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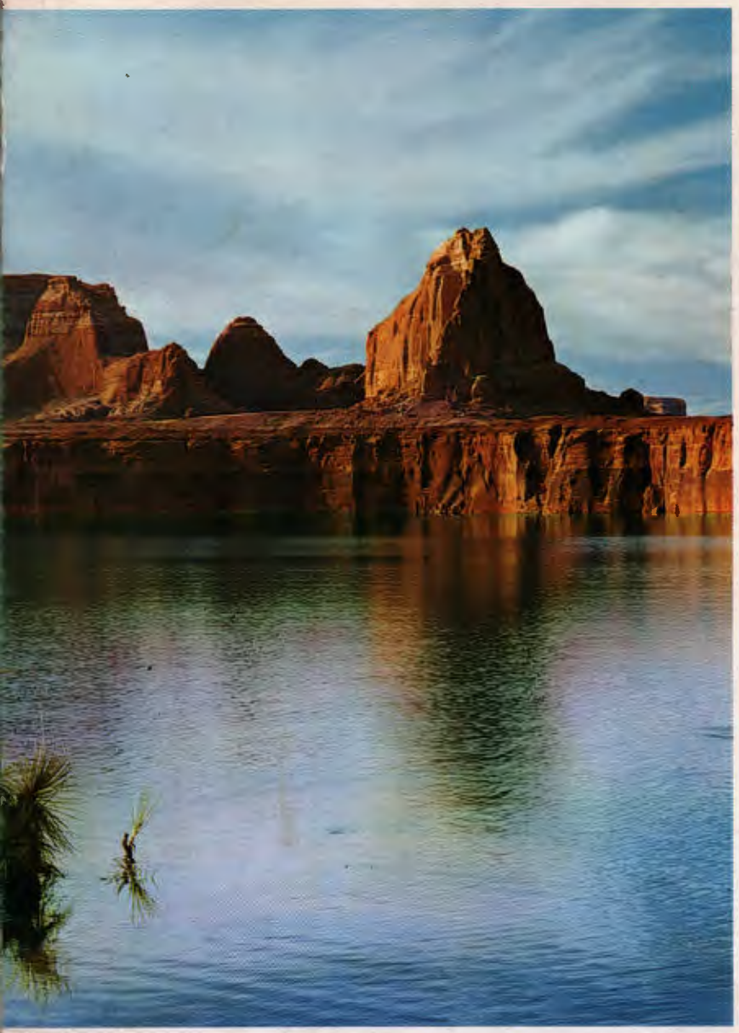
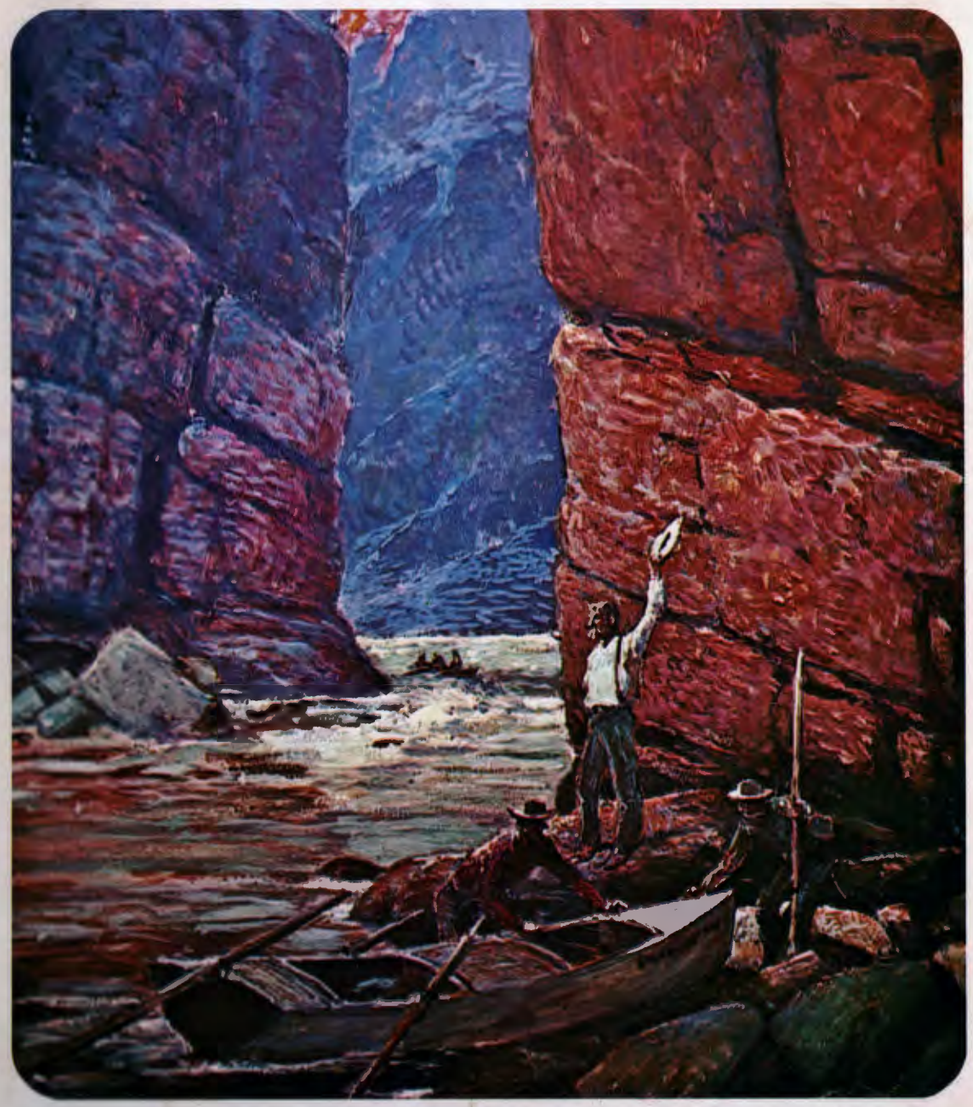


. . . mirrored beauty and inviting pastimes—welcoming at every turn around the huge new man-made lake named after Major Powell in Arizona and Utah.

RECLAMATION era

A WATER REVIEW QUARTERLY



CENTENNIAL ISSUE: 1869–1969

Colorado River Explorer Powell

February 1969 Vol. 55, No. 1

RECLAMATION era

Gordon J. Forsyth, Editor

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United States Department of the Interior
Walter J. Hickel, Secretary

Bureau of Reclamation, Floyd E. Dominy
Commissioner

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Appraisals Note Powell Gains

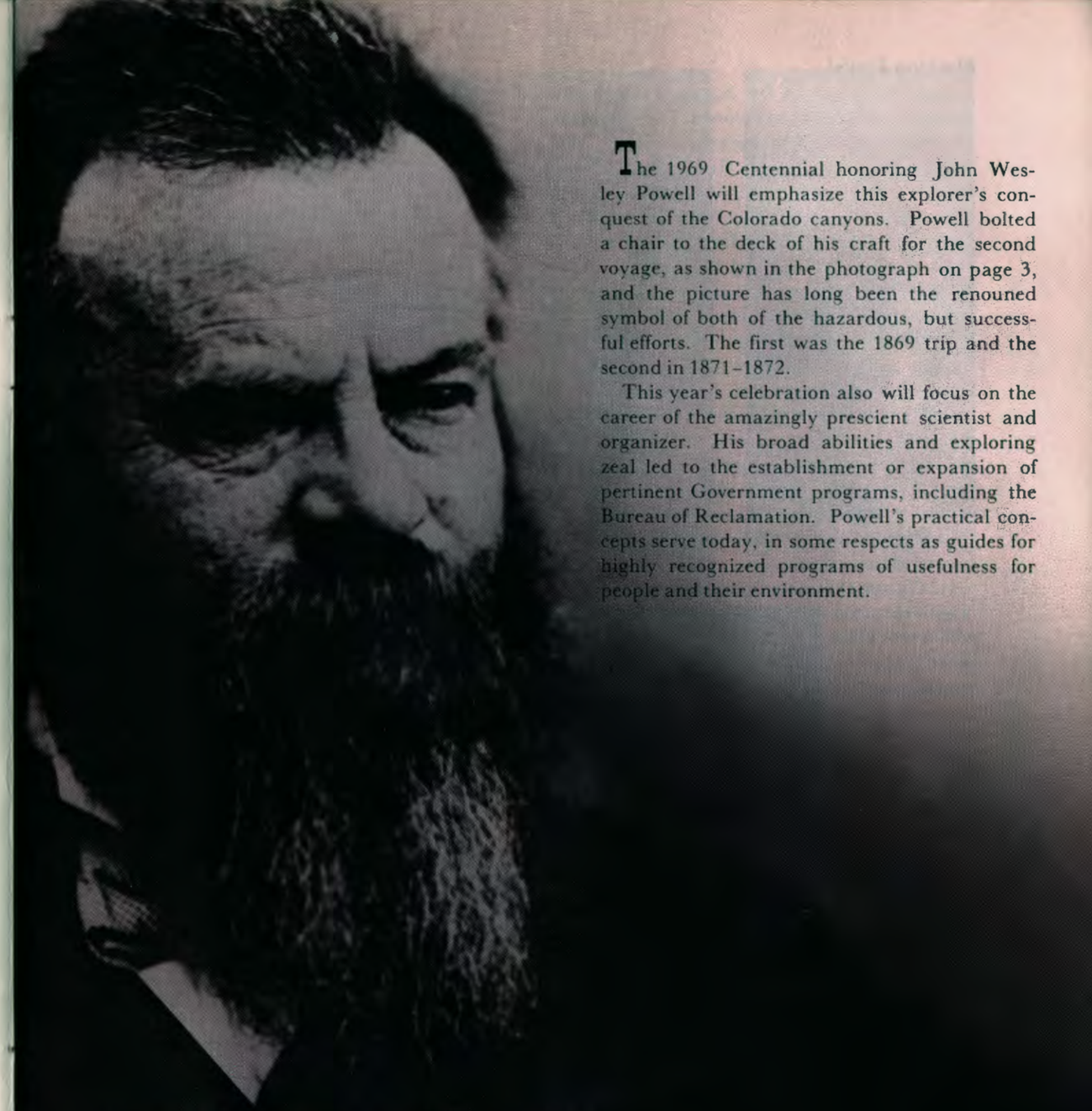
"Goes to Washington as a Scientist"

"Major Powell went to Washington as a scientist, not a politician, and began one of the greatest campaigns in politics—to force upon an unwilling government measures to reclaim the arid West and preserve the natural wealth of the country against the ruthless exploitation and monopoly control by vested interests. The conservation movement, the development of a federal land policy, the elevation of science in government bureaus to a position of dignity, were in large part inspired and directed by Major Powell."—William Culp Darrah ("Powell of the Colorado," Princeton University Press, 1951).

