

PRESENT CONDITIONS IN THE PANAMA CANAL ZONE.

BY A LAY CORRESPONDENT.

The excavation of the Panama Canal and the construction of its huge dams and locks is not alone the most stupendous engineering undertaking of modern times, but the preliminary work necessary to prepare the way for this enterprise has been fully as great. Never before in the history of the world has any government undertaken a more difficult task than ours to make fit for habitation an unsanitary district. In a little over three years' time, and at a distance of two thousand miles from the base of supplies, a small country or state has been organized; towns and villages built; and a decrepit railway converted into a modern double-track system. All this has been done in addition to, and much of it contemporaneously with, the actual construction of the canal itself. These things in themselves constitute a formidable task; but greater works than these have been accomplished. The canal zone, once a veritable pest hole, has become a sanitary district. Yellow fever, once the scourge of the Isthmus, has been unknown there since May, 1906; and the death rate is now lower than in many cities of the United States. The difficult problems of engineering, sanitation, feeding and housing employees have been satisfactorily solved. Many millions of dollars were expended in this work, and two cities, Colon and Panama, were renovated, paved and provided with waterworks and sewers and other improvements. To appreciate how tremendous has been the task, one must reflect that this work was done two thousand miles away from the base of supplies, and the locality furnished practically nothing. Lumber, machinery, nails, paint, engines, cars, plumbing materials, furniture, cooking utensils, food, all had to be shipped entire, or in parts ready to be put together, and adjusted after it reached the Isthmus. It was necessary to erect extensive machine shops in which to assemble and erect ready for use the various engines and machinery received at the ports.

What has been the result? With but few exceptions, people who have visited Panama agree that affairs are conducted on a business-like basis, that the Isthmus is becoming more and more safe as regards disease, and that the hospital system is surpassed by none. The supreme achievement has been the routing of yellow fever. It is well understood that the disease is carried by the *Stegomyia* mosquito, and so successful have been the government's methods of extermination that this particular mosquito has been practically driven from the Isthmus. Cases of fever cannot enter from outside because of a rigid quarantine. Other mosquitoes are fought by rigidly-enforced sanitary methods. Houses are carefully screened; stagnant water is not allowed to accumulate; streets are regularly cleaned; fumigation is carried on; and as a result not only yellow fever but malaria has been brought under thorough control.

The rapidity with which these things have been done is part of the marvel. At Culebra, built upon bluffs overlooking the great cut, is a town of five thousand inhabitants which has sprung up in three years time. It has a sewage system and pure water. Other sanitary towns have arisen out of piles of lumber deposited in forlorn looking jungles. When the Americans took the canal they obtained possession of about two thousand buildings, many houses for employees, some good hospitals and machine shops. The excavating machinery and much of the rolling stock for the railroad was too old-fashioned and out of repair to be of much use. Nevertheless the \$40,000,000 paid for French rights, privileges and property has been considered a fair sum.

The principal engineering features of the Panama Canal are so well known to the readers of the *SCIENTIFIC AMERICAN*, that it will be sufficient to give here merely a brief recapitulation. The total length of the canal from deep water in the Atlantic to deep water in the Pacific is about 50 miles. Ten miles of this, however, consists of deep channels dredged through the harbors at either end, the total length from shore line to shore line being about 40 miles. The plan of construction is to build a series of massive dams not far from each shore of the Isthmus; create a large artificial lake between them; connect the lake with each ocean by canals, and a series of locks by which shipping will be raised or lowered from the canals to the lakes as thus formed. Commencing on the Atlantic side, the canal is dredged for $4\frac{1}{2}$ miles through the shoal water of Limon Bay to the shore line. Two and a half miles beyond the shore it reaches the site of the Gatun dam, a huge earthen structure a mile and a half long, over half a mile wide, and 180 feet in height, which will serve to impound the waters of the Chagres River, and form a lake of over 100 miles area and 30 miles in length, whose level will be maintained at an elevation of 85 feet above the sea. The first 7 miles of the canal, from deep-sea soundings to the Gatun dam, will be at sea level, and the 85 feet difference of level between the canal and the lake will be overcome by a series of double locks in three flights, one set of locks being used for ascending and the other

