding of the natural processes which have produced a superlative example of his country's natural scene or of the human events and actions which have justified setting aside and displaying a site of historic or prehistoric interest. It has long been recognized as a Service obligation to both stimulate and satisfy this desire to know "Who?" and "When?" and "Where?" but even more important, "How?" and "Why?" It is felt to be the principal means by which the owners and users of the parks may derive from them deep and lasting satisfaction.

Rightly, and happily, Mission 66 takes full cognizance of the place of interpretive and informational programs in the management of the National Park System. Two of the eight major objectives make that plain. The third in the list reads: "Provide the services which will make the parks more usable, more enjoyable, and more meaningful, and thereby improve the protection of the park through visitor cooperation." While improved protection is a secondary result to be sought through a more effective interpretive and informational program, it is still one of great importance; in fact, it is essential, if the capacity of the System to provide enjoyment is to remain unimpaired.

The connection of such a program with the preservation and use of wilderness areas is spelled out in the last of the list of objectives, which says: "Provide for the protection and preservation of the wilderness areas of the National Park System, and encourage their appreciation and enjoyment in ways that will leave them unimpaired."

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Visitor Centers

Mission 66 recognizes that, with respect to both physical facilities and staffing, much more needs to be provided if users of the parks are to obtain the fullest measure of enjoyment and satisfaction from that use. The "visitor center" looms large in the program. This type of structure, of which about 100 are projected for the 10-year period of Mission 66, will serve both an informational and interpretive function. Situated as a rule in a center of visitor activity, its purpose will be both to provide needed information about accommodations, travel routes, park regulations, etc., and to supply some understanding of the character of an area and its significance. In its operation, not only a wide variety of physical aids—publications, exhibits, recordings, to cite a few examples—but also competent personal services are required. Each will have to be "tailored" to the specific requirements of the area in which it is situated.

New Roads and Interpretation

The planning now underway in connection with the new east-side road at Grand Teton National Park typifies the new concept of what a park road—in contrast with other types of roads—needs to be. There and elsewhere interpretation—in the form of roadside exhibits, signs, view-point turnouts, and markers—is being integrated with the other more usual phases of road construction.

Personnel Added

Material gains were made during 1956 in the direction of more adequate staffing, and both added facilities and the steady increase in public use will require considerable further additions during the 10 years of mission 66.

The establishment of Region Five required the services of both a regional chief of interpretation and a regional historian on the staff of the Regional Director; and a long-needed regional naturalist position was established and filled in Region One.

The year brought park historians, to both Harpers Ferry and Mount Rushmore, the first to be assigned to these two areas. Isle Royale and Hot Springs National Parks, and Colorado and Joshua Tree National Monuments, in all of which natural history figures importantly, now have on their staffs, also for the first time permanent park naturalists. In addition, three field teams of "museum planners," each consisting of a museum specialist and a naturalist or historian—all field positions—were established to develop, on the ground, preliminary but detailed plans for museum exhibits. This is a par-

ticularly necessary form of advance planning, in view of the considerable volume of museum and visitor-center construction envisioned during the next few years and the need for new and up-to-date exhibit plans for museums whose content does not reflect present-day techniques.

Interpretive and Informational Services

That visitors to the areas administered by the National Park Service appreciate the services rendered by interpretive personnel is indicated by the fact that so many make use of them. Conducted trips were taken by 2,261,000 visitors; 5,340,000 attended informal talks given by naturalists and historians. Hundreds of thousands of these were school children, gaining a widened view of the natural world around them and of American history, of which they and all Americans are a part. Park museums and similar installations were used by more than 13,268,000 persons. All these involved some degree of contact with and personal service from National Park Service personnel. Millions of other visitors used the roadside markers, the self-guiding trails, and other aids to perception and understanding and lasting enjoyment of their park experiences. Moderately increased staffs made it possible to give more campfire and other talks and to conduct a greater number of trips. At the same time, the use of self-guiding devices, and the installation of such devices, both increased.

Self-guidance

The evolution in interpretive methods employed by the Service during the past decade has been strongly influenced by the fact that the available volume of personal services was increasingly inadequate for performance of the interpretive task, but it also reflects the development of improved audiovisual and other devices during that time, to which the Service itself has contributed in notable fashion.

What is known as a self-guiding trail, or walk, started out to be a pedestrian route, along which signs or labels provided information about features of interest viewed from it; several of these remain in use in various areas of the National Park System. However, ordinary maintenance costs for the signs, plus the habit of a small segment of visitors of making off with easily removable signs, led to the wide adoption of a different technique, requiring readily visible numbered stakes along the way and printed or processed trail guides, keyed to them.

The issuance of self-guidance folders or booklets has become primarily the responsibility of the various official cooperating societies which serve single areas or groups of areas. The past year has seen

the issuance of a number of new self-guidance publications which meet high editorial standards and which reached a new high level of design and general appearance.

Historical, Archeological, and Natural History Research

To guide the development program underway at Jamestown, in anticipation of the 350th Anniversary Celebration at that site in 1957, the staff at Colonial National Historical Park completed important historical studies on tobacco cultivation, silkworm production, and colonial building construction. Archeological excavations at Jamestown revealed house foundations, including a row house, and many other objects of value in interpreting the Jamestown story. Archeological exploration on the Yorktown Battlefield uncovered the remains of historic Redoubt No. 10, a key outer defense of the British line captured by Washington's forces on October 14, 1781. It was in this fortification that Washington received and signed the articles of Cornwallis' surrender.

At Independence National Historical Park, Philadelphia, historical and architectural staffs concentrated upon studies related to restoring and refurnishing the first floor of Independence Hall. Such a study was completed during the year to guide the restoration and refurnishing of the Supreme Court Chamber. Special information for this study and other aspects of the restoration and refurnishing program was secured through the works of staff members in depositories from New York to California and in the archives in England.

Continued use of cooperating agencies and collaborators to augment the efforts of Service personnel also made possible the accomplishment of many valuable geological and natural history studies. Among these were the start of a 5-year study of the general geology of Death Valley; glacial studies at Olympic, Glacier, Yosemite, Rocky Mountain, and Mount Rainier; completion of studies in geology, history, and botany at Cape Hatteras; continuation of fish studies at Great Smoky Mountains, Shenandoah, and Yellowstone, and wildlife studies in Mount McKinley and Death Valley; and ecological studies at Olympic, Sequoia, Yellowstone, Great Smoky Mountains, and Big Bend.

Cooperative Studies

Archeological research of importance was performed by the University of Colorado, in Mesa Verde National Park; the University of Southern California, in Death Valley National Monument; Columbia

University, in El Morro National Monument; the University of Washington, in Olympic National Park; and the Florida State Museum, in Fort Caroline National Monument.

Salvage Archeology

Under cooperative agreements, archeological salvage work was performed by five local institutions, as well as the Smithsonian Institution. Groups from the University of South Dakota, the State Historical Society of North Dakota, and the University of Wisconsin worked in the Oahe Reservoir area, and from the University of Kansas and the Nebraska State Historical Society at Fort Randall Reservoir. The University of Missouri surveyed and partially excavated the Table Rock Reservoir area.

Using funds transferred from the Service, the Smithsonian Institution surveyed more than 100 sites, tested more than 40, and excavated 24 in 8 reservoir areas.

Foreign Studies

Dr. Charles W. Porter, III, represented the Service at the 6th International Castellological Congress in Montagnana, Italy, June 18–23, 1956. Also in June, Harold L. Peterson visited Sweden, Denmark, France, England, and Scotland to collect historical objects for the museums of the Service.

Wildlife

Although further reduction is necessary, the serious overgrazing in Yellowstone was greatly reduced by the elimination, in cooperation with the State of Montana, of 6,535 elk from the northern herd. Also, 373 bison were removed from Yellowstone. In Grand Teton 310 elk were shot by 624 permittees deputized under Public Law 787, and at Wind Cave 85 bison were eliminated under a cooperative agreement with Custer State Park. Small numbers of deer were removed from congested areas in several parks.

Black bears continued to present problems with 73 personal injuries in Yellowstone, 18 in Great Smoky Mountains, and 7 in Yosemite, and there was considerable property damage.

Wolves have increased at Isle Royale and studies are being made to determine the effect of their predation on moose, beaver, and hares. Studies of bats at Carlsbad Caverns were intensified following the discovery of rabies among them in the summer of 1955.

Museum Branch

The Museum Branch enlarged its technical staff within carefully calculated limits to keep pace with expanding needs. Mission 66 will require the central Museum Laboratory to plan, build and install museum exhibits at the rate of several hundred units per year. At the same time, museum collections, growing steadily in size and importance, require more preservative treatment and other specialized care.

Museum Planning

The scheduling of several visitor centers in the 1957 construction program created an urgent need for detailed exhibit plans. Three exhibit planning teams were set up to collaborate with park staffs. By the end of the year exhibit specifications and layouts were completed for 7 museums and were well underway for 5 more. In addition, another kind of exhibit plan, a "furnishing plan" for historic house museums, was adopted. The first of these was prepared for the Andrew Johnson Home.

Exhibit Construction

The Museum Laboratory prepared and installed the exhibits for the visitor center at Petersburg National Military Park, the Old Faithful Museum in Yellowstone National Park and the museum at Devils Tower National Monument. Exhibits were also completed for 9 other parks and were in progress for 6 more. An exhibit on the work of the Department of the Interior was prepared in collaboration with other bureaus for "The American Dream," a traveling exhibition to visit about 50 cities. Since the Laboratory could not build many exhibits urgently needed in the parks, park staffs at Mesa Verde, Yosemite, and Southwestern National Monuments produced some displays for their museums to fill the gap.

Museum Accessions

The museum collections of the National Park Service owe much to generous donors. The Thomas A. Edison Foundation presented hundreds of items representing the principal exhibits and equipment of the Edison Laboratory in West Orange which was to become the Edison Laboratory National Monument. The artist, Robert F. Williams, and his wife gave 30 oil paintings interpreting outstanding scenes in the national parks. Col. John J. Driscoll of Paris donated a collection of agricultural tools similar to those used by the 16th century French colonists who will be commemorated at the Fort Caro-

line National Memorial. Rare books, weapons and other objects for the Fort Caroline Museum were purchased with funds donated for this purpose. All these and other accessions were accepted only when they filled recognized needs to increase public understanding and enjoyment of the parks. To guide the continued growth of the collections, revised policies and procedures for this and other aspects of museum development and administration were issued.

The exceptionally valuable collection of Americana willed to the National Park Service by the late Lloyd C. Smith of Morristown was transferred to the Service. This collection includes not only manuscript material on George Washington and the Revolution, but much other manuscript material on American Colonial and Revolutionary history. It will be housed in the new library wing of the museum, for which a construction contract has been let.

Preservation of Scientific and Historic Collections

Expert treatment given by preservation specialists of the Museum Branch included one of the most extensive mural restoration projects undertaken with modern methods. The rotunda murals in the Old St. Louis Courthouse, Jefferson National Expansion Memorial, which include some 24 individual paintings, were cleaned and restored by a specially trained crew operating on scaffolds high above the floor.

Cooperative Activities

To assist State parks and other public agencies, the Museum Branch gave technical advice and, on a reimbursable basis, planned and prepared exhibits. New exhibits were installed for the St. Augustine Historical Society whose interpretive program is closely coordinated with that of the Castillo de San Marcos National Monument. The second group of exhibits for the Prehistoric Indian Mound State Park in Louisiana was completed and installed. A few exhibits were built for the Carnifex Ferry State Park, W. Va.

Audiovisual Progress

The Service's new audiovisual program provided additional help to visitors in many areas of the System through the means of audioguiding systems, automatic illustrated programs, and high-fidelity public address and sound devices. Audioguiding systems at Castillo de San Marcos and Fort Pulaski National Monuments were installed on self-guiding tours and proved popular with visitors. Under this program, 11 slide projectors and 7 projectographs synchronized with tape recorders were also developed to give automatic illustrated pro-

grams. New sound devices were developed to provide background music of the Civil War at the Manassas Museum. A new device was furnished for the orientation talk at the base of the Washington Monument. In the electronics laboratory an especially notable achievement was the development of a new electronic trigger circuit to synchronize slide projectors and projectographs with tape recorders.

In addition to this progress in reaching the public, the naturalist staff of National Capital Parks prepared a slide talk, Conducted Trips, an effective audiovisual training aid, which is being put to wide use.

Publications

The appropriation for 1956 provided increased funds, for the first time in several years, for the Service's publications program, and thus gave greater recognition to its importance both in management and interpretation.

During the year, the first of the proposed revisions of informational publications dealing with the 28 national parks came off the press. This was the Sequoia-Kings Canyon National Parks booklet, in a new and more effective format, written in a more friendly and less impersonal style. The booklet on Zion National Park, second in the series, went to the printer.

Revised editions of established publications off the press during the year included James Towne in the Words of Contemporaries; two historical handbooks (Saratoga and Petersburg); and two tree preservation bulletins (Ropes, Knots and Climbing; and Shade Tree Pruning). One new historical handbook (Bandelier), the first dealing with an archeological area, was also issued. The Chickamauga and Chattanooga, and George Washington Birthplace handbooks, were sent to the printer, as were seven handbook revisions (Saratoga, Fort Necessity, Hopewell Village, Kings Mountain, Fort Raleigh, Petersburg Battlefields and Custis-Lee Mansion); also a revised tree preservation bulletin Safety for Tree Workers. In anticipation of increasing public interest in literature dealing with Jamestown and Yorktown, because of the anniversary celebration in 1957, the booklet, America's Oldest Legislative Assembly and Its Jamestown Statehouses, also went to the printer in revised form.

