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GEN. OTIS' OBSERVATIONS

He Visits Laguna Dam and the Imperial Canal Heading

And Writes Entertainingly of What He Saw on His Trip. Also Gives Valuable Views on Future Developments

A short time ago General Harrison G. Otis of the Los Angeles Times made a trip to the Lower Colorado river and over the Imperial Valley for the purpose of studying conditions at first hands and familiarizing himself with the situation in this part of the country as it obtains at the present time. While he was in the Valley we had a very satisfactory interview with him and during our conversation he expressed the same views as those given in his paper of April 15th concerning the ultimate outcome of the irrigation development on the Lower Colorado. General Otis is president of the Colorado River Land company, a corporation which owns nearly a million acres of land below the line in Lower California. Their tract of land adjoins the 100,000 acre tract of the California Development company and the Imperial channel from the Colorado river to this Valley crosses his company's land. Several hundred thousand acres of that land is believed to be capable of irrigation and reclamation and it is therefore evident that General Otis and his company is interested in the question of securing the use of the waters of the Colorado river for irrigation and also of securing the very best method for bringing the water into such use. He has published a very interesting description of the Laguna Dam and the works being put in by the United States Reclamation Service for the control of diversions from the river and also some other observations and opinions on matters of much concern to Imperial Valley people. We quote the following:

THE RIVER

The Colorado river of the West, having its sources in the mysterious mountains of far-off Wyoming, takes its tortuous and turbulent way for more than 2,000 miles in a southwesterly direction, until it debouches upon the head of the Gulf of California, or the "Sea of Cortez," as it is designated on the early Spanish maps. It is one of the large rivers of the world, rising in the snows, traversing vast wooded upland regions, tearing its way through mighty gorges, chief am ng which is the Grand Canyon in Arizona, cutting the arid surfaces of hot and barren plains, and fertilizing valleys of marvelous richness wherever it is found possible to draw out upon the thirsty land sufficient of the precious waters to irrigate the responsive soil. But the area watered and cultivated along the line of the river is insignificant when compared with the total acreage that is susceptible of reclamation under the comprehensive plans of the government.

A vast region, that, for want of water on the land, though it be abundant enough in the river, has lain practically a desert during a period of time so far back in the past that history has failed to record it, is destined to be reclaimed, to be made cultivable, habitable, population-supporting and wealth producing. It will be a transformation the like of which the world has never seen.

In the lower reaches of the river, after it emerges from its prison walls in the rocky canyons, bearing on its irresistible way through the broad alluvial valley, the Colorado is probably the most perverse, uncertain, tortuous and changeable stream on the face of the earth. Being subject to an annual overflow in early summer, caused by melting snows in the high sierras, where it finds its sources, the river leaps its banks, which are low in the plains, and inundates great areas of land lying along its lower course.

HARNESSING THE COLORADO

Powerful and apparently unmanageable though the Colorado river is, the Reclamation Service has courageously and confidently entered upon the herculean task of harnessing the mighty stream, with the declared object of controlling its priceless waters for the uses of irrigation, which, in the ever-enlarging scheme of settlement, cultivation and civilization, has become paramount in the arid West. To this end the Laguna Dam, known officially as the "Yuma Project" (although it is not the entire project,) is now under construction, and has been ever since the nauguration of the work in 1905. The contractors have two years more in which to complete their difficult task.

The facts incorporated in my description are from official sources, and hence correct and authoritative.

THE CAPTAINS OF THE JOB

J. G. White & Co., the contractors under the government, are probably the largest contracting firm in this country, if not in the world, as they are operating through subsidiary companies in many lands. The head of the firm is at the head of the company in this country, known as "J. G. White & Co., Incorporated," with heasquarters in New York. Hugh Wallace (son of the well-known engineer, John H. Wallace,) is third vice-president, and has active charge of all the firm's work in the United States. C. G. Young is general superintendent of construction. M. L. Peppard is superintendent of construction at the Laguna Dam, and resides on the ground. He has a corps of about twenty assistants acting in the capacities of assistant superintendents, engineers, clerks, overseers etc. The company has employed at different times, from 300 to 550 men on the work since it was begun nine months ago. The work is carried forward under rules and specifications upon which the company based its successful bid.

