# WRD HISTORICAL NOTE 1

## L'AFFAIRE LaRUE

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E. C. LaRue

### PROLOGUE

**The control and development of** the Colorado River has been examined and studied extensively over the years by Federal agencies, and on each occasion, on the principle of engineering determinism – the advocacy of a single best plan. Among the names associated with planning and development of the river, John Wesley Powell and Herbert Hoover to cite two of the more prominent, that of E. C. LaRue is today least known. LaRue's work on that river stands midway in time between us and its first exploration by Powell. Hydrologically correct, his planning and advocacy may explain how the failure of the principle of engineering determinism inclined the Water Resources Division of the Geological Survey to a long role as an exclusively basic-data agency.

**Like so much of the Division's history,** this episode begins with Powell, whose investigations of the arid lands in the 1870's led him to the conclusion that because water, not land, was the decisive limiting factor in the development of the West, some rather hard choices lay ahead, and that the Western assets were to be measured in more than acres. Data on rivers and on the character and extent of the water resources were necessary.

**Imagine the situation at the time.** Powell's 1878 report on *Lands of the Arid Region* advanced a plan for the scientific management of the Public Domain, perhaps one of the most critical problems of Federal policy of post-Civil War times.[1] Yet there were no development agencies as we know them today. The agency for managing the Public Domain was called the General Land Office, and it was essentially that, because apparently it had not occurred to anyone that it was really *water as well as land* that was being disposed of. Plans for a resource-scientific management base of the Public Domain were almost entirely Powell's, and these became part of the goals of the U.S. Geological Survey. Hence, there were, in the first half of the Survey's history, units with such operational labels as *Water Utilization*, *Land Classification*, *Enlarged Homesteads*, *Power Resources*, *Hydro-Economics*, and, of course, the *U.S. Reclamation Service*. Each and every unit was not only directly involved with collecting data but also in making plans, entering recommendations, and even taking action for the management of the Public Domain.

**Such also was the work of** E. C. LaRue. For example, his record lists about 65 administrative reports between 1909 and 1923 with such titles as **Right-of-way application for Dubois reclamation project** (1910), **Available water supply for North End and Imperial North Side Companies** (1914), **Proposed development of Pringle Falls Electric Power Co.** (1917), and **Recommendation that lots 3 and 4 embrace a feasible damsite** (1920). These titles denote a program quite different from that of today.[2]

**Thus, as it neared a half-century of** service, the Geological Survey was still at the center of land and river development of the West. The Survey provided a scientific approach: the direct application of geographic facts to decisions about the use of the land. This was the *Era of Geographic Determinism*.

**LaRue was part of this western program** and of its dominant principle, *Data to Action*. Unlike Powell who found fame on the Colorado, LaRue found frustration – but together they shared an unswerving adherence to the determinism of the landscape.[3] [4] Because of its effect then, and because

of its manifestations that still pervade public policy, a review of this episode may be instructive.

## THE WORK OF E. C. LaRUE

**Born in 1879, in the same year as** the Geological Survey, Eugene Clyde LaRue entered on duty with the Survey directly upon graduation from the University of California in 1904. For the first six years he was a stream gager, first in California, and later in Idaho, where he became district engineer. Because Carey Act[5] projects were more actively promoted in Idaho than elsewhere, LaRue made more investigations of water supply than others in the Water Resources Branch (or Division as it is now named). In 1910, he was assigned to the newly created Division of Water Utilization[6] which evolved, according to Robert Follansbee,[7] from the conservation movement of the Theodore Roosevelt administration. The Act of June 25, 1910 (36 Stat. 2847), provided a general program of withdrawal of public lands and reserved "* * * the same for water-power sites, irrigation, classification of lands, or other public purposes." The Division of Water Utilization was established to carry out the field work necessary to land-classification and withdrawal.

**E. C. LaRue was the first engineer** assigned to the Division of Water Utilization whose activities included the field work not only needed in the examination of withdrawals under the Act of June 25, 1910, but also in applications for rights-of-way for irrigation and waterpower projects across public lands, Carey Act segregations, and examination of land for designation under the Enlarged Homestead Act. Such a program of activities entailed nearly the whole of water administration of the Public Domain, there being no other organization. The field investigations were handled by LaRue and the equally capable E. C. Murphy[8] on a "full-time" basis, with only occasional part-time assignment of perhaps three or four others from the Water Resources Branch.

**LaRue had probably seen and surveyed** more of the Colorado River than any person of his generation. From 1914 to 1924, he had traveled by boat through hundreds of miles of this river and its tributaries (see figure 1) – which anybody who knows that rugged, sparse country and turbulent river will recognize as romantic stuff. He was more than a voyager; he was there as an hydraulic engineer to select and prepare detailed surveys of the damsites, and to prepare reports upon the best method of utilizing its valued natural assets. He probably had more firsthand knowledge of the geography and hydrology of the Colorado River than any of his later critics, which was perhaps a handicap under the circumstances.