"Personification of Ideal of Service"

"Powell, the personification of ideal of public service that seems peculiarly a product of American experience. As the source and mouthpiece of ideas three quarters of a century ahead of their possible fulfillment, yet rooted in that same American experience. As the father of government bureaus far-reaching in their own effects and influential in the models they provided for other and later government agencies. Above all, as a champion and an instrument of social understanding and social change. . . Major Powell repudiated that reading of Darwinism which made man the pawn of evolutionary forces. In his view, man escaped the prison in which all other life was held, because he could apply intelligence and will to his environment and bend it."—Wallace Stegner ("Beyond the 100th Meridian," Houghton–Mifflin, 1954). (Also see Frank E. Smith's appraisal on page 17.)

The cover presents a color painting of the John Wesley Powell Expedition in action on the famous voyage a hundred years ago. As it might well have happened, the man standing represents Explorer Powell himself. He is exuberantly waving his hat and probably shouting echoing cheers to the crew of the third unpictured boat in his group, or simply at the mystically beautiful canyon along the course of the challenging river; his sturdy companions meanwhile skillfully handling their boating tasks. Artist Nick Eggenhofer did the painting, and our use of it is by courtesy of the Western History Department, Denver Public Library, Colo.



CENTENNIAL TO HONOR Powell

by GORDON J. FORSYTH, Editor

The 1969 Centennial honoring John Wesley Powell will emphasize this explorer's conquest of the Colorado canyons. Powell bolted a chair to the deck of his craft for the second voyage, as shown in the photograph on page 3, and the picture has long been the renounced symbol of both of the hazardous, but successful efforts. The first was the 1869 trip and the second in 1871–1872.

This year's celebration also will focus on the career of the amazingly prescient scientist and organizer. His broad abilities and exploring zeal led to the establishment or expansion of pertinent Government programs, including the Bureau of Reclamation. Powell's practical concepts serve today, in some respects as guides for highly recognized programs of usefulness for people and their environment.

Blocking Travel

Powell was one of the Nation's outstanding examples of scientist-explorers. He launched his two noted journeys from Green River, Wyo. to explore the deeply cut Green and Colorado Rivers, which always were obstacles blocking central travel routes to the West Coast. Immigrants coming from the East either perilously crossed the canyons, tried to cross, or chafed at the delay of detouring scores of wagon-miles around this forbidden region.

Powell was a geologist, ethnologist, and geographer. Also, because he was the first outstanding leader in reclamation, he might fairly be called the fosterfather of reclamation. His assesments of Western resources, and his warnings of land and water-use problems which were sure to develop—largely ignored or opposed in his day—are today reflected in our most advanced programs of dynamic reclamation and conservation.

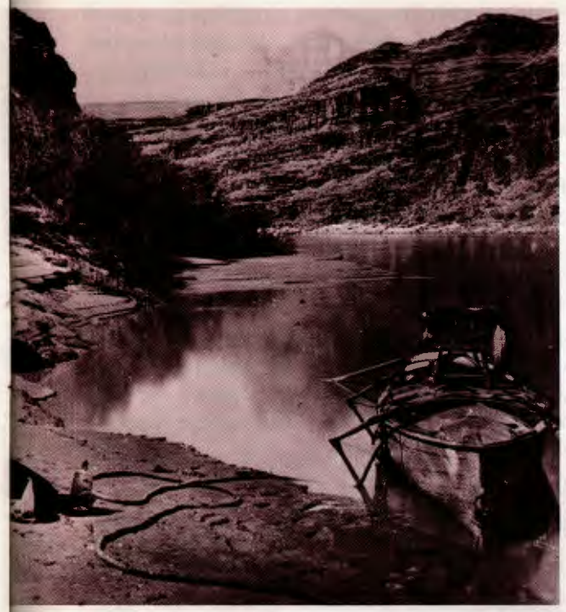
It is fitting that now, burdened as the Nation is with the need to make conservation decisions which will affect posterity, we take the time to recall the continuing contributions of this American who became an heroic figure. Considerable assistance in our understanding him as a person is provided by early photographs exhumed for use in this issue of *Reclamation Era*.

The Photos

Several of the illustrations on these pages had been stored away with only scant explanation of details, but their variety—especially those showing Powell in costumes—denote that he was greatly interested in people and their way of life. His ethnic knowledge and understanding of Indians and their language were some of his highly valued capabilities.

For example, in one photograph he is conferring with a group of Indians, and is seen sitting beside Jacob Hamblin, a famous Indian agent, peacemaker, pioneer and Mormon missionary. Powell spent much time traveling with Hamblin in Utah, Arizona and possibly Nevada. Most of such older photographs were made available from the National Archives, the Library of Congress and the Smithsonian Institution in Washington, D. C.

Powell enjoyed posing in costumes, as seen below, but we found no photos of him smiling. At the scene of action, right, is his chair-boat, "The Emma Dean." The Powell monument with steps is at Grand Canyon, and the taller one is at Arlington Cemetery. At lower center is the Powell group with boats at Green River launching point. At top right, Powell attends 2 Paiute tribal conferences, seated, he is beside well-known Indian agent Hamblin. Lower right, Powell, in right foreground at Survey staff lunch, about 1890.



First 35 Years

Powell was born March 24, 1834, at Mount Morris, New York. The qualities which enabled him so splendidly to perform his many self-imposed tasks, according to one of his companions on the river trip, were an inheritance from his parents, who possessed more than ordinary intelligence. His father's name was Joseph, his mother's Mary Dean. John Wesley was the fourth of nine children.

The family moved to Ohio in 1838, and to South Grove, Wisconsin when "Wes" was 12. The precocious youngster attended such country schools as was provided, but he was largely self-taught.

For brief periods, young Powell attended Illinois Institute, Illinois College, and Oberlin College. He took an early interest in natural science investigations. Before reaching age 27 he had taught school in Wisconsin and Illinois, taken lecture tours, and made long collecting expeditions, including along the Mississippi River.

Convinced that war with the South was inevitable, the winter of 1860 and 1861 found this resourceful man studying military tactics and engineering. He enlisted in the 20th Illinois Volunteer Infantry May 8, 1861. Although the next year he was wounded in the bloody Battle of Shiloh and his arm was amputated, he continued to serve with characteristic strength and fortitude until 1865 when he was discharged with the rank of Major and brevet Lieutenant Colonel.

That same year he returned to the college classroom as professor of geology. But he was still a man of action, and in 1867 and 1868 he led expeditions to the Rocky Mountains. In that arid and semi-arid frontierland he not only collected geological specimens and artifacts, but he also studied and became acquainted with the region's pioneering settlers and Indians.

Other significant events of Powell's life, starting with his celebrated 1869 voyage, are presented on page 23.

Centennial Highlights

Various phases of the John Wesley Powell story will be presented in publications during the National Centennial.

Articles and illustrations on these pages of *Reclamation Era* were especially prepared as a Centennial feature. The Bureau of Reclamation has joined with other agencies and private groups in sponsoring or providing information for a number of Centennial projects.

The Smithsonian Institution and the National Geographic Society also are joining in the observance, the theme being "A Century of Achievement, Our Debt to John Wesley Powell."

Powell's 1869 expedition is planned for reenactment this year. People interested in the history and development of the western United States also will find interest in Powell exhibits which will be on display this spring and summer in various parts of the country.

Publications and Articles

The Geological Survey is preparing publications and a motion picture for the Centennial. That agency, which Powell directed from 1881 to 1894, will distribute a collection of articles under two covers dealing with Powell and his work: "The Grand Canyon Region and John Wesley Powell," and "Powell and the Indians of the Colorado."

The nine-decade-old Survey also will publish an album of some of the best of Beaman-Hiller's photographs of Powell's second Colorado River trip, as well as a popular account of the geology of the Uinta Mountains.

The Survey motion picture will show and describe the geology of the Grand Canyon as Powell viewed and interpreted it.

Other publications planning content on the Powell celebration include: National Geographic magazine, of which Powell was a cofounder; Arizona Highways magazine; the May issue of GeoTimes, published by the American Geological Institute; and a publication by the Sierra Club. Oil companies and the Utah Highway Department plan to print a red line "Powell Scenic Route", or related notations on their highway maps.

River-Runs and Exhibits

An anniversary ceremony of the start of the Powell expedition is planned for May 24 at Green River, Wyo. The day's activities will include formal designation of "Expedition Island" as a National Historic Site by the National Park Service. The complete Powell voyage will be re-enacted by about 6 boat crews to be launched at intervals during that day for a 90-day trip. The river-runs are sponsored by the Sierra Club.

River float trips will depart from Flaming Gorge Dam after the Green River ceremony. These segmented trips will be conducted by Gaylord Staveley, 3225 North Childress Street, Flagstaff, Ariz. 86001. A display of photographs and woodcuts on the life of Powell is being prepared for the tourist season at Flaming Gorge Dam by the Bureau of Reclamation and the Forest Service.

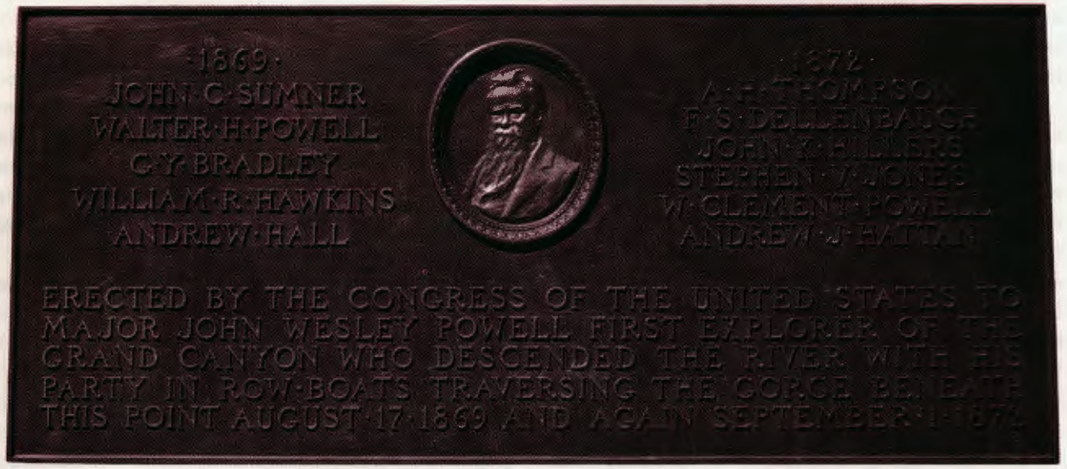
Vistors to Dinosaur National Monument will be able to see an exhibit there, and in Salt Lake City a Powell exhibit will be in the basement exhibit room of the State Capitol building. The latter is one of the special functions under sponsorship of the Utah State Historical Society and associates.

