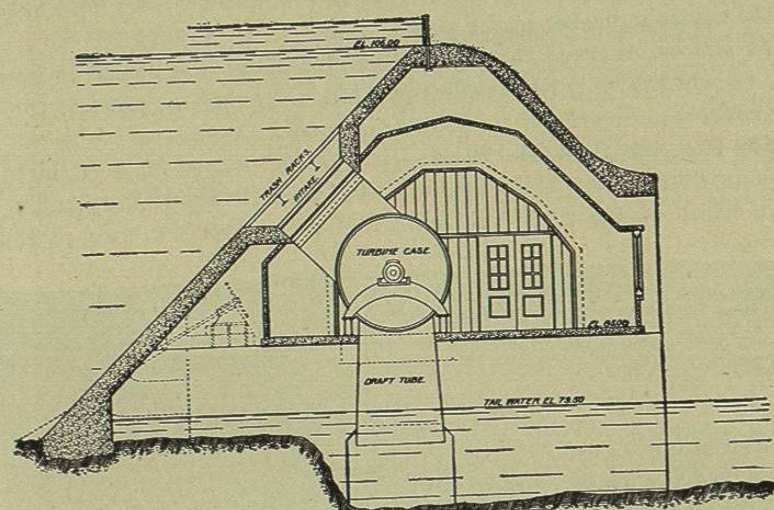

FIG. 318.—CROSS-SECTION OF PATAPSCO DAM AND POWER-HOUSE INSIDE.

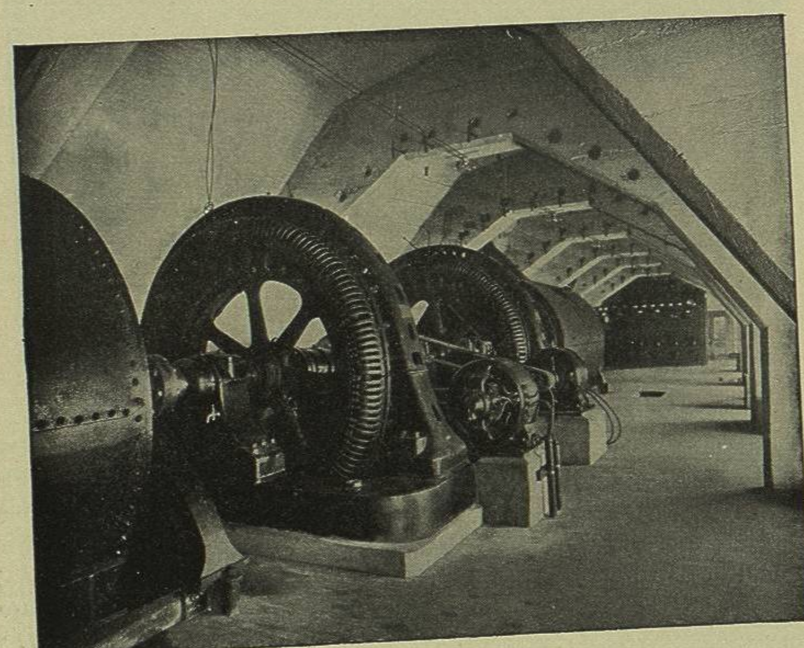

FIG 319.—INTERIOR OF PATAPSCO SUBMERGED POWER-HOUSE.

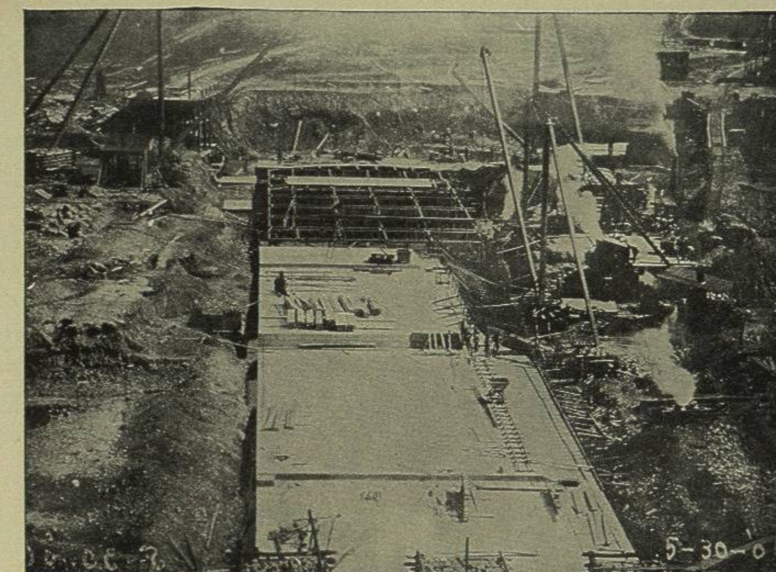

FIG. 320.—FLOOR CONSTRUCTION, JUNIATA DAM.