## PROBLEMS AND REPORTS ON THE LOWER COLORADO RIVER

**There were several reasons for** intensive interest in the Colorado

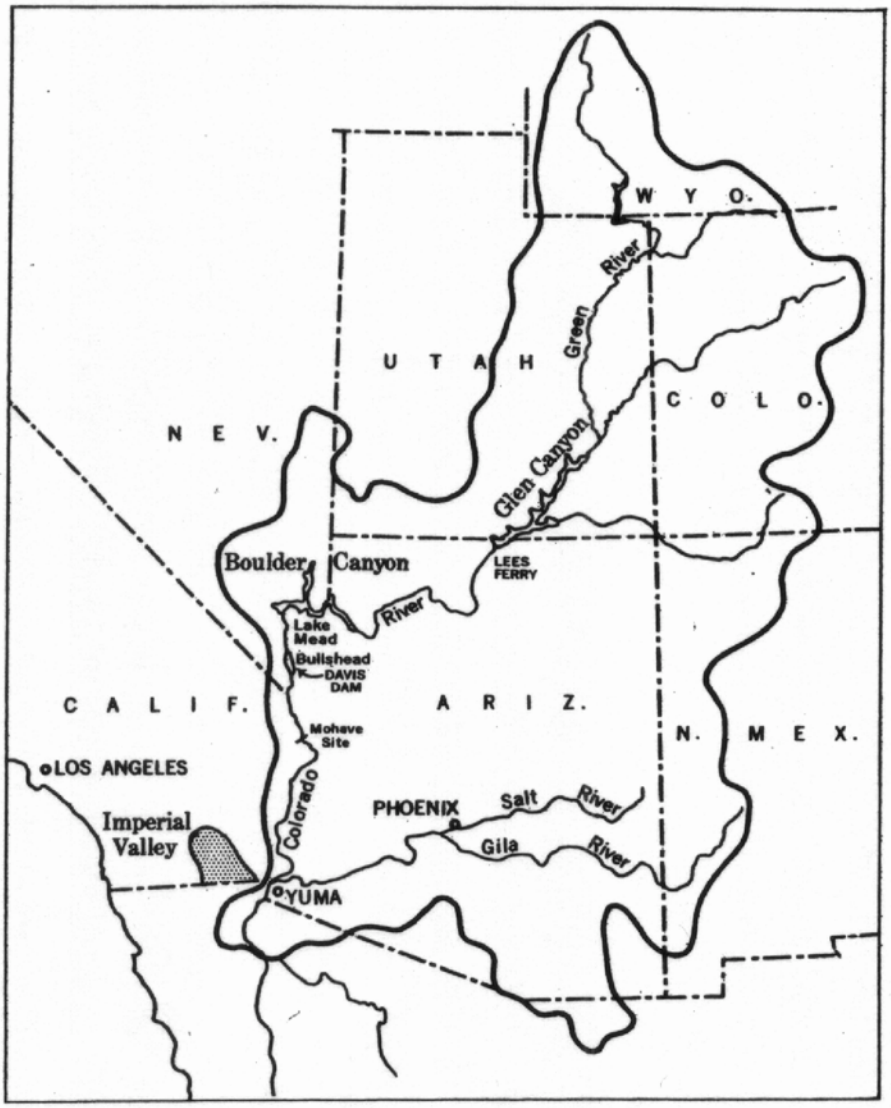


FIGURE 1

River. When Powell went down the river, frontier settlements had already begun to tap the Colorado and its tributaries for irrigation. In 1854, the Mormons had settled along the Green River in Wyoming. (Powell began his exploration in 1869 from the Green River settlement.) Other irrigated settlements began in the 1870's along the lower Colorado in California, in the 1880's near Grand Junction, Colorado, in 1890 at Yuma and on the Salt River in Arizona.

**In 1901, water from the Colorado** River began to irrigate Imperial Valley, as it was by then grandly named. Then in February 1905, during an exceptionally high flood, the Colorado River abandoned its usual course to the Gulf of California and entered the canal leading to the Imperial Valley and recreated Salton Sea to a depth of nearly 80 feet before the breach was closed two years later. Had it not been repaired, the Imperial Valley (being below sea level) would have been slowly inundated. Thus the demand was strong for control of floods on the Colorado River.

**Concurrently, there was rapid** development of irrigation in the southern parts of the river basin, not only in California but in the Yuma area of Arizona as well. Demands for power for burgeoning Los Angeles[9] and the improvement in the technology of long-distance transmission of electricity stimulated interest in the power sites along the canyon sections of the river. And, of course, the growing demands upon the finite resources created dissension and counterclaims – anxiety in the Upper Basin that rapid growth in the more favored Lower Basin would create rights upon the river and thus deny them use of the water in the future. There were arguments between the proponents of public and private power.