Requisitions for printing free informational publications dealing with units of the System totaled 117, and called for the production of 7,624,000 pieces of printed matter. Revised issues of the Eastern and Western United States maps, which have so greatly reduced mailings of other free literature, reflect further economy by providing for mailing without the use of envelopes. The folder, National Parks and National Forests, which has been so useful in clearing up wide-

spread public misunderstanding, was issued in a revised format and text. For the first time, information on Camping Facilities in the National Park System, was issued in printed form.

DESIGN AND CONSTRUCTION

In spite of difficulties encountered in recruiting the adequate professional staff required to implement the expanded 1956 construction programs and to initiate surveys and plans essential to the orderly progression of the more comprehensive construction programs of Mission 66, gratifying progress has been made toward both of these important objectives. Of a total construction program for buildings and utilities, roads and trails, and parkways, amounting to $35,807,359 including carryover balances from the 1955 fiscal year, it has been possible to effectively obligate or commit approximately 90 percent of the available funds. In addition, sufficient progress has been made on plans and surveys for construction projects included in the 1957 fiscal year program to encourage the hope that an appreciable percentage of this work as well as all of the 1955 carryover balance will be either under contract obligation or committed on day labor projects within the first quarter of the fiscal year.

Meeting the Employment Problem

Steps which have been taken to overcome the employment problem include contracting with private engineering and architectural firms for plan preparation and construction supervision, and contracting for surveys and mapping. Increased services have been obtained from the Public Health Service of the Department of Health, Education, and Welfare under memorandum of agreement. In addition to the increase in routine cooperative services needed to facilitate the Mission 66 program, arrangements have been made to assign to the Eastern and Western Design Offices, in lieu of engineering vacancies, approximately 10 reserve officers of the Public Health Service for a period covering the 3 summer months and 5 reserve officers for a 2-year period. The seasonal employees are for the most part college professors while those assigned for the 2-year period are all holders of B. S. degrees or advanced degrees in engineering. In the process of formulation is an agreement with the Forest Service of the Department of Agriculture to obtain necessary radio equipment certification tests and related services through the facilities of their Beltsville, Md., radio laboratory.

Efforts are also being made to influence future programs insofar as possible toward the concentration of construction activities at relatively few areas each fiscal year which will enable us to undertake a

greater volume of survey and field supervision work with a smaller field staff.

Roads and Trails

The roads and trails program includes $9,049,700 for construction projects in which the Bureau of Public Roads participates with the National Park Service under the terms of an interbureau agreement.

Twenty-one projects were placed under contract in 16 areas. The total obligations for these contracts, including the contract amount, extra work or change orders, plans, specifications, and supervisions, amount to $7,351,002.

The work being accomplished by the 21 projects includes the construction of 3.058 miles of new road to be completed under the present contract, 21.195 miles of road under varying stages of construction, 11.891 miles of roads in stage construction status to be completed under the present contract, 43.857 miles of roads to be reconstructed, the construction of 7 bridges, and such miscellaneous items as tunnel linings and portals, guardrails, and parking areas.

The Federal Aid Highway Act of 1956 authorizes the expenditure of $16 million for the construction and reconstruction of roads and trails for each of the years 1958 and 1959. An appropriation of funds in these amounts will enable the Service to concentrate contracts for road construction and reconstruction within a park area and to complete that phase of park development in a relatively short time, and will assist the Service to reach the goals described in Mission 66.

Parkways

The Federal Aid Highway Act of 1954, covering the fiscal years 1955, 1956, and 1957, provided a total authorization of $32 million for parkway construction. Of the $11 million programed, $4,307,100 was for the Blue Ridge Parkway in North Carolina and Viriginia; $3,630,200 for the Natchez Trace Parkway in Alabama, Tennessee, and Mississippi; $2,340,600 for the Colonial Parkway in Virginia; $432,100 for the George Washington Memorial Parkway in Maryland and Virginia; $90,000 for the Chesapeake and Ohio Canal in Maryland; and $200,000 for advance planning and surveys. With this type of appropriation, parkway construction during this 3-year period will move ahead at a rate compatible with land acquisition and construction priorities.

Major construction contracts totaling $3,371,000 were completed. These included 11 miles of grading, 4 bridges and grade-separation structures, 26 miles of bituminous paving, tunnel lining, hydraulic fills and other incidental work. The work under contract at the end

of the fiscal year called for the expenditure of $12,300,000 and applies to 71 miles of grading, 30 bridges or grade-separation structures, 30 miles of paving, plus slope stabilization, tunnel lining, and other work.

Master Plans

The results of the searching reappraisal of Service objectives and responsibilities accomplished by Mission 66 are being reflected in revised master plans for each park. Although this program has only begun, it will be accelerated in the forthcoming year as final Mission 66 prospectuses are approved. Priorities of master-plan preparation are coordinated with construction programs so that working drawings for projects scheduled early in the Mission 66 program will not be delayed.

Buildings

The construction program for buildings is geared to the theme of public service. Resumption of active work in this field will provide additional interpretive and information facilities in the form of new visitor centers in several parks, enlargement of campgrounds with new comfort stations to serve them, enlarged utility areas to shelter Service equipment, and construction of lodging and related accommodations for visitors in some of the more remote parks. The first substantial work toward alleviating the critical shortage of employee housing was begun; studies of standard house plans were prepared to accelerate selection and construction of dwellings in the parks.

Among the first new visitor centers will be those under construction at Yorktown and Jamestown Island in Colonial National Historical Park, Va.; Grand Canyon National Park, Ariz.; and Carlsbad Caverns National Park, N. Mex. Overnight tourist accommodations in the form of multiple-room lodges are being constructed in Isle Royale National Park. A concessioner's building and concessioner's employee dormitory are under construction in Mount Rushmore National Memorial. This will be augmented by a large amphitheater for use in the interpretive program there.

The Service employee-housing construction begun this year comprises units for both permanent and seasonal occupancy. Priority is being given to those remote areas which are in most urgent need of adequate housing.

Utilities and Miscellaneous Structures

This program included approximately 27 projects aggregating in cost about $600,000. Among these were water, sewer, power and

communication systems or extensions and additions thereto. In addition, contracts were awarded for similar projects, funds for which were carried over from the 1955 or previous fiscal years.

Notable among the larger projects placed under contract during the 1956 fiscal year are the following: The sewer and water systems for the Moose Headquarters of Grand Teton National Park, the sewer and water systems for the Canyon Area development at Yellowstone National Park, an addition to the sewage treatment plant and repair of major storm damage to the sewer system at Yosemite National Park, the extension of the water and sewer systems for the Swift Current development at Glacier National Park, completion of the water system for the Basin development at Big Bend National Park and the construction of a sewer system for Yorktown, Va., in Colonial National Historical Park.

Storm Damage

Widespread storms during 1955 in the Pacific coast region resulted in extremely heavy flood damage in nine areas administered by the Service. Repair and replacement of roads, trails, bridges, dykes, and electric systems have cost approximately $1,650,000.

OPERATIONS

The Division of Operations continued to give primary emphasis to assisting field organizations in caring for the park areas and in managing the increasingly large crowds of park visitors. Progress has been made on all phases of operations, conservation, protection, and betterment.

Many annoying problems arising from private ownership of lands which blocked operational efficiency or development have been resolved, although much remains to be accomplished. Concessions operations are in good condition, with most contracts and business concession permits current.

Because of the concern of this division with park operations it has been necessary for a number of employees of the division to spend considerable time on the Mission 66 program. It offers a real opportunity for actual increases in operating funds to fill many of the present most urgent needs. Also, in the Mission 66 study, attention was given to developing new work methods and many promising leads are being explored. The Division of Operations cooperated closely with area management studies which were made on a pilot study basis in each region.

A major task has been the 10-year forward projection of development programs to carry out Mission 66. These will be subject to alteration in future, but the basic job is done and the development and management patterns in each area are clearer now that for many years past.

Park Rangers

The Branch of Conservation and Protection worked particularly toward improvement of park ranger standards in cooperation with the Branch of Personnel. The importance of district rangers as key representatives of the superintendents was emphasized. The branch also reviewed and advised on many reclassification proposals for park rangers and professional employees.

Continuing attention was given to training protection personnel in special phases of their work, such as rock climbing, rescue, law enforcement, and informational services.

Structural Fire Control

A 10-day school, primarily designed to train park men in structural fire inspection, recognition of hazards, and control techniques, was conducted in Yosemite National Park by the California State Department of Education. Thirty-four rangers and others from 25 areas and offices of the Service took the course. Each trainee in turn conducted similar employee training courses in his own area.

Forest Protection

Considerable high fire hazard existed in the Southern States and northern Rocky Mountain areas; the sixth consecutive year of drought continued in the Southwest; and a short period of extremely critical fire danger occurred in California. For 7 tense days, September 3 to 10, 1955, a fire seriously threatened the General Grant Grove in Kings Canyon National Park, but the combined resources and fine cooperative efforts of State, Forest Service, and park protection forces held the fire at the boundary. Forest fire losses were well below the 20-year average. The value of prevention efforts directed at specific causes of fires is reflected in a reduction of smoker fires to 58 percent of the 25-year annual average, despite record visitation to the parks. The Service continued to assist in organizing and training the nearly 1,000 organized Southwestern Indian firefighters, who have proven so effective on large fires.

Forest Pests

Control programs, carried on with technical assistance from entomologists and pathologists of the Department of Agriculture, continued to provide generally good protection from forest insects and diseases. Progress was made toward protection from white pine blister rust in all park areas containing important stands of five-needled or white pines. Intensive research to find a means of controlling lodgepole needleminer, threatening high elevation pines of Yosemite National Park, has produced promising experimental results. If tests are successful, a major control attempt will be made. The threat of the southern pine beetle in Great Smoky Mountains National Park and Blue Ridge Parkway was greatly lessened by control work. In many public-use areas, spraying to control defoliators was continued.

The tree maintenance crew traveled into 39 areas, including 5 national cemeteries. About 3,000 trees were pruned, 380 dead or dangerous trees removed, and a tree feeding and bracing program carried on.

Maintenance

Continuing attention was given to maintenance staffing requirements in field areas in the Regional Offices and additional refinements were made in programing funds on a workload basis. Thus, Mission 66 projections could be based on known workload factors. Subsequent adjustments must be made to reflect increases in building and utilities construction prices due to rising labor and material costs. The Bureau of the Budget has reorganized this problem and provided increases to cover increased cost.

Travel to the Parks

Public use of the areas administered by the National Park Service continued the upward trend which has been constant since 1946. Visits to all areas totaled over 50 million in 1955 as compared to 47,800,000 in 1954, an increase of nearly 5 percent. Thirteen areas had more than 1 million visitors each, three of these had more than 2 million each.

Travel Survey

Further progress was made on the program of travel surveys for national parks. These surveys are made to obtain information on use of visitor facilities and on travel habits and expenditures, and are

conducted in cooperation with the Bureau of Public Roads and State highway departments. This year the Grand Canyon National Park survey report was published by the Arizona Highway Department. Field work began on a second survey of Great Smoky Mountains National Park.

Programing for Mission 66

Preparations were made for expeditious and efficient processing of the increased park development programs under Mission 66, beginning with those for the 1957 fiscal year. This 10-year forward projection has been completed. It provides a sound basis for analysis of future protection, conservation, use, and development needs, and for budget preparation and justification.

Streamlined Development Program Preparation

Steps were taken to decentralize many programing details to Regional Offices. At the same time much paperwork has been eliminated through lessened requirements for advance project-construction-proposal forms for individual projects.

Reporting Procedures on Construction Progress Improved

Improved reporting procedures have been developed whereby the eastern and western Offices of the Division of Design and Construction will report on the status of approximately 800 projects each month. This report form was developed cooperatively by the Division of Design and Construction, and the Branches of Finance and of Programs and Plans Control. It will serve as an essential management document and for many other purposes, including compliance with report requirements of the Bureau of the Budget and Congress.

Advance Program Approval by Congress

Approval of construction programs is being sought 2 or 3 years in advance, rather than for the one fiscal year as in the past, though of course subject to the usual budgetary limitations on appropriations for particular years. Because of increased flexibility, such advance approval would greatly facilitate both obligation of funds and work accomplishment.

Land Acquisition

During the fiscal year $1,250,000 was made available for land acquisition. As in 1955, $500,000 of this amount was received from

Jackson Hole Preserve, Inc., to match $500,000 of appropriated funds conditioned on matching donations. Some 46,000 acres of inholdings were acquired by purchase, donation, or exchange.

Donations included some 4,100 acres from the State of North Carolina and 270 acres from the Commonwealth of Virginia for Blue Ridge Parkway; 2,800 acres from the State of Mississippi for Natchez Trace Parkway; 10,680 acres from the Commonwealth of Kentucky, 2,030 acres from the State of Tennessee, and 7,480 acres from the Commonwealth of Virginia for Cumberland Gap National Historical Park; 720 acres from the Union Land and Grazing Co. for Fort Union National Monument, N. Mex.; and about two acres and improvements thereon from Thomas A. Edison, Inc., for the proposed Edison Laboratory National Monument, N. J.

Completed purchases and approved options cover some 17,500 acres of land and improvements in Big Bend, Glacier, Grand Canyon, Grand Teton, Great Smoky Mountains, Lassen Volcanic, Rocky Mountain, and Yosemite National Parks; Colonial and Saratoga National Historical Parks; Fredericksburg and Gettysburg National Military Parks; Manassas National Battlefield Park; Theodore Roosevelt National Memorial Park; and Death Valley, Devils Tower, and Joshua Tree National Monuments. Options totaling about $300,000 awaited approval at the end of the year.