A re-dedication of Lake Powell will be conducted at Page, Ariz. June 19. Among the groups planning to attend this ceremony is a summer school class from the University of Utah. The Page ceremonies also will commemorate the Centennials of both the Powell trip and the completion of the Transcontinental railroad in Utah. The Page-Lake Powell Chamber of Commerce is sponsoring a Powell museum in Page.

In Grand Canyon, where a sizeable monument and engraved plaque have been erected at Powell Point on the south rim, an observance of the Powell party's encampment will be held in early August. Also planned at this site is a Powell family reunion, and observance of the 50th Anniversary of Grand Canyon National Park.

In the Washington, D.C. area there are a number of Powell memorials: A 12—foot high grave monument is at Arlington National Cemetery. The house where he lived in Washington, D.C. is still standing. A sculptured Powell bust is in the Geological Survey library, and a large Powell expedition oil painting is in the museum of the Department of the Interior Building. Smithsonian Institution is preparing an exhibit of their Powell collection of Indian artifacts.

Publications which Major Powell authored, some of which have been used in preparation of articles herein, will be prominently displayed in libraries throughout the country. A few examples of these are: *Exploration of the Colorado River of the West and its Tributaries* (1875), *Canyons of the Colorado* (1895), *First Through the Grand Canyon* (1928), and his best known work on western resources development, *Report on the Lands of the Arid Regions of the United States* (1879).



This plaque at Grand Canyon is in monument on page 3.

Famous Trip Boosts Powell's Career

by MARY C. RABBITT, U.S. Geological Survey

On May 24, 1869, at 1:30 in the afternoon, they started from Green River City, Wyo.—10 men in four small boats. Packed in the boats were 10 months' rations, guns, ammunition, and traps to augment the food supply; ample clothing; tools to build cabins and repair the boats; and a variety of scientific instruments.

Ahead of them lay a region virtually unknown, a blank space on the map.

The Green River at launching point was more than 6,000 feet above sea level, and its rugged course was known for only about 200 miles. They knew the Grand River flowed southwest from its origin high in the Rocky Mountains of Colorado. Somewhere the two rivers would join to form the Colorado River which was best known only in its faraway low reaches a few hundred feet above sea level.

In between was a vast land of mystery, a labyrinth of gorges, high cliffs, and deserts. At only a few places had these barriers been crossed.

There were fantastic stories about the river—those who had tried to explore it disappeared. The Indians were fearful of it.

Three months and six days after the May 24 launching, only five men in two boats emerged from the canyon at "Rio Virgen"—a descent of over 5,000 feet elevation. The men were elated. But they were now gaunt, hungry, their clothing in tatters, their rations reduced to a little unpalatable bread and coffee. They had dared the river and the five men had won.

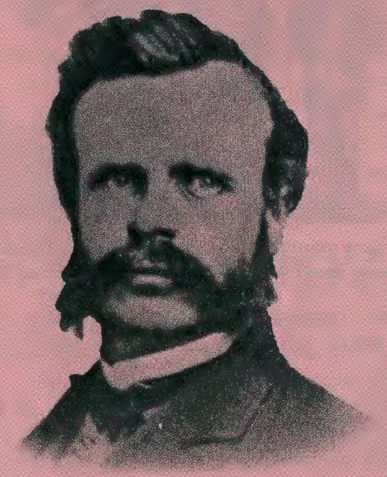
The last unknown part of the United States had been penetrated.

Powell Returned a Hero

The leader of this expedition was John Wesley Powell, returning to civilization a hero, newspapers throughout the country excitedly carried stories of the trip, and he was eagerly sought after on the lecture circuit.

Hitherto Major Powell had been a school teacher, a Civil War artillery officer who had lost his right arm at the Battle of Shiloh, and a professor of natural history at a small Illinois college. The expedition down the Colorado was largely self-financed, though some help had been received from Illinois Normal, Illinois Industrial Institute, the Chicago Academy of Sciences and from the railroads which contributed free transportation.

The trip was purported to be a scientific expedition—its object to "make collections in geology, natural history, antiquities and ethnology" and to "add a mite to the great sum of human knowledge." Yet outside its chief, Major Powell, the crew consisted entirely of amateurs who were serving without pay. Powell said the crew felt remunerated by



MAJ. JOHN WESLEY POWELL in December, 1869, on his return to Wheaton, Illinois, after his exploration of the Colorado River. (Courtesy, William Culph Darrah)

the opportunity to study. But to the hunters, guides, Indian fighters and sportsmen who made up the partnership, the study could have meant *seeing what no white man had seen before!*

The 1869 trip was often recounted simply as an adventure story, without scientific results, and in terms of the stated objectives the results were indeed scanty. Notes were lost, collections were not brought out, the latter part of the trip so arduous and hurried that observations were not made.

The map of the river was based on memory perhaps as much as measurement. Nonetheless, observations on many aspects of the region were registered in Powell's mind, to be developed, correlated with other observations, and a cause determined. So, it can truly be said that many of Powell's later contributions to science, to science in government, and to the development of the West had their beginning in this first canyon exploration.

Labor for Science

G. K. Gilbert, a noted geologist, described this process at the Powell memorial meeting of the Washington Academy of Sciences, when he said: "Those who labor for science do three things: They observe the facts of Nature, taking pains to observe them accurately; they arrange the observed facts in groups, or classify them; and they discover their relations of cause and effect, or explain them. . .The motive which actuates men of science in all this work is the increase of knowledge, but the results of their labor go far beyond increase of knowledge, for they include also increase of welfare."

Major Powell's observations of the famous voyage are recorded in his letters and diary covering the period from July 2 to August 28, in geologic notes, in newspaper accounts of his return and of lectures given during the following months, and in a report written soon after his return for W. A. Bell's book: "New Tracks in North America."

Unfortunately the diary for the first part of the trip was ill-fated, for when the 3 crew members, the Howlands and Dunn, left the river on

August 28, thinking they had a better chance of survival by going overland, only to be killed by Indians—they apparently took all copies with them.

The "Exploration of the Colorado River of the West" published in 1875 is even today exciting to read, but it contains observations of both the first and later trips without distinction. The Major's observations, however, are supplemented by existing letters and diaries of other members of the party.

Powell considered himself primarily a geologist in 1869, and his geologic observations are naturally most frequent. He gives many descriptions of the rocks, and here and there mentions fossils.

Contributions to Geology

Most interesting, however, are references to the rivers and land sculpture, for Powell's greatest personal contributions to geology—so novel and important in their time—have been in a classification and explanation of the behavior of streams and the processes of erosion.

As he later explained, some rivers cut straight into mountain ranges rather than go around them. Water does not flow uphill, so it must be concluded that the rivers are older than the mountains, and cut through the mountains as they slowly rose across the river's path, much as a log is cut when it is held against a revolving saw.

From these ideas he developed a classification of streams and stream valleys, some inkling of which must have been in his mind even in 1869. Because as early as June 2, while they were in camp at Flaming Gorge, he described to the *Chicago Tribune* how the mountains were carved by the waters and that a canyon is a river channel cut through the range. Later, as they approached the junction of the Green and the Grand, he referred to the river in terms of cutting through an anticlinal axis.

The second fundamental concept credited to Powell is that of the "base level of erosion," which he sensed in 1869 when he told an audience at Salt Lake City that the low lying areas of the Mississippi valley were examples of the

Powell gets earnest attention of this Paiute Indian while conversing about water supply location. Arizona 1873.

greatest erosion, and the Colorado, on the other hand, an example of the least possible erosion.

Powell's contributions to geology, of course, were not limited to his personal achievements. He gave freely of his ideas to the specialists who worked with him as both G. K. Gilbert and C. E. Dutton recalled.

Geology Indebted

But geology is also indebted to him for his service in the organization and administration of science. Geology in the late ninteenth century was in a period of rapid growth, maturing and becoming fully professional. In 1869 when Powell made his first trip down the river, there were already three surveys under government auspices in the western territories. The Powell survey would become the fourth.

Eventually, the interests of the different surveys began to conflict. A Congressional investigation in 1874 did not bring about a change, but in 1878 Congress called on the National Academy of Sciences for advice.

The plan which the Academy submitted was very close to that proposed by Major Powell and led directly to the establishment of the United States Geological Survey on March 3, 1879. Powell was not the first director of the Survey—it was left to Clarence King to organize the new bureau—but he became director in 1881.

Then for thirteen years, Powell guided the Survey as it became national in scope, and its program extended to include topography and water resources investigations.

Attention to Indians

The Major gave considerable attention to Indians, an interest that went back to his childhood. He had been encouraged by Joseph Henry, Secretary of the Smithsonsian Institution, to make observations and collections during his trips to the Rocky Mountains in 1867 and 1868. During the winter of 1868–69 he camped close to a tribe of Utes and had made friends with them, studying their language and way of life.

This interest is noted several times in his diary, beginning with the first entry on July 2 about the trip to the Uinta Agency. Also on July 3 he made a visit to observe the Indians' fields. The Major noted that irrigation of the fields had been done by white men, and some sowing as well, but that the Indians were learning fast.

(At this time, most of the Indians had gone to see the railroad which the white men had recently completed at Promontory Point, Utah. This also is a Centennial celebration this year.)

On July 29, just below the junction with the Dirty Devil, he examined the ruins of a house or houses and fragments of pottery. Several times during August he made references to old Indian camps or the remains of old Indian villages.

On September 13, in his lecture at Salt Lake City, one of the interesting discoveries reported by Major Powell was that part of the country had been thickly inhabited by a tribe of the diminutive Moqui (now called Hopi) Indians driven by stronger tribes to the region of the Colorado.

On later explorations in the region, the Major devoted considerable time to learning about Indians. He gained information on their handcrafts and language, their way of living, mythology and beliefs.

So widely did his ability to get along with the Indians become known that in the fall of 1872 he was called on by the Indian agent to address a great council, in their own language, on the advantages of adopting a more settled way of life.

Commissioner to Indians

The following year, he was appointed a Special Commissioner to visit the Indians of Utah and eastern Nevada as part of a program to relocate them on reservations. The report of this trip includes a plea for greater justice for the Indians and for educating them, an idea which was otherwise ignored at the time.