**In 1912, LaRue began a pioneer** comprehensive study of water supply of the whole river and of the problems of its utilization. The first of many reports on the river to come, his report (U.S. Geol. Survey Water-Supply Paper 395), published in 1916 on the water planning on the Colorado River, assembled the pertinent data on its flow, sediment load, irrigable areas, and reservoir sites. His analyses led him to certain conclusions:

1. (p. 167) That the Colorado River does not furnish enough water to irrigate all available acreage. A shortage of 3.8 million acre-feet in the Lower Basin may be indicated and therefore "the adoption of a policy or plan of development tending to prevent the unnecessary waste of water cannot be too strongly urged."

2. (p. 216) That 25 million acre-feet of storage capacity would be required to average out the flow at 21,800 cfs, but such regulation of flow is neither desired nor commercially feasible. "To make up the losses due to evaporation and other causes, it is probable that a storage of 18 million acre-feet may be required (p. 198)."

3. (p. 216) That about 6 million acre-feet of storage capacity would be required for control of floods in the lower river. After development in the Upper Basin only 3 to 4 million acre-feet may be required.[10]

**Meanwhile the U.S. Reclamation** Service was looking at projects in the Upper Basin and on the lower river. In the first annual report of the Reclamation Service (then part of the U.S. Geological Survey), J. B. Lippincott reported on reconnaissance trips made in 1902 on the lower canyon section, noting the damsites in Boulder, Black, and Pyramid Canyons. The same report also reviewed opportunities for diversion on the Arizona-California section of the river. There were dozens of other reports on the lower river.[11]

**However, floods again in 1916,** recurrent low summer flows that threatened water shortages in the Imperial Valley and problems on the Imperial Canal that passed through parts of Mexico, which claimed half the water, maintained interest in plans and studies. The Imperial Valley Irrigation District urged A. P. Davis, then Chief of the U.S. Reclamation Service, to undertake a new study. This reinvestigation, authorized by the Kincaid Act of May 18, 1920 (41 Stat. 600) resulted in the so-called Fall-Davis Report (S. Doc. 142, 67th Cong., 2d sess., 1922) which recommended not only a new "All-American" diversion canal from the Colorado River to the District, but also a high dam at or near Boulder Canyon. The dam was to be multipurpose, combining storage for flood control and irrigation and head for power generation – the latter to earn the money to pay for the project.

**Because of the nearly exclusive** benefits to California and to the Yuma area in Arizona, the Upper Basin States would not agree to further any development in the Lower Basin that might preempt their rights to the water supply of the river. To define these rights in a division of the supply, in 1922 an interstate commission was invoked to frame a compact among the seven States of the Colorado River Basin. Herbert Hoover, Secretary of Commerce and appointed Federal Commissioner, was elected chairman. Since the compact divided the estimated supply of water equally between the upper and lower groups of States, it did not resolve the difference between the Lower Basin States, especially California and Arizona. Arizona wouldn't sign, and then the Upper Basin States declared no compact – no Boulder project – and so on. At this distance in time, it is tempting to ask again, why the efforts devoted toward legal arrange-

ments were not instead directed toward erecting a basin plan or a means for reaching decisions on river management.[12]

## LaRUE'S PLAN AND ARGUMENT

**Meanwhile, LaRue was engaged in a** new study of the Colorado River, based on his extensive river surveys and comprehensive records of flow. In his second report, published in 1925 (U.S. Geol. Survey Water-Supply Paper 556), LaRue states there were two classes of plans. The one, essentially the Fall-Davis plan, centered on a large dam in the Boulder-Black Canyon region, (see figures 2 and 3), and was supplemented by diversion of water for California and lower Arizona, and by the development of additional run-of-the-river power sites that existed in the reach above the Boulder flow line and the boundary of Grand Canyon National Park. The other class embraced the plans which were based on the theory that major regulation of flow by storage could be developed by dams at or above Lees Ferry, Ariz. (see figure 4), and that one dam could be built in Mohave Canyon to furnish preliminary and, eventually, supplemental storage for flood control and irrigation. The canyon section of the river could thus be left free for power development, with the power dams incidentally providing for the storage of silt.

**LaRue advocated the second plan** and set it forth in detail in U.S. Geol. Survey Water-Supply Paper 556 which presents the records of river flow, topographic and geologic descriptions of the many damsites along the river, an analysis of the waterpower potentials, and reservoir sites for flood control. It is a combined account of physical and economic hydrography, with a plan for development of the Colorado River.