THE GOVERNMENT OFFICERS

The United States Reclamation enginers are on the ground to lay out the work, to see that it is properly constructed in accordance with specifications, and to safeguard the interests of the government generally. J. B. Lippincott, with headquarters in Los Angeles, is supervising engineer under Chief Engineer F. H. Newell of the U. S. Geological Survey; Homer Hamlin is district engineer, with his office in Yuma, and Captain E. D. Vincent is resident engineer, camping on the firing line so to speak. It was from this courteous and capable officer that I gathered the interesting and reliable data which has been expanded into this article. Captain Vincent was formerly in the Corps of Engineers of the Army in which he rendered years of valuable service, including a tour of duty in Cuba during the late war. He is now devoting himself with assiduity to the important engineering work to which he has been assigned.

THE SITE

The site of the dam is at a point ab ut thirteen miles above Yuma, where the valley is narrow and the river confined within narrow rocky walls rising frowningly above both the California and the Arizona banks. These firm walls constitute secure holding ground for the ends of the dam, the longer portion of which is to be built in the shifting sands of the river bed, and also for the sluiceways and canals, which provided with powerful steel gates, are designed to carry the surplus water—that portion not passing over the crest—past the ends of the dam, returning it to the river's channel at a point about 3500 feet below the dam.

DIMENSIONS

The authoritative figures showing the dimensions and weight of the great structure are interesting and informing:

The total length is 4900 feet; width, 226 feet; height, 10 feet; depth in the river section, 19 feet making the level on the top the same throughout the entire length of the structure. It is estimated that the entire weight will reach the enormous figure of 600,000 tons.

CONSTRUCTION

The body of the dam is of rock fill, composed of irregular blocks weighing from 4000 pounds down. Three massive walls, of concrete core, run longitudinally through the dam, built in the proportions of one part cement, 3 parts sand, and 7 parts broken stone.

CAPACITY

The canal on the Arizona side will be 60 feet wide on the bottom, with a capacity of 1600 second feet. The canal on the California side will be 22 feet wide on the bottom with a capacity of 200 second feet. This last-named canal is to be so constructed as to be capable af enlargement. At the same time the dam is to be so built that it will not depend upon relief from water pressure by the sluiceways and canals.

THE SILT PROBLEM AND THE SLUICEWAYS

The satisfactory disposition of the silt is one of the most difficult features of this formidable undertaking. Colorado river water is heavily charged with silt, carried down in solution by the swift current, which is ever tearing away the unstable banks. The grade of the stream is about one foot to the mile. At the east end of the dam a sluiceway 116 feet wide is being construcned extending down to the low-water depth of the river. At the west end another sluiceway 40 feet in width will be built, which will also be capable of enlargement. These sluiceways will be controlled by great steel gates, (one in the California sluiceway and three in the Arizona sluiceway,) each gate 35 feet long and 15 high; all to be operated by hydraulic machinery.

The diversion canals will take their water from the sides of the sluiceways above these gates. The engineers calculate that the areas of the sluiceways are so ample and the movement of the water will be so slow that most of the sediment will be deposited, as in settling basins, before reaching the canal intake. When the sediment has accumulated to any objectionable extent above the entrances to the sluiceways the gates will be opened and the sluiceways scoured out.

There are spillways as well as sluiceways, the distinction between them being this: A spillway is simply an opening for the escape of surplus water, and a sluiceway, while performing that same office, can, in addition, be so manipulated by gates, etc.. as to be forced to clear itself of sediment and any foreign matter.

There are no other methods of emptying the dam than by the sluiceways and canals at either end, for the dam itself, as constructed, will constitute a perfect weir, with its crest maintained at an elevation of 151 feet above sea level, and extending entirely across the valley from one rock abutment to the other.

In all silt bearing rivers, says Engineer Vincent, most of the sediment is carried in suspension near the bottom, or rolled along the bed, leaving the surface water relatively free. It is planned to convey the water from the sluiceways above the gates into the canals by a akimming process over a long row of gates, taking in about one foot in depth of the water surface.