Ethnology had become a serious preoccupation and life-long interest, superseding even geology at times. When consolidation of the surveys was under consideration in 1878, he pleaded for support of ethnologic research by the government. The rapid spread of civilization had placed the white man and the Indian in direct conflict, and while many of the difficulties were unavoidable, many were unnecessary and caused by a lack of knowledge of the Indians.

The Academy made no recommendations about government research in ethnology, but the bill which contained the legislation discontinuing the western surveys and establishing the United States Geological Survey also contained an appropriation for publication of Major Powell's ethnologic researches.

On this basis, the Bureau of American Ethnology was established in the Smithsonian Institution and Major Powell became its first director, continuing to serve in that office until his death in 1902.

Major Powell is best known for his "Report on the Lands of the Arid Region of the United States." This report had been transmitted to the Commissioner of General Land Office on April 1, 1878, and published later that same year. Bernard DeVoto, author, called it one of the most remarkable books ever written by an American, "a book which of itself opened a new era in western and national thinking."

It was more than a report, it was a program, including even proposed legislation. Land west of the 100th meridian, about 40 percent of the country, was arid except in a few areas. Annual rainfall was not enough to sustain an economy based on the traditional patterns of the humid regions. Within this arid region, only a small portion of the country was irriga-

ble, and cooperative labor or capital was necessary for the development of irrigation.

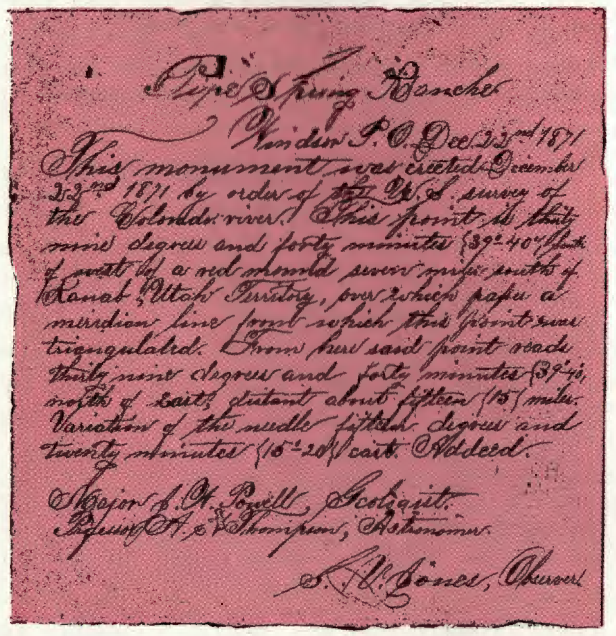
The report pointed out that reservoir sites should be selected and reserved so there would be no problem later in increasing irrigation by storage of water. Timber lands, constituting 20 to 25 percent of the arid region, could not be used as farm lands; they were valuable for forests only and must be protected from fire.

Also In Report

Pasturage lands were of value only in large quantities, and the farm unit there should not be less than 2,560 acres. Pasturage farms, or ranches, needed small tracts of irrigable land and water fronts, so the plots should be shaped by the terrain, and residences should be grouped to secure the benefits of local social organizations.

The ideas he presented in this report had been developed over a period of several years. In the Congressional hearings of 1874 Powell talked of the arid region, questioned how much of it could be used for agriculture, and pointed out the need for revision of surveying procedures.

During the intervening years he hammered away at the same theme, meanwhile accumulating more evidence. But even back in 1869 he had been observing the nature of the country and the uses to which it could be put.


Pipe Spring Ranche
Windsor P. O. Dec 22nd 1871
This monument was erected December 22nd 1871 by order of the U. S. survey of the Colorado river. This point is thirty nine degrees and forty minutes (39° 40') [illegible] of a red mound seven miles south of Kanab, Utah Territory, over which passes a meridian line from which this point was triangulated. From here said point reads thirty nine degrees and forty minutes (39° 40') north of east, distant about fifteen (15) miles. Variation of the needle fifteen degrees and twenty minutes (15° 20') east. Added.
Major J. W. Powell, Geologist.
Professor A. H. Thompson, Astronomer.
S. V. Jones, Observer

Agreed the penmanship is an artful example of a bygone "Handwriter's Age," this 1871 note mentioning Powell and noted Prof. Thompson was found in the 1930's in a surveyor's rock monument in southern Utah.

In his own diary there is the passage already mentioned in which he observed the use of irrigation at the Uinta Agency.

George Bradley's diary (one of his crewmen) records at several places the possibility of irrigation or the suitability of the land for cattle raising, showing that Major Powell's purpose even then was to study the land and how to make use of it.

However, the arid lands report was coldly received in 1878—any proposal to change the disposition of the public domain was unwelcome. (In 1879, during the debates on consolidation of the varied western surveys, the legislation was made acceptable only by deleting a provision for changing the method of surveying public lands.)

A decade later, when the droughts of the 1880's brought about an economic problem, Congress did take action. The Geological Survey was asked to survey and segragate the irrigable lands and reservoir and canal sites in the arid region.

Powell optomistically estimated that it would take several years and several million dollars to get the necessary facts. But time was against him. It soon was realized that all public lands had been closed to entry by legislation, and the survey was discontinued.

Ultimately, of course, Powell's ideas on the use of arid lands and water were vindicated. The Reclamation Service, now called the Bureau of Reclamation, was established in 1902 just a few months before Powell's death.

His life's quest "to add a mite to human knowledge" is being fulfilled in the government bureaus he influenced, in the development of the western region, in the pattern of science in government. His work has proven essential in filling blank spaces on the map of the West, and is bringing prosperity to the many people who choose to live there.

ABOUT THE AUTHOR. Mrs. Mary C. Rabbitt is Assistant to the Director of the Geological Survey, and Survey historian. She has been Editor of Geophysical Abstracts, Assistant Chief of Geophysics, and Staff Geologist for Publications.

Powell's Hard Look at Water Facts

by W. L. (Bud) RUSHO, Region 4 Information Officer

In arid southern Utah, he provided information to a Paiute.

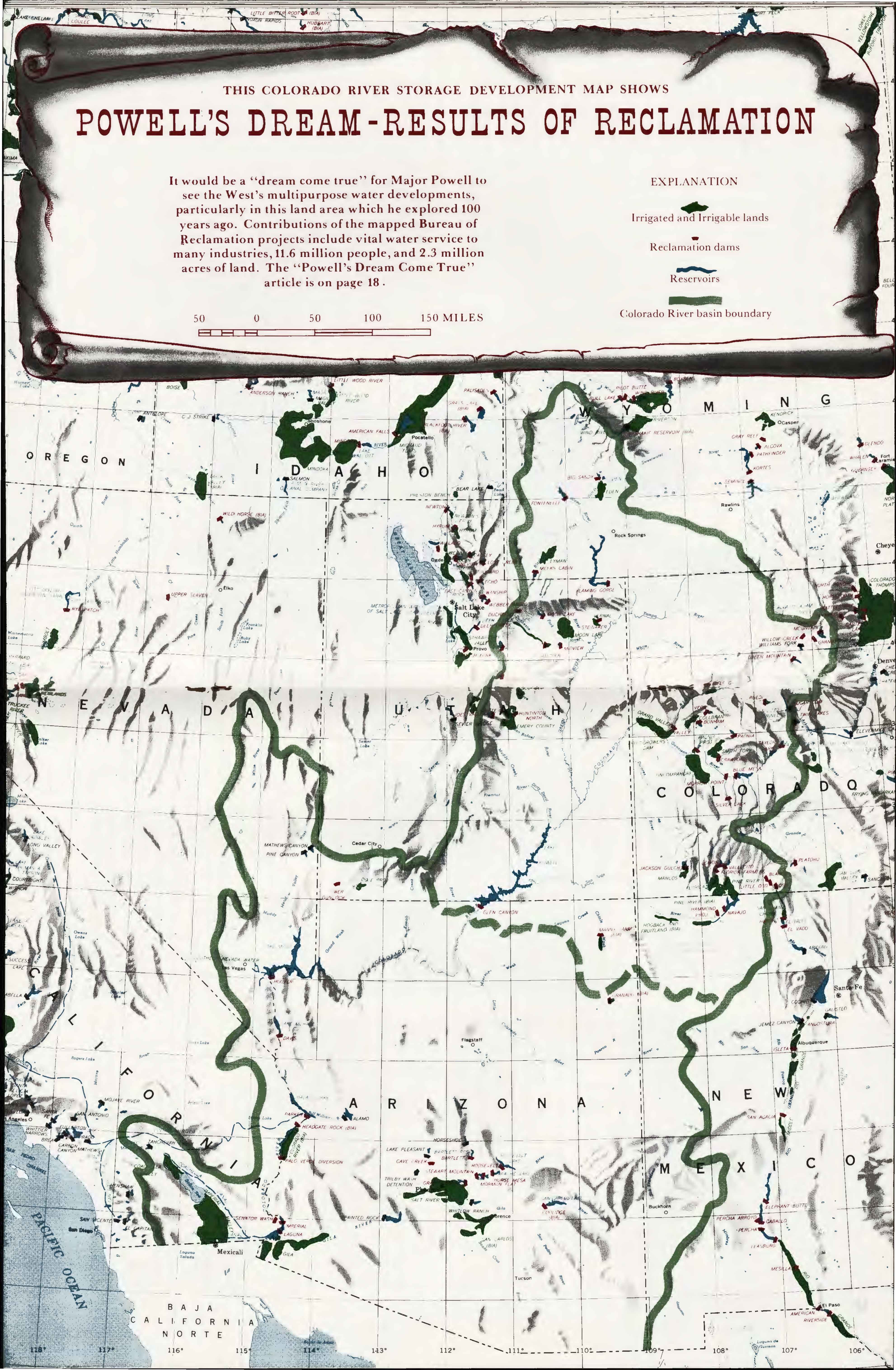
From the time of the cliff-dwellers to the present day, men who have chosen to live in the Colorado Basin either irrigated land to provide food for themselves or they had to move on.

Water from the Colorado River was practically unused in 1869, but the need was great. The new attitude that it was important to put this river to good use, if possible, was held by explorer John Wesley Powell when he headed the first successful explorations of the canyon sections of the river.

Others who have made important studies of the river are C. H. Birdseye, A. P. Davis, F. E. Weymouth, Walker R. Young, and E. C. La Rue. But none are more colorful than the one-armed Civil War veteran, Major Powell, who sat in a chair bolted to the deck of a boat as he ran the rapids of the river.