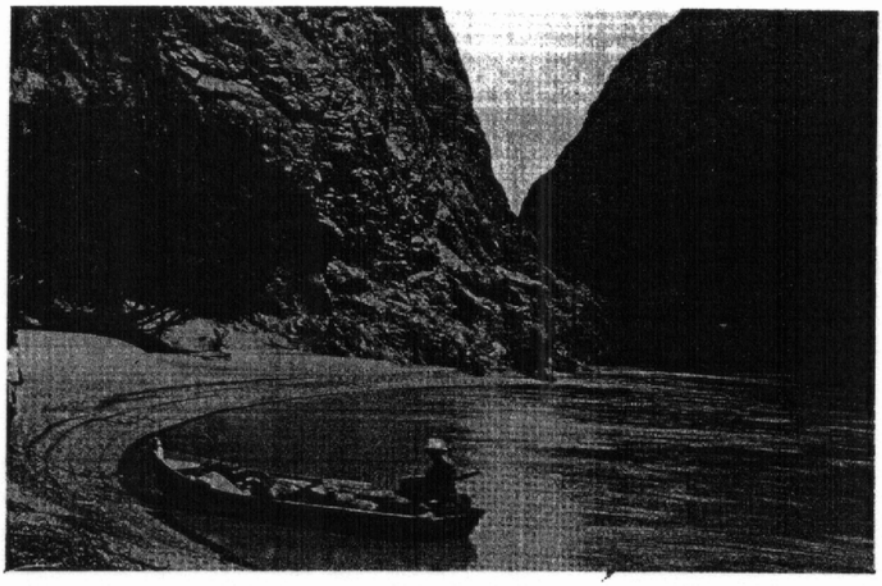

Figure 2. – Upstream view of the lower end of Boulder Canyon, September 25, 1922.

Figure 3. – Downstream view from Black Canyon damsite, September 26, 1922.

**In the lower river, LaRue proposed** essentially a heel-to-toe staircase of impoundments to develop the entire 4,000 feet of fall from Cataract Canyon in Utah to the lower river in Arizona (including the reach in the Grand Canyon National Park). There were 13 dams in all, ranging in height from 99 to 566 feet. Hydropower was the implicit major objective. The criterion for choice of damsites and capacity was minimum evaporation. His plan provided 10 million acre-feet of storage capacity back of a 556-foot dam at

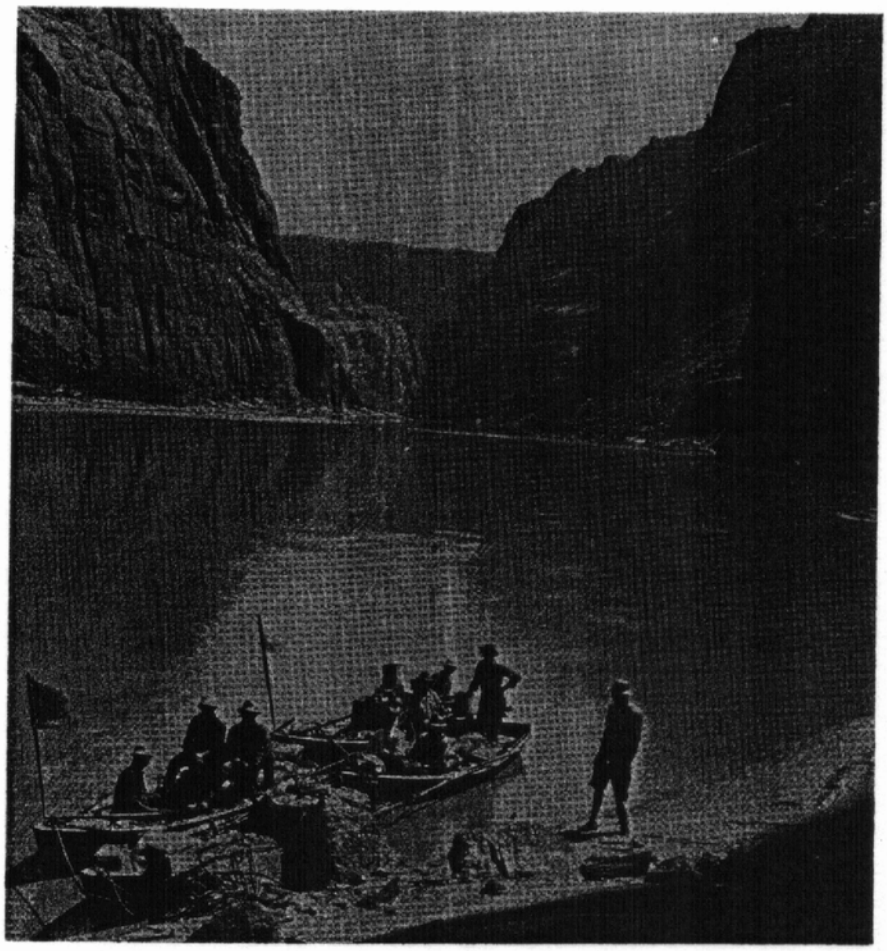

**Figure 4.** – A view down Glen Canyon at Lees Ferry damsite, September 16, 1922.

Glen Canyon to attenuate the fluctuations in flow, to firm up power production at the echelon of dams downstream, and to regulate the river flow for diversion of water not only to California but ultimately to central Arizona. The 10 million acre-feet of storage capacity at Mohave (see figure 1) was reserved for control of floods on the lower river.