HARNESSING THE STREAM

Perhaps the most interesting problems of all are these: "How is the dam to be sunk or laid in the sandy bed of the river, so that it will stand? (for, be it remembered, borings have been made to a depth of over 100 feet without striking hardpan,) and what will be the probable effect of the down-rushing masses of silt, packing at the bottom and throughout the entire face of the dam? Will these accumulations ultimately become hard and permanent, thus helping to make the dam still more water-tight? Is it calculated that the silt will gather in such quantities as to gradually rise to the crest of the dam, despite the masses that must inevitably be carried through the side canals?"

Gapt. Vincent's answers to the pertinent questions of mine were in effect as follows: The river is to be closed at the present channel by coffer-damming, and the flow thrown through the Arizona sluiceway. The river section will be pumped out and that section of the dam then built the same as other portions are being constructed at present. (This will of course be done at low-water stage.). The entire structure is expected to silt full, and the entire basin formed above the dam, and extending from eight to ten miles upstream, will be a mud flat, rising to the crest of the dam, with devious channels, self-formed and self-established, running to the two sluiceways.

"How much above the general surface of the river, at its normal flow, will the crest of the dam rise, and how are the gates to be constructed so as to control the output of the canal?"

At an ordinary stage the crest of the dam will be at a level with the water flowing through the canals. It is estimated that five feet will be the greatest depth of water that will ever pass over the crest of the dam, and this in flood times only. The water flowing over the crest will strike an ap[ron] many feet wide thus averting [the] sibility of an undertow and cu[t]ting der the main structure.

HOW WILLOW MATTRESSES AR[E]

This is a very interesti[ng] dam construction. How t[he] es are woven, their dim[en] payed out into the stre[am] into place, and how anchored there, these were questions asked by me and to them clear answers were given as follows:

The mattresses are woven of willows the stitch being the same as used in making an ordinary basket. The weaving is done on barges, which are then pulled from under permitting the mattress to float behind. The mattress is then sunk to the bottom by throwing heavy rocks upon it. In weaving the mattress the willow strands are tied together with three-eigths-inch wire cables, running longitudinally and also across the structure, the cables being ten feet apart. Any width of mattress can be woven and also any length. About forty-six cords of willows are consumed in a 100-foot length of maltress 70 feet wide. The willows grow in great abundance along the banks of the river hard by, and quantities are hauled in by aboriginal sons of the country, los Indios, in consideration of agreed amounts of coin of the realm in hand paid by Uncle Sam.

ANCHORING THE DAM

A question that the average reader will be sure to ask is this: As no rock bed has been reached at that point in the river, how is the dam to be built and anchored at the bottom, when it mnst rest on sand? . What measure of security is relied upon by the engineers to be derived from the element of weight of the structure? The security of the dam, even though resting on sand is depended upon because of its great width of base compared with its height. The weight, 600,000 tons, is also an important factor in the equation. This type of weir is in successfull operation in India and Egypt, but nothing of the kind has ever been completed in this country.

THE AREA CF LAND TO BE RECLAIMED

It is estimated that about 107,000 acres of arable but arid land, lying above and below Yuma but not including the Imperial settlement, can be brought within the present irrigation scheme. These valley and table lands composed mainly of very fertile alluvial soil, will, with abundant water and appropriate cultivation, yield superb crops and load an untold number of trains with their products destined for other markets.

The people of Yuma are looking eagerly forward to the completion of this great national work. They appreciate fully what it means to them and their city, to the entire valley, and to that section of Arizona.

In the Imperial settlement, lying some miles below, and to the west of Yuma, and which gets its water from the famous Imperial Canal, there is an estimated area of 350,000 acres susceptible of irrigation, of which perhaps 100,000 acres are already under ditch and cultivation, producing prodigiously wherever the conditions are right and the lateral canals are [com]pleted to their purposes. More th[an] including the above, [there] for 217,000 acres h[ave] A broad, general e[stimate] lion acres [is] ceptible [of] Va[lley] th[e]