About 25,000 of the 28,500 acres within the Cape Hatteras Seashore project have been acquired. However, in one condemnation case, involving about 2,000 acres, the commissioners appointed by the United States District Court recommended an award of $484,000. On the basis of appraisals obtained prior to instituting condemnation proceedings, $185,000 had been paid into the registry of the court as estimated just compensation. If the Government is unsuccessful in obtaining a lower award, additional funds must be found to complete the Cape Hatteras land acquisition. The State of Maryland continues efforts to acquire 800 acres of land for Harpers Ferry National Monument project. Acquisition of the extension to Wright Brothers National Memorial, with funds previously donated, continues. Some $7,300,000 of the $7,700,000 appropriated for acquiring the properties at Independence National Historical Park have been obligated; land acquisition there is virtually completed.

Special Uses of Park Lands

The majority of special use permits issued during the past year continued to be for agricultural use of small parcels of land to maintain historical and rural scenes, for access facilities from private lands to park roads, and for utility lines.

The Atomic Energy Commission in most cases has completed its reconnaissance surveys for strategic minerals in areas of the System. The number of requests for information on prospecting and mining in national parks and monuments decreased during the past year.

Water Rights

Progress in the establishment and preservation of rights to the use of water in Service areas continued with the preparation of 37 Federal claims. Of these, 7 claims are applications for appropriation of water to comply with water laws of various Western States; 11 support a Federal protest of conflicting private appropriations of waters of the Tuolumne River below Yosemite National Park, Calif.; and 18 define Federal interests in waters of the Lower Colorado River as part of Federal intervention in the case of *Arizona* v. *California* before the Supreme Court. Proofs for final licensing of 10 rights under 5 previously established permits were filed in Nevada and Utah.

Concession Authorizations

Fourteen concession contracts and 29 concession permits were negotiated during the fiscal year.

The new contract with the Yellowstone Park Co. calls for a construction program in Yellowstone in the amount of $3,500,000 during the first 5 years. This will be expended on construction in the new Canyon Village for which ground-breaking ceremonies were held on June 25.

Additional improvements are estimated to cost $10 million during the next 5 years of the contract. The Hamilton Stores, Inc., contract also provides for construction of facilities in the new Canyon Village and other locations. In Yosemite National Park, Degnan, Donohoe, Inc., is planning new construction in the New Village area. Several smaller concessioners have included improvement programs in connection with the issuance of new authorizations.

Prospectuses

Eight prospectuses were issued soliciting offers for operation of certain concessions at Mount McKinley, Glacier, and Olympic National Parks, Cape Hatteras National Seashore, Coulee Dam National Recreation Area, and Channel Islands National Monument. As a result, concessioners were found for Glacier, Cape Hatteras and Olympic.

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Concessioner Improvements

At Yosemite, the Yosemite Park and Curry Co. has completed a new development at Yosemite Lodge which includes lounge, lodging, and dining facilities costing nearly $1 million. At Grand Canyon National Park, Fred Harvey has expended some $694,000 for capital improvements on the South Rim and is planning a motel of 100 to 150 rooms at an estimated cost of $500,000. A new concessioner employee dormitory building, costing more than $200,000, was completed at Mount Rushmore National Memorial; this will be followed by construction of a new building to house concession operations. At Shenandoah National Park the Virginia Sky-Line Co. constructed a new general service building and two new cottages at Skyland. A marine service building at Flamingo Key in Everglades National Park is 90 percent complete. The Glacier Park Co. completed an employee dormitory, three 14-unit motels, and an extension to the Many Glacier Coffee Shop. Improvements were also made to the Many Glacier Hotel. Concessioners at many other areas completed minor improvement and building programs during the year.

The new Jackson Lake Lodge in Grand Teton National Park operated at capacity during the 1955 season. The Grand Teton Lodge Co. is now constructing a cabin development at Colter Bay which will be completed for the 1957 season.

RECREATION RESOURCE PLANNING

Progress was made in the Service's planning and cooperative assistance programs relating to park and recreation resources. These responsibilities, formerly called Cooperative Activities, were placed under the more descriptive and appropriate organizational title, Recreation Resource Planning.

New Areas Established

Cumberland Gap National Historical Park in Kentucky, Tennessee, and Virginia, authorized in 1940, was formally established; it contains more than 20,000 acres. Fort Union National Monument in New Mexico was established with approximately 720 acres, purchased by private subscription and donated to the Federal Government. Donated lands, buildings and exhibits were accepted to comprise the Edison Laboratory National Monument, N. J. (established July 14, 1956). Nearby "Glenmont," Thomas A. Edison's home, was established as a national historic site in non-Federal ownership.

New Areas Authorized

Acts of Congress authorized establishment of the City of Refuge National Historical Park in Hawaii and an area in Virginia to be known as the Booker T. Washington National Monument. An agreement between the city of Bayard, Nebr., the Nebraska State Historical Society, and the Secretary of the Interior paved the way for the establishment of Chimney Rock as a national historic site in non-Federal ownership. Pending as the year closed and subsequently enacted were bills authorizing establishment of Pea Ridge Battlefield National Military Park, Ark., Horse Shoe Bend National Military Park, Ala., and the Virgin Islands National Park. Laurance S. Rockefeller has purchased more than 5,000 acres within the latter park for donation to the Federal Government.

Area Abolishments

Legislation was enacted to abolish Old Kasaan National Monument in Alaska, Castle Pinckney National Monument in North Dakota, and Fossil Cycad National Monument in South Dakota, pending at the end of the year, were later passed and signed by the President.

Boundary Adjustments

Legislation was enacted to authorize the addition of 250 acres to Pipestone National Monument in Minnesota and the exchange of properties at Colonial National Historical Park in Virginia to consolidate Federal ownership there. Legislation was also approved to exclude about 800 acres in the North Unit of Theodore Roosevelt National Memorial Park in North Dakota, to add 60 acres at Medora in the South Unit, and to add about 155 acres to Devils Tower National Monument in Wyoming. Presidential proclamations corrected the description of Hovenweep National Monument in Utah and Colorado and added an important ruin thereto; added 960 acres and excluded 8,266 acres at Great Sand Dunes National Monument in Colorado; and added 320 acres to Rocky Mountain National Park in Colorado. Legislation approved in July added Zion National Monument to Zion National Park.

Bills were introduced, but not passed, to revise the boundaries of Lassen Volcanic National Park; to authorize additional acreage for Whitman National Monument, Wash.; to establish a Dinosaur National Park; to revise the boundaries of Sequoia and Kings Canyon National Parks, Calif.; and to extend the boundaries of Oregon Caves National Monument.

Special Studies

A contract was entered into with the Fort Hays Kansas State College to make a study to determine the location and extent of any remaining typical segments of original Great Plains grasslands.

Threats to the National Park System

The Corps of Engineers proposed the Smoky Range Dam in lieu of the Glacier View Dam on the north fork of the Flathead River. This proposal, opposed by the Department, would flood approximately 8,700 acres of Glacier National Park. There have been recurrent proposals to open Joshua Tree National Monument to prospecting and mining.

The continued and forceful opposition of conservation organizations throughout the country to the proposal to authorize construction of a dam at Echo Park, in Dinosaur National Monument, resulted not only in its omission from the legislation which finally authorized the Upper Colorado River project; the legislation specifically prohibited construction of any dams in any national parks or monuments in the upper basin.

Park Practice Program

Pursuant to recommendations made at the Public Services Conference held in Gatlinburg, Tenn., and Fontana Village, N. C., last September, the Service joined with the National Conference on State Parks to afford an effective means of exchanging ideas and experiences on park practices and solutions of park problems of all kinds. A Park Practice Section was established to handle the Service's participation in this joint undertaking.

Advisory and Consultative Assistance

The Service assisted 49 of the States and Territories on 354 occasions on a wide variety of park and recreation problems. Some of the more significant examples are: (1) Assisting the Arizona Development Board in making its survey and report on the need for establishing a State park system, (2) cooperating with the Maine State Park Commission in bringing up to date their statewide park and recreation plan, (3) consulting with the newly created Breaks Interstate Park Commission concerning planning, development, and operation of the highly scenic 946-acre Breaks Interstate Park in Kentucky and Virginia, (4) assisting in the study of forest management practices in Itasca State Park in Minnesota and preparation of the comprehensive

covering report, and (5) assisting the Texas State Parks Board in evaluating proposed park areas at Monohans Sands, Enchanted Rock, and a site on the Stamford Reservoir.

Assistance also was furnished to other Federal agencies such as the Bureau of Land Management, Bureau of Indian Affairs, and the Forest Service. Of particular significance is the development of a cooperative agreement under which the Service will prepare plans for the protection and development of the Dead Horse Point-Junction Butte Recreation Area, an area of outstanding scenic and scientific interest in southern Utah, administered by the Bureau of Land Management.

Real Property and Disposal

During the year, the Service investigated and reported upon 31 applications submitted by State and local agencies to the General Services Administration and other disposal agencies to acquire Federal surplus properties for park, recreation, and historical monument use; and upon 21 applications received by the Bureau of Land Management to acquire public domain lands for similar purposes. The work of determining and enforcing compliance with terms and conditions of the deeds transferring surplus properties now equals or exceeds that of initial investigations and will continue to increase.

State Park Statistics

The Service publication issued under this title for 1955 reveals 2,034 State parks and related recreation areas containing more than 5 million acres; expenditures of $21 million for capital improvements and $34 million for operation and maintenance; attendance exceeding 193 million; 5,657 year-round and 7,980 seasonal employees. Tent and trailer camping increased more than 19 percent over 1954.

Regional and Basinwide Surveys

A brochure, Our Vanishing Shoreline, summarized the results of an 18-month survey to determine the remaining opportunities to preserve outstanding natural seashore areas along the Atlantic and gulf coasts. Funds were donated to the Service for both survey and brochure. Of 126 undeveloped areas studied, 54 were recommended for some form of public ownership. Special reports were prepared on 16 of the most significant areas. At least two, the Great Beach area, on Cape Cod, and Cumberland Island, Ga., were considered of national significance.

The Recreation Subcommittee of the Columbia Basin Interagency Committee was organized and has been engaged in a basinwide analysis

of recreation. It has participated also in the reappraisal of the water-control possibilities of the Rogue River Basin. The development of long-range plans in the Missouri River Basin Recreation Survey was continued. Work was begun on a study of the recreation resources of Delaware River Basin.

Special Recreation Surveys

In the California Central Valley, activities in the Upper American River Basin included the preparation of a reconnaissance report on the recreation potentials of the basin and cooperation with other interested agencies to protest plans which would have resulted in the invasion of the Desolation Valley Wilderness and the inundation of Gold Discovery Site State Park.

Substantial progress was made on the recreation-resources portion of the Department's study of the natural resources of the six major coastal drainage basins of northwest California.

With the establishment of a field office in Yuma, Ariz., preparation of a recreation master plan for the Lower Colorado River was begun.

In cooperation with the State of Missouri a plan was prepared for the conservation and development of the recreation resources of the Current and Eleven Point River Basins, which were determined to be of such significance as to merit cooperative action by Federal, State, and local government agencies.

Reservoir Development

Cooperative studies of individual water-control proposals and projects included the appraisal of 11 sites for the Bureau of Reclamation, 1 area for the Fish and Wildlife Service, and 1 Corps of Engineers project. Review of applications for Federal Power Commission permits dealt with 25 proposals.

Four agreements were negotiated: State, county, and municipal agencies, for the administration of reservoirs constructed by the Bureau of Reclamation. The California Legislature voted in favor of transfer of the Millerton Lake National Recreation Area to the State for administration by the State Division of Beaches and Parks.

Nationwide Recreation Plan

Work was initiated on the National Recreation Plan, one of the important phases of the Mission 66 program. The nationwide study, to be completed in 1961, will focus attention on the growing need for outdoor recreation facilities and the role of the various levels of government in meeting this need.

ADMINISTRATION

Budget and Finance

Appropriations.—The cash appropriations to the Service for the 1956 fiscal year were substantially greater than those for the 1955 fiscal year. A large portion of the total increase was represented by a larger amount of cash appropriated to liquidate roads and trails and parkways contract authorization than was provided in 1955 and by additional amounts provided in supplemental appropriations to meet increased salary costs. While the Service's obligational authority for 1956 was greater than that for 1955, such increases were not as great as those reflected in the cash appropriations. The comparative amounts are as follows:

Appropriation item	1955 fiscal year	1956 fiscal year	Increase or decrease
Management and protection	[1] $9,227,730	$10,443,000	$1,215,270
Maintenance and rehabilitation	[1] 8,441,968	9,094,000	652,032
General administrative expenses	[1] 1,100,000	1,250,000	150,000
Construction	4,118,200	8,425,000	4,306,800
Construction (liquidation of contract authority)	9,500,000	19,654,300	10,154,300
Total cash appropriations	32,387,898	48,866,300	16,478,402
Construction (unfunded contract authorization for roads, trails, and parkways)	10,500,000	3,845,700	−6,654,300
Total obligational authority	42,887,898	52,712,000	9,824,102

[1] These figures include amounts transferred from other departmental appropriations to cover increased pay costs.