**LaRue's 1925 report argued for a** best single plan in strong terms. In the light of the many plans and reports then in print, and of the controversy already in progress, one may have been astounded by the author's claim that his recommendation "provides the most effective means of flood control and storage for irrigation (p. 73)," that "it solves the problem of silt storage for several generations," and that "it provides a maximum use of water for both irrigation and power development." Although these superlatives were amply supported by the Survey's annual appropriations referred to earlier, they should have been heady medicine in stark print – despite Nathan C. Grover's statement that the Survey "is not attempting to promote any particular project." (Grover was *Chief Hydraulic Engineer* for the Survey from 1913 to 1938.) One wonders whether Grover read the report or if he did, was attempting to separate the views of the author from the prevalent attitude toward neutrality which was already evident in Survey policy.

**The Boulder site became the center** of the controversy. LaRue wanted to develop the 580-foot fall from the base of Bridge Canyon to the lower Black Canyon, at three dams devoted exclusively to power generation. LaRue's principal engineering adversary was Arthur Powell Davis,[13] nephew of John Wesley Powell, and Director of the Reclamation Service from 1914 to 1923. Unlike his uncle, and unlike F. H. Newell, his predecessor, who as Director of the Reclamation Service, viewed irrigation as an instrument of land and water development, Davis was a construction engineer whose objective was to build wherever opportunity offered. His emphasis on construction was reported to be one of the reasons Secretary Work discharged him in 1923.[14] Thus, to Davis (Am. Soc. Civil Engineers Trans., p. 389, 1925), LaRue's plan "would destroy the best reservoir site in the Basin and seriously limit the usefulness of the river." Davis did not define the criterion by which he judged it the best site. (He probably meant damsite, rather than reservoir site, because Glen Canyon and Black Canyon reservoirs are about equal in capacity and surface area.) In his criticism (p. 390), Davis questioned the foundations of LaRue's proposal for a dam at Glen Canyon.

**LaRue, however, looked at it differently.** He wanted to put his regulating storage upstream, chiefly at Glen Canyon and thus provide regulated flow for power generation all along the 4,000-foot fall, downstream. He saw the Colorado River as a whole, and argued strenuously to support the merits of his proposals as part of a basin-wide plan that would also meet the needs of the Lower Basin. He emphasized that the demands for water would exceed the available supply and thus the water losses by evaporation should have been a serious and critical planning criterion.

**Engineer Davis was the author of the** Fall-Davis Report (1922). (Fall was then Secretary of the Interior.) This plan, as previously mentioned, proposed a major reservoir at the Boulder Canyon site, about 570 feet high, with a 28 million acre-feet capacity to provide at one site, flood control and water storage to regulate the variable river flow for irrigation and for hydropower. Power was to be the "cash register" to earn revenue to repay both the entire cost of the reservoir and that of a low dam below Boulder used to recapture the power releases at Boulder. The high dam at Boulder not only would meet the demands of California but it also would establish many world records for engineering structures.[15] (Ironically, the low dam below Boulder is now called Davis Dam, but the major reservoir above Boulder is called Lake Mead, after Davis' successor.)

**The recommendations of the Fall-**Davis Report were incorporated in a bill introduced in 1923 (H.R. 2903) by Representative Philip Swing of San Diego, and later co-sponsored by Senator Hiram Johnson of California. As the so-called Swing-Johnson bill progressed toward enactment, hearings were held by both houses.

## THE HEARINGS

**LaRue appeared before the House** Committee on Irrigation and Reclamation in March 1924, to present his conclusions. Although there was much discussion of the several damsites and diversion schemes, the Committee was most startled by his statement that the water supply in the Colorado River was not sufficient to irrigate all lands susceptible for irrigation and therefore asked him to reappear to present these data. This conclusion, which LaRue had published eight years earlier in U.S. Geol. Survey Water-Supply Paper 395, and which contradicted an optimistic conclusion published in the Fall-Davis Report,[16] is, of course, now well known to be an unfortunate fact of the Colorado River and the basis for recurrent plans to import water into the basin. The hearings must have appeared productive from LaRue's point of view.

**On December 9, 1925, soon after** the publication of Water-Supply Paper 556, he appeared before the Senate Committee on Irrigation and Reclamation. Besides Senator McNary of Oregon who was Chairman, nearly the whole committee was present which included such then famous persons as Hiram Johnson of California and Morris Sheppard of Texas. The only easterner on the committee, Senator Simmons of North Carolina, was also there. Also present was Representative Swing, co-author of the pending bill to authorize the Boulder Canyon project which was so eagerly sought by southern California.

**A good show was in sight. LaRue** was the only witness on schedule for the day and his position was already well known. His responses to questions were brittle; he wanted to persuade, yet he was reminded that the purpose of the hearings was to establish a record "for the benefit of any person who may read it (Senate Hearings, p. 537)." His answers did not evoke a sympathetic reaction that might have softened the sometimes savage questioning by Senator Johnson. Even Cameron and Ashurst, the Arizona senators who were present, did not come to his rescue.