Powell not only lived through the two death defying experiences on the river, but strongly preached water conservation. His concepts proved basic to influencing the making of the Reclamation law which is still in effect today for the development of beneficial large-scale water resources.

Frederick Dellenbaugh, a member of Powell's 1871 river trip, wrote: "I don't remember whether or not the Major ever had any vision of reclamation during our canyon voyage, but he did very soon after and his Lands of the Arid Region was the result. He then took up the problems of reservoir sites and secured the establishment of a survey for the purpose of surveying and reserving such sites." Cont. on page 14.


THIS COLORADO RIVER STORAGE DEVELOPMENT MAP SHOWS
POWELL'S DREAM-RESULTS OF RECLAMATION
It would be a "dream come true" for Major Powell to see the West's multipurpose water developments, particularly in this land area which he explored 100 years ago. Contributions of the mapped Bureau of Reclamation projects include vital water service to many industries, 11.6 million people, and 2.3 million acres of land. The "Powell's Dream Come True" article is on page 18.
50 0 50 100 150 MILES
EXPLANATION
Irrigated and Irrigable lands
Reclamation dams
Reservoirs
Colorado River basin boundary
OREGON
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
BAJA CALIFORNIA NORTE
PACIFIC OCEAN
LITTLE BITTER ROOT (BIA)
NOXON RAPIDS
HUBBART (BIA)
LOWER YELLOWSTONE
BUFORD TRENTON
LITTLE WOOD RIVER
ANDERSON RANCH
ANTELOPE
C.J. STRIKE
Shoshone
AMERICAN FALLS
Pocatello
MINDOKA
SALMON
PRESTON BENCH
BEAR LAKE
PALISADES
GRAYS LAKE (BIA)
BLACKFOOT RIVER (BIA)
NEWTON
HYRUM
WILD HORSE (BIA)
UPPER SEAVER
Elko
RYE PATCH
Franklin Lake
Ruby Lake
Winnemucca Lake
HUMBOLDT
TRUCKEE RIVER
Sevier Lake
Ogden
Salt Lake City
ECHO
WANSHIP
Provo
Utah Lake
SEVIER BRIDGE
HUNTINGTON NORTH
EMERY COUNTY
MATHEWS CANYON
PINE CANYON
Cedar City
Las Vegas
HOOVER
DAVIS
PARKER
ALAMO
HEADGATE ROCK (BIA)
COLORADO RIVER (BIA)
PALO VERDE DIVERSION
SENATOR WASH
IMPERIAL
LAGUNA
GILA
Mexicali
Laguna Salada
Owens Lake
Rogers Lake
MOJAVE RIVER
SAN ANTONIO
Los Angeles
WHITTIER NARROWS
FULLERTON
PRADO
CARBON CANYON
MATHEWS
TAHCHEVAH
HENSHAW
SAN VICENTE
San Diego
EL CAPITAN
COURTRIGHT
WISHON
LONG VALLEY
SUCCESS LAKE
PILOT BUTTE
WIND RIVER
BULL LAKE
RIVERTON
BOYSEN
BIG SANDY
EDEN
FONTENELLE
LYMAN
MEEKS CABIN
Rock Springs
FLAMING GORGE
MOON LAKE
STEINAKER
MIDVIEW
KENDRICK
Casper
GRAY REEF
ALCOVA
PATHFINDER
KORTES
SEMINOE
Rawlins
GLENDO
WHALEN
GUERNSEY
Fort Laramie
Cheyenne
Denver
GREEN MOUNTAIN
WILLOW CREEK
WILLIAMS FORK
GRAND VALLEY
COLLBRAN
BONHAM
PAONIA
SMITH FORK
CRAWFORD
BLUE MESA
MORROW POINT
SILVER JACK
UNCOMPAHGRE
TWIN LAKES
ELEVENMILE
PLATORO
JACKSON GULCH
MANCOS
VALLECITO
FLORIDA FARMERS
PINE RIVER
PINE RIVER (BIA)
HAMMOND PROJ
NAVAJO
HOGBACK AND FRUITLAND (BIA)
EL VADO
GLEN CANYON
MANY FARMS (BIA)
GANADO (BIA)
Flagstaff
LAKE PLEASANT
CAVE CREEK
BARTLETT
HORSESHOE
ROOSEVELT
STEWART MOUNTAIN
HORSE MESA
MORMON FLAT
TRILBY WASH DETENTION
SALT RIVER
PAINTED ROCK
WHITLOW RANCH
Florence
SAN CARLOS (BIA)
COOLIDGE (BIA)
Tucson
Buckhorn
Santa Fe
COCHITI
GALISTEO
JEMEZ CANYON
ANGOSTURA
Albuquerque
ISLETA
SAN ACACIA
ELEPHANT BUTTE
CABALLO
PERCHA ARROYO
PERCHA
LEASBURG
MESILLA
El Paso
AMERICAN
RIVERSIDE
RIO GRANDE
118° 117° 116° 115° 114° 113° 112° 111° 110° 109° 108° 107° 106°

(Continued from page 11.)

Observed Irrigation

Impressed by the Mormon organization in Utah, which had successfully brought about irrigation of the valleys bordering the Wasatch Mountains, Powell recommended that this type of cooperation be emulated throughout the arid region. In the 1870's he sent specialists Grove Karl Gilbert and Clarence Dutton to make detailed observations in Utah. The problems in the West, as Major Powell saw them, were that individuals were gaining monopoly of water, which was much more important than the monopoly of land.

Powell's thoughtfulness, his knowledge of various subjects and his faith in technical developments of the future were ahead of his time, as shown in one of his articles in the *North American Review* in 1889:

"In all of this country wherever agriculture is prosecuted, dams must be constructed and the waters spread upon the lands through the agency of canals. As the season of growing crops is comparatively short—in most of the country it lasts from 2 to 3 months only—the waters of the nonirrigating season will run to waste unless they are stored in reservoirs.

". . . In the region of country where land is more abundant than water, the value inheres in the water, not in the land. . . if the water right is dissevered, the land is valueless. . . . All of the early civilization of the world began in arid lands, and the best agriculture of the world today is carried on by means of artificial irrigation.

". . . Ultimately one of the great agricultural regions of this country will be found in the irrigated plains and valleys of the West. Sagebrush plains, sand-dune deserts, and alkaline valleys will be covered by gardens, fields, and groves, all perennially fertilized from thousands of mountain lakes."

Spoke Boldly

Also in 1889 Powell appeared before the North Dakota Constitutional Convention and spoke boldly to the delegates with this statement:

"Years will come of abundance and years will come of disaster, and between the two the people will be prosperous and unprosperous, and the thing to do is to look the question squarely in the face and provide for this and for all years.

". . . you are to depend hereafter in a great measure on the running stream . . . All other wealth falls into insignificance compared with that which is to come from these lands from the pouring on them of the running streams of this country. Don't let these streams get out of the possession of the people . . . The property should be in the land, and the right to the water should inhere in the land and no company or individual should have property in the running streams."

In 1890 Powell wrote a series of articles for *Century Illustrated Monthly Magazine*. In these he stated:

"Not only must these lands be redeemed because of the wants of the population of that country, they must be redeemed because they are our best lands . . . We of the East must recognize that . . .

". . . By the use of all the perennial streams during the season of irrigation, by the storage of the surplus water that runs to waste in seasons when irrigation is not practiced; by the impounding of the storm-waters, by the recovery of the floods accumulated in valley sands, and by the utilization of the artesian fountains, a vast area of arid lands will ultimately be reclaimed, and millions of men, women, and children will find happy rural homes in the sunny lands.

"When the waters are stored in the mountain lakes, and the canals are constructed to carry them to the lands below, a system of powers will be developed unparalleled in the history of the world. Here, then, factories can be established, and the rivers be made to do the work of fertilization, and the violence of mountain torrents can be transformed into electricity to illumine the villages, towns, and cities of all that land."

Makes Point Clear

Powell continued to try emphatically to impress those who maintained that the West was not a desert and did not need irrigation. In 1893, at a meeting of the International Irrigation Congress in Los Angeles, Powell stated:

"I wish to make clear to you . . . there is not enough water to irrigate all the lands . . . there is not sufficient water to irrigate all the lands which could be irrigated . . . only a small portion can be irrigated . . . . It is not right to speak about the area of the public domain in terms of acres that extend over the land, but in terms of acres that can be supplied with water . . . .

"Gentlemen, it may be unpleasant for me to give you the facts, and I hesitated a good deal . . . but I finally concluded to do so . . . A few years ago the question arose whether all the land could be turned over to cattlemen for cattle ranges . . . I spoke again and again begging that these lands might be held for irrigation, that the lands should not be turned over to individuals for cattle ranges . . . . The people howled at me because I wasn't interested in the broad horn-problem.

"Now you are speaking for irrigation . . . what matters it whether I am popular or unpopular. I tell you, gentlemen, you are piling up a heritage of conflict and litigation over water rights for there is not sufficient water to supply the land."

Green River railroad terminal.

Two men of the expedition take positions perilously near the cliff to make notes about the river and red chasm.

One of the crew, left, and Indian rest at DeChelley ruins.