FIG. 321.—JUNIATA DAM, AND POWER-HOUSE PARTIALLY COMPLETED.

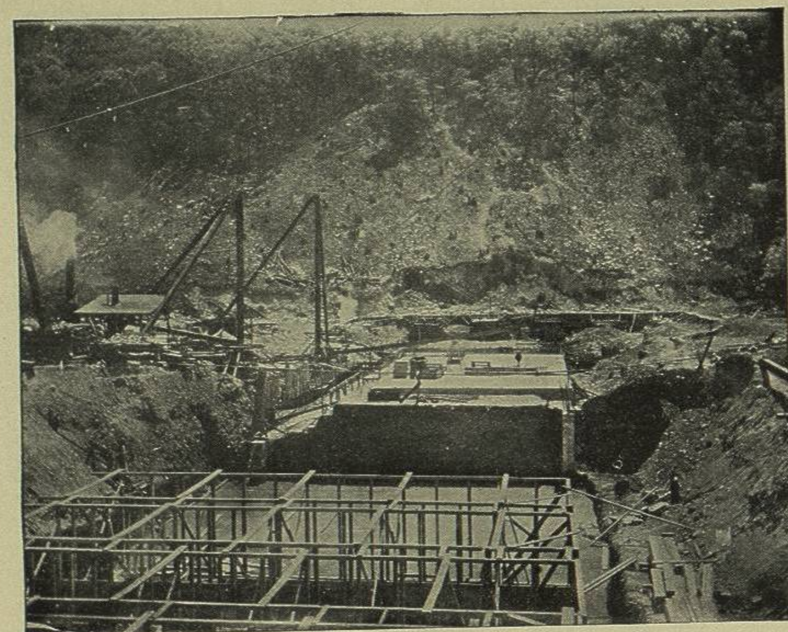

FIG. 322. —WHEEL PIT AND CUT-OFF WALLS, JUNIATA DAM.

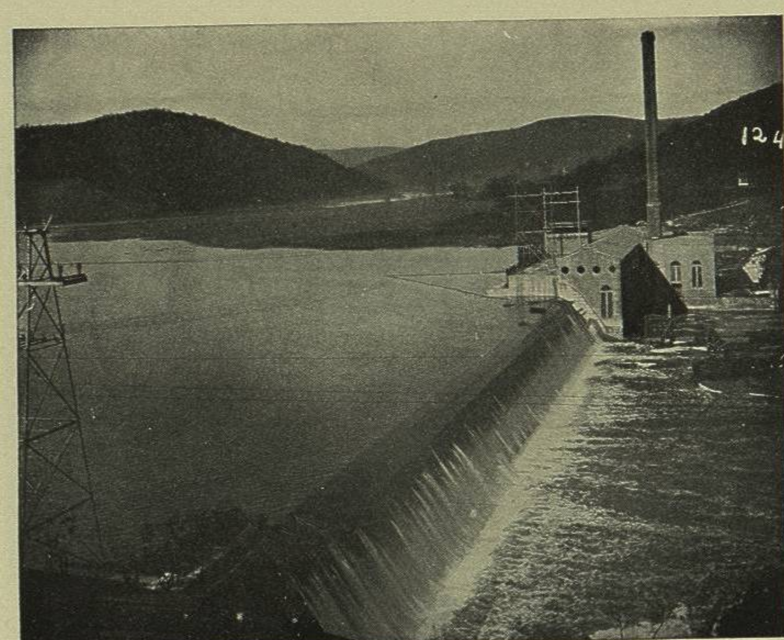

FIG. 323.—VIEW OF COMPLETED JUNIATA DAM.