**Because of its size and multipur-**pose use, the Boulder project was to be built by the Government, opening the prospect of power generation by the Government as well. The project was thereby drawn into the lively controversy of that time: public vs. private power. Johnson took advantage of this in his questioning to show that the Survey work was paid for, in part, by the Southern California Edison Company, and therefore, by implication, LaRue was reflecting their view in his opposition to Boulder. Thus, note the following excerpts (p. 590–591) from the 1925 Senate Hearings:

> Senator Johnson: *Do I understand you that the Southern California Edison people went through the canyon with you?*
>
> Mr. LaRue: *Yes, sir.*
>
> Senator Johnson: *Did the Edison people contribute anything to the work there?*
>
> Mr. LaRue: *They paid for half the cost.*[17]

**Exploited to the full by Senator** Johnson was LaRue's inability to produce drill-core evidence which therefore raised questions on the foundations of the damsites in his proposal. Only the Boulder-Black Canyon site had been drilled and so LaRue was cast in the role of advancing the uncertain, in the face of the known, the certain. Much was made of this point by the Reclamation Service which had the option of choosing the sites for drilling.[18]

**LaRue was followed by Herbert** Hoover, then the prestigious Secretary of Commerce, and the Chairman of the 1922 Compact Commission. Hoover put the choice of the Boulder site over other "theoretical" choices on the practical consideration of its proximity to the Los Angeles market. Boulder concentrated 570 feet of fall only 250 miles from Los Angeles. Such a location would likely earn enough revenue to pay for the project. He stated rather bluntly, "* * * logic drives us as near to the power market as possible, and that therefore takes us down into the lower canyon." (See Hearings on S. 320, 68th Cong., 2d sess., p. 601, Dec. 10, 1925.) The point was not new, having been made in the Fall-Davis Report. Briefly then, the trade-off was between *power now* and *water losses later*.

**LaRue was not a crank, nor was he** alone in his judgments. A paper[19] published in 1925 by the Chief Engineer of the Federal Power Commission, (an officer of the U.S. Army Corps of Engineers), which more or less advocated the same plan, for the same reasons as LaRue, was supported by several distinguished engineers. This paper added that the development of the river should not be aimed at a "one-shot" scheme but rather should

be staged as greater knowledge of the character of the river and of its needs was gained. Thus, LaRue only became more zealous; however the Reclamation Service was then equally deterministic in its planning as is made evident in the modern view of "Water and Choice in the Colorado Basin" described in the report of that name by the Committee on Water of the National Research Council (G. F. White, Chairman, 1968, NAS Rept. 1689).

## THE UPSHOT

**By 1926 the Boulder Canyon proj**ect was a settled issue. The dam was authorized by the Swing-Johnson Act of December 21, 1928 (45 Stat. 1057), and built from 1930 to 1936. G. F. White[20] credits Boulder as the prototype of the multipurpose project adding "and no structure in water management has greater significance in this respect. It was the first Federal project explicitly designed to use one gigantic structure to serve multiple purposes * * *. It substituted one structure for a number of structures and in so doing, it often gained economies of scale and of combination which otherwise would have been lost."

**One might therefore view LaRue's** plan as reflective of the old school and Davis' multipurpose project as reflective of the new. However, the contrast was not so stark. LaRue's plan was multipurpose and his proposed reservoir at Glen Canyon was at least dual purpose. He viewed this arrangement as easier to administer and involving fewer conflicts of interest. (For example, power dams could be privately owned.)

**It would be fruitless to compare** the merits of the proposals as many did at the time, especially the careful, competent Herman Stabler (1924),[21] later chief of the Conservation Division, because there was no explicit statement – let alone agreement – on the objectives or the criteria for choice. LaRue integrated his knowledge of the hydrology, and his guess about the future demands of society with his knowledge of technology, to produce a plan that he viewed as achieving the best use of the river. His objective was whole-river planning.

**His plea at the Senate Hearing that** "* * * all dams constructed on the lower Colorado River should conform to a comprehensive plan of development, which will provide maximum use of water resources and prevent an unnecessary waste of these resources" (Senate Hearings, p. 534, Dec. 10, 1925), was sound indeed, but was lost in the confusion of claims and counterclaims. Under the Colorado River Compact adopted in 1928, each region could pursue its own objectives. Arizona and the States of the Upper Basin sought legal protection against the aims of California rather than the enactment of "a comprehensive plan of development" of which they could have been a part. LaRue deserves an honorable place in history.

## RESIGNATION

**LaRue resigned from the U.S. Geo**logical Survey in July 1927. In the Senate Hearings (p. 590) he said "I was informed at that time [1920 when he first made known his opposition to the Boulder project – a bold action considering that his office was in Pasadena] I would be fired out of the Service if I did not keep still or if I opened my mouth." He did not identify the source of this threat. It is not conceivable that it was made by an official in the U.S. Geological Survey because his report on the Colorado River (U.S. Geol. Survey Water-Supply Paper 556, published in 1925) presents his recommendations and registers his opposition to the Boulder Canyon project. In addition, the report contains a glowing introduction by N. C. Grover, Chief Hydraulic Engineer, and a foreword by the Secretary of the Interior, Hubert Work of Colorado. Yet on June 10, 1926, six months after the Senate Hearings, Director George Otis Smith was impelled to telegraph LaRue as follows:

CRITICISMS AND COMPLAINTS OF YOUR PUBLIC UTTERANCES AND EVEN PRIVATE CONVERSATIONS HAVE BECOME SO FREQUENT THAT ONLY PRACTICABLE METHOD TO DEFEND SURVEY AND YOURSELF FROM CHARGE OF OPPOSING ADOPTED POLICY IS SILENCE *STOP* IN SPITE OF MY FAITH THAT YOUR INTENTIONS ARE OF BEST IN WHICH SECRETARY WORK JOINS ME I MUST DISAPPROVE ANY FURTHER DISCUSSION BY YOU OF BOULDER DAM OR RELATED SUBJECTS *STOP* SURVEYS FULL AND IMPARTIAL EXPOSITION OF ENGINEERING FACTS IN YOUR PUBLISHED REPORT IS OUR PART IN THIS CONTROVERSY WHICH HAS NOW REACHED SITUATION SO TENSE THAT MISUNDERSTANDING IS SURE TO FOLLOW ANY FURTHER CONTRIBUTION FROM YOU *STOP* GEORGE OTIS SMITH DIRECTOR

**LaRue's reply on the following day** explained that his papers and speeches were already well known and on the public record but that "* * * I assure you I am going to keep out of this or resign * * *" and then, because he felt some word of his previous activities may have reached the Director, he added, "Please don't let anyone convince you that I am holding interviews and directing the fight against Boulder Dam." This letter was noted by Director Smith and "shown to Secretary Work." LaRue's resignation was nevertheless inevitable.

**He went into partnership with** B. F. Jakobsen, but failed and saw hard times during the depression. I met him for the first and only time in 1940, when he was employed by the Corps of Engineers in their Los Angeles office. He died of a heart attack in 1947 in his 69th year.[22]

## EPILOGUE

**The U.S. Geological Survey began** on a keynote of *Data to Action*.

LaRue's 1925 report on the Colorado River (U.S. Geol. Survey Water-Supply Paper 556) was one of a series on the utilization of western rivers as authorized by annual appropriations, viz. "for the preparation of reports on the best methods of utilizing the water resources." However, LaRue's report was the only one which tried to measure up to the task of offering a specific plan for river development. The others were chiefly reports of basic data, lists of damsites, irrigable acreage, market areas, and so on, with only vague statements of the expected future, and judgments on the practical values of certain sites, or on the limitations imposed by the quantity or quality of the water available.

**LaRue's design embodied a range** of concepts and responses to needs for water in the Colorado River Basin. One gains the strong impression that whatever the deterministic bias of the times, LaRue had arrived at some thoughtful and fundamental results. His facts were correct; his analysis showed that (1) there was not enough water to supply all irrigable acreage, (2) that the Boulder Canyon reservoir would evaporate more water than other alternatives, and above all, (3) would preempt comprehensive planning for the whole river. What LaRue failed to do, was to recognize the enormous impact of the diverse value judgments that would govern the political decision. He spoke out loudly against overwhelming odds because, in his opinion, the building of Boulder would have denied the opportunities and limitations of nature. Only in this way, can one judge his persistence and his sacrifice of a fruitful career in public service.

**An important consequence of the** LaRue affair was the effect it had upon the Water Resources Division of the Geological Survey. It was not clearly perceived that the roots of LaRue's problem lay in the pursuit of a single plan of action rather than of available alternatives. As a result, the Water Resources Division shifted to an extreme position as an exclusively fact-finding agency serving chiefly Government action agencies. As a frequent participant in meetings in Chief Hydraulic Engineer Grover's office, I clearly recall the fear expressed by my seniors of involvement in any situation like LaRue's. The Division kept on that basic data tack for some 30 years, until rescued from this nervous state by a renewed program of research.[23]

**Fortunately, the modern view links** data and action in less direct but more practical ways. It interposes explicit recognition of objectives and of criteria for choice of action, or more simply expressed by Abel Wolman,[24] "the job of the planner, then, is to serve as the chief illuminator of choices." In this task, the role of science and basic data becomes greater than before for two reasons: (1) data become needed to portray diverse yet possible alternatives, and (2) because these alternatives may entail changes in the landscape, emphasis shifts to a knowledge of process that can be supplied only by research. The planner-engineer must be able to predict the hydrologic and the social consequences of each of several proposed actions.