New accounting system.—The new accounting system, which has been in the process of development as a cooperative undertaking of the General Accounting Office, the Department's Division of Budget and Finance, and the Service's Branch of Finance for the past 2 years, was installed in 15 of the 28 Field Finance Offices, including the five regional offices, during the 1956 fiscal year. It will be installed in all of the Finance Offices by December 31, 1956.

Changes in budgetary procedures.—In accordance with the recommendation made in 1953 by the Department's Organization and Management Survey Team, and in 1954 by the Accounting Survey Team, new budgetary procedures put into effect during the 1956 fiscal year require the consolidation of the field estimates by the regional offices into regional budget submissions.

Inventory control and equipment management.—During the 1956 fiscal year, a new heavy equipment inventory control system was established and basic principles and standards for equipment management were prescribed. Incident to putting the inventory control system into effect, equipment surveys were conducted throughout the Service on a regional basis to determine whether the Service has excess equipment items and what additional items are needed, and

to recommend equipment inventory levels at the various field areas. The survey was completed in May 1956. The new system of inventory control and the new precedural requirements are expected to result in much better utilization of equipment and in improvement in equipment management.

Personnel Management

Personnel actions.—The year brought a heavy volume of personnel actions, continuing the pattern established in the preceding year by the large number of transfers, promotions, and reassignments resulting from reorganization and from the staffing of the new Region Five Office. The most important action was that of establishing and filling the position of Associate Director early in the second half of the fiscal year. The appointment of Eivind T. Scoyen, a career employee, to this position resulted in shifts in several high level positions in the Service. Scoyen was promoted from Superintendent, Sequoia and Kings Canyon National Parks.

Assistant Director Thomas J. Allen succeeded Mr. Scoyen at Sequoia and Kings Canyon; Chief of Lands Jackson E. Price became assistant director; and Chief of Concessions Management Donald E. Lee became chief of lands. Region One Chief of Operations, A. Clark Stratton, was appointed chief of concessions management.

Decentralization of authority.—The trend toward decentralization of authority to field officials was continued. The most important single development was the establishment of 7 new personnel officer position, 1 in each of the 5 regional offices and 1 each in the Eastern Office and Western Office, Division of Design and Construction. With the addition of these positions, the level of appointing authority delegated to Regional Directors and to the chiefs of the two Design and Construction Offices was increased from grade GS–9 to grade GS–11, and a similar increase was made in the appointing authority of superintendents in grade GS–13 and higher. The addition of the Regional Personnel Officer positions was also responsible, in part, for a decision that, for the first time, limited position classification authority (through GS–7) could be delegated to the Regional Directors.

Staff operations.—The reduction in the volume of individual cases, which resulted from the broadened delegation of authority to field officials, enabled the personnel staff to devote more time to staff operations, such as the preparation of manual material and standards. For the first time, a Personnel Management section appears in the Administrative Manual of the Service, and chapters on position classification, training, leave, and retirement have been completed. Revision of the class specifications for the park ranger series adopted

in 1948 was completed and is now in the hands of the Civil Service Commission.

Training.—Continued strong emphasis was placed on training and employee development. To get the decentralized classification authority off to a good start, the new Regional Personnel Officers were put through an intensive 6-week position-classification training course in the Washington Office.

The 15th general administration training course was conducted in the Region Four Office for the benefit of 24 employees, bringing to 365 the number of men who have completed the course since 1941.

A pilot course in instructor training, with splendid assistance from the California State Board of Education, was undertaken very successfully by the Region Four Office at Sequoia National Park, Calif., in April, for the benefit of selected supervisors and instructors from Region Four field areas.

The year also saw the completion of a very important training aid, The National Park Service Manual of Training Methods, a publication designed to acquaint supervisors with the more important methods and principles of individual and group instruction.

Safety

Visitor-accident fatalities.—Visitor-accident fatalities for the calendar year 1955 followed the pattern of previous years, namely, about one visitor-accident fatality per million visitors. For 1955, the rate was 1.08 per million visitors. Motor vehicle accidents and drownings continued to be the leading causes. The increasing popularity of small motorboats suggests the needs for a more active program of water safety in locations such as Lake Mead National Recreation Area.

Training of personnel.—At the request of the Regional Director, Region Three, Santa Fe, N. Mex., a course in the installation, operation, maintenance, and inspection of liquefied petroleum gas systems was given at Big Bend National Park to selected Region Three personnel.

Employee safety.—The Service is cooperating fully with the Department in its employee safety program. The helpful interest of the Department in employee safety has stimulated increased Service activity in this field.

Current problems.—The Service is aware of its responsibility for the safety of visitors and employees. An expansion of the safety staff will be made as soon as practicable in order to meet such responsibilities more adequately and to prepare safe practice standards, keep them up to date, and handle all such matters more expeditiously.

DIVISION OF AUDITS

The internal audit program carried out by the Division of Audits is intended to provide management with an objective appraisal of operations and to provide a systematic and recurring review of all phases of financial management. As a result of this program many recommendations have been made which have been of significant value to management. Effective procedures have been established for issuing reports on audit and other examinations, and for determining whether appropriate action is taken. Major reports completed during the year included those on the audit of the United States Park Police; the Organizational Structure of National Capital Parks; McKinley Park Services, Inc., Mount McKinley National Park, Alaska; and the operations at Yellowstone National Park, Wyo.

The difficulty of recruiting auditors qualified to participate in this broad internal audit program at the grade levels authorized continued to be a major problem.

The claim of $25,074.15 against the Sutton Line, Inc., resulting from a prior year audit was settled by the Department of Justice. The claim against B. B. Wills in the amount of $54,765.71 is still pending.

NATIONAL CAPITAL PARKS

Physical Improvements

Significant physical improvements in the parks of the National Capital included the Columbia Island parking lot at the motorboat marina; a new dining hall at Catoctin Mountain Park; Roosevelt Island comfort station; Annapolis interchange and completion of landscaping of all other interchanges on the Baltimore-Washington Parkway; and the reconstruction of East Beach Drive from Broad Branch to Military Road in Rock Creek Park.

Special Events

Some 290 special events were held in the parks, including such major undertakings as the Christmas Pageant of Peace, the Independence Day Celebration, and the President's Cup Regatta.

Visitor Services

Historical and natural history programs were carried on, including school assembly talks, junior naturalist training course, and organized museum visits. A 3-minute recording for visitors was introduced at

the Washington Monument. An extensive collection of photographs and other relics were donated to the Lincoln Museum.

Research and Planning

The study to determine the most appropriate treatment for the preservation of Ford's Theater progressed with the completion of the reports on the historical and architectural features and the structural analysis. A historical study on the Old Stone House and a research paper establishing the site of "Suter's Tavern" were completed.

Investigations were made to improve the floodlighting at the Thomas Jefferson Memorial and the Washington Monument and for new electrical services at the Washington Monument. Construction plans were completed for the Virginia section of the George Washington Memorial Parkway from Spout Run to Glebe Road.

Scientific research projects in agronomy, plant pathology, and horticulture, in the control of crabgrass and Dutch Elm disease, were conducted.

Protection

The United States Park Police were commended by President Dwight D. Eisenhower for their services during the 51-day Capital Transit strike.

Land Acquisition

Some 37 land parcels were acquired, including the Smoot Sand Gravel Co. tract which permits construction of the George Washington Memorial Parkway from the Lorcum Lane connection to Chain Bridge in Virginia.

OFFICE OF TERRITORIES

Anthony T. Lausi, *Director*

THE primary function of the Office of Territories is to coordinate rather than to control the relationships between the Federal Government and its territorial areas. It was established, not to govern, but to promote the growth of self-government. This does not preclude the exercise by the Office of direct governmental responsibilities in areas where political and economic realities require it. But in such areas the ultimate goal is the transfer to territorial people of all the obligations of democracy which they can reasonably be expected to assume.

This kind of policy is the antithesis of colonialism. It means that one measure of the success of the Office of Territories is the extent to which it can divest itself of political and economic responsibilities.

A major accomplishment along this line occurred in fiscal year 1956. In Alaska the mental health program will at long last become a territorial responsibility as a result of the enactment by the Congress and approval by the President of the Alaska Mental Health Enabling Act of 1956. The Office of Territories, through a private hospital in Portland, Oreg., has administered Alaska's mental health program for many years. Nevertheless, the Office, in cooperation with the Department of Health, Education, and Welfare, played a major role in recommending and securing the legislation which will eventually transfer this obligation to Alaskans.

As a result of the passage of the Federal Aid Highway Act of 1956, Alaska's road program, long operated by the Office of Territories, is being transferred to the Bureau of Public Roads in the Department of Commerce. Henceforth, the Territory of Alaska, with respect to highway developments, will be treated far more as though it were a State than has been true in the past.

The Alaska Road Commission was created 51 years ago to build and maintain Alaska's highway system and has been operated by the Department of the Interior since 1932. Road construction in the Terri-

tory was greatly stimulated by the program of military construction which followed Word War II. Appropriations to the Commission which had averaged $1,600,000 per year from 1932 through 1947 jumped to over $20 million per year during the following 8 years.

As a result the period of Interior responsibility for building and maintaining Alaska's highways has seen old roads reconstructed and new roads built connecting all the major cities in western Alaska with high standard roads, almost all of which have been hard surfaced. Many secondary and farm roads have also been built and, equally important, all of the primary system and much of the secondary system is now kept open to traffic winter and summer alike.

The needs of the future will require large additions to Alaska's highway system. In the meantime the Department is transferring its responsibilities to the Bureau of Public Roads in the sure knowledge that the highway construction and maintenance program under the Department's supervision has made a great contribution to the economic and social life of Alaska and to the defense of the United States.

The Department continues to operate The Alaska Railroad but is proposing legislation which will make it a government corporation. The Railroad closed the fiscal year with a net surplus of more than $2 million, while at the same time track, roadway, and equipment were greatly improved, new transportation services were inaugurated, and many freight rates reduced.

In the Trust Territory and in American Samoa the responsibilities of the Department of the Interior, through the Office of Territories, are both more direct and more comprehensive than in most other territorial areas. In these Pacific islands the fiscal year has brought important advances in local government, public health, and education.

In the Trust Territory another islander has become a top district official. While the process is necessarily a slow one, a major administrative goal in the Department is the appointment of Micronesians to government positions, including official positions as rapidly as they can be trained to take over such responsibilities.

An historic development in local government occurred in Ponape when the village of Kolonia became the first chartered town in all of Micronesia. In the field of public health the use of new drugs has come close to eliminating from trust territory islands the dread scourge of leprosy.

In American Samoa important progress has been made in an area where meager resources have meant straitened economic circumstances for many Samoans. While improvements in agriculture have been made, the most significant change has been a tripling of exports

through the operation by private enterprise, with government encouragement, of a large fish cannery.

The first commercial air service to these islands began operations during the year and plans for a large airport were progressed which will make American Samoa an essential stop on major Pacific air routes.

Passage of the "omnibus bill" for Guam made a number of Federal laws applicable to the island. This means that Guam can now be included in various programs of the Federal Government relating to health, education, and welfare.

ALASKA

Territorial Prosperity Continues

The high level of economic activity in Alaska continues to confound the prophets who have expected a decline based on decreases in governmental expenditures, particularly in defense construction. It is true that the decline in Government spending has been much less than anticipated. It is also true that private enterprise activity has shown healthy growth.

In western Alaska the success of The Alaska Railroad in achieving a $2 million surplus while reducing freight rates in the face of declining gross revenues is of some signficance. The Railroad lost business to the military Haines-Fairbanks pipeline, but increased its commercial traffic and made substantial economies in operating expenses.

The influence of Federal expenditures will, of course, be very great in the Territory for years to come. But maintenance activities increase as construction declines, while private business, generated in the first instance by military expenditures, goes on to serve both civilian and military needs.

In southeastern Alaska the utilization of the vast coastal forests is destined to be far more important to Alaskan prosperity than government expenditures in that area. Pulp manufacture which began at Ketchikan is extending north and there is growing interest in the possibilities of both pulp and lumber throughout the Panhandle. During the fiscal year preliminary timber sales were made covering approximately 12.75 billion board-feet, looking toward the construction of pulp and lumber mills at Juneau and Sitka.

In western Alaska, interest in oil and gas development continues unabated. While no strikes have been made, drilling has continued, and additional areas of petroleum exploration are being sought.

Legislative and Political Developments

The Department of the Interior recommended to the 84th Congress the enactment of several items of legislation designed to encourage the further economic development of Alaska and to permit the Territory to provide the services required of it by its citizens. Among those enacted were laws authorizing Alaska to incur bonded indebtedness; releasing funds held in escrow under the Tongass Timber Act for road and school purposes; authorizing the Secretary to dispose of lands now included within highway, pipeline and telephone line withdrawals; and creating an International Rail and Highway Commission to study new overland transportation routes between Alaska and the United States.

The 1955 Alaskan Legislature authorized the election of delegates to a convention convened for the purpose of drafting a constitution for a future State government. The convention which met at the University of Alaska concluded its deliberations on February 5, 1956, with the signing of the draft constitution by the delegates. The document was presented to the electorate of Alaska on April 24, when it was ratified by a majority of the voters. In accordance with the terms of ratification of the constitution, a copy has been transmitted to the President for submission to the Congress.

Alaska to Assume Responsibility for Mental Health Program

One of the outstanding items of legislation enacted by the 84th Congress with respect to the Territories was the Alaska Mental Health Enabling Act, approved by the President on July 28, 1956. The act becomes effective 210 days after its approval date.