Colorado River Development

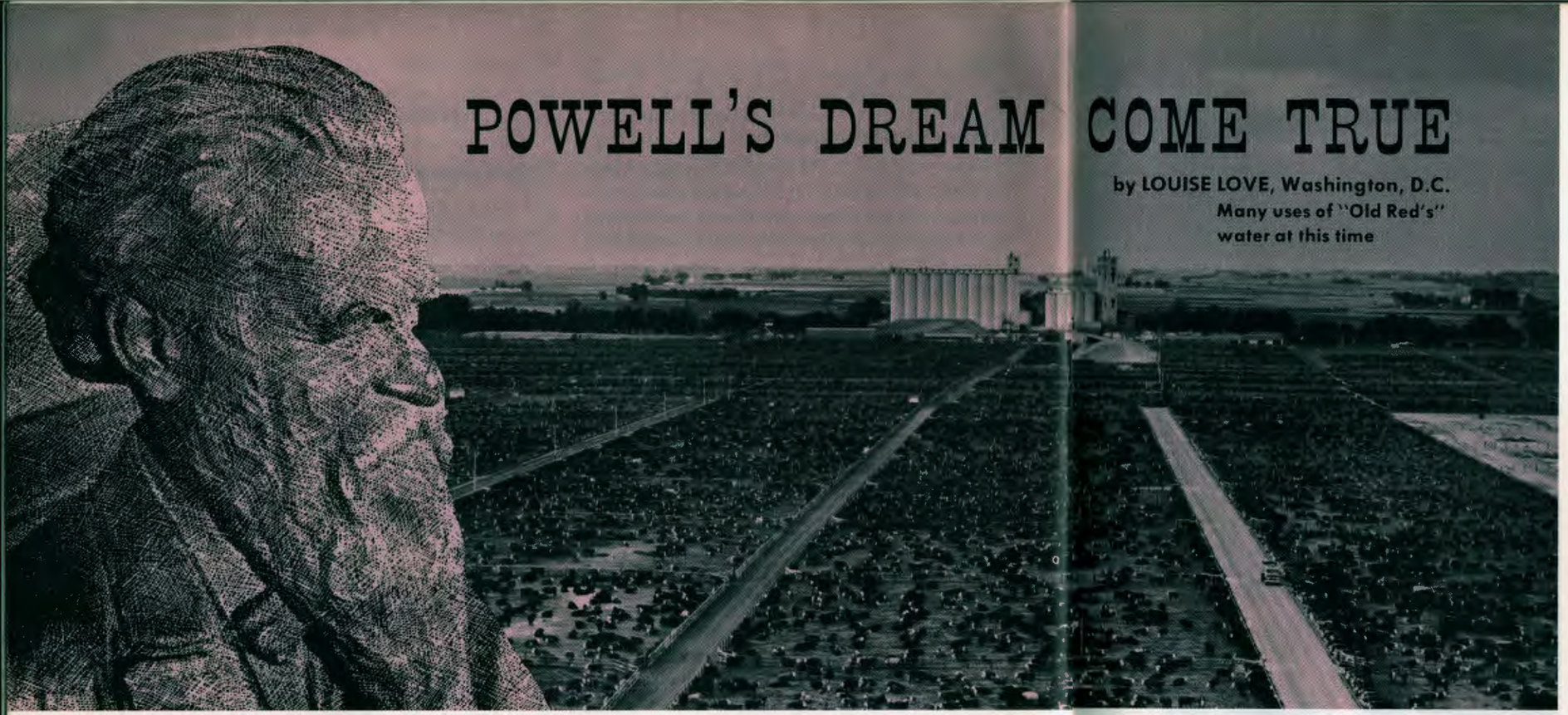
Although it is quite apparent that Major Powell had only a partial concept of dam building on the Colorado River when he made his voyage, Frederick Dellenbaugh says that at least the idea was talked about by members of the expedition of 1871–72:

"I had an idea of making dams in the Grand Canyon, but not for power—merely to make it possible to navigate. My plan was to tunnel side cliffs and then blow the cliff off into the river with dynamite! People laughed at me, but I enjoyed talking about it anyway."

A short time later Powell did realize that developments on the Colorado surely were possible, provided only that the tremendous amounts of money be obtained to build the structures:

"The region below the canyon on each side of the Colorado is one of great aridity with an annual rainfall of not more than 3 or 4 inches. It

POWELL'S DREAM COME TRUE



by LOUISE LOVE, Washington, D.C.

Many uses of "Old Red's" water at this time

After the Civil War some veterans of that bitter conflict looked West for the promise of a future. Among them was Major John Wesley Powell, the steel-nerved Union soldier who in 1869, undertook scientific exploration of the Colorado River.

What Major Powell saw on that momentous trip were treacherous, narrow canyons cut through forbidding, cold mountains in upper reaches. Downstream, he saw desert—a lonely land of a few isolated settlements, a handful of Indian shepherds with their charges, lizards, and some hardy wild animals.

This man, however, saw not only the barbaric beauty of the land and the river; he envisioned ahead great agricultural developments and communities which would welcome throngs of settlers from the East.

Although the resourceful Powell did not at that time foresee great dams on "Old Red" to control the sometimes raging, sometimes meandering current, the idea of controlling and utilizing its waters was significant to him. He cherished such thoughts and later he spoke strongly on the subject regarding the entire arid West. In 1890 he wrote about the Colorado in the *Century Illustrated* magazine: "The low flood plain along the river is narrow and only small tracts within it can be redeemed. If the waters are to be used, great works must be constructed costing millions of dollars, and then ultimately a region of country can be irrigated larger than was ever cultivated along the Nile, and all the products of Egypt will flourish therein."

With his understanding of land, water and ecology—far ahead of his time—the Major possibly envisioned the kind of development which is taking place in the Colorado Basin now. The sparsely settled plains and desert that Powell and his party studied in 1869 and later, now comprise huge prospering areas of productive farms, thriving communities, humming industries, and great outdoor playgrounds.

100 Dams

Dotted along that river and along its main tributaries are more than 100 dams which control the erratic Colorado and store water for irrigating fertile farms and other uses. The stored water is released for quenching thirst, watering lawns, filling swimming pools of the of the communities, and generating electric power to light homes and turn the wheels of industrial plants. To the manmade lakes, thousands of visitors come to admire and to boat, swim and fish.

Today more than half as many people live in the Western States, through which the Colorado flows, as dwelt in all of the United States when Major Powell made his famous odyssey down the Colorado.

At that time the river was the harsh master of fate for those who dwelt along its banks—

This huge beef cattle operation is at Greeley, Colo.

but Reclamation development as Powell envisioned—has made it the servant of man.

It was along its southern reaches that development of the river began, actually dating back to the early Christian era. The Hohokam Indians dug ditches to divert water from the Salt River onto the dry land alongside, where they grew crops.

Centuries after the Hohokams disappeared from the scene, American frontier farmers again brought water from the Salt out onto the parched plains of Arizona. A small irrigated crop was harvested there just the year before Major Powell made his famous trip down the river—a token second birth of reclamation on a small part of the central Arizona desert.

But the descendants of the 19th Century pioneers who built the Salt River canals did their homework. They sought the help of Washington, D.C. where the forthright utterances and scientific exploits of Powell had become an influence. Powell's strong leadership in regards to large scale use of water and land helped launch the reclamation era for America.

The willing Arizonans were anxious to receive Federal financing and improved irrigation techniques for use against the desert, and they were first to benefit by the creation of the Federal reclamation program. Under the historic U.S. Reclamation Act of 1902, the Salt River development project was among the first to be started.

Early 1900's Challenge

Builders who constructed Reclamation works in the early 1900's found conditions challenging. The project's first major structure—Theodore Roosevelt Dam—had to be built in the tortuous canyons of the Salt, 65 miles by horse and wagon from the railroad terminal. The task was Herculean in scope, but the structure—America's largest masonry dam—was completed in 1911, and still massively blocks the Salt River gorge.

Five other dams subsequently have been built on the Salt and its tributaries. They are successfully operating today, furnishing water

is also a region of high temperature in summer, and it has almost a frostless winter. Here, date palms flourish with a luxuriance never known in Egypt; oranges, lemons, pomegranates, and figs grow and bear in abundance, and the lands are well adapted to sugar and cotton.

"On the west lie Nevada and California. On the east Arizona stretches away to the summit of the Rocky Mountains. The lands to which the waters can be taken greatly exceed the area that can be served. How shall they be divided? The low flood plain along the river is narrow, and only small tracts within it can be redeemed.

"If the waters are to be used, great works must be constructed costing millions of dollars, and then ultimately a region of country can be irrigated larger than was ever cultivated along the Nile, and all the products of Egypt will flourish therein."

Competence Needed

After the Johnstown Flood in 1889, Powell had some rather pointed things to say about builders who construct their water works without enough design data:

"In American engineering, that which has been most neglected is a precise determination of the duty of the dam—the conditions which it must fulfill or else be destroyed. . . .

"To neglect the essential facts is to be guilty of criminal neglect. The history of mountain-lake construction, throughout all the countries of engineering enterprise, is full of lessons like that taught at Conemaugh (Johnstown, Pennsylvania), and the lessons have always been enforced by the destruction of property and life; they have always been emphasized by dire diaster.

"Modern industries are handling the forces of nature on a stupendous scale. The coal-fields of the world are now on fire to work for men; chemical forces, as giant explosives, are used as his servants; the lightnings are harnessed and floods are tamed. Woe to the people who trust these powers to the hands of fools."

Municipal and Industrial Water

Powell could see that reclamation was needed not only for irrigation on farm lands but also to supply the needs of growing cities in the West:

". . . health in the waters of the heavens; and the people must have pure water. The demand for highland waters for such purposes is rapidly increasing. The speedy development of city and town life under the new industrial conditions makes this one of the most important uses to which water can be applied. Wherever the houses of men are clustered reservoirs or systems of reservoirs must be built. Nothing can be more certain than that the storage of water for this purpose will greatly and quickly increase throughout the United States."

Hydro Energy

Although hydropower was still in its infancy Powell could see that dams could be made to supply this energy:

". . . it is probable that the resort to water-power will rapidly increase in the immediate future. It certainly will if the dream of modern electrical science is realized, so that waterpower can be economically converted into electric power and transported from place to place. If this is done,—and its accomplishment is hardly to be considered Utopian,—all our highland streams will immediately become of value as powers, and dams and reservoirs must be constructed in far greater numbers than in the past."

Weather Modification

Powell was thoroughly convinced that weather modification was a waste of time—at least as it was practiced in the 19th century according to the *North American Review* in 1892:

"Before science can do anything of value to man in the control of winds and storms it must learn to control powers of a magnitude almost beyond human imagination."

An airplane recently taking part in a weather modification experiment—a potential not envisioned by Powell.

Government Participation

While Powell was Director of Geological Survey from 1881 to 1894 he advocated government ownership of the water, government survey and land classification. However, he advocated only privately financed reclamation works.

But Federal government participation in the construction of reclamation works was a logical development. In 1897 Captain Hyrum M. Chittenden of the Corps of Engineers made a survey for reservoirs in Colorado and Wyoming, and in his report he proposed that the government construct the reservoirs, administer the distribution of water, and leave the states to manage the matter of irrigation. Walter Webb in *The Great Plains* states:

"We have seen that irrigation in the West went through five well-defined stages: individualistic, corporate, district (as advocated by Major Powell), state (as under the Carey Act), and national (as expressed in the Reclamation Act of 1902). The tendency has been for the unit of organization and administration to expand until it became the nation itself working through the Bureau of Reclamation."

It was observed in the latter part of his career that Powell felt there should be Federal Reclamation projects.

According to W. C. Darrah, author of *Powell of the Colorado*, Major Powell conceded agreement with President Theodore Roosevelt's message to Congress in 1902 urging Federal government assistance in irrigation. The President said: "It is as right for the national government to make the streams and rivers of the arid region useful by engineering works for water storage as to make useful the rivers and harbors of the humid region by engineering works of another kind."