### FOOTNOTES

1. Peffer, E. L., 1951, The closing of the public domain: disposal and reservation policies, 1900–1950: Stanford, Calif., Stanford Univ. Press, 372 p.
2. The Geological Survey maintains a program for the classification of water-power sites and storage-reservoir sites as authorized by several acts; see U.S. Geological Survey Circular 400, revised 1965. The program also includes recommendations for withdrawal from entry of such sites, and for their restoration when the withdrawals no longer serve the public interest.
3. An introduction to the subject of geographic determinism may be found in – Carter, G. F., 1974, Man and the Land: New York, Holt, Rinehart, and Winston, p. 5–9.
4. Huntington, Ellsworth, 1945, Mainsprings of civilization: New York, John Wiley & Sons, 660 p.
5. Carey Act (28 Stat. 372) provided for grants of irrigable land to the States or assignees provided these were developed for irrigation. Construction companies usually promoted the schemes and sold water rights to settlers. Not more than 160 acres were available to any one person and only to those who contracted for water rights.
6. The *Division of Water Utilization* became the *Division of Enlarged and Stock Raising Homesteads* in 1920 and was reconstituted in the late 1920's under R. W. Davenport, who had been detailed to the Federal Power Commission after its formation in 1920, to supervise relations with that Commission; because of Davenport's broader interests and those of W. G. Hoyt, then of the Conservation Division, who also shared an interest in power development, the Division became in effect the hydrologic analysis unit. In 1956, it became the *General Hydrology Branch*; the name *Water Utilization* was resurrected for a small group with the responsibility for preparing reports on water use, probably the only time in its history that the name clearly fit the purpose.
7. Follansbee, Robert, A history of the Water Resources Branch of the United States Geological Survey to June 30, 1939: 459 p. [privately printed]
8. Memoir of E. C. Murphy – Am. Soc. Civil Engineers Trans., 1935, v. 100, p. 1697–98.
9. Los Angeles County was increasing in population at a 10% annual rate.
10. These conclusions do not differ greatly from those reached independently several years later by Herman Stabler of the U.S. Geological Survey. (See House Hearings Comm. on Irrig. & Reclamation, on H.R. 2903, 68th Cong., 1st sess., p. 833–845, 1924.)

    "The conclusion is obvious that the water supply is inadequate * * * (p. 841)." "The storage capacity adequate to maintain reasonably uniform annual

flow is difficult to determine. It is evidently greater than 5 million and pretty certainly as great as 10 million acre-feet and less than 20 million acre-feet (p. 840)."

11. Wilbur, R. L., and Ely, Northcutt, The Hoover Dam Documents, House Doc. 717, 80th Cong., 2d sess., 1948 (1st ed. published in 1933).

    The introduction to this report includes an account of the several reports, investigations, hearings, and legislation leading to the construction of the Hoover Dam (formerly Boulder Dam). Aside from indirect bibliographic listing of two of LaRue's Water-Supply Papers, this account makes no reference to his work or to the results of his investigations.

12. There were indeed several recommendations of this sort at the time. In 1924 the suggestion was made to create an interstate power and irrigation district to plan and carry out the development of the river (C. E. Grunsky *in* Am. Soc. Civil Engineers Proc., p. 1482, Nov. 1924). R. L. Olson in a privately published book entitled "The Colorado River Compact," Sept. 1926, proposed a Colorado River Authority on the model of the New York Port Authority, with continuing responsibility for planning and development throughout the basin.

    L. M. Hartman and Don Seastone (1970) in a more recent book, "Water Transfers, Economic Efficiency, and Alternative Institutions," (Johns Hopkins Press, Baltimore, Md.) conclude that people are better served with water when allocation decisions are administratively made. Trials in court customarily are limited to experts and evidence introduced by the adversaries; the court does not involve others or make independent studies based on its own evidence or data.

13. Biography of A. P. Davis – Am. Soc. Civil Engineers Trans., 1935, v. 100, p. 1582.

14. Statement on dismissal of A. P. Davis – Engineering News-Record, v. 90, p. 1139, June 28, 1923.

15. Department of the Interior: Memorandum to the press, Mar. 17, 1924.

16. The 18th annual report of the Reclamation Service (p. 407, 1919) also had stated "that there is sufficient water supply in the Colorado River, if storage is provided, to supply all future irrigation requirements within the drainage basin."

17. Cost sharing was undertaken through the Federal Power Commission, before which the Edison Company had an application for a license to develop power in the canyon reaches of the river.

18. On Nov. 3, 1921, Director of the Reclamation Service, A. P. Davis, wrote Chief Hydraulic Engineer of the Geological Survey, N. C. Grover, the following:

    "* * * information collected by the Reclamation Service, based on surveys and detailed studies as compared with assumed and estimated data for the Lees Ferry site. Naturally such comparisons cannot form the basis of a reliable conclusion or comprehensive plan of development." (The Lees Ferry site is the same as the Glen Canyon.)

19. Kelly, William, 1925, The Colorado River problem: Am. Soc. Civil Engineers Trans., v. 88, p. 306.

20. White, G. F., 1969, Strategies of American water management: Ann Arbor, Michigan Univ. Press.

21. Memoir of Herman Stabler – 1943, Am. Soc. Civil Engineers Trans., v. 108, p. 1641.

22. Memoir on Eugene Clyde LaRue – Water Resources Bulletin [WRD Bulletin] May 10, 1947, p. 79–80.

23. In 1974 research constituted about 35 percent of the appropriated funds of the Water Resources Division.

24. Wolman, Abel, 1970, Multiple purpose river development: Am. Water Works Assoc. Jour., (Feb.) v. 62, no. 2, p. 71–74.

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