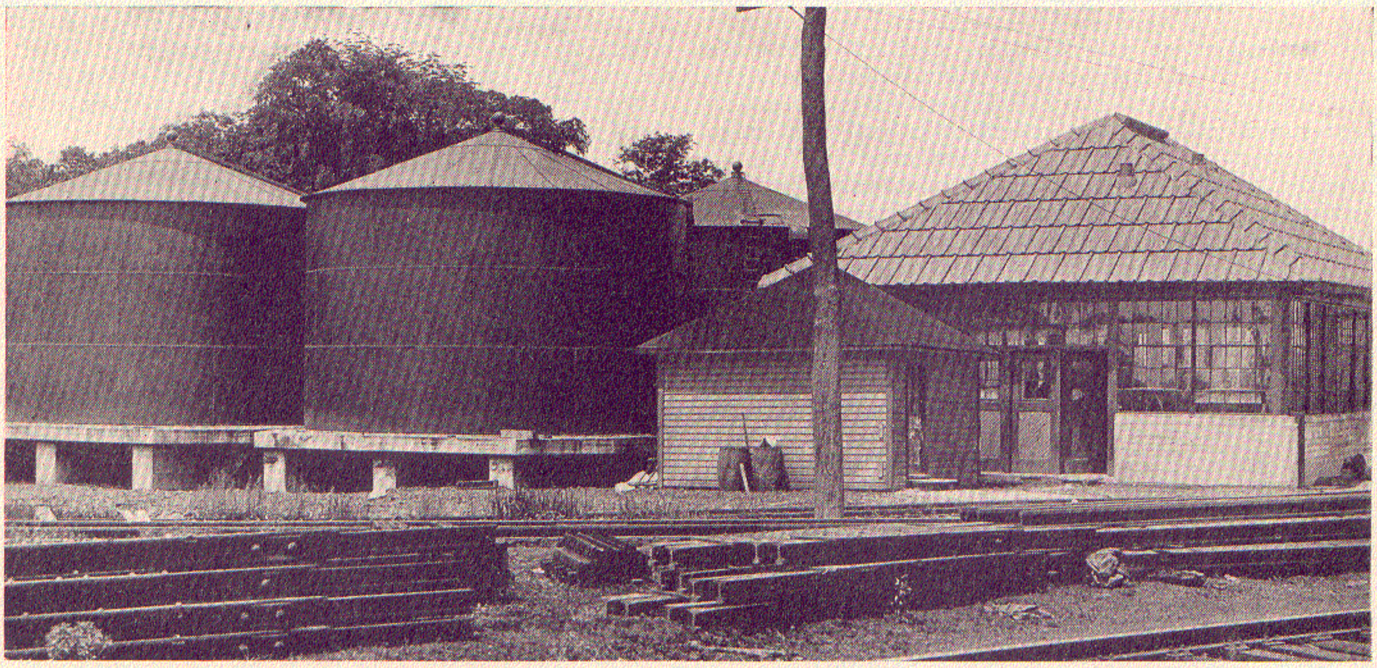

Pump House, Lime House and Settling Tanks

New Lackawanna Water Station Shows Low Operating Cost

New Fuel Oil Engines Reduce Expense of Pumping to Only 51 Per Cent of That Incurred With Old Equipment

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THE COST OF delivering water into storage tanks has been cut practically in half by the installation of new equipment at the pumping station of the Delaware, Lackawana & Western at Groveland, N. Y. This has resulted from the installation of fuel oil engines in a new plant in place of steam equipment in an old combined power house and pumping station. Following the installation of this equipment the expense per thousand gallons pumped to the storage tanks was only 51 per cent of that in 1923, the last year the old plant was in service.

Groveland is located about 70 miles east of Buffalo, N. Y., at the foot of a 13-mile grade known as the Dansville hill. All eastbound freight trains require pusher service and all freight trains in both directions take water, the daily consumption ranging from 300,000 gal. to 500,000 gal. An engine house, coaling plant and power house are maintained at this point.

