After one hundred and ten years, more water required by the . . .

Charlottesville, Virginia Water Works

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EDITOR'S NOTE: Like many another community, Charlottesville, Va. has had to lift its water supply literally by its own bootstraps. Mr. Haney's story sums up the century-long struggle and reports the need for yet another dam-site.

THE HISTORY of our water works goes back prior to the Civil War, when the town was served by private scattered springs and wells. The people carried water in pails to their homes. The town owned one well, now covered with the Lewis Clark statue.

In the 1850's a small dam was built at the foot of Lewis Mountain and a 2½" pipe carried the water to a small lake at the site of the present gymnasium. From this lake a covered canal conveyed the water to a steam-driven pump, which lifted it to a tank in the top of the Rotunda, providing gravity flow to the professor's homes. This water was not used for drinking. The operator of this pump had a stick tied to a float—by looking out his window he could observe the stick and operate the pumps accordingly, although on several occasions he must have failed to shut the pump down.

In 1868 the wells were being closed from pollution and the water problem was indeed bad. At this time a one-half million gallon reservoir was built on Observatory Mountain and a 4" cast iron pipe brought this water to the Rotunda.

In June 1871 the council agreed to pay $25.00 towards the repair of one pump, and contracted for the use of another well at a cost of $48.00.

In 1873 a committee recommended the employment of an engineer to devise a plan for the securing of a pure and abundant supply of water. In April of the following years an engineer was retained, but nothing came of this movement.

In 1884 another engineer was hired and a report on location of the dam-site, pipes and other facilities was made. A contract was entered into with the University of Virginia wherein the University was to pay about one sixth of the total cost, since the University was by this time as badly in need of water as was the town. An earth-filled dam was built, (Fig. 1) three miles west of town at Ragged Mountain. The dam was 45 feet in height and formed a reservoir having a capacity of 182 million gallons. Supplied by a few small springs, it has drainage area of 300 acres. A 10" cast iron pipe

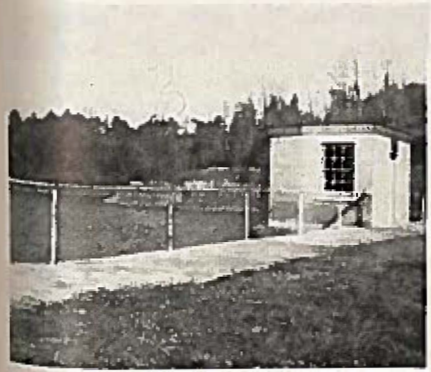


FIG. 1. DAM and 182 mg reservoir at Ragged Mountain.

FIG. 2. TOP OF DAM at Moorman's River.

FIG. 3. UPSTREAM VIEW of Moorman's River Dam.

line connects this reservoir with the town.

For a few years the town enjoyed an abundance of water and in 1888, the city fathers removed the charge on water for bath tubs. This must have been a popular edict with the citizens. However, a few dry seasons must have changed the picture for in 1891, the University laid a 6" pipe line to the reservoir, and in 1893, a small dam was built near Moore's Creek and Maury Branch about two miles below the reservoir to catch the leakage, and run off in the intervening two miles. Two steam pumps were installed to pump this water back into the reservoir.

With the increased use of water in the 1880's and the adoption of more up-to-date and more numerous plumbing fixtures, the problems of sanitary conditions, and the disposal of sewage presented itself. In 1893, the services of a well known engineer, Mr. Rudolph Herring of New York, were employed. A study was made and the sanitary system installed under his direction.

A few of the water rates in 1898 are very interesting. The following rates are annual:

Dwellings valued at less than $10,000	$ 5.00
For each $100 valuation add	.15
For laying brick 10c per thousand brick	
Bathing establishments	25.00
Hotels (without water closets)	40.00
Water closets in Hotels and Public places, first seat	8.00
Each additional seat	5.00