set for descending vessels. These locks will be 110 feet wide and 1,000 feet in usable length. They will be built of reinforced concrete, and because of their great dimensions will far exceed any construction of the kind yet built. For the first 11 miles of their progress through the Gatun Lake, ships will have from 80 to 50 feet depth of water, and from 500 to 1,000 width of channel through which to navigate. As the lake narrows down between the hills which inclose the Chagres River, the canal will decrease in width to 800 and 500 feet until it reaches the Culebra range of mountains, through which it will pass, still at the Lake level of 85 feet above the sea, by a channel with a maximum width of 200 feet. This 200-foot channel will be about 8 miles in length. On the Pacific side of the mountains, at Pedro Miguel, descent will be made by a single lock to an artificial lake formed by a dam at Miraflores, a point about 2 miles farther on toward the Pacific. At Miraflores descent will be made by two locks to Pacific sea level, and from that point to deep water, a distance of 9 miles, the canal will be excavated to a uniform width of 500 feet. The minimum depth for the whole canal will be 41 feet; hence, on the day of its opening, which will probably take place in the year 1915, it will be capable of accommodating the largest ships afloat, including the "Lusitania" and "Mauretania" and the two giant White Star boats, over 900 feet in length, which are being built at Belfast.

Now that the full excavating plant has been delivered at the Isthmus, excavation is proceeding at a rate that was never dreamed of, even in the most sanguine estimates of the engineers. During March of last year, about $3\frac{1}{2}$ million cubic yards was excavated; and it is possible that an even greater maximum will be obtained in the dry season of the present year. The excavation will be completed long before the locks and dams are finished. The examination by bore holes and test pits has shown the character of the ground for both dams and locks to be favorable, and it is probable that the Commission of Engineers, which is now at the Isthmus with Mr. Taft, will report in favor of completing the canal upon the plan which we have outlined above.

As the Isthmus of Panama is situated in the Torrid Zone, it has a tropical climate with little variation, the average daily range being from 72 to 86 degrees in summer or winter. The summers are trying to strangers on account of the humidity in the rainy season. The Canal Zone proper is 10 miles wide and about 45 miles long. The cities of Colon and Panama are not under American jurisdiction, save in the matter of sanitation; but there are numerous small towns of from one hundred to five thousand inhabitants under the direction of the United States. Exclusive of Colon and Panama, there are about 50,000 people on the Canal Zone. About six thousand of these are American employees, and fifteen hundred of them are American women and children.

Though much of the business is transacted in Washington, the Isthmian Canal Commission has its headquarters on the Isthmus. The work is done under several departments, and employees are assigned to their respective departments immediately on reaching the Isthmus. Clerks, bookkeepers, stenographers, typewriters, surgeons, physicians, foremen, blacksmiths, bricklayers, carpenters, train conductors, diamond-drill setters, engineers, firemen, ironworkers, masons, painters, plasterers, plumbers, quarrymen, tinsmiths, wiremen, are among the many who find positions on the Isthmus to-day. Men who have specialized are desired, and there is no demand for unskilled American labor. The laborers come from the Isthmus, West Indies, and southern Europe. Many of the skilled employees have to pass a civil service examination.

Most of those employed on the Panama Canal sail from New York, though steamers run from New Orleans and the Pacific ports. They are furnished free steamboat transportation, and are advised to carry light-weight clothing. Khaki is extensively used for work dress, and white linen for evening wear. When the employee gets to Panama, he finds buildings constructed on the best principles of sanitation. That food may be preserved and shipped properly, there are refrigerator plants on the government steamers, cold storage plants at the ports, and refrigerator cars on the Panama Railroad. In this way food is transported under continuous refrigeration from the United States to dwellings in Panama.

Hotels and mess houses have been established along the line of the canal, and some fifteen are conducted for the white employees. It is not intended to make any profit on these, but to give good food, cooked and uncooked, at cost prices plus the actual cost of transportation. It is calculated that for thirty cents a high-grade employee can obtain a meal, and a laborer can get one for ten cents. A course dinner at a hotel costs from fifty to seventy-five cents. One of the worst problems that faced the Commission was the feeding of the unskilled laborers, who are largely recruited from the blacks. There seemed no food at a price low enough to induce them to eat. Cooked food at ten

cents a meal and uncooked food at a less price were both refused. After several experiments food was cooked and given them, and they ate it heartily. It was decided to pay them a certain rate per hour and their board. This not only solves the problem, but, it is hoped, will increase their ability to withstand disease. These are not the only provisions made by Uncle Sam for his people, for nearly four hundred separate houses and thirteen large buildings have been constructed for married couples, and there are several buildings where bachelors are housed free of charge. These are partially furnished and fuel, electric light, and water are given free. The problem of a supply of drinking water has been solved by the construction of reservoirs at different points along the Canal Zone.