This legislation, Public Law 830, vests in the Territory of Alaska authority comparable in scope to that of the States and other Territories in the field of mental health and authorizes the Territorial Legislature to enact such laws on the subject of mental health as it deems appropriate. Public Law 830 also provides a financial grant over a 10-year period of $6 million to assist in the development of a comprehensive mental health program; a grant of $6,500,000 to construct hospital facilities in Alaska, and a grant of 1 million acres, including mineral deposits, of vacant, unappropriated, and unreserved public lands in Alaska. Income and proceeds from such lands are to be administered as a public trust and must first be applied to meet expenses of the mental health program.

Commitment procedures for the Alaskan mentally ill were enacted by the Congress in 1900 and have been virtually unchanged since that date. For the past 50 years the Department of the Interior has provided the care and treatment for these persons through a contract with

a private institution at Portland, Oreg., with 365 patients under care on June 30, 1956.

The Department of the Interior on May 17, 1955, submitted to the 84th Congress legislation to modernize antiquated commitment procedures and transfer responsibility for mental health to the Territory including various grants substantially the same as those finally adopted by the Congress. The commitment procedures were approved by the American Medical Association, the American Psychiatric Association, and the National Association for Mental Health.

Widespread public misunderstanding concerning the commitment procedures led the Senate to delete them from the bill and to adopt a provision giving the Territory full authority to establish such procedures. In adopting this course of action the Senate Committee on Interior and Insular Affairs stated that it "wishes to go on record as stating emphatically that its action is in no way a repudiation or disapproval of the provisions approved by the House of Representatives and endorsed by such a large number of qualified experts."

The Alaska Railroad Earns Surplus of $2 Million

Despite almost a million-dollar decline in revenues, The Alaska Railroad developed new freight and passenger traffic during fiscal year 1956. Services were improved and new equipment was purchased. No congressional appropriations were requested and net income was again over $2 million.

Overnight passenger service between Anchorage and Fairbanks started during the winter, when two renovated sleeping cars were acquired from the Pullman Co. The new train, "The Midnight Sun," was well received by the traveling public and a third sleeping car was added in the spring. The daylight passenger train, the "AuRoRa," was suspended until summer.

Shippers received benefit of lower rates, under Tariff 5–M, on through cargoes between Pacific coast ports and the Railbelt. This was achieved mainly by increasing the minimum weights for carload freight.

Diversion of traffic to the Haines-Fairbanks military pipeline reduced the movement of bulk petroleum products. Revenue losses were offset by the introduction of unit rail box and trailer-on-flat-car (piggy back) services, which brought new traffic to The Railroad.

Nine unit rail boxes equipped with Thermo King temperature control units were purchased for experimental use. The 24-foot vans are loaded with perishables in Seattle and transported by steamer, flatcar, and truck to the consignee in Anchorage. With their practicability proved, 65 more units were on order—40 nonrefrigerated and 25 with temperature control devices.

Physical improvements started during the year included reconstruction of the Seward dock, with two berths and adequate transit sheds planned. Sixty miles of the Seward-Portage section were ballasted with crushed gravel and three steel bridges in the Matanuska Valley were completed. Over 300 telegraph poles were replaced. New train radios were installed and six locomotives were equipped with dynamic braking devices.

Management improvement programs included further refinement of the new accounting system and the reclassification and rewarehousing of railroad stores. Inventory was reduced substantially. A departmental reorganization was effected to more clearly define staff and line authority. Wage increases made during the year added $280,000 to annual employee payroll.

Summary of The Alaska Railroad income and expenses

	1955	1956
Operating revenues	$17,719,769.04	$16,750,984.84
Operating expenses	13,576,031.52	13,956,082.17
Net operating income	4,143,737.52	2,794,902.67
Other income (net)	−1,526,458.80	−717,646.92
Net income	2,617,278.72	2,077,255.75
Operating ratio—percent	85.80	88.40

Important to the Railroad and to territorial transportation are the plans of the Alaska Steamship Co. to construct two 18-knot trainships for service between Seattle, Wash., and Whittier, Alaska. Each vessel is designed to carry 110 rail cars and forty 40-foot trailer vans with service every 4 days. Bids for construction of the vessels were scheduled for opening in September 1956.

Alaska Road Commission

The Alaska Road Commission, created by act of Congress in 1905 as an agency of the War Department and transferred to the Department of the Interior in 1932, has administered the major portion of the Territory's highway development program. The highway system under the jurisdiction of the Commission on June 30, 1956, totaled more than 3,500 miles.

The present highway system consists of a net of all-weather routes connecting the ice-free ports of Valdez, Seward and Haines with interior Alaska's principal cities and military installations, and with the continental United States via the Alaska Highway through Canada. A secondary system connects farming, mining, and industrial areas to the primary network. In addition to the connected network,

the system includes 570 miles of isolated roads connecting inhabited areas with air, rail, or water transportation facilities.

During the 1956 fiscal year, 48 projects valued at $23,577,413 were under contract, 27 of which, valued at $17,160,493, were carryover projects from prior years, and 21, valued at $6,416,920, were awarded during the year. Twenty-five projects, valued at $10,055,789, were completed during the year, leaving a balance of 23 active projects valued at $13,521,624 on June 30, 1956.

Winter maintenance mileage has increased steadily in the past several years, until the entire primary system and approximately 1,000 miles of the feeder system are maintained open the year-round. The fact that winter maintenance has been provided over increased mileages without a substantial increase in appropriation reflects the increased efficiency of the Commission's maintenance operation. The Congress appropriated $3,500,000 for operation and maintenance purposes for fiscal year 1956.

The Federal Aid Highway Act of 1956, Public Law 627, approved June 29, 1956, extended the benefits of the Federal aid highway program to the Territory for the first time. The Act also provided for the transfer of the Alaska Road Commission to the Department of Commerce within 90 days of approval of the legislation. At the end of the fiscal year negotiations were underway between representatives of the Departments of Commerce and Interior looking toward the transfer, tentatively set for September 16, 1956.

Alaska Public Works Program

In 1949, by Public Law 264, the 81st Congress authorized a $70 million program of public works in Alaska to foster economic and social development through provision of facilities for community life. This 5-year act was later extended by Congress to June 30, 1959. Under this program the Federal Government, upon application by a public body, such as the Territory, a city, a school or utility district, finances the entire cost of construction of approved projects and, upon their completion, transfers them to the public bodies for whom they are built at prices that will return to the Treasury of the United States not less than 50 percent of the total cost.

Through the fiscal year 1956 the Congress appropriated $53,708,200, with which 126 projects have been financed, including 49 schools, 6 hospitals, 8 other municipal buildings, 34 sewer and water projects, and 29 other projects, including streets and utilities. Of these, 75 projects, costing approximately $29,371,000 have been transferred to applicants, and 15 others, costing in the neighborhood of $4,677,000, are in process of transfer. There are 24 projects, estimated to cost $15,836,000, under construction. Of the remaining 12, estimated to

cost $3,741,000, some will be under construction this summer and the others will be started at the beginning of the 1957 season.

This has been a popular program in Alaska and Alaskan citizens have been more than willing to authorize the necessary taxes to repay their share of its cost. While there remains to be appropriated only $11,324,000 of the originally authorized $70 million, there are pending at the present time applications for projects estimated to cost $40,860,000.

HAWAII

Conditions in Hawaii during the year were excellent in almost all respects. The economy of the Territory continued its rising trend and the increased collections of the general excise tax indicated that the volume of business on which the tax is based was larger than ever before. Tourism continues to hold out the best promise of immediate gains in the wealth of Hawaii. During the last 6 months of the year tourists arriving in the islands exceeded the number arriving in the same period the previous year by 25 percent.

During the year a 3-year labor agreement in the pineapple industry and a 5-year agreement in the sugar and stevedoring industries were negotiated. These agreements should insure a more favorable outlook in the three industries. The reasonably constant price of sugar during the year was helpful to the sugar industry and a majority of the plantations paid dividends. The larger producers in the pineapple industry improved their mainland marketing conditions considerably with consequent beneficial results in their economic position.

TRUST TERRITORY OF THE PACIFIC ISLANDS

In the Trust Territory of the Pacific Islands project has followed fast on project, and program on program, with the Administrative offices and the district centers sharing in the activity. In the present stage of island development progress in local government, in health and education, and in business life continues to depend more on the initiative of the Federal Government than will be true in the future.

During the fiscal year financial problems were satisfactorily resolved which have heretofore prevented the payment of compensation to Micronesians for land used by the United States during and after World War II. Such payments were begun in May 1956, with $39,918.24 paid on 229 separate claims in Truk District. Arrangements were completed in June 1956, for the transfer from the Department of the Navy to the Office of the High Commissioner of $1,245,000, originally appropriated by the United States Congress for settlement of these claims.

A United Nations visiting mission consisting of four members and accompanying secretariat made an exhaustive tour of the districts over a month's period beginning February 13, 1956. In June, the Acting High Commissioner served as special representative of the United States in reporting to the United Nations Trusteeship Council on the administration of the Trust Territory during the 1955 fiscal year.

Significant progress in local government during the year included actions of the Palau Congress in implementing the collection of taxes and fees, establishing a district budget, setting up minimum qualifications for elementary school teachers and providing financial assistance in aiding teachers to attain established standards. In Truk, for the first time, the annual Magistrates' Conference approved a district-wide budget. In Ponape, the first chartered town in Micronesia (Kolonia), came into being.

Improvements in Agriculture and Transportation and Communication

Since copra is the main export and agriculture the principal industry of the Trust Territory, a strengthening of the Department of Agriculture and Fisheries was a major administrative objective. A noted specialist was engaged on a 2-year contract to study methods of increasing the quality and quantity of copra produced, dried and marketed. A staff marine biologist was employed to carry out a similar project with respect to trochus, which is the second most important resource. New lands were made available during the year for homesteading, a program which is being accepted favorably in the territory.

Majuro in the Marshall Islands District has become established as a world port, with major ocean-going vessels calling for the collection of copra and delivery of trade goods. A Marshallese-owned company has taken over the Marshall Islands intradistrict shipping, with two ships in service as of June 30, 1956, and another expected to be in operation before August 1956. Local trading companies in other districts are making plans for assuming some of the intradistrict shipping duties which are currently provided under Government contract.

Major radio stations in the districts and at Guam were linked by high-powered transmitters, and new efficient antenna systems have replaced the old. All Trust Territory communications traffic is expected shortly to be routed through Truk where the Chief Communicator is stationed. Eighteen secondary stations have been installed outside district centers.

Work proceeded on needed public works facilities in the districts, including power plants, warehouses, reefers, roads, administration housing, and harbor and dock installations. Construction expenditures for the fiscal year ended June 30 amounted to $932,253.16.

Education and Public Health

A permanent site, selected in Ponape District for the Government-operated Pacific Islands Central School, has been surveyed and preliminary plans drawn. The addition of a third year of schooling at PICS will go into effect in September 1956, with 25 graduate students enrolled. Continued stress in the districts was placed on the development of study materials in the local languages and teacher training sessions were held throughout the territory. In cooperation with other departments, particularly health and sanitation, coordinated team visits were made to local municipalities.

A new hospital was completed in the Rota District, and additional hospital facilities were placed under construction at Koror (Palau District), Ponape, Truk, and Yap. The school of nursing was moved from Ponape to Palau District, and a permanent concrete structure erected. Grants from the China Medical Board of New York help support the work of the school. A model health center has been created at Ngerechelong, Babelthuap Island, Palau District.

Use of the newest sulfone (DDS) for leprosy has succeeded in almost eradicating the disease from the Trust Territory. The total number of cases now is only 30, as compared with more than 100, 5 years ago. All were transferred from the leprosarium at Tinian during the year and are now being treated in their home districts. Tuberculosis remains the biggest health problem, and educational health programs were directed toward preventive measures and early detection of existing cases.

Management Improvements

In the field of management, an inspection program and a property accountability system were instituted. The first annual capital inventory was submitted, as of April 30, 1956, to the Office of Territories. An electrical consultant surveyed the power needs of the districts to determine how these needs could be met at the lowest possible cost and a research consultant conducted a survey of the tax structure and potentialities of the territory. Safety measures were increased throughout the territory.

A development expected to improve the personnel situation was the transfer of the majority of American employees from appointed contract status to competitive civil service. Two Micronesians were

elevated to top administrative positions, Dwight Heine as District Director of Education, and Arobati Hicking as District Director of Public Health, both in the Marshall Islands.

Budget and Expenditures

Obligations incurred during 1956 in the administration of the Trust Territory were as follows: High Commissioner's Office, $34,766.37; judiciary $44,310.15; construction, $932,918.12; operations and administration $5,933,258.52; total obligations, $6,945,253.16. Of the foregoing obligations, a total of $5,984,359.00 was actually expended, leaving $960,894.16 as unliquidated obligations at the end of the year. The 1957 budget is for $6,250,000.

GUAM

Progress and improvement characterized the activities of the Government of Guam during the fiscal year 1956.

More than $31 million worth of goods poured through Guam's commercial port during the year. The port was able to complete repayment of its original $100,000 operating capital into the Government's general fund.

During the year, cargo-handling rates were reduced and a large expansion of port facilities was undertaken with Navy cooperation. A stepped-up training program continued as work efficiency levels rose.

The Department of Agriculture continued its program of promoting more modern farming methods and there was an increased use of demonstration and experimental farms. Livestock breeds were further improved. Gratifying results in poultry-improvement programs had a marked effect in the reduction of the price of fresh eggs in the face of heavy local egg demand in both civilian and military markets.