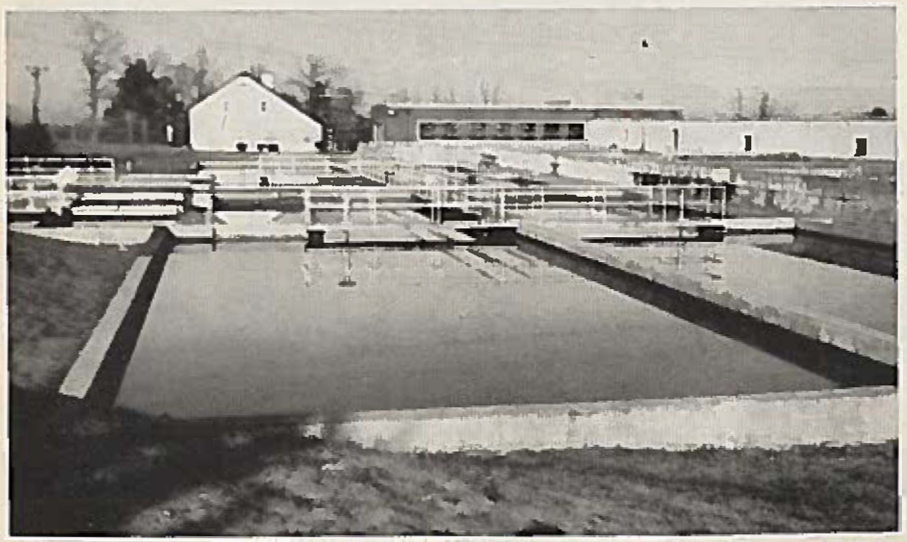


FIG. 4. VIEW of filter plant. Note superintendent's residence, upper left.

In 1904 the Mayor made this report, "The most important matter for the council to consider is the water question. Its importance is so great that it cannot be magnified or exaggerated. I would suggest that you avail yourselves of the service of local or other expert service in solving this problem to the end of a wise issue of this important matter".

In 1906, a new dam was constructed just below the Ragged Mountain Dam. This reservoir is known as the Lower Reservoir or Mayo's Rock Dam. It is a concrete structure of the usual gravity section and 60' high. The capacity of the reservoir is 433 million gallons, and has a drainage area of two square miles. From this reservoir an 18" cast iron pipe conveys the water to the city.

These two reservoirs took care of the demand for quite a few years. However a combination of increased demand, and dry seasons depleted these reservoirs to such a point that the growth of algae, and other organisms resulted in a most unpalatable water. In 1920, the New York firm of Hazen, Whipple and Fuller made a study of the situation. In 1921 Williamson, Carrol and Saunders of Charlottesville, together with Fuller and McClintock designed a 2.0 mgd slow sand filter plant. This plant took care of the quality but not the quantity of water, so in 1923 Fuller and McClintock made a most through study of six sources. The Moorman's River Water shed was used. A small intake dam was built at the foot of the Blue Ridge Mountains and an 18" cast iron pipe 13½ miles in length was installed connecting with the 18" line at the lower reservoir. The drainage area of this watershed is about 18 square miles. The capacity of the 18" Moorman's River gravity line is approximately 4.8 mgd. When the demand for water is below the flow in the 18" main, the excess is diverted into the Ragged Mountain Reservoir. Normally these reservoirs will not fill from the run-off of this watershed.

From the completion of the Moorman's River project in 1925 to 1930, the city enjoyed perhaps the most quiet period of its water works history. During the unusual drought in 1930, the city installed a 3.0 mgd pump on the 18" line at Mechum River. This pump was never used.

The filtration plant, built in 1922

FIG. 5. VIEW of filter floor showing control console.

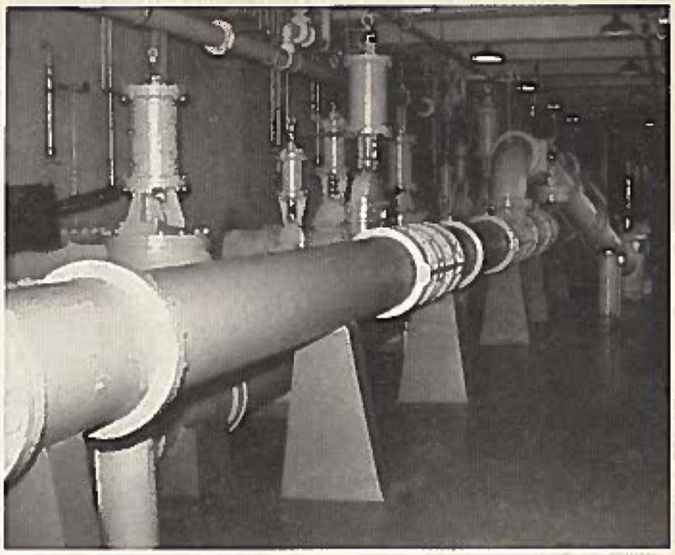


FIG. 6. SECTION of pipe gallery showing effluent controllers.