All employees are allowed free medical, surgical, and hospital attendance, and practically every religious denomination is represented. Chaplains hold service, visit the hospitals, and are now urging the erection of buildings which can be used as churches and for lodge purposes. The public school system is essentially American. American teachers are employed, American school books and songs are used, and the flag floats over every school house. Realizing that the white people would be thrown entirely on their own resources for entertainment, the Commission is building a clubhouse or recreation hall in each of the villages under the jurisdiction of the United States. These structures—those in Culebra, Empire, Gorgona, and Cristobal are finished—contain a parlor, card room, billiard and writing room, and assembly hall. Each has a library of five hundred volumes, and weekly and monthly periodicals and newspapers are subscribed for. A comprehensive plan has been devised whereby the Commission working with the Young Men's Christian Association manages these buildings, and good entertainments are given, the entertainers coming from the States and ranking with those employed by first-class lyceums. There are also many social, athletic, and literary clubs among the employees.

The canal will be open in 1915. It will have cost us probably not less than \$300,000,000; but its commercial and military value, the prestige which will accrue to the United States, will yield a rich return for this outlay of time and capital.

Museum of Safety and Sanitation.

Announcement has just been made of the acceptance of the trusteeship of the Museum of Safety and Sanitation by Frank A. Vanderlip. An executive office for the administrative and promotive work of the Museum has been opened at the United Engineering Societies' Building, 29 West 39th Street. Notice of competition for the *SCIENTIFIC AMERICAN* medal will be given in ample time in these columns.

A committee on plan and scope includes Prof. F. R. Hutton, chairman; Dr. Thomas Darlington, Commissioner of the Health Department of the city of New York; P. T. Dodge, president of the Engineers' Club; William J. Moran, attorney-at-law, and Henry D. Whitfield, architect.

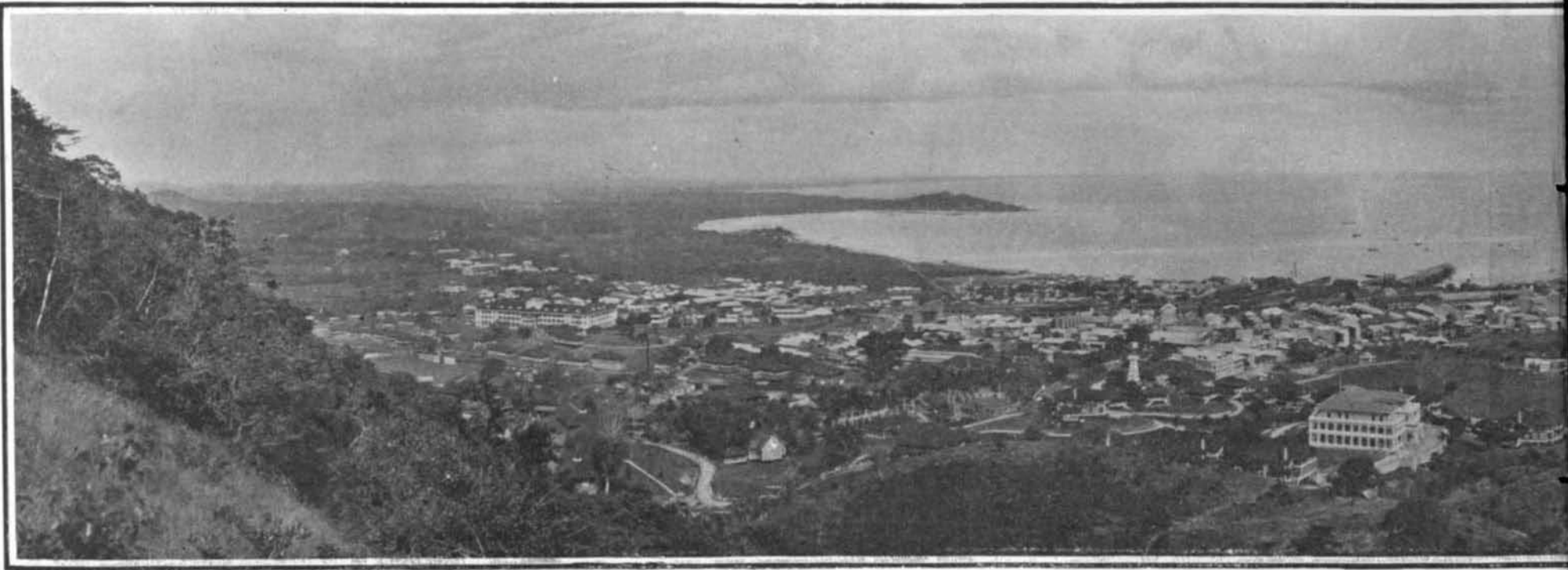
Plans are being pushed along practicable lines to prevent the enormous loss of life and limb to American life and labor, through the Museum of Safety and Sanitation, where safety devices for dangerous machines and preventable methods of combating dread diseases, may be demonstrated. Charles Kirchhoff, editor of *The Iron Age*, is the chairman of the Committee of Direction; T. C. Martin, editor of *The Electrical World*, vice-chairman, and Dr. William H. Tolman, director.