The Juniata Dam, Huntingdon, Pa.—This interesting dam is built on a foundation of porous gravel, underlaid by hardpan at a depth of about 18 feet. A trench was first sunk to the hardpan at each edge of the dam, and a reinforced concrete cut-off wall molded therein, intercepting the underflow. (See Fig. 322.)

The completed floor forming the base for the superstructure of the rollway is illustrated by the photograph, Fig. 320, on page 480.

The reinforcement of this floor is proportioned to distribute the pressure to an average of 1.3 tons per square foot.

Fig. 321 gives a clear view of the work at an advanced stage, with the river flowing through openings beyond the cofferdam, and Fig. 323 shows the completed dam and power-house. The dam in the rollway section is 28 feet high and 460 feet long. It contains 6400 cubic yards of concrete, including abutments and bulkheads.

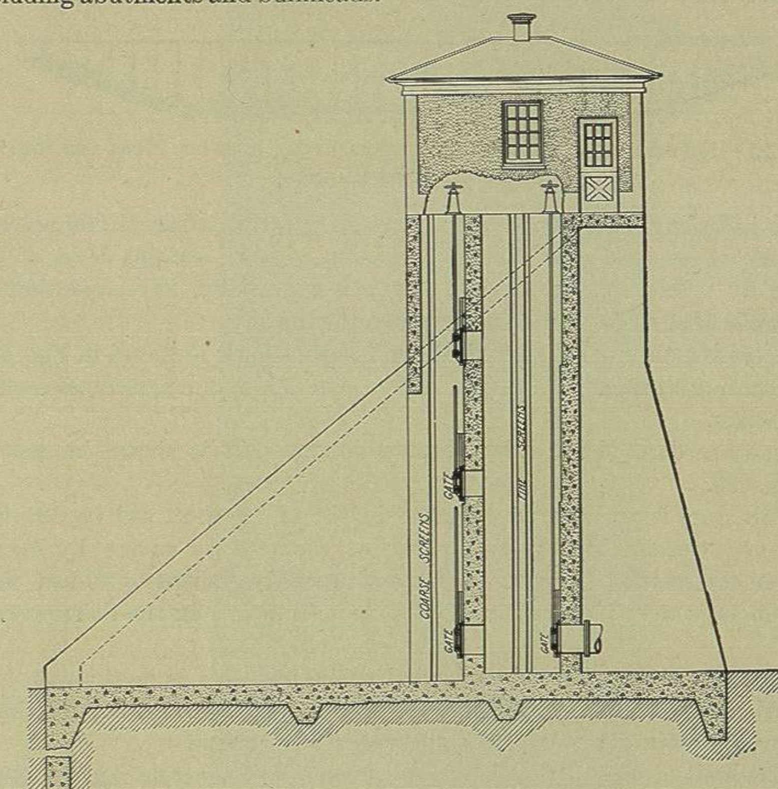

FIG. 324.—SECTION OF PITTSFIELD DAM, SHOWING GATE-HOUSE CONTAINED.

The Pittsfield Dam, Mass.—This structure, 42 feet high, 465 feet long, containing 3950 cubic yards of concrete, was begun Sept. 1, 1907, and completed March 1, 1908, a total of six months. It is founded on gravel, underlaid at a depth of 12 feet with dense yellow clay. Cut-off walls at each edge extend down 3 feet into the clay at bottom and sides. The gate-house is incorporated with the dam, utilizing the space between two piers for that purpose. Fig. 324 is a cross-section through the gate-house.

The longitudinal section, Fig. 325, shows the footings adapted to the hillside, and soft foundation. The completed dam is shown in Fig. 326.

The work was carried on continuously throughout freezing weather, when the thermoneter reached a minimum of 12 degrees below zero, by heating the materials, and by using "salamanders" in the bays beneath the deck, for which the hollow dam construction was favorable. There is said to be no discernable difference in the quality of the concrete laid in the winter months and that which was placed in moderate weather.

A dam of this type has been designed for construction during 1908, which is to be 115 feet high, 1,300 feet long, and contains about 85,000 cubic

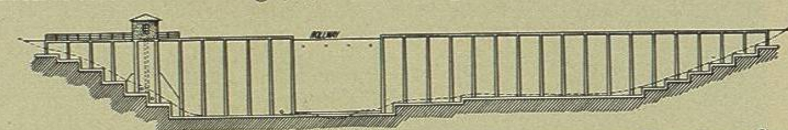

Fig. 325.—Longitudinal Section of Pittsfield Dam, showing Piers and Stepped Footings on Slopes.

yards including the power-house. Floods approximating 40,000 second-feet are to be cared for without variation of the working level of the water by a series of waste gates between the several bays, operated by hydraulic lifts, and by a movable crest on the rollway.