Old Equipment In Deteriorated Condition

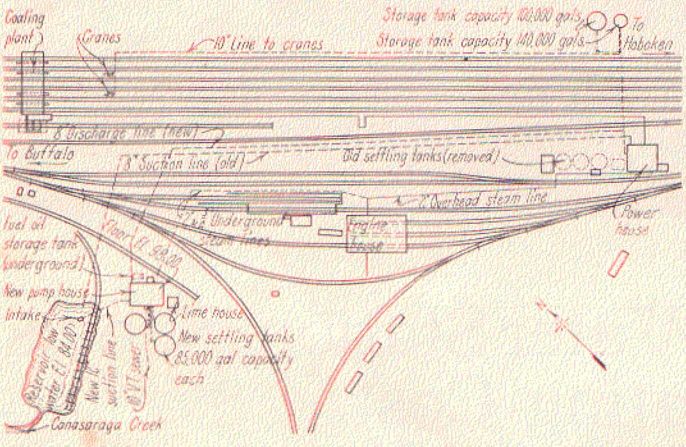
The old plant was a brick structure located at the east end of the yard about 1100 ft. from the reservoir and Canasaraga Creek, the source of the water supply. The source of power in the old plant consisted of two old 150 hp. locomotive-type boilers, injector fed, with the exhaust from equipment going to the atmosphere. The pumping equipment consisted of two 12-in. by 8-in. by 12-in. and one 14-in. by 8-in. by 12-in. reciprocating pumps. The treating apparatus included lime and soda ash tanks, one small solution pump, one locomotive-type air pump and two standard Lackawanna filter tanks. A 50 kw. generator driven by a 30 hp. steam engine was also located in the pumping room which was used for lighting and power purposes. All equipment was badly worn and in constant need of repairs.

During the busy season, the day shift was not able to allow the water to settle sufficiently after treatment before pumping to the storage tanks. Water is stored in two tanks, one of 140,000 and one of 100,000 gal. capacity. These are located across the main tracks from the power house, the top of the higher tank being 67 ft. above the top of rail.

At the time of renewal of these facilities it was decided to separate the water service from the power service, necessitating a new water service or pumping station. Upon its completion and the removal of the old equipment from the power house, a new 50 hp. steam engine was installed to drive the 50 kw. generator and a 30 kw. generator installed for the 30 hp. steam engine in the old pump room, together with a Cochrane feed water heater and feed water pumps. The 14-in. by 8-in. by 12-in. pump was also left in the pump room to supply raw water to the engine house for washout purposes. The additional electrical equipment was not installed solely for additional requirements at the new pumping station, this being only 8½ kw. at peak load, but to maintain the required service at the coaling plant during periods of maximum demand.

The new building is located 90 ft. from the reservoir. It is 51 ft. long by 34 ft. wide, and is a concrete and steel structure with hip roof. Concrete side walls were built to sill height, with continuous steel sash from sill to cornice. The building presents a pleasing appearance with its red cement tile roof and ridge ventilator. The inside vertical clearance is 16 ft. as required by the engines. The continuous sash permits maximum venilation so that the building is not uncomfortable from the heat of the exhaust pots of the engines in extreme weather. The heating requirements for winter were designed for 55 deg. F., and are met by sixteen 11-section radiators.

A 12-in. suction line with a 12-in. foot valve was laid from the reservoir on a straight grade of about 11 per cent. The intake in the reservoir is a 6-ft. by 5-ft.



The Layout at the Station, Showing Location of New and Old Facilities

piling and timber framework, with removable ¼-in. by No. 14 gage screens on three sides. The 12-in. suction line is 90 ft. long as compared with the old 8-in. line 1100 ft. long and made possible the installation of more economical pumping units. The center of the impeller of the pumps is such that the total suction lift is 18.33 ft.

Three 6-in. suction and 6-in. discharge single stage centrifugal pumps were installed. They were designed for a capacity of 750 gal. per min., and to work against an average head of 100 ft., including pipe friction and a suction lift of 17 to 19 ft. They are driven at a belt speed of 4,000 ft. per min. or 1,200 r.p.m. All three pumps are exactly alike and interchangeable in all parts except that one is fitted for a speed of 800 r.p.m. This pump is used for a total head of 35 ft., including 17.33 ft. total suction lift, and is set in a recess 12 in. deep. It is used only to pump water from the reservoir to the settling tanks.

The three pumps are set in a straight line, with the suction piping in a pit alongside and the discharge piping in a pit on the other side, both pits being deep enough to allow entrance and exit of piping below the frost line outside without additional fittings. The pump at the east end is used only to pump water from the settling tanks to the storage tanks. The middle pump is so connected by piping and valves that it can be used for either suction to settling tanks or discharge to storage tanks. The fact that both suction and discharge lines in the pits are connected in straight lines from the west end to the east end facilitates the use of a minimum number of valves and fittings. Provision has also been made in the size of the pits to allow the two higher speed pumps to be connected in series by installing additional fittings if increased pressure is desired for fire protection. Priming is accomplished ordinarily by maintaining water pressure on the pumps from the service main, as there is a foot valve at the end of the suction line. An ejector operated by air is installed as an emergency priming unit.