In commenting about the President's message, Major John Wesley Powell said to his nephew, Arthur Powell Davis: "These things take time, Arthur. You must learn to control impatience, but always be impatient."

Appraisals Note Powell Gains

(Continued from Inside-Cover)

"Owe Legacy of Government Initiative"

"The country owes thanks to Major Powell for his courage and audacity in running the Colorado River, the first scientific exploration of the passes south through the Rockies in 1869, and for his integrity and vision in the years that followed. To his shrewd talent as the builder of an expanding bureaucratic empire, without which his knowledge of the land and water would have been of little value to the Nation, we also owe the legacy of government initiative to preserve and protect its resources.

"His most valuable, as well as best known government publication was *Report on the Lands of the Arid Regions*. The report was the first step toward comprehending the necessity for scientific and realistic government management of the public domain and toward the encouragement of those same factors in the private management of private lands in the West. After its publication, there was no longer any excuse among learned men for the popular myth of 'rain following the plow', or the widely accepted notion that the arid lands of the West were adaptable for Midwest farming.

"The report specified that water was the key to land use and that the sharply limited supply demanded classification of land for use and management. Few government reports have stood so well the measure of hindsight.

"Although it is common for latter-day commentators to bewail the failure of the country to adopt the Powell recommendations for the western lands, a more realistic attitude might be one of thanks for the long-range guidelines which they laid down in a day when so little foresight was being shown. Tragically, much land and water resources were still to be destroyed, but the Powell recommendations were to become the basic philosophy of progressive federal conservation policy for the next two generations."—Frank E. Smith ("The Politics of Conservation," Pantheon Books, 1966).

for irrigation of 234,000 acres of land, for municipal and industrial water supply, hydroelectric generation, and recreation. This desert area has become a leading vacation and industrial complex in the Southwest.

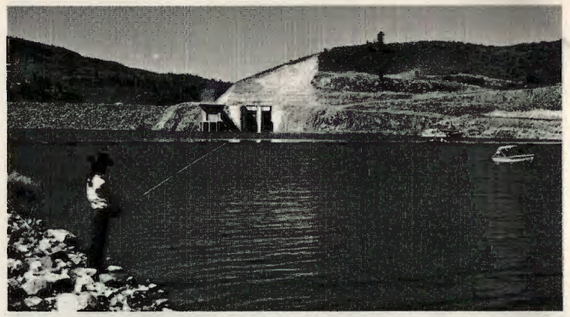
Other reclamation project areas have developed similarly. In 1904 Powell's nephew, Arthur Powell Davis, an engineer for the budding United States Reclamation Service—as it was then known—conceived a broad proposal for development of the lower Colorado under unified control of the Federal Government, with a great dam to store floods and to serve as the heart of the project.

The "great dam"—Hoover Dam—was built much later, but construction on a Federal reclamation project for the Yuma, Arizona, area was started in 1905. From this unit the first Reclamation-developed water was delivered. Today about 70,000 acres in the Yuma project and its auxiliary unit receive Colorado River water to irrigate cantaloups, winter vegetables,. small grains, and citrus fruits.

Water is delivered to the distribution system by the All-American Canal, which also serves more than half a million acres of rich farmlands in California's Imperial and Coachella Valleys.

Keystone of this Colorado River development—the granddaddy of all multiple-purpose river control structures—is Hoover Dam. Built in the 1930's at the Nevada-Arizona border as the key feature of the Boulder Canyon Reclamation Project, this engineering marvel of concrete changed the river from a menace to a blessing. Since Hoover Dam started storing water in 1935 there has not been a flood of any consequence nor a drought in the project-served lower basin.

Hundreds of throusands of people every year take the guided tour to see this structure, still the second highest dam in the Western Hemisphere. Its reservoir, Lake Mead, which stretches 115 miles upstream, stores enough water to inundate the entire State of Virginia to a depth of one foot.



To Nevada Project

Construction has begun on the newly authorized Southern Nevada Water project. Its major feature is a four-mile tunnel through the River Mountains which lie between Lake Mead and the Las Vegas Valley.

Further regulating the Colorado to perform its life-sustaining services to the people of the lower basin, the Bureau of Reclamation built multi-purpose Davis and Parker dams.

Davis, 67 miles below Hoover, produces electric power, reregulates releases from Hoover, and assists in regulating the river's water deliveries to Mexico in accordance with the Mexican Water Treaty.

Parker, 88 miles farther down, provides a forebay and desilting basin for the Colorado River Aqueduct of the Metropolitan Water

Grove in Imperial Valley, Calif. gets crop between rows. Top left. Reservoir recreation area, Blue Mesa Dam, Colo. Left. Visitors atop Flaming Gorge Dam, Utah.

District of Southern California, which carries municipal and industrial water to the Los Angeles-San Diego megalopolis. Both dams impound reservoirs that furnish superb outdoor recreation and enhance fish and wildlife habitat.

Three hundred miles below Hoover, Imperial Dam diverts water from the river into the All-American Canal and the Gila Gravity Main Canal, the service areas of which comprises some of the most fertile farmland on the continent. Crops valued at more than $4 billion have been grown on these high-productivity lands.

For many years prior to the 1956 authorization of the Colorado River Storage Project, upper basin states had to watch precious Colorado River water flow through their dry lands largely unused, while their fields lay parched alongside and progress, based upon water resources, passed them by. Now, however, three of four planned storage units are completed and a vast 5-State development program is well underway.

In northern Utah, Flaming Gorge Dam regulates the flow of "Old Red's" chief tributary, the Green River. It was Major Powell who aptly named the gorge for its flaming red walls. Today, where the Powell party approached the head of "the first canyon we are to explore," this majestic dam has impounded a scenic lake which already is rated one of the great reservoir fisheries of the West. Stretching 91 miles upriver, far into Wyoming, it also offers boating, water skiing, and swimming to its throngs of visitors.

A 108,000-kilowatt Flaming Gorge powerplant generates hydro-electricity to help pay project costs.

On The Gunnison

In Colorado on another tributary, the Gunnison River, the Bureau of Reclamation is presently building the Curecanti Storage Unit. Blue Mesa Dam, with a 60,000-kilowatt powerplant, began commercial operation in 1967. Its reservoir, situated between the perpendicular walls of fabulous Black Canyon, is the largest lake in the State of Colorado and attracted more than 182,000 visitors in 1967.

Just recently completed 12 miles downstream from Blue Mesa is the Morrow Point structure. This landmark dam incorporates a free-fall spillway which creates a waterfall about twice as high as Niagara Falls. The powerplant, 225 feet deep in the canyon's rock wall, is under construction. Curecanti's Crystal Dam, reservoir, and powerplant are authorized for construction further downstream.

On the San Juan tributary in northern New Mexico, Navajo Dam and Reservoir is the main feature of the Navajo Storage Unit. This earthfill structure makes possible diversion of water for irrigation on the Navajo Indian Irrigation Project.

Major storage unit of the Colorado River Storage Project is Glen Canyon Dam, just a few miles north of the Lees Ferry landmark in Arizona. Here majestic Glen Canyon Dam stands as the final guardian of Colorado River water for the states of the upper basin. Selected by the American Society of Civil Engineers in1964 as the outstanding engineering achievement of the year, Glen Canyon rises 710 feet above bedrock between multi-colored steep canyon walls.

The river in this canyon remained much as it was when Major Powell viewed it—and christened it Glen Canyon—until the 1950's when modern Paul Bunyans arrived with bulldozers and dynamite to force a giant concrete plug between the walls. The reservoir which Glen Canyon Dam impounds has been named for the famous explorer, who left us the

first detailed description of Glen Canyon. Lake Powell has been described by former Interior Secretary Stewart L. Udall as "the most beautiful man-made lake in the world."

Backing up 186 miles behind the dam, the jewel-like Lake Powell ventures watery fingers into dozens of side canyons hidden through the ages from all but a few human eyes. A visitor center, marinas, and other public facilities have been built to accommodate the thousands of visitors who are being attracted to this unusual wonderland.

Scenic Values

While the Glen Canyon Storage unit is affording visitors incomparable views, glorious boating, and excellent fishing—not only in the lake but in the now clear-flowing stream below the dam—its 900,000-kilowatt powerplant is generating hydropower that ultimately will meet the lion's share of the expenditures for construction of the facilities and for other basin development to come.

Six participating projects or units of projects have been completed in the upper basin to irrigate farming in Utah, Colorado, and New Mexico. Sixteen others are under construction, in planning stages, or recently authorized in these states and Wyoming. When these units are all in operation, they will supply irrigation water to nearly 875,000 acres of land.

One of the participating projects presently under construction is the San Juan-Chama in Colorado and New Mexico. The development involves a transmountain diversion via Azotea Tunnel, which recently was "holed through" under the spine of the Continental Divide. On the eastern slope of the Divide, construction is underway on Heron Dam, which will impound water to be transported for municipal use in the city of Albuquerque and for irrigation of farms in the Rio Grande basin.

Since authorization of the Colorado River Storage Project (CRSP) in 1956, about $715 million of Federal funds have been expended on dams, reservoirs, powerplants, transmission systems and other facilities of the five-state project. About 90 percent of this sum will be paid back to the United States Treasury by water and power users.

The CRSP is the comprehensive framework within which the upper basin is developing its water resources. However, several decades before this project was authorized, an ambitious plan evolved in Colorado to permit that State to utilize on the arid plains east of the Divide some of its Colorado River water naturally flowing down the western slope of the Rockies.

First Transbasin Tunnel

Finally authorized as a Federal Reclamation project in 1937, the Colorado-Big Thompson project was one of Reclamation's major transbasin water diversions. A milestone accomplishment, this project—having a 13.1-mile-long water tunnel through the Continental Divide—last year marked 21 years of growth since initial delivery of water. The project is operaged by the Northern Colorado Water Conservancy District, and the dollar value of crops produced for the farmer and livestock feeder, has risen from about $63 million in 1951 to about $95 million in 1967.