A section through the bulkhead and power-house is shown in Fig. 328, representing all essential details clearly. Fig. 327 is a longitudinal section of the dam.

Another dam planned for construction in 1908, is shown in section in Fig. 329.

This dam is to have an ultimate height of 120 feet, will be 520 feet long and contain 54,000 cubic yards of concrete, as shown by dotted lines in the section. The first construction will be limited to 80 feet, with a temporary wooden apron supported on steel beams on the down-stream side.

La Prele Dam.—This dam for irrigation purposes is now under construction near Douglas, Wyoming. It is 135 feet high and 250 feet long, and will contain about 15,000 cubic yards of concrete.

The limit of height to which dams of reinforced concrete may be safely built is as yet to be determined. Preliminary designs for a structure 315 feet high were computed by request of engineers in Government service, and it is stated that no insuperable difficulties were encountered, the unit stresses being kept the same as on smaller dams, and the ratio of material and costs holding about as in other cases.

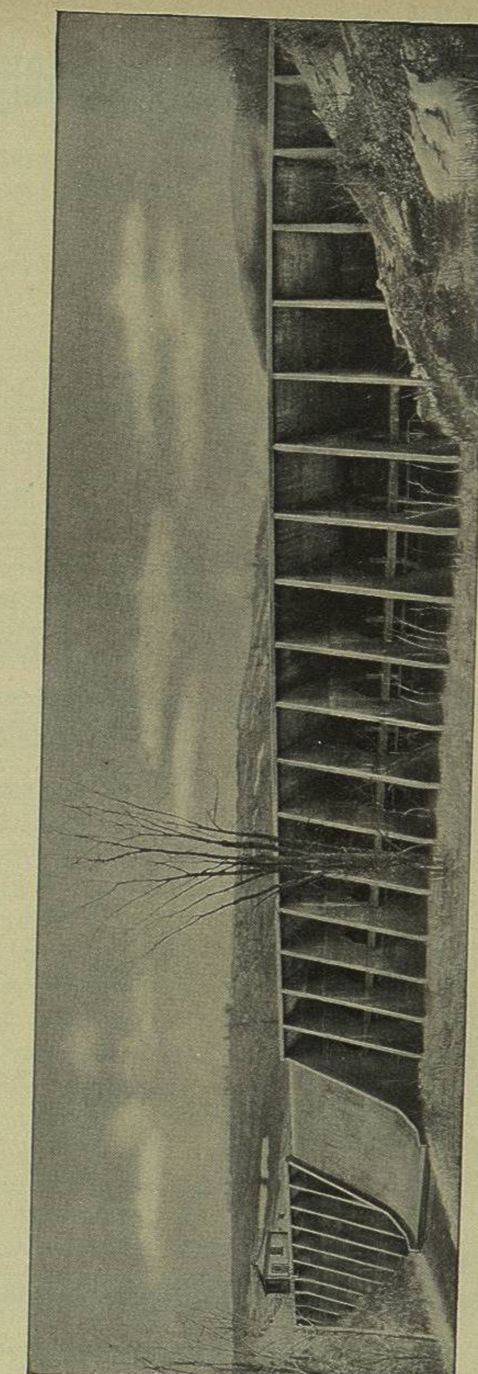

Fig. 326.—The Pittsfield Dam as Completed.

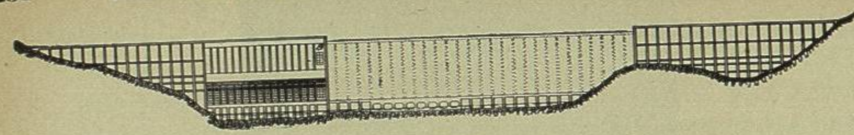

Fig. 327.

