

Second, the spring flow could be assisted in periods of deficiency by a small pumping plant near the city, preferably one near La Fossette, which is also desirable if nothing else can be done, and could easily be installed to augment the supply obtained from springs.

Third, a large pumping plant in the North Plain could be made to supplement the spring flow or to replace it entirely. The water would probably be of excellent quality, and the only reason for hesitating to adopt this plan is the expense of installation and maintenance.

Fourth, a surface water supply could be brought from some river, probably the Haut du Cap, in the mountains south of the North Plain. This also is an excellent plan, the chief objection being the expense of installation.

Whatever plan may be adopted, it will be desirable to use all or at least some of the springs to supply the higher outlying parts of the city.

NOTES ON WATER SUPPLY OF SOME OTHER TOWNS AND VILLAGES.

Port-de-Paix.—All the drinking water used in Port-de-Paix is carried on burros from Les Trois Rivières, which is at a considerable distance from the city. Some water of poor quality, used for certain domestic purposes, is obtained from shallow wells in the alluvium that underlies the city. In the hills south of Port-de-Paix there is an old colonial reservoir in which water from small mountain streams was impounded and thence led to the city in a masonry conduit. The Gendarmerie post uses a small reservoir located south of the Champs de Mars to store water from a small stream. It is brought to the barracks in an old colonial conduit, but because of pollution is not used for drinking.

The possibility of utilizing any part of the old colonial gravity system was not investigated. It is not likely that valuable artesian flows can be obtained near the city, and the best source for a city supply would probably be Les Trois Rivières. The water would require purification.

Môle St.-Nicolas.—Most of the water used for domestic supply at Môle St.-Nicolas is carried on burros from Rivière du Môle, which disappears in stream gravels about 3 kilometers from the sea south of the town. Frequently the water is collected carelessly at the lowest point of flow, where it is badly polluted by the washing of clothes and by refuse. Water from shallow wells in the small alluvial plain at the city is used to some extent, but it is said to be often brackish, and it is doubtless unsanitary. The town should have an aqueduct to bring water from the locality called La Gorge, on Rivière du Môle. Purification would be desirable, but even without it the water would be greatly preferable to that now in use.

Baie de Henne.—The only water available for domestic use at Baie de Henne comes from a brackish spring that issues from the limestone sea cliff at the southeastern edge of the village. The cliff consists of Qua-

ternary coralliferous limestone and is about 5 meters high. The spring emerges through a solution channel about 0.5 meter in diameter, and the flow probably is as much as 2,000 liters a minute. The outlet of the spring is completely covered at high tide but is exposed at low tide, the tidal range being probably about a meter or more. Water is obtained at low tide, when the outlet is exposed. It has a distinctly brackish taste, but is used without any ill effect by persons and by animals accustomed to its use. It is said that persons not accustomed to the water occasionally suffer slight illness from its use.

An analysis of a very small sample of this water showed that its chloride content is 1,048 parts per million. This high salinity is due to the admixture of a small quantity of sea water with the fresh water near the outlet of the spring. A tunnel driven horizontally into the cliff for 10 or 15 meters along the channel of the stream, to get water a little farther from the shore might obtain fresher water.

A small amount of water for irrigation and for domestic use could be obtained from shallow dug wells in the alluvium of the little plain in the rear of Baie de Henne. Pumping probably would not pay, however, unless windmills could be used for power.

Anse Rouge.—There are no streams or springs near Anse Rouge, and the region is too dry even to permit the storage of rainwater. The village depends entirely on water carried by boat from Gonaïves or La Pierre. A deep drilling here would be warranted, for there is some chance of obtaining flowing water, or at least water that would rise within easy pumping distance of the surface. The statements made regarding the Arbre Plain (see p. 535) apply to this place. Fifty or more meters of coralliferous limestone would be penetrated first. Artesian water, if obtained, probably would come from the underlying Miocene sandy marls. A thorough test might involve drilling to a depth of 300 meters. The water might possibly be made salty by original sea water included in the Miocene beds.

Gonaïves.—The water for Gonaïves comes from a large spring in La Pierre ravine, about a kilometer north of the village of the same name, which is on the coast about 10 kilometers west of Gonaïves. The spring is at an altitude of about 110 meters above sea level, at a place where massive brecciated limestone full of solution cavities overlies dense, sheeted chalky limestone. The water emerges at the contact of these rocks in the ravine. The spring has built up below its outlet an enormous deposit of travertine, which constitutes a sort of bench or platform about 100 meters long. The travertine contains abundant imprints of leaves and pieces of preserved wood. The outer edge of the platform is a sheer cliff, about 25 meters high, that drops off to the bed of the ravine, which continues below. A considerable flow of water issues also at the base of this cliff and flows to the sea at La Pierre.

