

Apparently the plan was to dam up and divert the water at a place called La Porte, between Gros-Morne and Pilate, where Les Trois Rivières passes through a steep-walled gorge that is said to be 64 meters in depth, but a rather careful survey is said to have shown that the divide into La Quinte basin was considerably higher than the gorge, and the plan was abandoned. This plan may be worthy of further investigation.

There are some shallow wells in the area, but ground water generally is not much used. The region is underlain by Miocene and older rocks that generally dip seaward, and artesian conditions probably exist at some places, but wells drilled at such places probably would not furnish large supplies.

NORTH PLAIN.

SURFACE FEATURES.

The North Plain slopes very gently seaward, its altitude at the base of the mountains that border it on the south being generally from 50 to 100 meters above sea level. Although its relief is small, it has a variety of surface features, and large parts of it are considerably dissected. The best agricultural land is around Limonade and Quartier Morin and west of those places and is rather smooth, including only a few hills, which are low. Large bodies of level land are found also in the northeastern part of the plain. The annual rainfall over most of the plain probably averages 1,500 millimeters and at some places is more. This is considerably greater than the rainfall on most of the lowlands of the Republic and the difference is due to the position of the plain on the windward side of the most northerly mountain ranges.

STREAMS.

The North Plain is crossed by several streams that originate in the mountains to the south. The largest of these streams, named in order from east to west, are the Rivière Massacre, Rivière Marion, Rivière du Trou, Rivière Fossé, Grande Rivière du Nord, and Rivière Haut du Cap. The Grande Rivière du Nord is the only one of these that is listed among the large streams of the Republic (p. 34). In addition to the larger streams there are some smaller ones, which originate in the mountains and generally disappear on the plain. According to Moreau de St. Méry, there are also a few streams, such as the Rivière des Mapoux, that originate in springy and marshy areas on the plain.

UTILIZATION OF WATER AND FLOOD CONTROL.

In colonial days and at present, agriculture on the plain seems to have been carried on almost entirely without irrigation. In normal or wet years the natural rainfall produces abundant crops, but dry years are

frequent and exceedingly disastrous. Irrigation probably would pay as a means of crop insurance, especially for sugar cane. Sugar was the principal crop of the French colonists, and they diverted water from nearly all the larger streams for use in turning cane mills. The Grande Rivière du Nord and the Fossé and Haut du Cap were utilized completely for this purpose by the rich sugar-raising parishes of Limonade, Quartier Morin, and Petite Anse. The largest diversion works were at the village of La Tannerie, where the Grande Rivière du Nord debouches onto the plain. So much water was diverted here and elsewhere that in 1786 the whole bed of the lower Grande Rivière du Nord was dry.¹

All the streams of the plain fluctuate greatly in volume during the year and are subject to sudden and violent floods. The colonists had great difficulty in controlling floods, which often devastated some of the richest plantations. Long lines of levees were used, particularly along the Grande Rivière du Nord, but they were not always maintained in good condition and were frequently broken. The stream courses in the western part of the plain are unstable, as the river beds are rapidly aggraded and become higher than the surrounding land, causing the streams to shift their courses rapidly. Flood control is one of the serious problems in any plan for improving the water supply on the North Plain.

GROUND WATER.

Alluvial beds that dip very gently seaward underlie most of the plain. The alluvium consists of gravel, sand, and silty clay. At some places near the inland edge of the plain there is a bedrock bench. At the eastern end of the plain similar but more consolidated beds underlie the alluvium, and these also dip seaward. The depth of the alluvium in the western part of the plain probably does not exceed 100 or 150 meters, but in the eastern part the alluvium and the older Quaternary beds may reach a considerably greater thickness. As the rainfall is fairly heavy and the runoff from the adjacent mountains is copious it is virtually certain that the porous beds are saturated with fresh ground water at no great depth. The conditions in general resemble those on most of the other alluvial plains of the Republic, except that the beds which are likely to contain water are probably not so thick, at least in the western end of the plain, and the dip of the beds is more gentle. For these reasons ground water can probably be obtained in abundance, generally within pumping distance of the surface, on most of the plain, especially the western part. In fact, several shallow wells (5 to 6 meters deep) dug on the plantation of Mr. Kapham, about 2 kilometers southwest of Limonade, yield an abundance of water for stock and for cane mills. This place is well back toward the inland edge of the plain. The chances for flowing water are poorer there than in some other places.

¹ Moreau de St. Méry, *op. cit.*, vol. 1, p. 233.

The presence of ground water that is probably under some pressure is attested by springy and marshy areas, such as give rise to the Rivière des Mapoux and the Petite Rivière du Quartier Morin, which originate far out on the plain. Flowing wells may possibly be obtained near the shore around the mouth of the Grande Rivière, but the flows will probably not be large. The only well that affords any evidence on this subject is that drilled at the Cap-Haïtien Railroad station at the mouth of Rivière Haut du Cap, which is more fully described elsewhere (p. 588). It is a small well, 25 meters deep, but at first yielded a slight flow. Better results might be had from deeper wells of large diameter, but they would have to be drilled farther from the sea, for the sea water affects somewhat the water of the well just mentioned, and the water probably would be worse if the well were drilled deeper.

In the eastern part of the plain, between Fort-Liberté and Ouana-minthe, the rainfall is less, the relief is greater, and the depth to water is probably greater, so that shallow wells would perhaps be less successful. But the shore of the plain here is longer and the beds are better sorted, so that the possibility of obtaining artesian water in areas not much above sea level appears better.

MOUNTAINS AND HIGHLANDS.

Most of the mountain regions of the Republic of Haiti receive more rain than the lowland plains and valleys. Where their surface features and soil are favorable they are more likely than the plains to produce crops without irrigation; indeed, irrigation would be quite impossible at most places in the highlands on account of their rugged surface. Water is needed mainly for domestic use and for stock and generally is obtained from streams or springs. Some of the mountain regions receive but little rain and are semi-arid; and large areas in the regions underlain by limestone have subterranean drainage, so that the scarcity of water causes the land to be almost uninhabited. Examples of these conditions can be found in the region of Grands-Bois; in Section Plymouth, southeast of Jérémie; on the Bombardopolis Plateau; and on Gonave and Tortue islands.

Not much of value can be recorded about the streams of the mountain areas, and the geology is at most places so complicated that only a few generalizations regarding ground water can be based on the hasty observations made. The springs, which are common and at many places valuable, are described on pages 550-566.

Many of the mountain ranges are composed of hard limestone, which is generally considerably folded and disturbed and overlies igneous rocks that are exposed at many places, chiefly in the center of the ranges and in valley bottoms. Water circulates freely in the limestone through joints and along bedding planes, many of which have been greatly enlarged by solution, which has at some places formed large caverns. A large part