was increased in capacity in 1936 by the addition of a ¾ mgd unit. In the 1940's another ¾ mgd unit was added, giving a total of 3.5 mgd plant capacity. At the filtration plant, we have a one-million and a two-million gallon finished water reservoir.

These facilities were satisfactory until 1946, when raw water storage became inadequate. In order to provide additional storage, a 75" arch concrete dam was built upstream from the Moorman River intake dam. (Figs. 2, 3) This reservoir has a capacity of 430 million gallons.

In 1949 the engineering firm of Wiley and Wilson, Lynchburg, Virginia, designed a chemical treatment building, mixing, flocculation, and settling basins for 5.5 mgd. These units were put into operation in 1950. The raw water is very low in turbidity, for other characteristics see table 1.

In coagulating this water we use alum lime and activated silica, prepared continuously from sodium silicate and chlorine in a Silactor*. In the summer we find it impossible to form settleable floc without the addition of this coagulant aid. Coagulants are not required during the winter months when all the reservoirs are full.

When the treated water was applied on the slow sand filters, we soon found out that slow sand filters were not designed to operate on the water from the coagulation basins. The very small amount of floc carried over would seal the sand. The sand size was 0.3 mm. So we had solved one problem and created another and at the same time the demand had exceeded the slow sand rate.

In 1952 the firm of Wiley and Wilson was employed to design a 5.0 mgd rapid sand filter plant. This plant was completed in 1954. At this time we used the new plant to its designed capacity and the slow sand plant only when the demand exceeded 5.0 mgd. During 1954 and each year since we have exceeded a 7.0 mgd demand. In order to eliminate the cost of manual washing the slow sand filters, we had the rate controllers on the rapid sand filters rebored to deliver 4.0 gpm. The slow sand filters were discontinued and converted to secondary settling basins.

TABLE 1

Total alkalinity	8-	14	ppm
Total Hardness	8-	14	ppm
Total Iron	0.1-	0.4	ppm
ph		6.7	
Total Solids, maximum		50.0	ppm
Color	5.0-	150.0	ppm

* Except during times of heavy run off due to rain or snow

(Fig 4). Fig 5 shows part of our filter floor, while Fig 6 is a view of the pipe gallery.

Water from the Moorman's River Reservoir flows by gravity to the filtration plant. Water from the Ragged Mountain Reservoir has to be pumped, due to the level of these reservoirs being approximately 40' lower than the filtration plant.

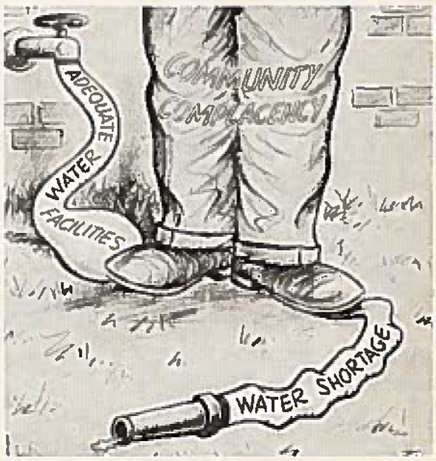
In order to take care of the demand in case of a broken raw water main, an 18" concrete lined cast iron pipe was installed from the plant to the Ragged Mountain Reservoir. On this line we have a 2800 gpm pump. With our piping arrangement at the Ragged Mountain Station, we can use any source of water in any combination of the lines from there to the plant.

As usual at the present we are making a survey to find an additional source of raw water, and a dam site.

*Product of Wallace and Tiernan, Belleville, New Jersey.

W & SWM Association P. R. Program

This is the first of a series of cartoons focusing on what has been called "the wörst public works problem." These cartoons are being sent



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