The Death of Luke Kavanaugh.

Luke Kavanaugh, inventor and mill owner, died at his home in Waterford on January 24 after a brief illness. He was born in 1825 in Dublin, Ireland.

In 1862 he invented the movable-bladed knitting burr, which was used by every knitting mill in the world and was one of the principal causes of making Cohoes the greatest knitting mill center in the world. This patent he followed with others in 1863, 1864, and 1871 on improvements on knitting machinery. In 1867 he established the Bishopton knitting mill at Cohoes.

Short and odd lengths of lumber is the subject of a brief bulletin sent out by the United States Forest Service. It is stated that 25 per cent of the felled trees are never hauled from the woods simply because specifications of builders and architects cling to conventional lengths, whereas the actual construction is such as easily to use the short and odd lengths. The work of a prominent architect was examined and it was found that 40 per cent of the siding on frame buildings was under 6 feet in length. It was found that in cutting and grading finished lumber generally 5 to 10 per cent was bound to come in lengths under 10 feet, of which all under 6 feet is burned and all over is sold at reduced prices. This bulletin asks for closer specifications, better understanding of the timber situation as a help to the lumbermen and for the preservation of the lumber supply.



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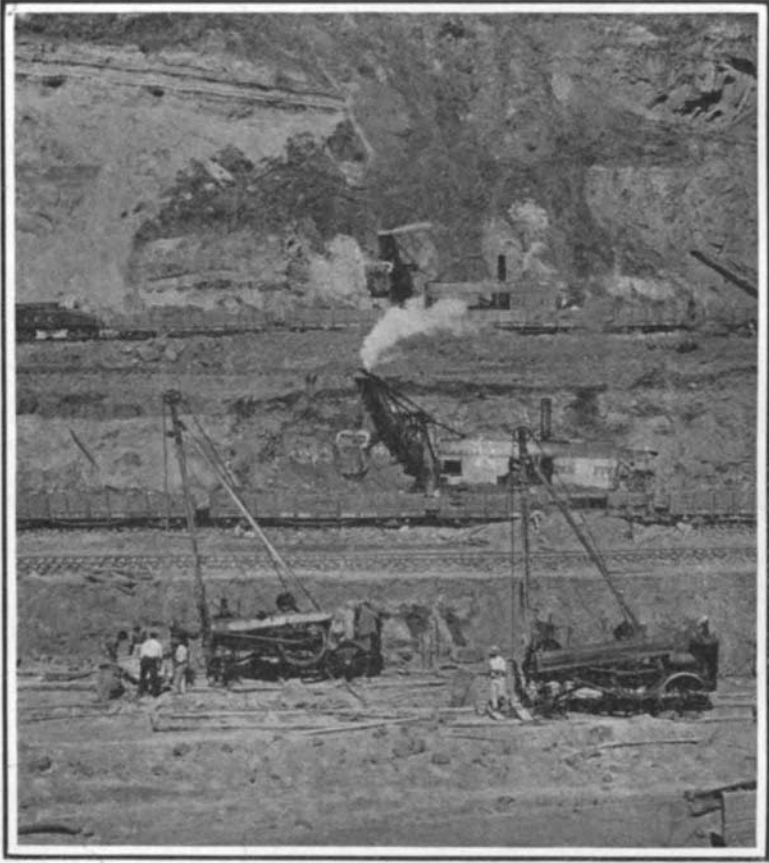
The Tivoli hotel.

New police headquarters.