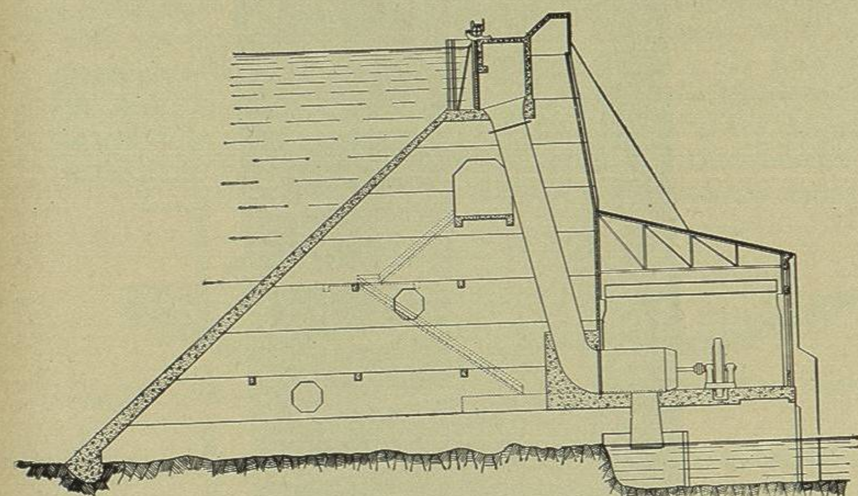

Fig. 328.—Section of Dam 115 Feet High, with Power-house.

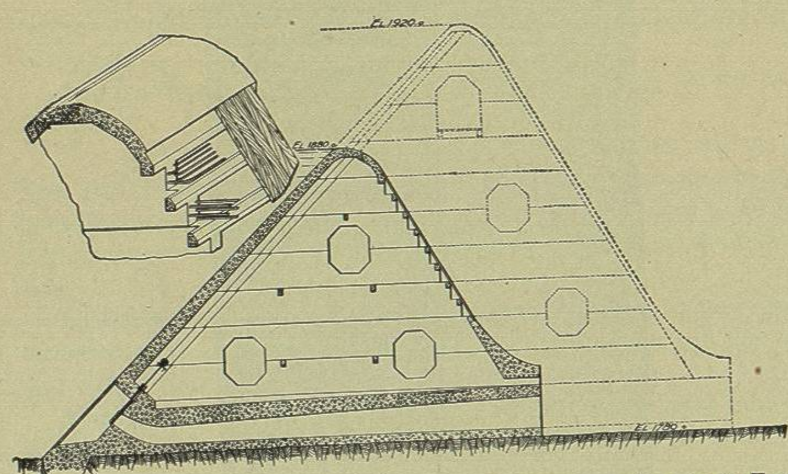

Fig. 329.—Section of High Dam, planned for Increase of Height in Future.

CHAPTER VII.

NATURAL RESERVOIRS.

On the great plains east of the Rocky Mountains there are thousands of natural basins which have no outlets and which gather the storm-water run-off from a few hundred acres of surrounding territory, and hold it in shallow ponds until it is lost by evaporation. Many of these depressions have been utilized as storage-reservoirs by carrying water to them from adjacent streams, and by providing them with outlets, either by tunnels or cuts; and many more have been selected for future utilization. They are often at the proper elevation to command large areas of arable land, and can usually be converted into safe storage-reservoirs at small expense. Such natural basins appear to be invariably water-tight, and in every way suitable to the purpose, except in occasional instances where they contain deep beds of alkali.

In the mountains, too, many natural basins are to be found, which have been formed by land slides, but more frequently by glacial moraine deposit, often of great depth and width, forming natural dikes of enormous magnitude. These basins are usually occupied by lakes, which can be converted into storage-reservoirs, either by restoring a portion of the originally higher dike which has been worn down by the channel of the outlet of the lake, and thus increase the capacity of the lake basin, or by the deepening of this channel by artificial cut, or by both these methods. Frequently these lakes are of very great depth, held back by dams built by Nature's hydraulic-fill methods, and suggesting the limitless heights to which such dams can be built, provided they be made of adequate dimensions. The author has seen a natural dam on a branch of the Umpqua river in Oregon, over 300 feet high, formed by a landslide from the adjacent sandstone cliff. The base of this dam was not over 3000 to 4000 feet. Floods of several thousand second-feet pass over the top of it every year, and it is practically water-tight, as it holds back a good sized lake. This is a natural rock-fill dam, composed of enormous blocks of stone, whose voids are filled with smaller stone and rock dust ground up in the process of falling.

Lake Como, in the Bitter Root valley, Montana, is an instance of a very deep natural lake basin formed by a terminal moraine of fine and