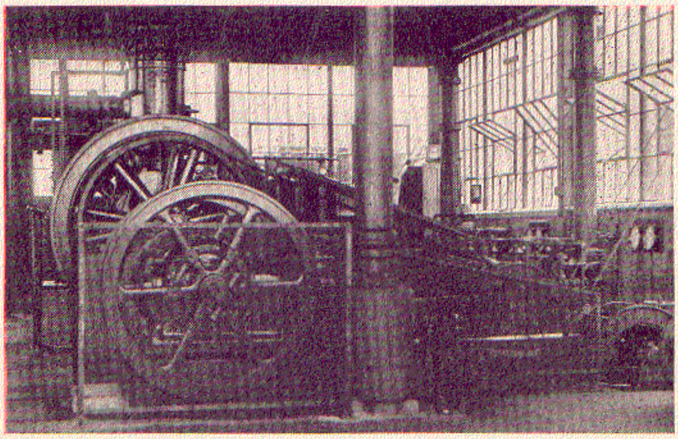
Well Designed Piping Layout

All water piping is 8 in. standard weight, black steel pipe inside the building and leading to the settling tanks. Flanged fittings were used in the building. The 8-in. discharge line from the building to the storage tanks is standard weight cast iron H. & S. pipe. All pumps are belt-connected to the engines, a 9-in. by 9/32-in. double leather belt being used in all cases. Adjacent to the pumps are Lenix overhead drive idler systems, counterweighted by overhead cables and weights along the wall. This system reduces the distance from center of engines to pumps to 10 ft., saving about 5 ft. in the width of the building. This saving would have been greater if it had not been for the necessary pipe pit between the pumps and engines.

The driving engines for the two higher speed pumps are 50 hp. Type Y Fairbanks-Morse vertical, two cycle, single cylinder, fuel oil engines. For the lower speed pump a 15 hp. horizontal, fuel oil engine of the same make and type is used. Cooling water is supplied from the service mains. Fuel oil is piped in trenches under the floor from an outside pit adjacent to the building in which is stored an auxiliary fuel oil tank for each engine. About eight feet from this pit, a 6075-gal. capacity steel fuel oil storage tank is buried underground. This tank is filled by gravity from a car on the siding alongside and fuel oil is transferred to the auxiliary tanks by a rotary hand pump with a flexible steel hose.

The Treating Facilities

All water taken from Canasaraga Creek must be treated and the treatment at this point is of the intermittent type, utilizing lime and soda ash. Air agitation is used and the mixture is allowed to settle for

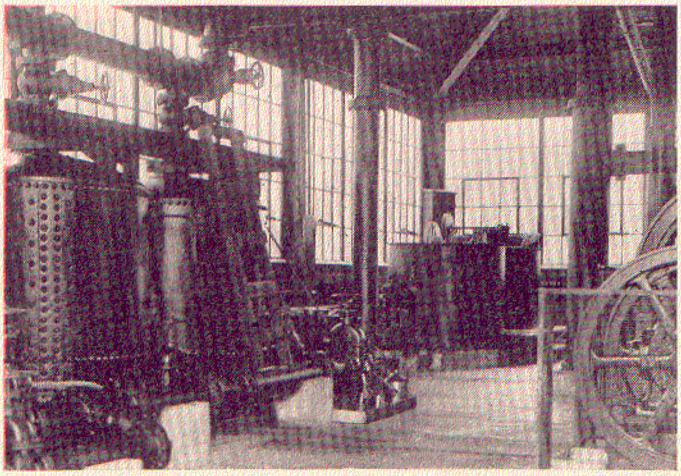


Fifteen Horsepower Engine and Centrifugal Pump Used as Suction Unit in Foreground, Spare 50 hp. Unit in Rear

four hours before being pumped to the storage tanks. The settling tanks are of steel, 30 ft. in diameter by 18 ft. high, with a conical roof, and were furnished and erected by the Chicago Bridge and Iron Works. They have a working capacity of 85,000 gal. each, and are supported by a 14-in. reinforced concrete slab resting on three piers, each 30 ft. long by 2 ft. wide, placed 10 ft. center to center. The 8-in. inlet pipe runs inside to the top of the tank so that the sediment at the bottom, which is cleaned out periodically through a trap door at the bottom, is not disturbed by the entrance of water. The 8-in. outlet pipe consists of a galvanized iron swinging arm with a float at one end and attached to an 8-in. swing joint at the bottom of the tank, permitting the drawing of water from the top surface. An electrical annunciator system notifies the operator in the building when the tank has been pumped nearly empty so that there is no probability of running the centrifugal pumps when dry. The tanks are also equipped with the standard indicator.