City of Panama and harbor from Ancon



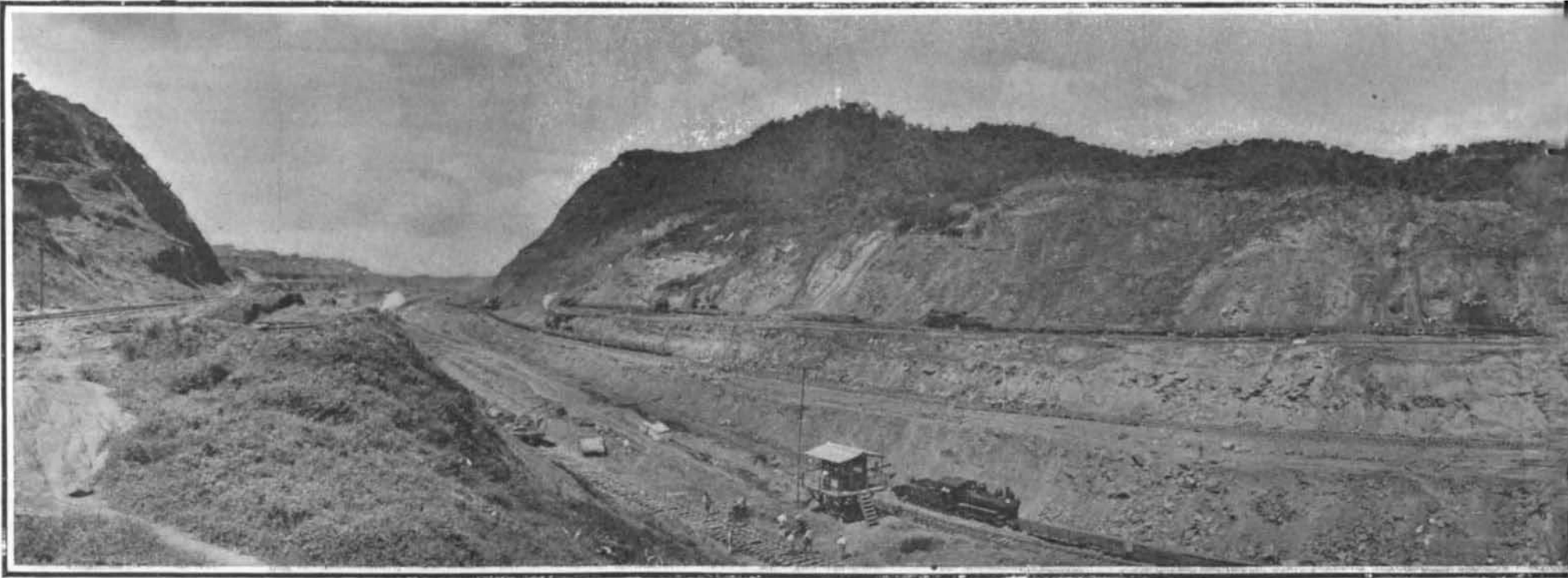
New police headquarters at Ancon.



Steam shovels and dump cars in one of the big excavations.



Test pit sunk to determine character of soil below Miraflores dam.



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Contractors Hill.

Train dispatcher's office.

Gold Hill.