The Department of Medical Services was able to report a sharp reduction in the death rate from tuberculosis, the island's most serious health problem. The inauguration of BCG tuberculosis vaccine programs throughout the Island was an important step in reducing TB on Guam to a minimum. Continued emphasis was placed on preventive medicine and public education through the Public Health Division.

Important additions were made to Guam's educational facilities. During the year the $300,000 Santa Rita School was completed, and the Inarajan junior high school was under construction. Initial work was also started on the new Tumon junior-senior high school. Academic standards are high, and the demand for teaching personnel

is being met. However, school facilities remain a serious problem for the Government of Guam.

The tax enforcement program continues under the Department of Finance. In fiscal 1956 the income tax audit section was successful in locating $127,000 in delinquent taxes due the Government of Guam. A promising training program to increase local accounting personnel was initiated.

Training activities also included a stepped-up program for public safety personnel. Guam has noted a sharp decrease in traffic accidents and traffic fatalities and vice and gambling are at negligible levels.

The Department of Land Management during the fiscal year, brought up to date a heavy backlog of land records, an important step in unsnarling Guam's land title problems. The third Guam Legislature passed an important zoning code for Agana.

In public works, the new Guam Memorial Hospital was in the final construction stage and the important Agat-Umatac road, which brings southern villages closer to Agana, was completed. Public utility facilities are continually being expanded to provide more service to more people, as additional funds become available.

AMERICAN SAMOA

A quickening in economic activity was the major feature of fiscal year 1956 in American Samoa. This was reflected in the increased number of letters of credit and loan applications in the Bank of American Samoa, and the fact that money turnover has been accelerating.

Encouraging advances have been made in the fishing industry which employs about 350 people per day. The canning and processing of fish constitutes the major new industry in American Samoa. Approximately $4,600,000 worth of fish and fish products were exported during fiscal year 1956.

Improvements in Air and Water Transportation

Improved air and surface transportation to Hawaii and the mainland also contributed to an improved economic situation. January 1956, for example, marked the beginning of the first regularly scheduled commercial airline service to American Samoa. Improvements were made in existing facilities to accommodate these flights and it is expected that during fiscal year 1957 the territory will be served by two regularly scheduled flights per month.

Plans for an international airport to accommodate large commercial aircraft have been developed and heavy equipment for construction is being assembled for transfer to the Government of American Samoa.

This territory, by reason of its facilities and location, will thus be able to provide the most modern commercial air facilities in the islands of the South Pacific.

During the year the Government terminated its operations in the interisland shipping business and transferred its activities to private enterprise. The leasing of the petroleum tank farm to a United States oil company was made possible by airport improvement and increased surface shipping. These developments resulted in replacing what previously had been essential governmental services.

Pago Pago Harbor was improved in fiscal year 1956 and the number of freighters putting into the harbor has increased greatly. In November 1956 the Matson Navigation Co. will institute a South Seas passenger service with two new luxury liners, scheduled to stop at Pago Pago once each 21 days.

Future Development Possibilities

Plans for future economic development will emphasize the tourist industry, and local cottage industries, chiefly handicraft and mat making. It is expected that about 10,000 persons will visit American Samoa each year, which will mean greater local cash income, particularly through the sale of handicraft items. The need for coordinating the various aspects of territorial development resulted in the establishment of a development and planning office for economic, social, and political matters.

Local Government, Education and Public Health

Much thought and work has gone into plans for a greater degree of self-government for the Samoan people. Work has continued on the draft of a constitution, which is nearly ready for consideration by a constitutional convention. Also, more responsibility is being placed on Samoan employees, and Samoans are being employed to replace stateside employees wherever possible. Added Samoan representation on boards and commissions has resulted in increased participation in policy decisions.

In public education, villages continue to improve and construct their own school facilities by means of group effort. A good permanent school building, made of locally fabricated concrete blocks, has become a mark of distinction and pride. Two villages completed new buildings of this type during the year and three others commenced work on them. With the assistance of the Barstow Foundation, a scholarship program was established to send four Samoan teachers annually to Hawaii or the mainland for further training.

In the field of medical services, the staff of physicians was increased to 5, 1 of whom is the first locally born Samoan to receive a medical degree. An educational program was instituted to provide occupational therapy for patients hospitalized for long periods of time. Three teachers provide school-type educational facilities for patients, mostly children, confined to cardiac and tubercular wards, and for patients in the leprosarium.

The total cost of operations during fiscal year 1956 was $1,579,042.94. Accrued revenues totaled $670,205.85 as compared to $591,317.00 in fiscal year 1955. Export values in fiscal year 1956 jumped to $4,933,988.40 from $1,270,548.10 in fiscal year 1955, largely due to the export of canned tuna.

THE VIRGIN ISLANDS

On August 15, 1955, the President of the United States announced the appointment of Walter A. Gordon, of California, as Governor of the Virgin Islands to succeed Governor Archie A. Alexander who submitted his resignation effective August 31, 1955. Governor Gordon took the oath of office in Washington on October 7, 1955, and assumed office in the Virgin Islands on October 16.

On January 26, 1956, the Governor convened a special session of the Legislature to consider the revision of an inadequate tax law, appropriations for 5 of the 9 departments of the Government as well as for the Legislature, and other measures. Fifteen of the items on the agenda were passed and approved, 1 was vetoed, and 2 were tabled by the Legislature.

During the first of the year contracts were let for the waterfront highway, St. Thomas, and for the construction of two schools in St. Croix, the consolidated elementary and high school in Frederiksted, and the elementary school at King's Hill. Approximately $100,000 was spent on repair and construction of highways and roads on St. Thomas, and $150,000 on St. Croix. For sewer expansion on St. Croix, $90,000 was allocated, and $40,000 on St. Thomas; $58,000 was allocated for the extension of the Telephone System on both islands; $125,000 was used to purchase heavy construction equipment to meet the demands required by the public works program.

Construction projects on the Island of St. John were held in abeyance pending approval of the proposed Virgin Islands National Park by the Government of the United States. However, the construction of new schools at Cruz Bay and Johns Folly, and the renovation of those at Coral Bay were completed.

Many of these projects were begun under the Federal Virgin Island public works program, previously administered by the Office of Terri-

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tories. The Revised Organic Act of the Virgin Islands (Act of July 22, 1954) transferred responsibility for this program to the territorial government. The transfer was completed during the fiscal year and plans for all projects, included in the Federal program, were turned over to the Virgin Islands Government which was thus enabled to get important work under way with a minimum of delay.

For the first time positive steps were taken by the Government to improve the fresh water supply in the Virgin Islands. A tug and a water barge, capable of carrying 266,000 gallons of fresh water, were purchased. Water has been successfully brought in from Roosevelt Roads, Puerto Rico and, unless there is a dire emergency, it will not be necessary again to request the Navy to bring water to the Virgin Islands.

A contract was made with an engineering firm to study the airport needs of the Virgin Islands in order that advantage might be taken of Federal participation in airport projects. The Legislature appropriated the sum of $200,000 this year to match Federal funds of $600,000.

In the Department of Health, the Division of Special Health Services was organized to promote and coordinate the public health services and medical care programs. A nurse-midwifery training program was instituted, the fifth annual mental workshop was conducted, and fluoridation programs were put into operation. A major accomplishment was the installation of a full-time resident physician on St. John.

A $15,000 fire on St. John, where there is no firefighting equipment, indicated a need to correct this situation immediately. At Richmond Penitentiary a new program has been instituted whereby inmates are kept gainfully occupied in many fields. A recreational park has been constructed by the prisoners within the penitentiary.

In September 1955, a veterinarian was employed in the Department of Agriculture and Labor. It was found that hog cholera existed in several sections, and a quarantine was placed in effect until the vaccination program in St. Thomas and St. John was completed.

The Department of Tourism and Trade performed such duties as were possible within the limits of the extremely low budget which was appropriated by the Legislature. During the year 32 cruise ships visited St. Thomas and 60,000 folders were distributed to travel agents, airlines, and steamship lines. The Department of Education inaugurated a hotel training school to assist the hotels in securing qualified personnel.

The total amount of the revenues received during the year for the operation of the government, was $5,289,666.86. Of this amount, $2,553,993.85 were received from local taxes; $357,781.20 were received from fees and other revenues and taxes; and $2,377,891.78 were received

from (i) matching funds, and $2,045,332.98 from (ii) funds under the provisions of the Organic Act.

Virgin Islands Corporation

The Virgin Islands Corporation is responsible for aid in developing the economy of the Virgin Islands. Its principal operations cover the production and manufacture of sugar, provision for electric power, making of loans, and carrying on certain action programs which contribute to agricultural development and land and water conservation, such as the construction of dams, land clearance, reforestation, and livestock improvement. The agricultural programs are coordinated and carried out in cooperation with various agencies of the United States Department of Agriculture.

During 1956 VICORP produced 83,570 tons of sugarcane. The production per acre was 36.52 tons—the highest on record, and for the first time in its history the Corporation showed a profit, $53,696.86, in the production of sugarcane. The Corporation processed 135,258 tons of sugarcane and manufactured 12,885 tons of raw sugar. The factory operation has continuously shown substantial financial losses, and while some improvement was made, 1956 losses amounted to $357,091.70.

Power operations have improved steadily, both in efficiency of service and income, since the acquisition of the local power facilities by the Corporation. While consumer rates have been substantially reduced, 1956 net income amounted to $84,799.59. Power was extended to two small islands in St. Thomas harbor and a project to provide power to the Island of St. John was begun. Extensive reconstruction and building of new distribution lines were carried out on both islands.

A total of 18 earth dams were completed, 14 in St. Croix and 4 in St. Thomas and St. John, making a total of 84 dams constructed to date under this program, with a total estimated impounding capacity of over 400 million gallons of water. The results of the dam program have been so oustanding and effective in providing water and in raising the general water table with resulting increase in available well water, that its monetary value would be difficult to calculate.

The other agricultural programs, including land clearance, improved livestock production, and forestation, have also contributed to the overall development of the islands, particularly in St. Croix. Appropriations for these purposes and for the dam construction program amounted to $130,000, all of which was used during the fiscal year.

The Corporation has operated for the second year the properties located on St. Thomas, formerly utilized by the Navy and now as-

signed to the Secretary of the Interior under a use permit. These properties consist of the airport, housing facilities, dock facilities, beaches, and miscellaneous buildings leased as hotels and for industrial purposes. The income from these properties during 1956 amount to $152,113.

PUERTO RICO TRAINING PROGRAM FOR TECHNICAL ASSISTANCE

The Puerto Rico training program for which the Department of the Interior serves as the Washington office continued to expand during the fiscal year 1956. Nearly 1,000 foreign nationals from all over the world visited Puerto Rico for purposes of academic or inservice training, or to act as observers of various activities carried on by the Commonwealth government and private enterprise. The number of foreign nationals by area and sponsorship is shown below for the period July 1, 1955, to June 30, 1956.

Sponsor	Latin America	Near East, Africa, and South Asia	Far East	China and Indochina	Canada and Europe	Total
International Cooperation Administration	297	66	116	23	9	511
ICA-Caribbean DOTS	138					138
United Nations and specialized agencies	92	13	2	2	1	110
U. S. Department of State	55					55
Nongrant	53	1	2	2	1	[1] 59
Other foreign visitors	54	22	5		9	90
Total	689	102	125	27	20	963

[1] Includes 20 grants made by Puerto Rico under the Commonwealth exchange program.

—United States visitors concerned with technical assistance (not in total), 60.

Office of the Administrative Assistant Secretary

D. Otis Beasley, *Administrative Assistant Secretary*

THE Administrative Assistant Secretary discharges the duties of the Secretary with respect to administrative management, including Administrative Services, Budget and Finance, Inspection, Management Research, Personnel Management, Property Management, and Security. Secretarial divisions bearing these titles are under his direction and supervision.

A report for each staff division is included:

Division of Administrative Services

Floyd E. Dotson, *Director*

THE Division of Administrative Services maintained its full program of services to the Department plus supplying the housekeeping and operating services to the Office of the Secretary, other departmental offices, and the Commission of Fine Arts. Despite a heavy increase in load levels all work is on a current basis.

Branch of Library Services.—Statistics for the Central Library show—31,469 reading room patrons; 18,464 telephone calls; 94,293 items circulated; 6,557 inter-library loans; 16,317 reference queries; 89,512 books and periodicals received. Total holdings rose to 448,257 volumes.

Fiscal Section.—Normal budgetary and accounting services were provided for all units of the Office of the Secretary, other departmental

offices and the Commission of Fine Arts. Expenditures for the year totaled approximately $7 million and operations financed from the working capital fund came to slightly more than $1,200,000. The Section also handled the control budgeting and reporting work on approximately $3 million transferred from other Federal agencies for work performed in their behalf by the various bureaus and offices of the Department.

Records Management.—Approximately 400 cubic feet of obsolete records were destroyed and 150 feet of low-activity records were transferred to storage space. One hundred and five file cases were released to other agencies.

Personnel Operations.—An employee handbook was developed for distribution to all new employees to assist in their orientation toward the Department's programs and activities. Under authority of Public Law 763, several categories of positions were transferred from Classified to Wage Board status and a wage board was established to fix their wages. The usual personnel services were supplied to all units of the Office of the Secretary, other Departmental offices, and the Commission of Fine Arts.

Museum.—Visitors to the Museum totaled more than 50,000 for the year, and more than 10,000 people attended the periodic showings of educational and historical films. Twenty-two regular exhibits were updated and seven special exhibits on current Department programs were put on display.