The spring above the platform has been developed by digging out the dirt in the ravine and placing around the pit a masonry wall bearing a sheet-iron roof. The water is carried to Gonaïves in a large cast-iron pipe laid on top of the ground. The flow is probably as much as 1,000 liters a minute.

The yield of the spring appears to be inadequate to supply the needs of Gonaïves, although the insufficiency seems to be due in part to clogging of the pipes by calcareous deposits. An analysis of the water (see p. 543) shows that its chief characteristic is bicarbonate hardness. A temporary deficiency in the supply might be remedied by pumping from the spring below the cliff into the mains above.

St.-Marc.—Water is brought to St.-Marc from springs in the hills east of the city, but neither the source nor the distributing system was examined. Flowing artesian water might perhaps be obtained in or near the city, which stands on a synclinal fold of Miocene rocks. Test wells would have to be 200 or 300 meters deep, and the water obtained might be made salty by connate sea water in the Miocene beds.

Léogane.—As stated on p. 529, artesian flows of low head might be obtained at some places near Léogane and on the lower part of the Léogane Plain. Flowing wells would furnish purer water and probably a larger supply than that now available, which is obtained in part from canals from Rivière Momance and in part from springs in the northern part of the town. No study of the water supply was attempted.

Pestel.—The only drinking water at Pestel is that caught in rain barrels from roofs. In dry seasons the water shortage is often great. On the beach just north of the town there is a brackish spring, which supplies water for some domestic uses but is too salty for drinking. The town is at the end of a deep valley in which there are several sink holes in limestone, which probably represent the course of an underground stream, perhaps the same one that emerges as a brackish spring on the beach. A well drilled in this valley some distance from the sea probably would yield good water. The best locality for obtaining water easily would be in one of the two or three sink holes in the southern part of town, for the depth to water there is least and the chances of tapping the underground channel and getting an abundant supply are best. A well in such a location should be guarded very carefully, however, to keep it clean. A well drilled between the sink holes in the heart of town, about opposite the Gendarmerie barracks, should be equally satisfactory and much safer from contamination. It would probably not need to be more than 30 meters deep.

If wells were used to supply water the cemetery in one of the big sinks south of the town should be abandoned. If burials at this place were discontinued the cemetery should not be a source of danger.

Jérémie.—No examination of the water supply at Jérémie was attempted. The water is obtained from a spring in limestone and is said to be satisfactory. Artesian water can not be obtained at the city and a

surface supply probably could be had only from Grande Rivière. Springs are doubtless preferable if they can supply enough water.

Les Cayes.—The water supply of Les Cayes was not examined but it was very unsatisfactory in 1921. Plans were under consideration in 1922 for the development of a better supply, probably either from a small spring-fed lake on the plain about 5 kilometers north by east from the city, or from the Source Moreau, a large spring that issues from a limestone cavern at the northern edge of the plain near Camp Perrin. Either of these sources doubtless would be a great improvement. As a temporary measure it is reported that a shallow well has been dug on the plain near the city. The water pumped from this well seems to be good, and it has considerably increased the supply.

As suggested on page 530 there is reason to expect that flowing wells can be obtained at Les Cayes and farther west along the coast of the plain. Artesian water might afford a satisfactory city supply at less cost than surface water or spring water.

Jacmel.—Jacmel is in a basin underlain by Pliocene rocks, from which flowing water might be obtained in a small area near the city. Such water, however, might be salty. Test wells should be sunk to a depth of 200 or 250 meters. The present supply of the city is derived from springs.

Saltrou.—Saltrou stands on a small alluvial plain at the rear of which there are high hills of limestone. Along the shore there are deposits of beach sand and shingle that are higher in altitude than the town. Some good water is carried to the town from a small stream several kilometers to the north, in the hills, but most of the water used is obtained from shallow wells in the alluvium in the town. This water is brackish and probably also unsanitary. Wells dug in the alluvium north of the town and farther from the sea would furnish better water.

Grand-Gosier.—The village of Grand-Gosier stands on a rocky limestone coast. The only source of water is a shallow hole on the beach less than 5 meters from the sea. The water is very salty. Along the coast northwest of the village, near the mouth of a ravine, there are several springs that yield a large flow of salty water. This ground water could be tapped by digging shallow wells in the ravine farther inland, at least 60 meters from the coast, where it probably would be fresh.

NOTES ON WATER POWER AND DAM SITES.

Considerable water power could be developed in the Republic, but accurate maps and reliable figures showing stream-flow are needed as a basis for any operations. Stream gaging on the larger streams should be undertaken at the earliest opportunity.

Northeastern part.—The mountains of the northeastern part of the Republic, from Grande-Rivière du Nord to the Dominican border, are composed of igneous rocks that would hold water at almost any site where