The chemical tanks are of the Graver type and are located inside the building. The lime tank is 5 ft. in diameter and has a capacity of 500 gal. It is mechanically agitated by revolving blades driven by a belt connected to a 1 hp. motor. The soda ash tank is also 5 ft. in diameter with a capacity of 500 gal. steam for heating the solution and air for agitating it are supplied to this tank.

A 3½-in. by 4-in. Gould triplex plunger pump, connected to a 2 hp. motor, delivers the solution to the settling tanks. It has a capacity of 30 gal. per min.



Two of the Three Filter Tanks at Left and Triplex Pump, Soda Ash Tank and Lime Tank at Center in Rear

against a total head of 60 ft. Air is supplied to the settling tanks for aeration and agitation by a 7-in. by 6-in. Ingersoll-Rand air compressor driven by a belt-connected 7½ hp. motor. It has a capacity of 50 ft. of free air per min. at 50 lb. pressure and is also used for emergency air priming of pumps and for agitation of the soda ash mixture. After the treated water is pumped from the settling tanks it is run through three Lackawanna standard pressure filters 5 ft. in diameter and thence to the storage tanks. Washout of these filters is accomplished by reversal of flow through them with pressure from the service mains.

Work Started in 1923

The construction of this project was started in 1923. It was found necessary owing to the very poor bearing capacity of the soil in the vicinity of the creek to drive piling under all structures, including those of the lightest character. To construct the intake, it was necessary to dam the reservoir at its inlet and pump it down below the elevation of the flooring under the foot valve. Water service from the old power house was maintained during this construction.

At the beginning of operation the east 50 hp. unit was used for its regular work and the 15 hp. unit for its regular work for one week. The second week the spare unit took the place of the 15 hp. unit. The third week it took the place of the east 50 hp. unit, and the fourth week the procedure was repeated as above described. This system allows the operation of each unit for two weeks steadily with the following week idle. It also makes necessary the operation of all valves at stated intervals, keeping them in working order. The increased cost per thousand gallons of water pumped by using the spare 50 hp. unit for suction purposes requiring only 15 hp. is negligible.

The present capacity of this station is 720,000 gal. per day, allowing four hours' settling treatment for each tank. The addition of a fourth settling tank and using the spare 50 hp. unit to fill two tanks at the same time will increase the capacity of the plant 33 per cent as the spare unit, when used for suction purposes, pumps water at the rate of 1100 gal. per min.

Plans and specifications for this station were prepared under the general direction of G. J. Ray, chief engineer, and F. L. Wheaton, division engineer, and under the personal direction of D. R. Young, assistant engineer of the Lackawanna. F. J. Nies, architect, prepared the building plans and H. J. Force, chemist and engineer of tests, supervised the treating apparatus. H. M. Warren, electrical engineer, acted as consulting engineer on the general layout. The writer prepared the plans and supervised the construction and installation of equipment.

Raise Coal Chute Two Feet With the Use of 78 Jacks

THE ASSIGNMENT of new Mikado and mountain type locomotives to the Kansas division of the Chicago, Rock Island & Pacific recently gave rise to a troublesome difficulty at the coaling station at Herington, Kan. The tenders of the new locomotives are so much higher than those provided for the older types that the aprons from the coal chute were too low to deliver coal satisfactorily to the newer engines. A study of this difficulty led to a plan for jacking up the entire coal chute a distance of two feet, which, because of the character of the structure and the large area it covered, necessitated the use of 78 jacks operated simultaneously by a gang of nearly 100 men.

The coaling station is of the elevated incline trestle type with a bin capacity of 600 tons in 40 coal pockets arranged in a double row along the two sides of the structure to serve two coaling tracks. An average of 40 locomotives are coaled a day, requiring about 9,500 tons of coal per month. With the coal aprons too low for the engine tender the ends of the chute would descend a considerable distance into the coal pocket of the tender so that long before the tender was loaded the coal backed up into the chute and had to be shoveled off, causing delay in loading and the spilling of coal on the ground. After considerable study it was decided that the only solution would be to raise the entire station two feet.

The first step in this work was to go over the substructure of the chute carefully and remove and replace any worn out and decayed timbers with new ones that would stand the strain of lifting. Jacking blocks were bolted to the timbers under the bin portion and also under the approach trestles. Temporary blocks 8 in. and 16 in. high and permanent blocking 24 in. high were cut and distributed at the various jacking points. After this preliminary work had been completed 74 14-in. screw jacks and 4 35-ton jacks were assembled from the various divisions. On a Sat-