Central Services.—Statistics for the year show 20,000 duplicating jobs, 3,300 telephone changes, 14,000 photographic jobs, 2,500 printing and binding requisitions, 7,000 requisitions for stock supply items, 2,800 procurement actions, and 6,000 dispensary treatments.

Division of Budget and Finance

Sidney D. Larson, *Director*

THE Division of Budget and Finance is responsible for staff supervision of the budget and financial activities of the Department. It represents the Department in these fields working in liaison with the Bureau of the Budget, other Federal agencies, and appropriation committees of the Congress.

Appropriations made to the Department by the Congress for the fiscal year ending June 30, 1956, totaled approximately $455 million,

of which $204 million was appropriated to the water and power bureaus and $251 million to the other bureaus of the Department.

The Division continued its program of improving the budget justifications submitted to the Congress in order to make them concise, easily understood, yet fully reflect the need for the funds requested. Forms and procedures used to present summary budget information to the Secretary and Assistant Secretaries were simplified. Thus, these officials were provided with an effective basis for deciding policy on the type and magnitude of departmental budget programs. In accordance with the Hoover Commission recommendations on Budget and Accounting, reviews of the Department's budget structure were initiated. Determinations of those areas where changes in the activity breakdown would be desirable were being made in order to more nearly align the budget structure with the organizational pattern of the bureaus.

The Division participated in the joint programs of the Bureau of the Budget, Treasury Department, and General Accounting Office for improving accounting and fiscal reporting. An accounting survey was instituted in the Bureau of Mines to determine the need for modifying the present accounting system due to a change in procedures for authorizing work projects. Assistance was given to the National Park Service in the installation of a modern accounting system in the various fiscal offices of the Service. Continued assistance was provided other bureaus of the Department in accounting systems improvements and other fiscal matters.

The Division continued to cooperate with the General Accounting Office and with the bureaus of the Department in the comprehensive audit program and provided the leadership for correcting deficiencies in fiscal and other matters set forth in the audit reports.

Division of Inspection

W. Darlington Denit, *Director*

THE Division of Inspection is responsible for the inspection and special investigative activities of the Department. A formalized program of inspection was initiated in the fiscal year 1955, and substantial progress in program development has occurred during the past fiscal year. Major responsibility for actual inspection performance is placed in the bureaus of the Department. The bureaus report that

many inspection assignments were completed during 1956 and greater diversity in inspection work is being developed.

The major underlying purpose of the Department's inspection program is to preserve and foster high standards of moral and ethical conduct in the management of the Department's affairs. The increasing momentum of the inspection effort is providing information which enables the anticipation of regulatory needs and the application of corrective measures.

The investigative phase of the activities of this Division has been sponsored by the Department for many years. This activity extends, in the main, to special investigations of alleged administrative irregularities in the discharge of official duties. Special investigations of other matters within the responsibility of the Department are conducted as authorized by the Administrative Assistant Secretary. Only limited investigative authority has been delegated to the bureaus. During fiscal year 1956 a general improvement in the investigative program was made possible by organizational and personnel changes. An accumulated backlog of investigative cases on which no final decision had been made was removed and the rate of performance in field investigations was sharply increased. These factors have contributed to a total result which finds the investigative case load being handled on a current basis in all respects.

The Government employment policy of nondiscrimination, as provided in Executive Order 10590 and related Department regulations is being applied on a departmentwide basis. Specific complaints of discrimination have been at a minimum and periodic checks have revealed conscientious policy compliance in all bureaus.

Division of Management Research

Arthur B. Jevens, *Director*

THE Department's objective of expanding program performance with a minimum of increases in appropriations and personnel has given impetus to the development of more efficient and effective administrative processes. The Division of Management Research provides facilities for initiating, defining, and coordinating efforts throughout the Department towards accomplishing this objective.

The continuing development of the Departmental Manual, established last year to provide a single medium for the issuance of secre-

tarial instructions, remains a major work assignment of the Division. Organization statements for all of the bureaus and offices have been published in the Organization Series of the Manual and are maintained current as changes in organization receive Secretarial approval. Policies and procedures in the field of departmental administration have also been issued and include instructions on a number of aspects of personnel management, finance, management improvement, administrative services and records and other property management. In the Program Series of the Manual, departmentwide instructions on watershed protection, the leasing of Federal farmlands, and fire protection and assistance have been published.

The Division conducted specific studies assisted by other Secretarial Divisions on the specialized problems relating to the functions of land appraisal and Indian education.

The Land Appraisal Study identified problem areas; outlined basic objectives, functions and programs; and recommended resolution of the management problems revealed.

The Indian Education Survey examined the management aspects of the education function of the Bureau of Indian Affairs including the evaluation of the administrative, financial, and staffing requirements of the program. Members of the survey team compiled basic source material, conducted field studies and prepared a written report on the organizational effectiveness of the existing program, and made recommendations for improvement of the general management pattern.

The management bulletin Management Highlights inaugurated last year by this Division has become an important medium for disseminating significant administrative management information to supervisors throughout the Department. It is published bimonthly and carries articles by members of the Division and others in the Office of the Secretary on their various management specialties, as well as reviews and summaries of articles on management in general. Increased demand for copies of Management Highlights has resulted in broader distribution. It is estimated that at least 8,000 supervisors read each issue.

The following reflects a cross section of the Division's other projects and outlines the scope of assistance rendered to the bureaus:

1. Coordination of the preparation of special reports and replies to the House Civil Service Committee's Subcommittee on Manpower Utilization and Federal Personnel Management;

2. Development of recommendations concerning the feasibility of establishing a centralized administrative service for the Department's activities in Alaska;

3. Initiation and participation in preliminary studies on the application of electronic computers and arranged for a Seminar on this subject;

4. Cooperation with the Cabinet Secretariat in the establishment of an effective committee management program;

5. Development and preparation of a Civil Defense Emergency Operation Handbook for use by the Department in connection with the relocation and emergency planning;

6. Assisted the Bureau of Land Management and Geological Survey work toward the development of a memorandum of agreement on mineral leasing procedures;

7. Assisted the Bureau of Indian Affairs in the reorganization of the Commissioner's Office; and

8. Coordination of the reports on the Commission on Organization of the Executive Branch of the Government.

The annual scheduling of management improvement program projects has been reviewed and the instructions revised. It is now clearly limited to major items for which scheduling is appropriate and useful. The former method included many day-to-day improvements which added considerably to the reporting burden.

There has been an increase in the Incentive Awards Program activities. This effort is directed toward the recognition of employees and supervisors on suggestions and improvements in the manner of carrying out the Government's business and rewarding individuals and groups for outstanding performance and meritorious distinguished service. During the past year there has been an 81.5 percent increase in the number of suggestions received and an estimated savings totaling over $7,600,000.

		Dollar savings
Number of suggestions received	2,897	$766,628
Superior performance awards	556	5,167,285
Special act awards	25	1,651,400
Honor awards granted:		
Distinguished	43	
Meritorious	111	
Commendable	263	

Division of Personnel Management

Newell B. Terry, *Director*

DURING this year the activities of the Division of Personnel Management were geared to increasing demands in the field for personnel administration and to a highly competitive labor market in the critical occupations. At the end of the fiscal year the Department had 54,143

employees on its rolls. To carry out its programs large numbers of professional, subprofessional, and supporting personnel are required. Recruitment in these fields has been difficult. The Division conducted 2,700 interviews with applicants for all types of positions, and answered 2,200 letters of inquiry about employment.

A Branch of Safety Engineering was established within the Division in September 1955, dedicated to the prevention of accident losses in cooperation with bureau and office safety programs. A program has been formed to reduce accidents which provides for continuing executive direction, definite assignment of responsibilities, effective engineering controls, adequate safety training, employee cooperation, and accident records to show causes, trends, and costs.

The Division worked in cooperation with the Civil Service Commission in bringing about within the Department broad programs to enhance recruitment possibilities. Among these were the extension of the civil service to Alaska, Guam, and the Trust Territory of the Pacific Islands; increasing the minimum pay rates for engineers; and administering the Federal Service Entrance Examination.

A comprehensive review was made of all training activities in the Department resulting in a strengthened and reissued training policy. Twenty-nine bureau trainees successfully completed the seventh Departmental management-training program which covered a 7-month period. The training program was handicapped by a lack of adequate authority to provide training in non-Federal facilities.

Pursuant to Public Law 763 approximately 2,300 Classification Act employees were changed to wage board schedules. Conferences with Alaska Railroad employee representatives resulted in a study of prevailing wage rates and employment conditions in the Anchorage-Fairbanks area of Alaska. A uniform pay schedule was established for seasonal employees in Alaska to be effective January 1, 1957. Classification and wage administration training conferences held in Denver, Portland, and Washington were attended by 208 conferees from all bureaus of the Department.

Fifty Civil Service regional inspection reports provided a means of reviewing personnel management throughout the Department. In addition, special studies were made and numerous reports prepared concerning many phases of personnel administration. Some were prepared as a basis for program development, others to meet requests for information from the Congress, the Bureau of the Budget, and the Civil Service Commission. The Division is especially pleased that one audit report disclosed the fact that the Department of the Interior had the lowest record of sick leave used of any agency participating in the study.

A complete revision of the departmental personnel instructions was instituted. This includes chapter issuances as part of the Depart-

mental Manual, a personnel management letter series for issuing temporary instructions and information, and a general information bulletin series to convey information about functions and programs.

The Division participated in mobilization planning including the establishment of an Interior executive reserve unit.

Division of Property Management

N. O. Wood, Jr., *Director*

DURING the fiscal year 1956 the Division of Property Management developed criteria for determining the real property needs of the several bureaus, and directed the disposition of a number of major property holdings which proved to be excess to the Department's program requirements. In the field of contracting and procurement, the Division developed guideline regulations for administration of the "Buy American" act to carry out the purposes of Executive Order No. 10582, and issued detailed procedures for the Department giving full effect to the small business preference provision of section 214 of the Small Business Act of 1953, as amended. Additional emphasis was also placed on the observance of the nondiscrimination provision of Federal contracts, in cooperation with the President's Committee on Government Contracts. Educational material explaining this program was given widespread distribution.

As implementation of a Hoover Commission recommendation on paper work management, a directive was issued requiring each of the bureaus to establish and maintain a forms management program; guidelines were outlined to assist the bureaus to meet the departmental standards. Disposition of inactive and obsolete records continued satisfactorily. At the end of the year there were more than 80,000 cubic feet of inactive records of the Department being stored and serviced by Federal record centers.

Field inspections of the real and personal property operations, inventory practices, and records management procedures undertaken during 1956 and recognition was given to field auditor's reports submitted by the General Accounting Office with corrective action taken where appropriate.

During the year 306 radio frequency assignments were issued to provide for the radio-communication requirements of the various offices and bureaus of the Department. Individual frequency assign-

ments registered with the International Telecommunications Union totaled 323. Procedures were developed for the processing of frequency assignments for broadcasting stations under the control of the Department. Procedures were also developed for issuing certificates to operating personnel of Interior ship and aircraft radio equipment. Assistance was given the Office of Defense Mobilization in the development of mobilization plans for the use of radio frequencies in wartime emergency.

The staff of the Division continued its participation on a number of interdepartmental boards and committees established to improve administrative regulations and establish technical standards on a governmentwide basis.

Division of Security

J. Cordell Moore, *Director*

THE activities of the Division of Security during the fiscal year ending June 30, 1956, have placed specific emphasis upon physical security and civil defense. The physical security area has been extensively studied; recommendations were made and implemented with effective results.

The Division of Security continued planning development in the civil defense area of its responsibilities. The disaster relief program under Public Law 875, 81st Congress, continues to improve as more experience is gained by the field organizations. The Regional Defense Liaison Officers organization has been modified, utilizing, where possible, the field committee chairman as Departmental Defense Liaison Officers (DDLO's). In each civil defense region, the DDLO's have made considerable progress in developing inventories of technical personnel, material and equipment which would be useful in disasters of all types. The Department's participation in disaster assistance during the past year indicates a very satisfactory degree of liaison with FCDA at local, State and National levels. It is also apparent that the Department's planning has had concrete results in aiding various disaster areas.

The Division of Security, in cooperation with others of the Department, contributed to the development of relocation and continuity of Government planning. The Department's operations in this area have progressed effectively.

OFFICE OF THE SOLICITOR

J. Reuel Armstrong, *Solicitor*

THE fiscal year ending June 30, 1956, was a productive one in many respects. This fiscal year was the first full year during which the field offices operated as components of the integrated Office of the Solicitor. The results have been gratifying. The new system has been found to be satisfactory by administrative personnel of bureaus which formerly had their own attorneys in the field. Other administrators are taking advantage of what is to them a new opportunity to obtain legal services in the field. An illustration of this trend was the increasing use of the services of the attorneys in the Portland region by the Fish and Wildlife Service, which in the past has had no attorneys in the field. There was evidence too, during the fiscal year, that the bureaus had begun to follow the advice of this Office to consult the lawyer "on the spot" without respect to his prior "bureau affiliation". Thus, for example, the State supervisor of the Bureau of Land Management turned to the field solicitor at Santa Fe for legal advice and excellent working arrangements have been established between the office of the regional solicitor at Tulsa and the office of the Geological Survey in connection with the administration of oil properties and interests of the Indians.

As was anticipated, the integration of the field offices has in a number of instances divorced lawyers from administrative tasks which were not properly theirs and has made possible a flexibility respecting the assignment of work which serves the interests both of economy and efficiency. For example, mention was made in the report for the fiscal year 1955 of the transfer to the Denver region of the leasing of mineral lands acquired by the Department of Agriculture in connection with land utilization projects. Although the full impact of this work has not yet been felt, the Billings field office, without increase in personnel, examined in excess of 2,000 titles during the fiscal year.