The

Panoramic view of the great Culebra cut through the

PRESENT CONDITIONS IN THE



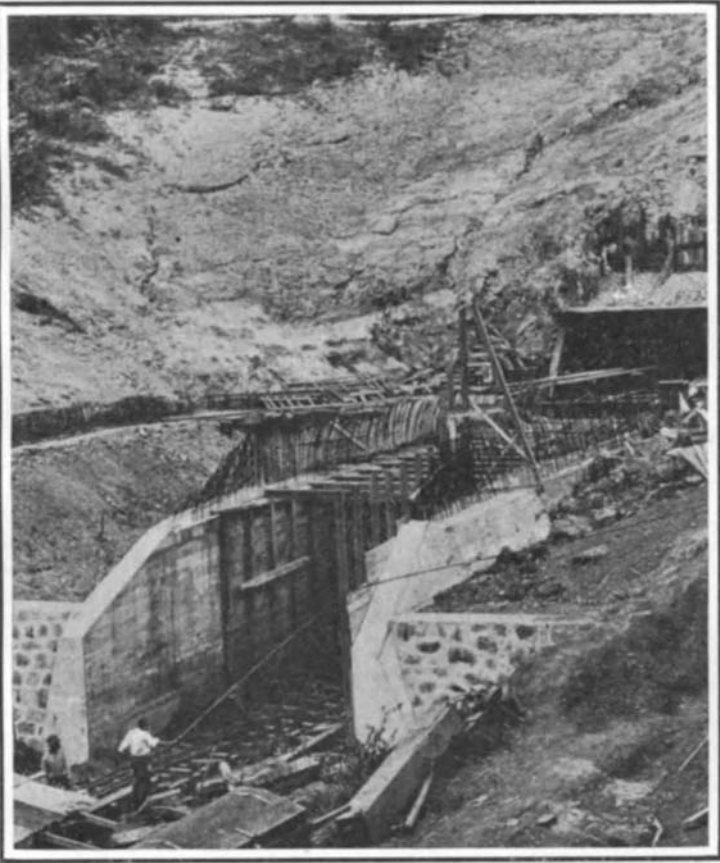
New concrete reservoir,

Pacific entrance of canal is to the right of these islands

on Hill looking toward the Pacific.



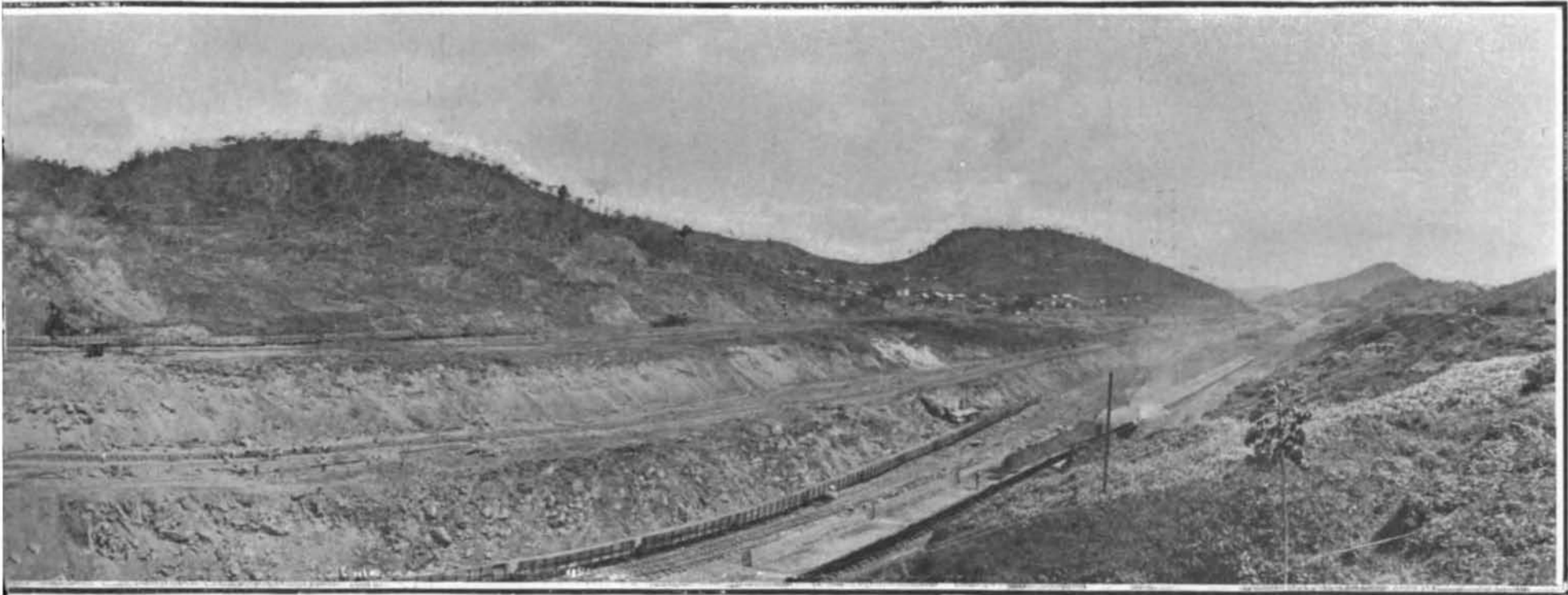
er of foundations
m.



South end of Miraflores tunnel, where slides have occurred.



One of the better class residences in Panama.



stretch between Gold Hill and Cucuracha is sliding, necessitating much extra excavation,

Cucuracha village.

mountain divide between the Atlantic and Pacific.

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