Bureau of Reclamation
Water Headquarters Offices

COMMISSIONER'S OFFICE:
C St. between 18th & 19th Sts. NW
Washington, D.C. 20240

CHIEF ENGINEER'S OFFICE:
Bldg. 67, Denver Federal Center
Denver, Colo. 80225

IDAHO (Except SE tip)
WASHINGTON
MONTANA (NW corner)
OREGON
(Except Southern wedge)
(Region 1)
Federal Bldg.,
550 W. Fort St.,
Boise, Idaho 83707

CALIFORNIA (Northern & Central)
NEVADA (Northern & Central)
OREGON (Southern wedge)
(Region 2)
Federal Bldg.,
2800 Cottage Way,
Sacramento, Calif., 95825

NEVADA (Southern)
CALIFORNIA (Southern)
ARIZONA (Except NE tip)
UTAH (SW tip)
(Region 3)
P.O. Box 427
Boulder City, Nev. 89005

UTAH (Except SW tip)
COLORADO (Western)
NEW MEXICO (NW tip)
WYOMING (SW tip)
IDAHO (SE tip)
(Region 4)
P.O. Box 11568
125 S. State St.
Salt Lake City, Utah
84111

TEXAS
OKLAHOMA
KANSAS (Southern half)
NEW MEXICO (Except W third)
COLORADO (Southern wedge)
(Region 5)
P.O. Box 1609
7th & Taylor
Amarillo, Tex. 79105

MONTANA (Except NW corner)
NORTH DAKOTA
SOUTH DAKOTA
WYOMING (Northern)
(Region 6)
P.O. Box 2553
316 N. 26th St.
Billings, Mont. 59103

COLORADO (Eastern)
NEBRASKA
KANSAS (Northern)
WYOMING (SE)
(Region 7)
Bldg. 20, Denver Federal Center
Denver, Colo. 80225

The "Big-Tom" project provides water and electric power for use in many communities, and its reservoirs make available healthful, water-based recreation opportunities to nearly 2 million people per year.

Today the Bureau of Reclamation is constructing another trans-mountain diversion project in Colorado, the Fryingpan-Arkansas Project, which will develop long needed multipurpose water supplies for both the Colorado and Arkansas River basins.

In the upper (northern) basin development, some 40 additional proposed subdivisions of the Colorado River Storage Project are being studied with a view to putting to use a large part of the remainder of the water allotted to the 5 States involved.

A crowning achievement in development of the Lower (southern) Colorado River Basin will be the Central Arizona Project, authorized by Congress last September. The culmination of nearly 20 years of hard, and frequently discouraging, efforts by basin residents, and local, State and Federal officials, the $932 million project is a bright promise of further water usefulness and prosperity in Central Arizona.

The river gorge areas from Glen Canyon to Lake Mead—which John Wesley Powell was the first man to traverse—has been left without developments. It and the rest of the basin's highly scenic rivers and streams are magnificent fresh-air playgrounds for sports and nature buffs, and inspiring outdoor classrooms for Americans of all ages.

Such benefits and the ultimate wise utilization of the West's land and water resources will bring to fruition the dream of Major Powell, and the visions of many people through the years. Meantime, much work remains to be done—to plan, fund, and build facilities still needed.

Thomas Jefferson once said, "The face and character of our country are determined by what we do with America and her resources." Probably the prime illustration of the great patriot's premise is the extraordinary development of the Colorado River—a goal of the extraordinary leader in Reclamation.

Powell's Career Highlights From 1869

The daring Major Powell was 35 when he led a party of 10 men, in 4 boats, down the canyons of the Green and Colorado Rivers, largely self fininanced, in the summer of 1869. (His earlier life is noted on pages 1 through 4.)

In 1870 Congress established the Geographical and Geological Survey of the Rocky Mountain Region with Powell in charge.

In 1871–1872 he led his second exploratory voyage down the Green and Colorado Rivers.

From 1870 to 1879 he directed the survey and mapping of the "Plateau Province" which had been opened up by the 1869 expedition. Powell and the men he took with him mapped and named Glen Canyon and many other features in the region.

In 1879 he took a leading part in establishing—was one of the founders of—the U.S. Geological Survey while, himself, becoming Director of the Bureau of Ethnology in the Smithsonian Institution.

In 1881 he succeeded Clarence King as Director of the Geological Survey.

From 1888 to 1891, he conducted the Irrigation Surveys which became the basis of the Reclamation Service created in 1902, to be called the Bureau of Reclamation a few years later. He was, in effect, one of the founders of this agency.

He resigned as Director of the Geological Survey in 1894, but continuing as Director of the Bureau of Ethnology. Died at age 68, September 23, 1902, at his summer home in Haven, Maine. Buried in Arlington National Cemetery, Arlington, Va. # # #

VISITOR CENTER AT GLEN CANYON DEDICATED

The $1.2 million Carl Hayden Visitor Center overlooking Glen Canyon Dam in Arizona, shown in the photograph, was dedicated last September 26. Secretary of the Interior Stewart L. Udall gave the dedicatory address. Commissioner of Reclamation Floyd E. Dominy was Master of Ceremonies. The new visitor center—a joint effort of Reclamation and the National Park Service—was begun in 1965 and completed in 1967. A sculptured bust of the recently retired Arizona Senator Hayden will be installed near the entrance.

National Wildlife Week

"Provide Habitat—Places Where Wildlife Live" will be theme for the 1969 observance of National Wildlife week March 16–21, according to the National Wildlife Federation.

★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—329–030

MAJOR RECENT CONTRACT AWARDS

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DC–6672	Missouri River Basin, N. Dak.	Oct. 10	Construction of Killdeer substation, stage 01	United Power, Contractors and Engineers, Inc., Seattle, Wash.	$396,858
DC–6675	Southern California Edison Company, Nev.	Oct. 2	Construction of River pumping plant for Southern California Edison Co. Mohave generating plant.	Oakland Construction Co., Inc., Salt Lake City, Utah.	188,238
DC–6676	Missouri River Basin, Iowa.	Nov. 13	Construction of stage 07 additions to Sioux City substation.	Addison Construction Co., Cheyenne, Wyo.	111,253
DC–6677	Southern Nevada Water, Nev.	Oct. 9	Construction of 7.5 miles of Boulder City lateral	Hood Corp., Whittier, Calif.	1,156,204
DC–6680	do	Nov. 5	Construction of pumping plant No. 1A, forebay No. 1A and switchyard No. 1A.	S. S. Mullen, Inc., Seattle, Wash.	2,886,881
DC–6681	Central Valley, Calif.	Oct. 9	Construction of pipe portions of five canal crossings and one canal and road crossing for San Luis drain.	Oscar C. Holmes, Inc., and Holmes-Clair, Inc., Menlo Park, Calif.	367,820
DS–6684	Colorado River Basin Pilot, Colo.	Nov. 6	Ground-based instrumentation network and surface meteorological data collection for supporting weather modification research in Colorado. (Negotiated Contract)	Western Scientific Services, Inc., Fort Collins, Colo.	695,916
DC–6685	Central Valley, Calif.	Oct. 17	Relocation and bituminous surfacing of 2.8 miles of Auburn-Foresthill county road.	O. K. Mittry & Sons, Gardena, Calif.	1,326,648
DC–6687	Columbia Basin, Wash.	Nov. 26	Construction of administration building for Grand Coulee third powerplant.	George A. Grant, Inc., Richland, Wash.	719,795
DC–6692	Paonia, Colo.	Nov. 26	Rehabilitation of Colorado Highway No. 133 near Paonia, Colo.	Mile High Drilling Co., Inc., Wheatridge, Colo.	272,262
DC–6693	Central Valley, Calif.	Nov. 29	Preconsolidation of lateral 7R, Sta. 189+54.9 to 376+97.4, and reservoir and pumping plant sites for Westlands Water District distribution system.	Industrial Pipelines Intermountain, Inc., Murray, Utah.	279,174
DC–6695	Pacific Northwest-Pacific Southwest Intertie, Nev.	Dec. 12	Construction of a million-gallon concrete water storage tank and 1.6 miles of auxiliary waterline for Mead substation.	TAB Construction, Inc., Las Vegas, Nev.	242,900
100C–1014	Columbia Basin, Wash.	Oct. 16	Construction of 3 miles of compacted blended earth lining for existing laterals, supplemental construction and modification of existing structures, Blocks 85, 86, 87 and 89.	Clark F. Cass & Walt Alloway, Moses Lake, Wash.	115,990
100C–1017	do	Nov. 4	Construction of 13.9 miles of buried pipe drains for D75–36, D75–72 and D75–87 drain systems and D75–87D pumping plant, Block 75.	Equipco Contractors, Inc., Ephrata, Wash.	257,435
100C–1018	do	Oct. 16	Construction of 7.9 miles of buried and .25 mile of open ditch drains for D85–99 and D–85–114 drain systems, Block 85.	Clark F. Cass & Walt Alloway, Moses Lake, Wash.	151,153
100C–1019	do	Oct. 21	Construction of 2.1 miles of concrete lining for laterals, 4.3 miles of buried pipelines and structures for W3F laterals, Block 70.	Peters and Wood Co., Pasco, Wash.	302,696
100C–1020	do	Oct. 8	Construction of 5.6 miles of buried pipe drains for D20–212–2 drain system, Block 20.	Equipco Contractors, Inc., Ephrata, Wash.	147,964
100C–1021	do	Oct. 21	Construction of 19.6 miles of buried pipe drains for Blocks 18 and 47.	M & J, Inc., Moses Lake, Wash.	299,713
200C–721	Central Valley, Calif.	Oct. 1	Construction of Red Bluff park, including picnic area, paving picnic and parking areas and landscaping for Red Bluff diversion dam.	James E. Byrne, Red Bluff, Calif.	113,304
200C–728	do	Oct. 2	Rehabilitation of 14 timber bridges along Friant-Kern and Madera canals.	Hertel Construction Co., Inc., Sacramento, Calif.	271,275
200C–729	do	Oct. 14	Removal of five and rehabilitation of three timber bridges and concrete lining canal extensions between Miles 70.01 and 116.5, and rehabilitation of pipeline crossings between Miles 85.0 and 110.3 for Delta-Mendota canal.	Oscar C. Holmes, Inc., and Holmes-Clair, Inc., Menlo Park, Calif.	737,366
200C–730	do	Nov. 12	Relocation of Pacific Avenue, including overpass and Boardman canal siphon, in Auburn, Calif.	Thomas Construction Co., Fresno, Calif.	327,182
200C–734	do	Nov. 6	Construction of parking area and related features for Auburn dam temporary overlook.	Sutherland Construction, Inc., Auburn, Calif.	129,180
400C–393	Weber Basin, Utah	Oct. 24	Construction of 4.8 miles of concrete lined Willard laterals, 1.8 miles of open and 1.5 miles of closed Plain City area C drains, Schedule II.	Ray W. Coleman, d.b.a. R. W. Coleman Construction Co., Brigham City, Utah.	263,806
500C–278	Pecos River Basin Water Salvage, N.M.	Nov. 12	Clearing Pecos River from McMillan dam to New Mexico-Texas state line.	Armstrong and Armstrong, Roswell, N.M.	238,000