There was no diminution in the heavy volume of legal work throughout the Office. More than 131,000 matters were disposed of during the year. On the whole, the work was kept reasonably current and there were fewer matters undisposed of at the close of the fiscal year than were pending at the beginning. On an average throughout the year there were 173 attorneys in the Office. Substantial progress was made by the examiners of inheritance in the field in disposing of Indian probate cases. Of 3,121 cases pending at the beginning of the year, 1,921 were decided. Some 2,127 new cases were reported, of which 815 were decided. At the end of the year there were 2,512 cases awaiting action. The per capita distribution of tribal funds to the Menominee Indians of Wisconsin and the Kaw Indians of Oklahoma placed an additional burden on certain of the examiners of inheritance. Arrangements were made to accelerate the preparation and prosecution of applications for patents on inventions made by employees. The progress in this field should serve as an incentive to invention within the Department.

A further reduction was made in the number of pending appeals in land cases. Some 184 such appeals were decided during the fiscal year. Seventy appeals were pending at the close of the year as compared with 98 at the beginning. The Board of Contract Appeals took final action on 33 appeals during the year. Of the many appeals in various categories of Indian matters decided during the year, the greatest number involved the preparation of final membership rolls of various tribes under legislation terminating Federal control and supervision. Some 298 such enrollment appeals were decided. Some 237 tort and irrigation claims were disposed of in the headquarters' office and by the regional and field solicitors and final action was taken on 12 appeals from determinations by field attorneys.

The heavy volume of requests for reports on legislative proposals continued from the Congress. During the 84th Congress, 1,373 requests were received as compared to 1,137 for the 83d and 1,158 for the 82d Congresses. Despite the greater number of requests made by the 84th Congress, the Department was able to respond to more than was the case, comparatively, in the preceding two Congresses. The record of enactment of proposals that were on the President's legislative program was one of considerable success. In the second session of the 84th Congress, the Colorado River Storage Project Act (Public Law 485) was enacted, as was the Washita River Basin Act (Public Law 419) providing for the development of water resources, respectively, of the Upper Colorado and the Washita River basins. The bill for the Fryingpan-Arkansas project, Colorado, failed of enactment by a narrow margin. The act of July 4, 1955, relating to the construction of irrigation distribution systems was amended (Public Law

520) to incorporate the changes recommended by the President at the time he signed the original act. The bill to admit Hawaii did not pass, but the Congress did enact the Alaska Mental Health Enabling Act (Public Law 830). Other important enactments were the establishment of the Virgin Islands National Park (Public Law 925), the Fish and Wildlife Act of 1956 reorganizing the Department's administrative machinery for the management of fish and wildlife functions (Public Law 1024). Several acts were passed either terminating or looking to the termination of Federal control over Indian tribes (Public Law 921, Peoria; Public Law 943, Ottawa; Public Law 887, Wyandotte). It is interesting to note that out of 640 bills passed in the second session of the 84th Congress, approximately 190 were of direct interest to the Department of the Interior.

The Federal Range Code, the Alaska grazing regulations, and the rules of practice in land cases were completely revised during the year. The Office participated in the work of the "Interdepartmental Committee for the Study of Jurisdiction Over Federal Areas Within the States" throughout the year. In April the committee completed its study of the practical aspects of legislative jurisdiction over Federal areas within the several States and made several recommendations, which were approved by the President. As an aid to the Department's work a Guide to Federal Tort Law and a Guide to Government Contract Law were prepared during the year. These guides consist of digests of selected judicial and administrative decisions and legal and technical bibliographies.

There follows a selected list of important cases decided by or pending in the courts during the fiscal year, of important administrative decisions, and of significant opinions of this Office. A discussion of cases of especial importance to the Bureau of Reclamation appears in the report of the Commissioner of Reclamation for the fiscal year.

United States v. *Louisiana*, Original No. 15 (U. S. Sup. Ct.).—This suit seeks to determine the respective areas of jurisdiction of the United States and the State of Louisiana on the outer Continental Shelf off the Gulf of Mexico. Opposition of the State during the year to a proposed sale by the United States resulted in a prohibition by the Court of further leasing or the drilling of wells in the disputed areas except by agreement of the parties filed in the Court.

Arizona v. *California*, Original No. 10 (U. S. Sup. Ct.).—This case (which is also noted in the annual report of the Commissioner of Reclamation) involves, among other things, claims to rights in waters of the Colorado River by large numbers of Indian tribes and individual Indians.

Squire v. *Capoeman* (351 U. S. 1).—Direct income from lands allotted to Indians under the General Allotment Act of 1887 is not subject to Federal income taxes.

Yakutat Development Company (63 I. D. 97).—Irrevocable powers of attorney and agrements executed by oil and gas offerors which gave a single agent extensive powers of control over the offers and any leases to be issued and a substantial beneficial interest in proceeds to be obtained under the leases served to make the agent chargeable with the acreage in the lease offers.

M. A. Machris, Melvin A. Brown (63 I. D. 161).—Where an oil and gas lease was relinquished before the end of its primary term but the relinquishment was not noted on the tract books until after the end of the primary term, the land in the lease did not become available for further filing at the end of the 5-year term but only after the relinquishment was noted on the tract books.

Thomas F. McKenna et al. (62 I. D. 376).—The Secretary has no authority to reinstate a relinquished oil and gas lease.

Howard M. Wilson, The Navajo Tribe (63 I. D. 36).—The owner of a fee simple estate in land under a deed reserving the minerals to his grantor is entitled to assert a preference right to purchase contiguous public land offered at public sale and an Indian tribe holding the beneficial interest in land purchased in trust for the tribe by the United States is entitled to assert such a preference right.

Walter H. Bullwinkle, Joseph E. Vogler (63 I. D. 172).—Clarifies the cultivation requirements under the homestead law for an entryman entitled to credit for military service.

The Pelton Water Wheel Company et al. (62 I. D. 385).—The insolvency of a subcontractor or supplier is not an unforeseeable and excusable cause of delay entitling a contractor to the benefits of an escalator clause.

Jeneckes' (62 I. D. 449).—An appeal opens up the entire record and the Board of Contracts Appeals may disallow a claim allowed by the contracting officer.

Sam Bergesen (62 I. D. 295).—Where a contractor voluntarily accepts and signs a change order or similar form of contract modification, he cannot, in the absence of fraud or duress, successfully assert a claim for additional costs alleged to have resulted from changes ordered.

Electric Engineering and Construction Service, Inc. (63 I. D. 75).—A claim based on an alleged unreasonable delay by the Government in furnishing material is in the nature of a claim for unliquidated damages and is not allowable under a provision of the specifications permitting reimbursement for expenses incurred because of suspension of work, when a suspension order was not issued by the contracting officer.

R. P. Shea Company (62 I. D. 456).—A claim for additional compensation because of large overruns in estimated quantities is a claim for breach of an implied condition of reasonability in the clause of

the specifications relating to approximate quantities and constitutes a claim for unliquidated damages which cannot be allowed.

Roxie Thorson et al. (63 I. D. 12).—The reduction or dilution by activities of the Bureau of Reclamation of the mineral content of Soap Lake, Wash., is not a foundation for a valid irrigation claim against the Government.

Kathryn L. Rogers (63 I. D. 150).—The rights and duties of private persons within Yellowstone National Park, a place over which the United States has acquired exclusive jurisdiction, are governed solely by Federal law.

M–36350 (63 I. D. 188).—The Secretary of the Interior has no authority to call a special election for the election of councilmen by an Indian tribe incorporated under section 16 of the Indian Reorganization Act, if such authority is not conferred upon him either by the tribal constitution or by statute.

M–36310.—Tribal royalties from Government leases for the development of oil and gas resources on the Fort Peck Reservation, Mont., are subject to the privilege and license tax authorized by the State under an act of Congress.

Memo, Reg. Sol., LA.—The failure to submit a bid form prior to bid openings is an informality which may be waived when in the interest of the Government where the intention to submit a bid is otherwise sufficiently evidenced by the submission of a properly executed bid bond together with a signed Standard Form 23 (construction contract) which specifies the amount bid and refers to the contract specifications by number.

M–36294.—The act of May 11, 1938, as amended, did not contemplate that title to fishery facilities on the Columbia River constructed on State-owned lands would pass to the States.

M–36322.—Payment of royalties is required with respect to gas produced from certain leases maintained pursuant to section 6 of the Outer Continental Shelf Lands Act on which sulfur mining operations are conducted where the gas is used for fuel in the sulfur mining operations.

M–36330.—The act of June 4, 1954, amending the act of June 14, 1926, providing for the disposition of lands for recreational purposes, did not terminate the provisions for the reversion of title and land-use contained in patents issued under the act of 1926.

M–36295.—Sand and gravel and other low-grade rock materials which are useable only for "filling" purposes and "blow" sand and other materials used principally for agricultural and horticultural purposes are not subject to entry and patent under the mining laws.

M–36351.—Where lands applied for in a State school indemnity selection are classified as improper for such selection, the application

is subject to rejection, but it may not be rejected on the sole ground that the base lands which had vested in the State prior to the inclusion of the land within the exterior boundaries of a reservation are less valuable than the selected land.

M–36222.—The Department is without authority to obtain excess equipment, material, and supplies without reimbursement for the governments of Alaska, Hawaii, Puerto Rico, the Virgin Islands, and Guam but it may obtain such property for the governments of American Samoa and the Trust Territory of the Pacific Islands.

TECHNICAL REVIEW STAFF

Roy W. Morse, *Director*

DURING fiscal year 1956, the Technical Review Staff provided staff services for the Presidential Advisory Committee on Water Resources Policy, of which the Secretary of the Interior was Chairman. Other members were the Secretaries of Agriculture and Defense, with the Departments of Commerce, Justice, and Health, Education, and Welfare and the Bureau of the Budget cooperating in the development of the report. On December 22, 1955, the report was submitted to the President and on January 17, 1956, the President transmitted it to the Congress.

The TRS is responsible for coordinating activities of the bureaus under the Watershed Protection and Flood Prevention Act of August 4, 1954. A Watershed Manual on procedures and policies was issued by the Department on November 3, 1955. As of June 30, 1956, departmental comments on 30 work plans had been submitted to the Department of Agriculture for transmittal to the Congress.

The TRS provides departmental representation on an Antarctic Working Group which recommends operating policy for, and monitors, the United States antarctic program. The principal antarctic matters affecting Interior have to do with the preparation of maps and with geological and biological investigations.

The TRS has continued to coordinate certain aspects of the Department's defense mobilization activities and to do staff work in connection with the secretariat's participation in meetings of the Defense Mobilization Board. Pursuant to arrangements requested by the Office of Minerals Mobilization, a member of TRS serves as operational liaison between the OMM and the Bureau of Mines and Geological Survey in connection with the Department's defense responsibilities in the field of minerals and as staff liaison between the Office of Minerals Mobilization and the ODM on problems of mineral supply. Thus, the TRS has participated in the review of 14 briefing reports and in the preparation of 22 reports concerning the supply-require-

ments situation of individual minerals as requested by the Office of Defense Mobilization. The TRS also provides the departmental representative on the Industry Evaluation Board. From July 1, 1955, through June 30, 1956, 50 analyses—of which several pertained to mineral production facilities—were prepared, reviewed and approved by the IEB, plus a 158-page analysis of telecommunications.

A staff member of TRS is chairman of a group, composed of representatives from the ODM, Departments of Defense and Commerce, and the Federal Power Commission, making a study to evaluate the power situation in the Niagara area in the event of an enemy attack.

The National Rural Fire Defense Committee, on which the TRS furnishes the principal representative for the Department, completed during the year "Guidelines for the Development of Rural Fire Defense Plans and Operations Designed to Cope With Enemy Fire Attacks in Rural Areas of the United States." At the close of the year, plans to accomplish this objective were being prepared throughout the entire United States.

The TRS provided departmental representation on the United States delegation in tariff negotiations held in Geneva, Switzerland, from January to May 1956, under the General Agreement on Tariffs and Trade. The United States completed negotiations with 21 other governments involving trade of about $1 billion, and included concessions given and received on various minerals and fuels and fish and fish products.

The TRS has the staff responsibility for the appraisal of public domain administered by the Department as requested by the House Committee on Government Operations; also for the appraisal of public domain minerals in the continental United States, Alaska, and the Continental Shelf, for areas administered by all Federal agencies. The TRS has prepared appraisal procedures and has acted in a consultant capacity with bureaus and agencies engaged in the actual appraisal work.

The TRS continued to carry the responsibility for the coordination of forest protection programs in the Office of the Secretary. Fire control was signally successful during the year with only 360,803 acres of land burned over, as contrasted to the 10-year average annual loss of over 1 million acres. Approximately 1½ million ribes bushes were destroyed in the program to protect the white pine forests from blister rust. Prompt and effective action was taken against many forest insect infestations.

Staff work as it relates to the coordination of timber management of commercial forest lands either federally owned or in trust, under review by congressional committees, was provided by the TRS. This review has as its primary objectives that of improving timber sale

practices, modernizing timber sale procedures, and increasing the availability of Federal stumpage for sale.

Continuing operations of the TRS include the provision of Departmental liaison with the field committees, with the Bureau of the Budget on coordination of statistical standards, with the National Science Foundation, and with other Federal agencies on program matters of mutual concern. A number of special problems were also referred to the TRS during the fiscal year.

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